Section 5.0 Alternative Methods of Carrying Out the Undertaking & Impact Assessment

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Section 5.0 Alternative Methods of Carrying Out the Undertaking & Impact Assessment

This section of the EA Report describes the generation and evaluation of the three vertical expansion alternatives (Alternative Methods) and provides the rationale for the selection of the Preferred Alternative. Further, as part of the ToR approval letter from the Minister, Brooks Road Environmental committed to considering alternative methods of leachate treatment. As such, this section of the EA Report also describes and evaluates alternative leachate treatment options and the rationale for the selection of the preferred leachate treatment option. The impact assessment of the Preferred Alternative is also presented.

Further detail on the evaluation of the Alternative Methods is provided in the individual discipline assessment reports provided in **Appendix E**.

5.1 Alternative Methods for Vertical Expansion

As presented in Section 6.0 of the approved ToR and restated in **Section 3.0** of the EA Report, Brooks Road Environment identified Alternative 3 – expand the existing landfill (vertically) as the preferred Alternative To the Undertaking. "Alternative Methods" of carrying out a proposed undertaking (i.e., the proposed vertical expansion of the capacity of the Site) are different ways of doing/achieving the same activity. Identification and evaluation of alternative methods is a key element of the EA process. The alternative methods described here include alternative conceptual vertical capacity expansion designs which are similar in addressing the problem/opportunity for the project, but operationally different enough to conduct a proper comparative evaluation.

Three vertical expansion alternatives have been developed for comparative analysis, as described in the Conceptual Design Report (CDR) (see **Appendix D**). The CDR presents alternative conceptual designs for a vertical capacity expansion of the landfill within the existing approved limit of waste and forms the basis for the comparative analysis of the vertical expansion options by the individual technical disciplines. The alternatives were identified in consideration of the criteria and assumptions outlined below and based on public input received during the ToR.

Many aspects are identical across all three vertical expansion alternatives and are discussed in further detail below, including:

- An expansion capacity of 421,000 m^3, including waste, daily cover, and interim cover.
- The limit of waste (i.e., landfill footprint).

- Traffic associated with importing waste, daily cover, and interim cover.
- The location of the site entrance, scalehouse, and other ancillary supporting features.
- The size and location of all buffer areas.
- The final cover design (0.6 m of compacted fine-grained soil overlain by a 0.15 m thick vegetative layer).

5.1.1 Conceptual Design Basis

5.1.1.1 Overview

A series of criteria and assumptions were established to guide the development of the vertical expansion alternatives for the Site. These include Brooks Road Environmental's projected waste disposal capacity requirements and regulatory requirements relating to landfill design geometry. In addition, assumptions were made relating to operational traffic levels, leachate generation rates, and aspects of site design and operations. These criteria and assumptions are discussed below.

5.1.1.2 Landfill Capacity and Fill Rate

The Site currently has an approved capacity of 624,065 m^3, including waste, daily cover, and interim cover. The vertical capacity expansion proposed under this EA is for 421,000 m^3 (including waste, daily cover, and interim cover), over a five to seven year planning period. This capacity is the same for all vertical expansion alternatives considered and the feasibility of this additional capacity was confirmed through volumetric calculations based on site geometry (see **Section 3.1**).

The Site currently has an approved maximum fill rate of up to 500 tonnes per day. As part of the EA, it is proposed that this rate be revised from a daily maximum to an annual maximum in order to provide operational flexibility during busier periods during the spring and summer. Assuming an average fill rate of 500 tonnes per day over 302 days (six days per week per year minus 10 public holidays) equates to a maximum proposed annual fill rate of 151,000 tonnes. To be conservative, and for the purposes of predicting and modeling potential and net effects to the environment, the project team used a maximum fill rate that may be experienced at the Site of 1,000 tonnes per day (i.e., double the currently approved maximum rate). This was done to demonstrate that the maximum amount of waste could be managed appropriately on-site and that the potential effects of this larger per day amount could be mitigated to acceptable levels. It should be noted that as part of the ToR and EA, the proponent expressed a need to alter the daily limit from 500 tonnes per day in order to accommodate busier months of operation in the spring and summer. The minimum daily fill rate would be 0 tonnes per day.

This equates to an annual average of 500 tonnes per operating day (302 annually) and an annual maximum fill rate of 151,000 tonnes per year.

5.1.1.3 Landfill Geometry

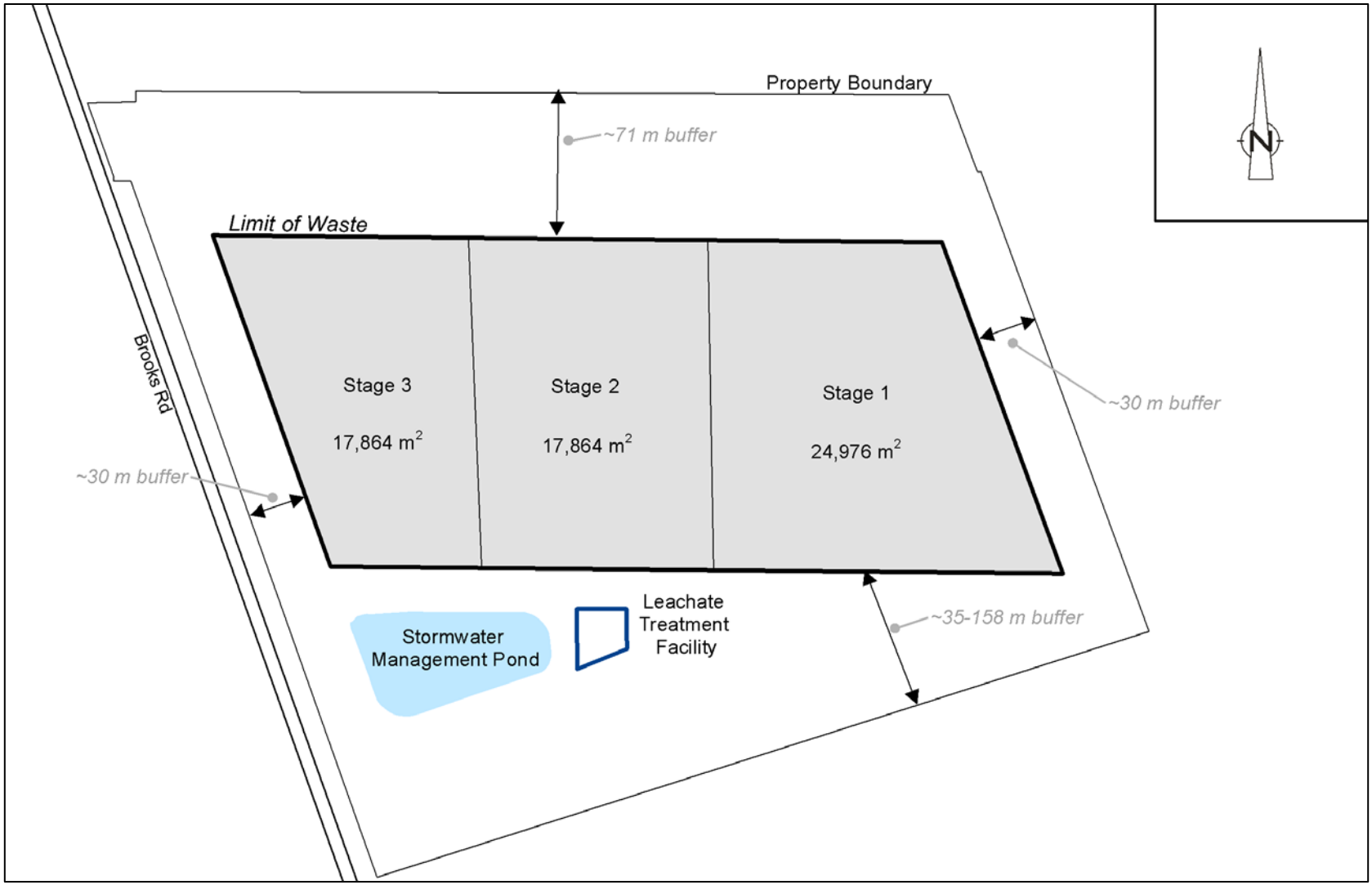
Ontario Regulation (O. Reg.) 232/98 and the accompanying Landfilling Standards Guideline specify requirements and/or provide recommendations for key landfill design parameters. The parameters identified in the regulation relevant to the development of a vertical expansion are summarized below.

Buffer Areas

The regulatory requirements specify a 100 m wide buffer area between the limit of the waste footprint and the site boundary, but allow this to be reduced to 30 m if it is shown to be appropriate based on a site specific assessment (e.g., if the buffer provides adequate space for vehicle movements, ancillary facilities, and ensures that potential effects from the landfill operation do not have unacceptable impacts outside of the site). Approved buffer areas have already been established around the perimeter of the waste fill area, and will not be altered as a result of vertically expanding the final contours. The approved buffer areas are shown in **Figure 5.1**, below, and include the following:

- A 30 m buffer between the western limit of waste and the western property line adjacent to Brooks Road.
- A 30 m buffer between the eastern limit of waste and the eastern property line adjacent to undeveloped, privately owned rural properties consisting of old fields used for passive livestock pasture purposes and forested areas.
- A 35 m to 158 m buffer between the southern limit of waste and the southern property line adjacent to undeveloped, privately owned rural properties consisting of old fields used for passive livestock pasture purposes and forested areas.
- A 71 m buffer between the northern limit of waste and the property line adjacent to a rural property owned by the proponent consisting of old fields (i.e., long-term inactive agricultural crop production lands now undergoing natural regeneration) and forested areas.

Figure 5.1 Existing Brooks Road Landfill Site & Approved Buffer Areas



Final Slopes

The regulatory requirements specify a maximum slope of four units horizontal to one unit vertical (4H to 1V, or 25%) and a minimum slope of 20H to 1V (5%), but allow variance where it can be shown to be appropriate. Given that no changes are proposed to the existing landfill footprint (i.e., vertical expansion only), maximum slopes of 3H to 1V (33%) were used in developing the alternatives in order to meet the desired capacity expansion. The suitability of the proposed slopes will be evaluated in more detail once a preferred alternative is chosen.

Landfill Height

There are no regulatory requirements specifically constraining landfill height, although maximum height is indirectly governed by regulatory requirements to ensure that adequate foundation conditions exist and that slopes are stable. Additionally, there is no by-law restricting the height of a landfill in Haldimand County and this includes the site-specific zoning by-law. The suitability of the proposed height increase relative to the subsurface conditions will be evaluated in more detail once a preferred alternative is chosen. It is noted that the landfill is adequately screened by existing vegetation to the north, east and south sides of the Site. There is an existing vegetated screening berm (approximately 4 m high, with an additional 2 m of vegetation on top) that runs the entire length of the west side of the Site (excluding Site access points), adjacent to Brooks Road. As required, the existing screening berm will be vegetated and/or additional on-Site plantings will be introduced to mitigate potential impacts from a visual and noise perspective.

5.1.1.4 Leachate Generation

The leachate generation rate is an important parameter used in assessing the operational and environmental performance of a landfill site. It will vary over the operational and post-closure period of the facility, and is influenced by factors including precipitation, degree of landfill development (e.g., area of landfill that is actively undergoing development versus areas where interim/final cover has been placed), final cover design, and other factors.

For the purposes of facilitating a comparative analysis of the proposed vertical expansion alternatives, an approximate range of leachate generation rates for each vertical expansion alternative were calculated based on the requirements of O. Reg. 232/98:

- The proposed final cover consists of 0.6 m of compacted fine-grained soil overlain by a 0.15 m thick vegetative layer.
- The final cover allows a minimum infiltration rate of 0.15 m per year.

In order to estimate the amount of precipitation expected at the Site, Environment Canada weather data records for a nearby weather station in Hagersville was considered. The Canadian Climate Normals between 1981 to 2010, were used to estimate the anticipated annual precipitation at the Site, resulting in an anticipated average annual precipitation of approximately 956 mm. A portion of this amount can be assumed to be lost to direct evaporation resulting in a maximum anticipated average annual precipitation of less than 956 mm.

The vertical capacity expansion proposed under all vertical expansion alternatives considered for this EA is 421,000 m^3 (including waste, daily cover, and interim cover), over a 5 to 7 year planning period. The leachate generation rate is influenced by the phasing of landfill development and will vary over the life of the Site, and is generally higher during operation than in the closed state. The landfill is anticipated to be developed in three cells as shown in **Figure 5.1**.

The following infiltration rates were used to estimate leachate generation for the various conditions that will be present throughout the development of the landfill:

- Type 1 Areas – landfill areas completed with well graded interim cover (no vegetation) have an anticipated infiltration rate of approximately 270 mm per year.
- Type 2 Areas – landfill areas (active) completed with daily cover have an anticipated infiltration rate of approximately 100 mm per year (this relatively low infiltration rate is due to the water retention capacity of the newly placed waste).
- Type 3 Areas – landfill areas completed with moderate to high quality, well graded final cover have an anticipated infiltration rate of 175 mm per year (minimum infiltration rate of 150 mm per year as per O. Reg. 232/98 for an engineered liner design).

These area types and associated infiltration rates were used to estimate leachate generation over the life of the Site. The development of Cells 1 through 3 is anticipated to be staged in accordance with the conditions outlined in **Table 5.1**.

Table 5.1 Modelled Scenarios for Cell Development

Year	Cell	Development Area Type (%)		
		1	2	3
0	1	100%	0%	0%
	2	100%	0%	0%
	3	100%	0%	0%
1	1	100%	0%	0%
	2	0%	100%	0%
	3	100%	0%	0%
2	1	100%	0%	0%
	2	100%	0%	0%
	3	0%	100%	0%
3	1	0%	100%	0%
	2	50%	50%	0%
	3	100%	0%	0%
4	1	100%	0%	0%
	2	50%	50%	0%
	3	0%	100%	0%
5	1	0%	50%	50%
	2	50%	50%	0%
	3	100%	0%	0%
6	1	0%	0%	100%
	2	0%	50%	50%
	3	0%	100%	0%
7	1	0%	0%	100%
	2	0%	0%	100%
	3	0%	0%	100%

The average daily leachate generation rate is expected to be the same across all vertical expansion alternatives, and will vary from approximately 26 m^3 per day to 55 m^3 per day during the active waste placement period. Under the post closure scenario, the infiltration rate through the final cover is designed to be a minimum of 150 mm per year in accordance with O. Reg. 232/98 for an engineered liner design. Assuming an infiltration rate of approximately 175 mm per year over the entire Site, the average leachate generation rate under post closure conditions is expected to be approximately 29 m^3 per day.

An on-site leachate treatment system for the Site is currently being constructed. The site will utilize a batch leachate treatment system with a rated capacity of 30 m^3/day and peak daily

flow of 60 m^3/day. Treated leachate that meets ECA requirements will be discharged to the roadside ditch that runs along the east side of Brooks Road. No major changes to the leachate treatment system are anticipated to be required as a result of the proposed vertical expansion alternatives.

5.1.1.5 Stormwater Management

O. Reg. 232/98 requires that landfill sites be designed to protect surface water to specified performance standards based on the following principles:

- Divert or control clean surface water flowing onto the site.
- Control quality and quantity of runoff discharging from the site to control erosion, sediment transport, and flooding.

The stormwater management system for the Site has already been designed and is currently being constructed. The stormwater management system consists of a perimeter ditch around the outside of the landfill footprint and a wet detention stormwater management pond in the southwest corner of the site, complete with inlet structure, forebay, outlet structure, and emergency bypass structure. Quantity and quality requirements outlined in the ECA must be satisfied prior to discharging stormwater runoff to the roadside ditch adjacent to Brooks Road.

Given that no changes are proposed to the existing landfill footprint (i.e., vertical expansion only), the drainage area serviced by the current stormwater management system will be similar across all alternatives and will not differ significantly from the pre-expansion conditions. As such, no major changes to the existing stormwater management system are anticipated as a result of the capacity expansion.

5.1.1.6 Landfill Gas Management

O. Reg. 232/98 requires the mandatory collection of landfill gas for sites with a waste capacity greater than 1.5 million m^3. Given that the total expanded capacity of the landfill will be 1,045,065 m^3, gas collection is not required. Further, given that the anticipated types of waste to be accepted will consist primarily of non-hazardous IC&I wastes, there will be insufficient landfill gas produced to warrant collection.

To confirm the above, methane generation modelling analysis was completed for the Brooks Road Landfill and the proposed vertical capacity expansion and documented in a memo (see **Appendix F**). Modelling used an average annual waste quantity calculated based on actual Site waste disposal numbers for the period October 8, 2009 through October 9, 2016. A waste acceptance rate (WAR) of 75,500 tonnes per year (half of the maximum annual waste

acceptance rate) was assumed for future years (starting in 2017) until the landfill design capacity is reached for both the Existing Landfill (approximately 624,065 tonnes assuming a density of 1 tonne per cubic meter) and the proposed vertical expansion (approximately 421,000 tonnes assuming a density of 1 tonne per cubic meter). The landfill accepts mostly construction/demolition waste (approximately 53 percent) and inert material (approximately 30 percent). Waste composition for future years was assumed to be consistent with the 2009 through 2016 waste composition. Without a landfill gas collection and control system, peak methane emissions from the Brooks Road Landfill (in 2024) are estimated to be approximately 809 tonnes of methane (approximately 20,224 tonnes of carbon dioxide equivalent [CO2e]). Converting to units of standard cubic feet per minute (scfm), the maximum methane generation rate is approximately 80.5 scfm (in 2024). Based on the low level of methane generation at the Brooks Road Landfill and the negative environmental, energy and economic factors associated with a landfill gas collection and control system (see **Section 5.7.10** for a discussion of the impacts associated with the operation of a gas collection and control system), it is concluded that the operation of such a system is not feasible.

5.1.1.7 Traffic

Vehicle traffic associated with the development of the landfill is important in assessing the potential impacts of the Site on various receptors. Traffic levels were estimated based on the following:

- Each vertical expansion alternative is projected to have waste, daily cover, and interim cover receipts of up to 421,000 m^3.
- Final cover requirements are expected to be similar across all vertical expansion alternatives, with approximately 38,000 m^3 of clay and 10,000 m^3 of topsoil.
- All construction materials are assumed to be imported from off-site.
- Tonnages for each material were calculated based on assumed densities.
- Total vehicle traffic volumes were calculated based on assumed vehicle types and average capacities.
- Vehicle traffic associated with the construction of other site works (e.g., perimeter road, stormwater management system) was not considered as these are assumed to be completed at interim closure.
- Vehicles associated with staff or other site operations are assumed to be negligible.
- Average vehicles per day was calculated for each alternative based on a minimum 5 year planning period, and 302 operating days per year.

Traffic volumes are expected to be the same across all vertical expansion alternatives, and will average approximately 16 vehicles per day, although this value will vary depending on Site operations and construction scheduling. This value could also be reduced by 10 percent provided the on-site soil stockpile is suitable for construction of the final cover clay.

5.1.1.8 Landfill Operations

O. Reg. 232/98 requires that landfills be designed and operated to ensure that nuisance impacts are minimized, and the regulation requires that the proponent prepare a report describing all aspects of the operation as well as maintenance procedures that will be followed.

A key objective in planning landfill operations is to minimize nuisance impacts including noise, litter, vectors, dust, and odour. Typical operating practices relating to these issues include:

- Vehicles transporting waste to and around the Site are tarped as required to prevent litter from blowing out of the vehicle.
- Daily cover is applied to exposed waste to confine light weight material.
- The working face is selected based on the direction and intensity of the wind to provide maximum shelter. The extent of the working face is kept to a minimum on windy days.
- Litter control fencing is utilized as required to control blowing litter.
- Litter is collected on an as-needed basis, both from the Site and, if required, from the adjacent lands and roadway.
- On-Site equipment is operated in such a manner as to minimize noise impacts, wherever possible.
- All landfill construction equipment associated with the development, operation, or closure of the Site should comply with the noise levels outlined in applicable MOECC guidelines and technical standards.
- If landfill odours become an issue, established protocols are followed to investigate the source, and steps are taken to reduce odours where possible.
- Waste compaction is carried out immediately after placement and spreading.
- Vector and vermin are controlled as required.
- The landfill development sequence is planned to allow for the progressive closure of the landfill, including commencing construction of the final cover as early as possible.
- The Site design includes screening features such as a berm and tree plantings which can attenuate visual impact and noise.

- Site haul roads are constructed to minimize mud trackout. Dust mitigation measures are employed on an as-needed basis and may include the following:
  - During dry periods, the speed limit of on-Site vehicles is reduced.
  - During dry periods, on-Site roadways and surfaces used by refuse trucks may be watered or covered with wood chips.
  - On extremely dry and windy days, the wetting of working and stockpiling areas may be undertaken.

It is anticipated that these landfill operating practices would be common to all vertical expansion alternatives. While these would not significantly influence the comparative analysis they should nevertheless be considered in reviewing the vertical expansion alternatives. Any modifications to the landfill design and operations will be outlined during the detailed impact assessment of the preferred vertical expansion alternative.

5.1.2 Alternative Method 1

The design for vertical expansion Alternative 1 is presented in **Figure 5.2** and **Figure 5.3**. This alternative consists of 3H to 1V (33%) side slopes to a crest elevation of 218.1 metres above mean sea level (mAMSL). The top (peak) slope is 20H to 1V (5%) with a peak elevation of 219.7 mAMSL. The elevations and slopes given are for the top of final cover. The approximate quantity of final cover needed is 37,914 m^3 of compacted fine grain soil and 9,479 m^3 of topsoil.

Figure 5.2 Vertical Expansion Alternative 1

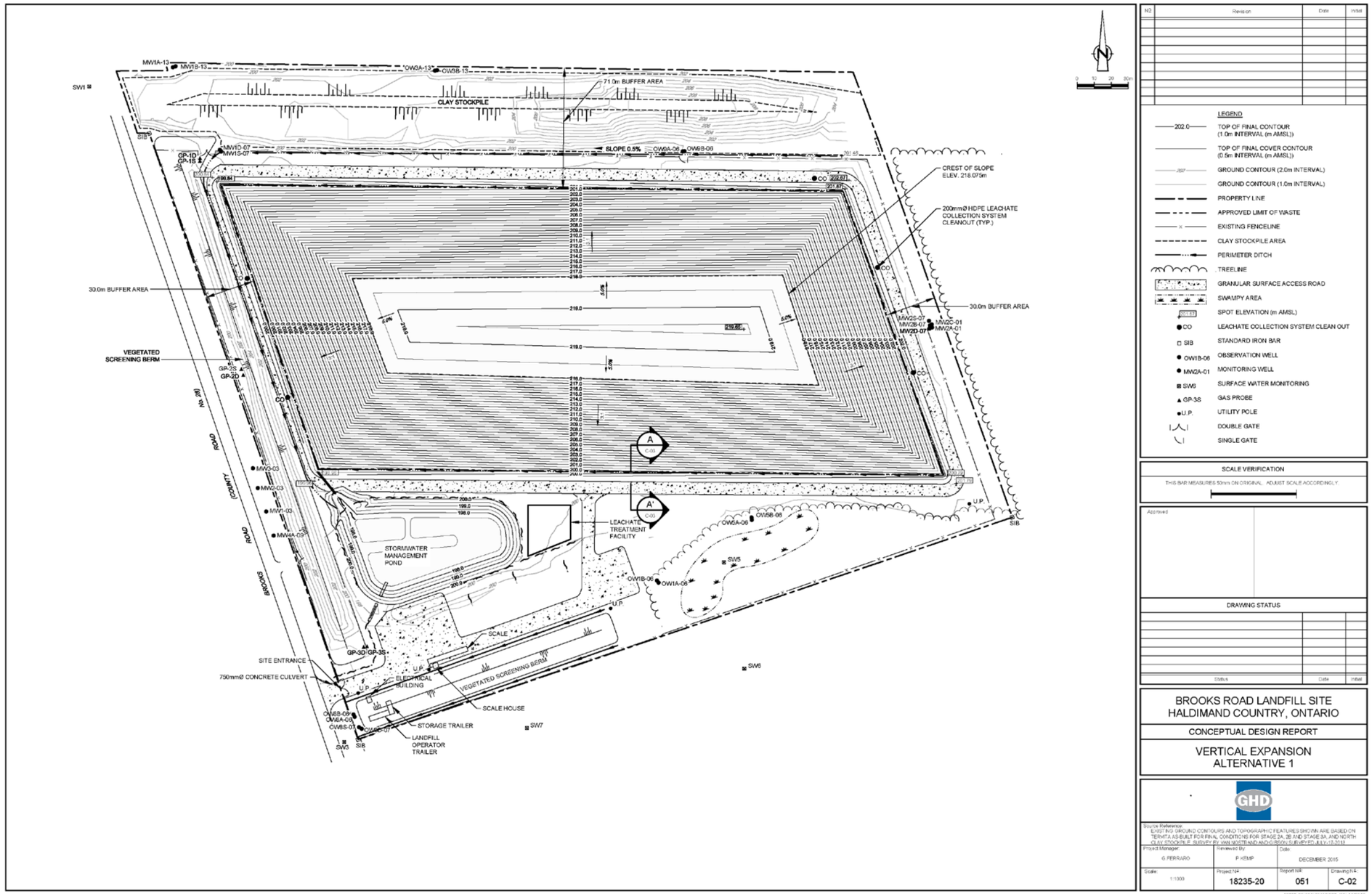
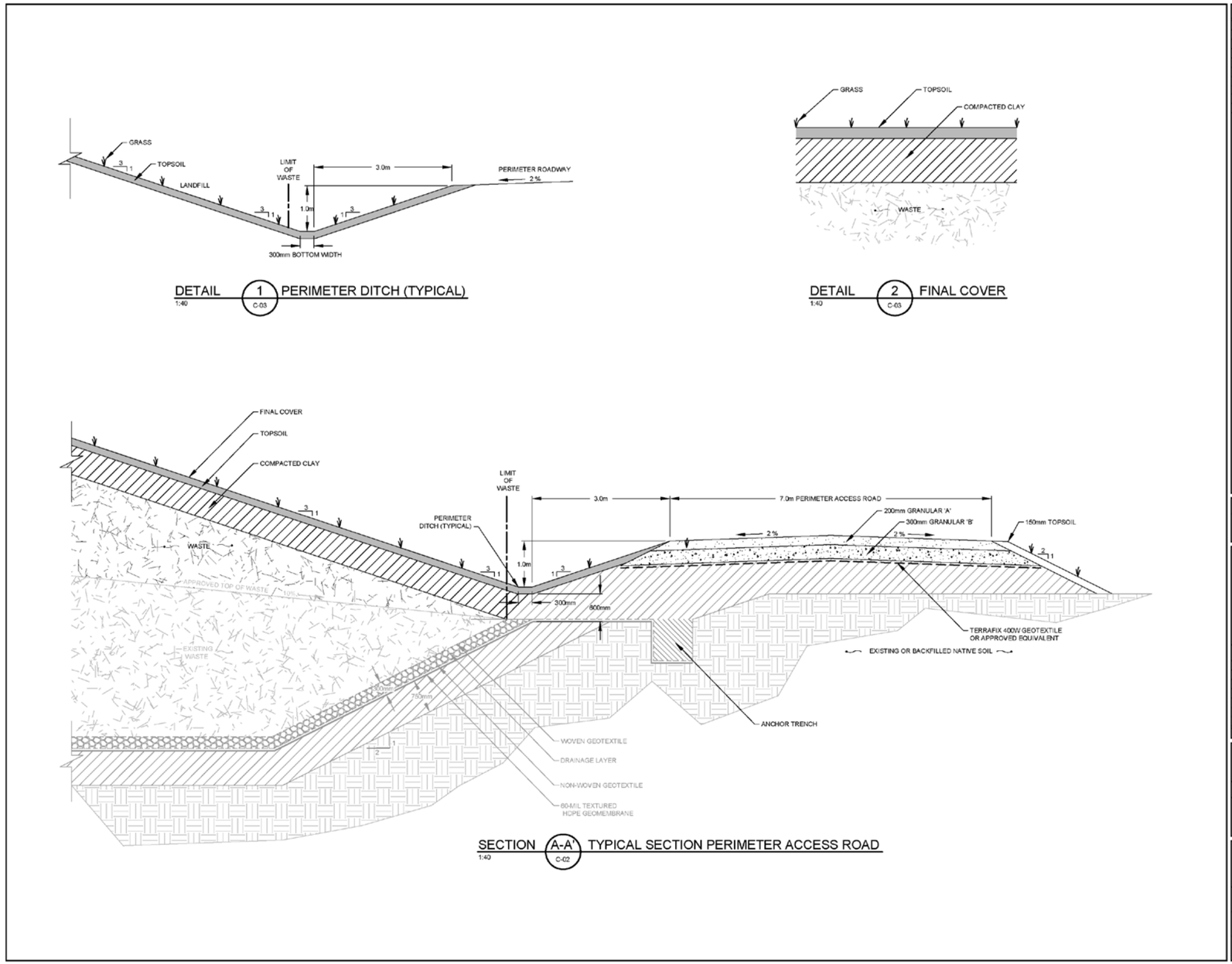


Figure 5.3 Vertical Expansion Alternative 1 Details



5.1.3 Alternative Method 2

The design for vertical expansion Alternative 2 is presented in **Figure 5.4** and **Figure 5.5**. This alternative consists of 4H to 1V (25%) side slopes to a crest elevation of 221.0 mAMSL. The top (peak) slope is 20H to 1V (5%) with a peak elevation of 221.5 mAMSL. The elevations and slopes given are for the top of final cover. The approximate quantity of final cover needed is 37,475 m^3 of compacted fine grain soil and 9,369 m^3 of topsoil.

Figure 5.4 Vertical Expansion Alternative 2

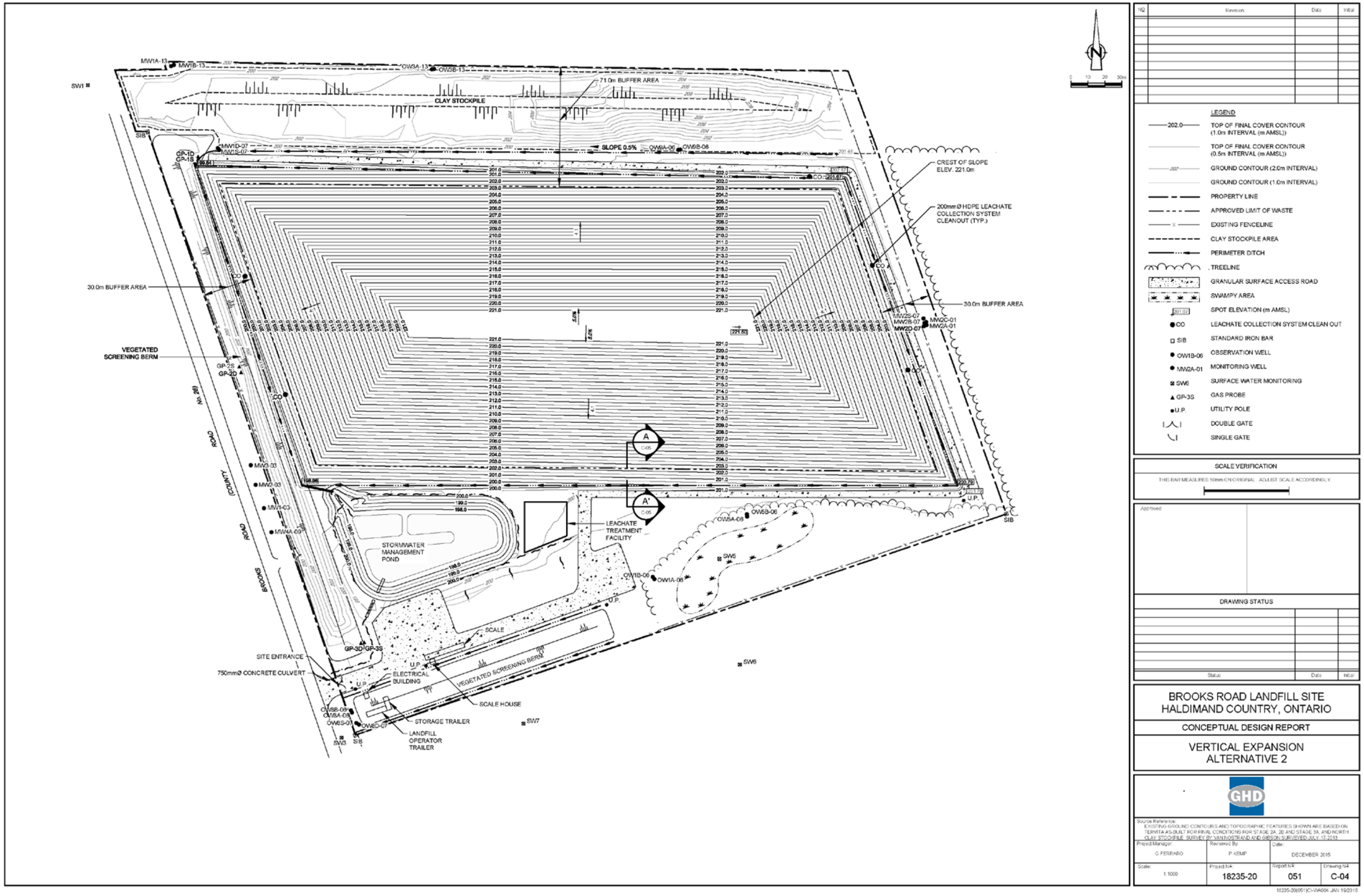
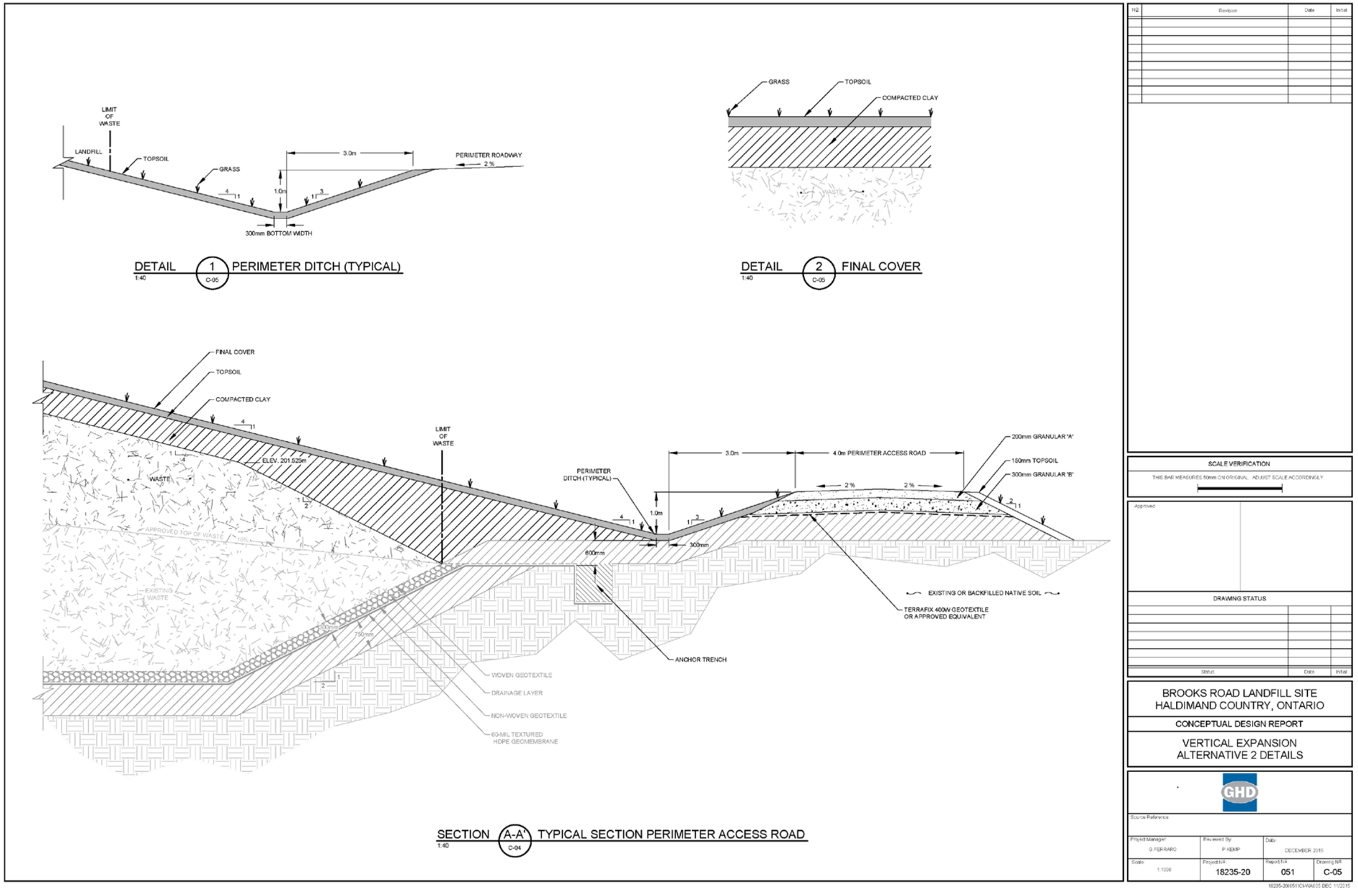


Figure 5.5 Vertical Expansion Alternative 2 Details



5.1.4 Alternative Method 3

The design for vertical expansion Alternative 3 is presented in **Figure 5.6** and **Figure 5.7**. This alternative consists of 3H to 1V (33%) side slopes to a crest elevation of 221.3 mAMSL. The top (peak) slope is 20H to 1V (5%) with a peak elevation of 222.1 mAMSL. There is an additional 4.0 m wide bench located at an elevation of 210.0 mAMSL. The elevations and slopes given are for the top of final cover. The approximate quantity of final cover needed is 38,053 m^3 of compacted fine grain soil and 9,513 m^3 of topsoil.

Figure 5.6 Vertical Expansion Alternative 3

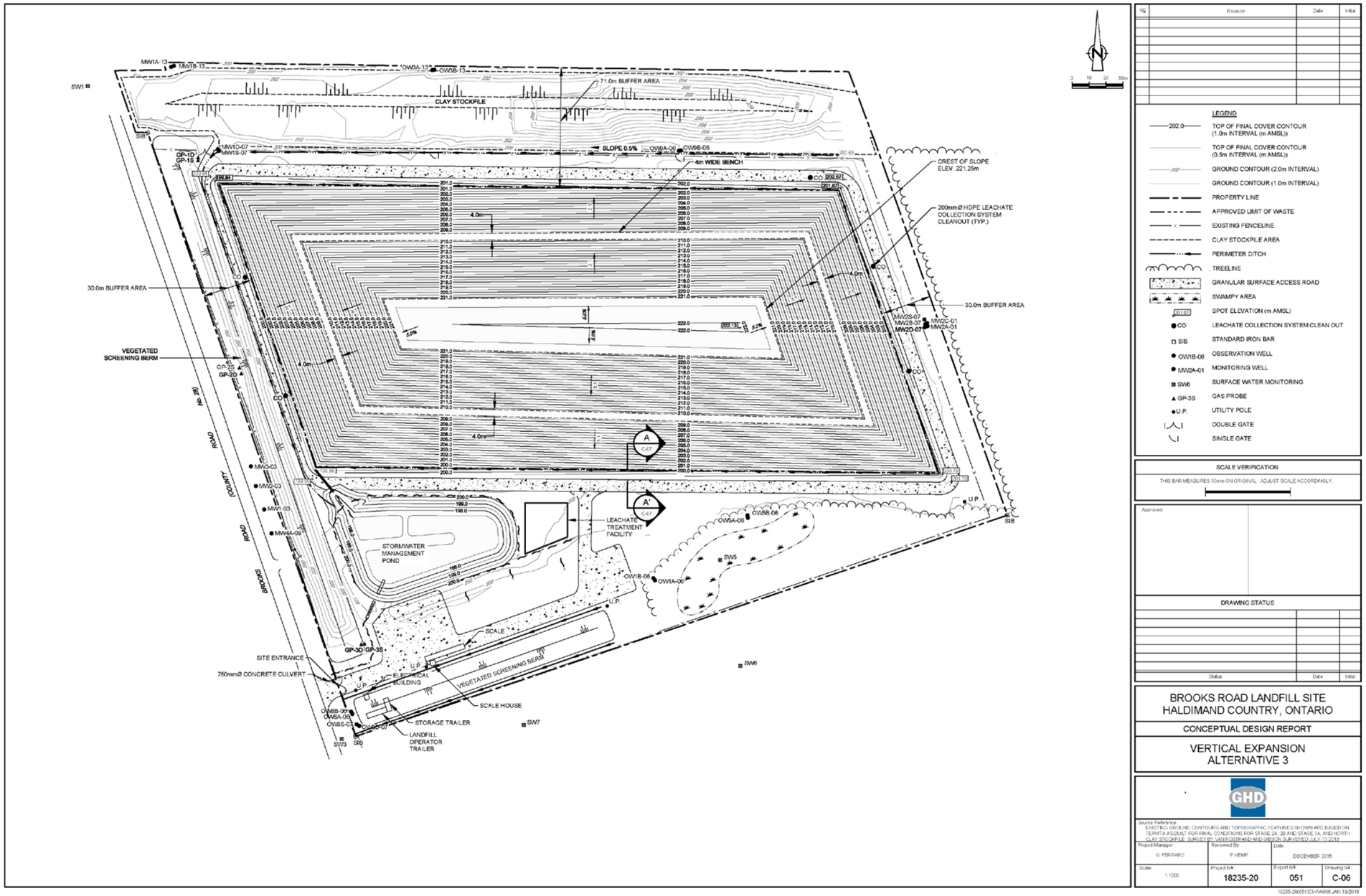
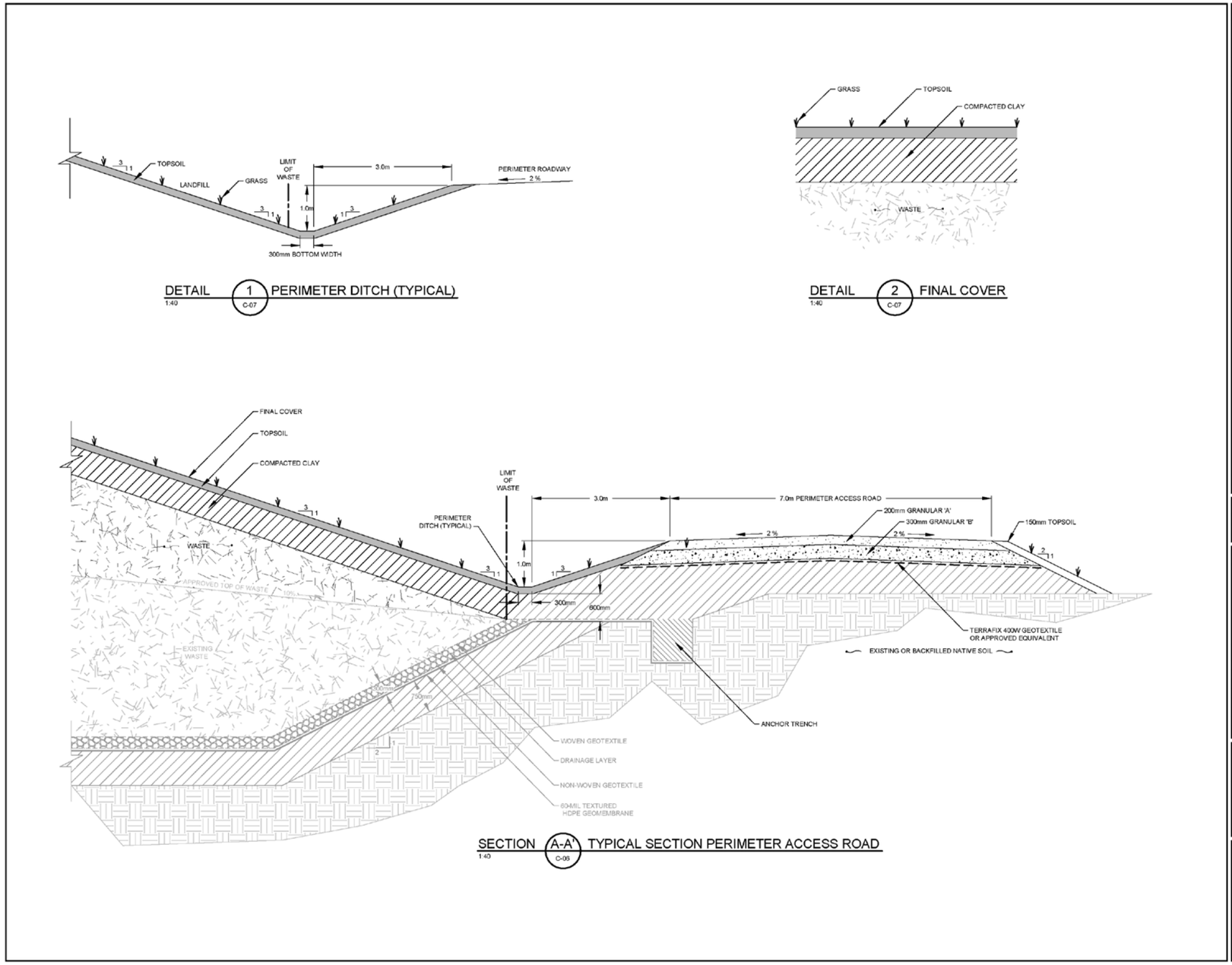


Figure 5.7 Vertical Expansion Alternative 3 Details



5.1.5 Summary of Alternative Methods for Vertical Expansion

The key attributes of the three vertical expansion alternatives are summarized in **Table 5.2**. These attributes are provided at a conceptual level of detail/design, which is appropriate for completing a comparative evaluation of the vertical expansion alternatives. It should be noted that some refinements of the attributes listed may be necessary as part of the impact assessment work, but will not result in significant changes to the overall design.

Table 5.2 Comparison of Vertical Expansion Options

Attribute	Alternative 1	Alternative 2	Alternative 3
General Description	Expansion capacity with 3H to 1V slopes to a crest elevation of 218.1 mAMSL, and a peak elevation of 219.7 mAMSL	Expansion capacity with 4H to 1V slopes to a crest elevation of 221.0 mAMSL, and a peak elevation of 221.5 mAMSL	Expansion capacity with 3H to 1V side slopes to a crest elevation of 221.3 mAMSL, a 4.0 m wide bench at 210.0 mAMSL, and a peak elevation of 222.1 mAMSL
Approximate Elevation of Top of Landfill (including final cover)	219.7 mAMSL	221.5 mAMSL	222.1 mAMSL
Approximate Height of Landfill Above Existing Grade of 198.96 mAMSL	21 m	23 m	23 m
Post-Closure Leachate Generation Rate	29 m^3/day	29 m^3/day	29 m^3/day
Number of Vehicles Per Day Associated with Waste and Construction Materials	16	16	16

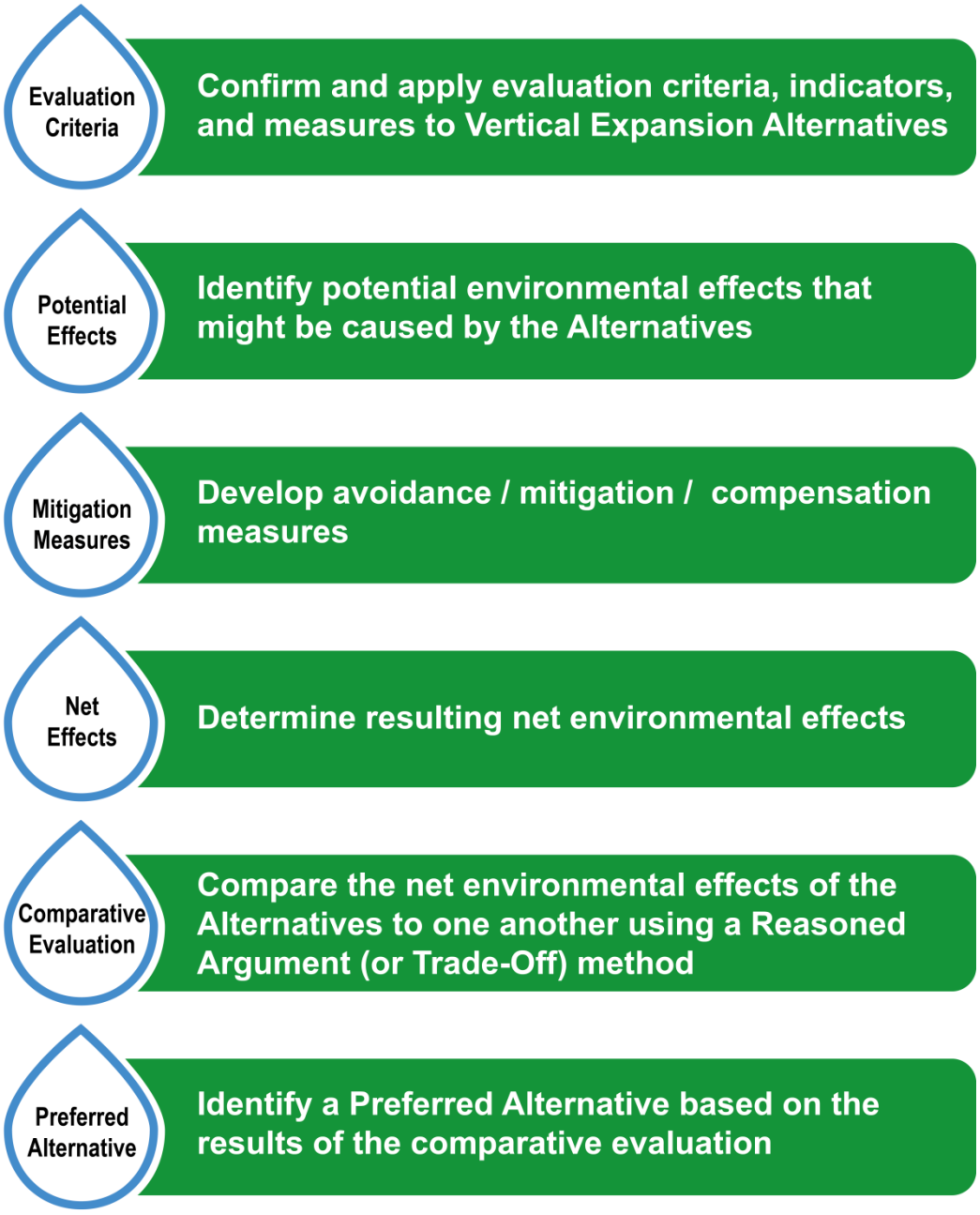
5.2 Assessment Methodology

Following the identification of the vertical expansion options, an assessment and evaluation of the three vertical expansion alternatives was undertaken via the following three steps:

- Step 1 – Confirm Evaluation Criteria and Indicators/Measures
- Step 2 – Undertake the Net Effects Analysis
- Step 3 – Carry out the Comparative Evaluation

As identified in **Figure 5.8**, the multi-step process began with confirming the evaluation criteria and indicators proposed in the approved ToR (see **Section 5.2.1**, below). With a final list of evaluation criteria and indicators established, they were applied to each of the three vertical expansion options through a Net Effects Analysis to determine the net positive or negative environmental effects (see **Section 5.2.2**, below). Next, a Reasoned Argument or Trade-off method was carried out using this information to determine a preferred alternative method (see **Section 5.2.3**, below).

Figure 5.8 Vertical Expansion Alternatives Assessment Methodology



5.2.1 Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the approved ToR, reflecting the definition of the environment as provided in the *EA Act*, were reviewed and confirmed for application to each of the vertical capacity expansion alternatives. **Table 5.3** provides the Criteria and Indicators that were used in comparing the alternatives.

Table 5.3 Evaluation Criteria & Indicators

	Environmental Component	Evaluation Criteria	Indicators	Data Sources
NATURAL	**Atmospheric Environment**	Air quality	• Predicted off-Site point of impingement concentrations (µg/m^3) of indicator compounds • Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	• Environment Canada or MOECC hourly meteorological data and climate normals • Site ambient air monitoring, continuous emissions monitoring data • Applicable MOECC guidelines and technical standards (i.e., Ore. 419/05 Schedule 2, Schedule 3 and Schedule 6 Standards) • Aerial photographic mapping and field reconnaissance • Off-Site receptors confirmed on recent mapping • Emissions Summary and Dispersion Modelling (ESDM) reports • Available background ambient air data • Waste materials and leachate characterization and sampling data • Proposed facility characteristics • Landfill design and operation data
		Odour	• Predicted off-Site odour concentrations (odour units (OU)) • Number of off-Site receptors potentially affected (residential properties, public facilities, businesses and institutions)	• Published odour studies for similar source types • Site specific odour source data and/or ambient odour monitoring data • Environment Canada or MOECC hourly meteorological data and climate normals • Applicable MOECC guidelines and technical standards (i.e., Ore. 419/05 Schedule 2, Schedule 3 and Schedule 6 Standards) • Site odour complaints history • Aerial photographic mapping and field reconnaissance • Off-site receptors confirmed on recent mapping • Odour assessment reports • Waste materials and leachate characterization and sampling data • Proposed facility characteristics • Landfill design and operation data

Environmental Component	Evaluation Criteria	Indicators	Data Sources
	Noise	• Predicted off-Site noise level • Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	• Site-specific equipment noise measurements • Manufacturer provided noise specifications • Applicable MOECC guidelines and technical standards (Noise guidelines for landfill sites N-1, Oct, 1998; NPC-300, August, 2013; NPC- 233) • Aerial photographic mapping and field reconnaissance to confirm off- Site receptors • Land Use Zoning Plans • Acoustic Assessment Reports • Proposed facility operational characteristics and scenarios • Landfill design and operations data
Geology & Hydrogeology	Groundwater quality	• Predicted effects to groundwater quality at property boundaries and off-Site	• Hydrogeological and geotechnical studies • Water well records • Determination of water well users in the area • Annual Site Monitoring Reports • Proposed leachate control concept designs • Environment Canada Canadian Climate Normals • Leachate generation assessment • Provincial Water Quality • Monitoring Network (PWQMN)
	Groundwater flow	• Predicted groundwater flow characteristics	• Hydrogeological and geotechnical studies • Water well records • Determination of water well users in the area • Annual Site Monitoring Reports

	Environmental Component	Evaluation Criteria	Indicators	Data Sources
	Surface Water Resources	Surface water quality	• Predicted effects on surface water quality on-site and off-site	• Topographic maps • Air photos • Facility layout, drainage maps and figures • Proposed on-site stormwater management concept designs for vertical expansion alternatives • Existing leachate management system • Annual monitoring reports • Interviews and discussions with staff, MOECC, Conservation Authorities, and Environment Canada • Published water quality and flow information from MOE, Environment Canada and conservation authorities • Site reconnaissance • PWQMN
		Surface water quantity	• Change in drainage areas • Predicted occurrence and degree of off-site effects	
	Terrestrial & Aquatic Environment	Terrestrial ecosystems	• Predicted impact on vegetation communities • Predicted impact on wildlife habitat • Predicted impact on vegetation and wildlife including rare, threatened or endangered species	• Site surveys • Published data sources
		Aquatic ecosystems	• Predicted changes in water quality • Predicted impact on aquatic habitat • Predicted impact on aquatic biota	• Site surveys • Published data sources
CULTURAL	**Archaeology & Cultural Heritage**	Cultural & heritage resources	• Cultural and heritage resources (built and landscapes) in the Local Study Area and predicted impacts on them	• Published data sources • Cultural/heritage assessments • Commemorative statements • Criteria for Evaluating Archaeological Potential: A • Checklist for the Non-Specialist
		Archaeological resources	• Archaeological resources in the Local Study Area and predicted impacts on them	• Published data sources • Stage 1 and Stage 2 (possibly Stage 3 and 4) archaeological assessments • Commemorative statements • Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist

	Environmental Component	Evaluation Criteria	Indicators	Data Sources
BUILT	**Transportation**	Effects on airport operations	• Bird strike hazard to aircraft in Local Study Area	• Transport Canada data sources
		Effects from truck transportation along access roads	• Potential for traffic collisions • Disturbance to traffic operations • Potential road improvement requirements	• Transport Canada data sources • Previous traffic study
	Land Use	Effects on current & planned future land uses	• Current land use • Planned future land use • Type(s) and proximity of off-site recreational resources within 500 m of landfill footprint potentially affected • Type(s) and proximity of off-site sensitive land uses (i.e., dwellings, churches, cemeteries, parks) within 500 m of landfill footprint potentially affected	• Haldimand County Official Plan • Aerial photographic mapping and field reconnaissance • Published data on public recreational facilities/ activities • Haldimand County Zoning • Provincial Policy • Statement, 2014
	Agriculture/ Soils & Mining	Effects on soils & existing agricultural & mining operations	• Predicted impacts on surrounding agricultural operations; • Type(s) and proximity of agricultural operations (i.e., organic, cash crop, livestock) • Type(s) and proximity of mining operations • Soil classification	• Provincial Policy Statement, 2005 • Haldimand County Official Plan • Aerial photographic mapping and field reconnaissance • Haldimand County Zoning • Canadian Lands Inventory (CLI) mapping
	Site Design & Operation	Site design & operational characteristics	• Complexity of site infrastructure • Operational flexibility	• Conceptual Design Report

	Environmental Component	Evaluation Criteria	Indicators	Data Sources
SOCIO-ECONOMIC	**Economic**	Effects on/benefits to local community	• Employment at site (number and duration) • Opportunities to provide products or services	• Census Data for Haldimand County • Vertical expansion alternatives
	Social	Visual impact of facility	• Predicted changes in perceptions of landscapes and views	• Vertical expansion alternatives, including 3D visual renderings • Site grading plans • Aerial mapping and field reconnaissance
		Effects on Local Residents	• Number of residences	• Aerial mapping and field reconnaissance • Census information
	Aboriginal Communities	Potential effects on Aboriginal communities	• Potential effects on use of lands for traditional purposes	• Discussions with local Aboriginal communities

5.2.2 Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the alternatives was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment.
- Develop and apply avoidance/mitigation/compensation/enhancement measures.
- Determine net effects on the environment.

Each of these activities is documented in a separate table for each alternative.

Identify the Potential Effects

Potential effects on the environment resulting from the proposed vertical expansions are based on the existing conditions information contained in the individual discipline assessment reports provided in **Appendix E**. The evaluation criteria were applied to each alternative to determine the potential environmental effects. Specifically, this was accomplished by applying the indicators to each alternative. The results of applying these indicators is expressed in the context of their corresponding measures, either quantitatively or qualitatively, as appropriate, in the potential effects column of the net effects table for each alternative.

Develop and Apply the Avoidance/Mitigation/Compensation/Enhancement Measures

Once the potential effects on the environment were identified for each alternative, the appropriate avoidance/mitigation/compensation/enhancement measures were developed and documented in the net effects table for each indicator. The intent of these measures is as follows:

- **Avoidance**: The first priority is to prevent the occurrence of negative effects (adverse environmental effects) associated with implementing an alternative.
- **Mitigation**: Where adverse environmental effects cannot be avoided, it will be necessary to develop the appropriate measures to remove or alleviate to some degree the negative effects associated with implementing the alternative.
- **Compensation**: In situations where appropriate mitigation measures are not available, or significant net adverse effects will remain following the application of mitigation, compensation measures may be required to counterbalance the negative effect through replacement in kind, or provision of a substitute or reimbursement.
- **Enhancement**: Wherever possible, the opportunity should be taken to enhance the positive environmental effects associated with implementing an alternative rather than simply mitigate and/or compensate.

With these intentions in mind, the avoidance/mitigation/compensation/enhancement measures were developed based on the professional expertise of the Project Team reflecting current procedures, historical performance, and existing environmental conditions. These developed measures are documented in the avoidance/mitigation/compensation/ enhancement measures column of the net effects table for each alternative.

Determine the Net Effects

Once the appropriate avoidance/mitigation/compensation/enhancement measures were developed and applied to the potential environmental effects of each alternative, the remaining net negative or net positive effect was determined and documented by the Project Team members in the net effects column of the net effects table for each alternative. In cases where the net negative or net positive effect cannot be addressed through the application of avoidance/mitigation/compensation/enhancement measure(s), the potential net effect remains unchanged and; therefore, is still identified as the net effect.

The net effects associated with each vertical expansion alternative were identified and carried forward to Step 3.

5.2.3 Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each alternative method in Step 2 were compared to one another in order to identify a Preferred Alternative. The comparison of net effects was completed using a Reasoned Argument or Trade-off method, as provided for in the approved ToR. This method is based on the following activities, described in further detail in the subsections below and shown in the example provided in **Figure 5.9**:

- **Activity 1**: Identify the relative level of effect (*No*, *Low*, *Medium* or *High*) associated with each alternative for each indicator (see 1 in **Figure 5.9**).
- **Activity 2**: Rank each vertical expansion alternative from most preferred to least preferred based on the identified level of effect in Activity 1 for each evaluation criterion (see 2 in **Figure 5.9**).
- **Activity 3**: Rank each vertical expansion alternative from most preferred to least preferred based on the identified evaluation criteria ranking in Activity 2 for each environmental component (see 3 in **Figure 5.9**).
- **Activity 4**: Determine the overall ranking for each vertical expansion alternative from most preferred to least preferred based on the identified environmental component rankings in Activity 3 (see 4 in **Figure 5.9**).

Figure 5.9 Comparative Evaluation Methodology – Simplified Example to Show Activities 1 to 4

Environmental Component		Evaluation Criteria	Indicator	Alternative X	Alternative Y	Alternative Z
NATURAL	Atmospheric Environment	Air Quality	Predicted off-Site point of impingement concentrations (µg/m^3) of indicator compounds	HIGH NET EFFECTS	NO NET EFFECTS	LOW NET EFFECTS
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	LOW NET EFFECTS	LOW NET EFFECTS	LOW NET EFFECTS
			Criteria Ranking:	3rd Least Preferred	1st Most Preferred	2nd Less Preferred
		Odour	Criteria Ranking:	3rd Least Preferred	1st Most Preferred	2nd Less Preferred
		Noise	Criteria Ranking:	2nd Less Preferred	1st Most Preferred	3rd Least Preferred
		Environmental Component Ranking:		3rd Least Preferred	1st Most Preferred	2nd Less Preferred
	Geology & Hydrogeology	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
	Surface Water Resources	Environmental Component Ranking:		2nd Less Preferred	1st Most Preferred	3rd Least Preferred
	Terrestrial & Aquatic Environment	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
CULTURAL	Archaeology & Cultural Heritage	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
BUILT	Transportation	Environmental Component Ranking:		2nd Less Preferred	1st Most Preferred	3rd Least Preferred
	Land Use	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
	Agriculture/ Soils & Mining	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
	Site Design & Operations	Environmental Component Ranking:		2nd Less Preferred	1st Most Preferred	3rd Least Preferred
SOCIO-ECONOMIC	Social	Environmental Component Ranking:		1st Most Preferred	2nd Less Preferred	3rd Least Preferred
	Economic	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
	Aboriginal Communities	Environmental Component Ranking:		Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference	Tied for 1st No Substantial Difference
OVERALL RANKING				2nd Less Preferred	1st Most Preferred	3rd Least Preferred

1
2
3
4

5.2.3.1 Activity 1: Level of Effect Determination of the Alternatives

As mentioned, the Reasoned Argument or Trade-off method was used to highlight the relative level of effect of each alternative based on the net effects determined in Step 2. More specifically, a relative level of effect ranging from *No effect*, *Low effect*, *Medium effect* or *High effect* was determined for each alternative by each indicator. As the Reasoned Argument or Trade-off method is a qualitative evaluation (rather than a quantitative evaluation), thresholds were not established for assigning low, medium or high effects; rather, professional judgement was used in determining relative level of effect, based on established standards and regulatory limits/ legislation (e.g., MOECC air quality standards), where applicable.

5.2.3.2 Activities 2, 3 and 4: Ranking of the Alternatives

The net effects identified for each alternative in the previous step were then compared to one another in order to identify a Preferred Alternative. The comparison of net effects was completed using a Reasoned Argument or Trade-off method, as provided for in the approved ToR. Under the Reasoned Argument approach, the difference in net effects associated with the various alternatives was highlighted. Based on these differences, the advantages and disadvantages of each alternative were identified according to the evaluation of trade-offs between the various evaluation criteria and indicators. The relative significance of potential impacts was examined to provide a clear rationale for the selection of a preferred alternative. The term Trade-offs is defined as "*things of value given up in order to gain different things of value.*" Each alternative was compared against the others to distinguish relative differences in impacts to the environment, taking into account possible mitigation measures.

For example, during the comparative evaluation of the alternatives, the rankings were combined (aggregated) for each environmental indicator and criteria into a single ranking (*1st, 2nd, 3rd or Tied*) for each environmental component. These results were aggregated further into a single preference rating for each vertical expansion alternative in order to rank the alternatives (incorporating trade-offs and professional judgement) and identify a Preferred Alternative.

Each individual discipline first assigned rankings for each individual criteria based on the level of effect determined for each indicator under that criteria. After each of the criteria were ranked, each environmental component (i.e., Atmospheric Environment, Land Use, Geology and Hydrogeology, etc.) was then ranked based on the rankings from each criteria. Following this, the Project Team determined an overall ranking for each alternative based on the individual environmental component rankings (i.e., an overall ranking of "1st" or most preferred was applied for an alternative having a greater number of higher placed – "1st " and "2nd" place – individual environmental component rankings).

The comparative evaluation described in the sections below has been prepared as per the steps outlined above so that a clear, traceable, and replicable process is provided.

5.3 Net Effects Assessment

The following subsections present the net effects analysis for each of the vertical expansion alternatives following the methodology outlined above.

5.3.1 Natural Environment Net Effects Assessment

5.3.1.1 Atmospheric Environment Net Effects

5.3.1.1.1 Air Quality & Odour Net Effects

Air Quality & Odour General Assumptions

The Air Quality and Odour net effects assessment was carried out using both worst-case equipment and elevations. The worst-case equipment locations were selected based on proximity and elevated line-of-sight to the property boundary. The worst-case elevation was selected based on Landfill cell development and the corresponding topography detail.

The development and consideration of alternative Site cell configurations utilized historical data developed at the Site during the past 40+ years, as well as available secondary source information detailed in **Section 4.0**. It should be noted that particulate matter is the only compound of concern in terms of Air Quality and; therefore, only particulate emission results were compared for the Air Quality criteria.

Air Quality & Odour Potential Environmental Effects

Fourteen off-site residential dwellings will be potentially impacted from the existing Landfill activities. However, air quality and odour impacts from the Site are evaluated at the property boundary and therefore, all residential dwellings are expected to be below the applicable air quality and odour emission limits.

From a potential air quality impact exposure perspective, Alternative Methods 1, 2 and 3 are nearly identical, because the landfill operations and number of vehicles operating at the site are identical. The only difference between the alternatives is the landfill elevation and the difference in elevation is not significant enough to make a material change in the air quality effects.

As noted in **Section 4.3.1.1**, a value of 1 OU is sometimes used by the MOECC as a limit for odour impacts at sensitive receptors such as residences. Based on the existing conditions odour studies, it has been shown that odour levels at the nearest sensitive receptors will not exceed 1 OU.

Odour was not modelled for the alternatives within this EA as odour impacts from the vertical expansion of the Site are expected to remain the same or lower than the existing conditions. This is due to the fact that the Site will still be receiving a maximum of 151, 000 tonnes per year and will continue to accept the same type of waste resulting in an unchanged odour profile. Additionally, the area of the active face will remain relatively unchanged and will occur further from the property boundary to allow for proper landfilling slopes to occur. This will reduce and/or maintain any odours present along the property boundary of the Site. Furthermore, operations will occur within the Site's existing waste footprint and Site boundaries.

GHD completed a theoretical landfill gas generation rate for the site. Based on the existing and proposed waste to be disposed at the site, it was determined that the maximum amount of landfill gas that will be generated is less than 200 cubic feet per minute. This would be distributed over an area of approximately 14.3 hectares or 143,000 square metres, resulting in a landfill gas exit velocity of only 0.000004 metre per second. This amount of landfill gas generation is anticipated to be insignificant from an overall odour site profile. As such, landfill gas production is not expected to result in any off-site odour impacts.

Additionally, as noted in **Section 4.3.1.1**, GHD conducted numerous odour analyses in 2014 and 2016 and concluded that there were high odour levels near the leachate tank and the working face, but did not identify any odour at the neighbouring residences. The limited odour detected around the Site boundary was attributed to the historical leachate management system. With the leachate management system currently being implemented by Brooks Road Landfill it is expected that any off-site odour impacts will be reduced. Odours at the concentration currently observed at the site typically do not result in complaints at off-Site sensitive receptor locations. This has been investigated through numerous odour monitoring programs that did not identify any on-site odours being observed at off-site locations. Odour monitoring results are provided in **Appendix E-1**.

Lastly, the Site currently implements several operational measures in order to reduce and/or mitigate odour impacts from the Site and they will continue to implement these throughout the vertical expansion. These include:

- Continuing with the daily odour monitoring program carried out by the Site Operator.

- If odours are evident on the property boundary, increase the amount of daily cover applied on the waste.
- Minimize the active working face. Apply interim cover at a minimum thickness of 300 mm on areas of the landfill where landfilling has ceased for 6 months or more.
- Limit exposed areas of the leachate collection system.
- When not in use, ensure blind flanges are placed on leachate collection system cleanouts and sump risers.
- Continue with the use of odour control granules for odour mitigation. Assess areas of placement and their effect on odour mitigation.

Particulate emissions related to vehicles operating at the landfill are the primary emissions of concern at the landfill. Particulate may be defined in various particle size categories, including total suspended particulate (TSP), particulate less than 10 microns (PM10) and particulate less than 2.5 microns (PM2.5). All fractions of particulate were assessed for the potential landfill emissions.

The assessment for particulate matter focused on the re-suspension of particulate matter from truck traffic. The air quality assessment used worst-case assumptions to conduct the emissions estimates. The air quality assessment assumed all daily truck traffic to and from the Site to be garbage trucks weighing 40 tonnes when entering the site and 20 tonnes when exiting the site, resulting in an average of 25 trucks per day (carrying 500 tonnes of waste) and a maximum of 50 trucks per day (carrying 1,000 tonnes of waste). The emissions for vehicle exhaust and brake and tire wear for this number of vehicles is insignificant compared to the particulate matter emissions from re-suspension.

The total suspended particulate emission factor for trucks traveling on an unpaved road is 2,620 grams per vehicle kilometer traveled (g/VKT). For paved road the emission factor is 708 g/VKT. For heavy duty vehicles (HDV) the emission factor for PM10 from vehicle exhaust and brake and tire wear the emission factor is 0.264 g/VKT.

The potential emissions from vehicle exhaust and brake and tire wear for HDV is 0.01% of the emission factor for HDV travelling on unpaved roads. The potential emissions from vehicle exhaust and brake and tire wear for HDV is 0.04% of the emission factor for HDV travelling on paved roads. As the potential emissions from the vehicle exhaust and brake and tire wear for the HDV on the proposed trucks routes is less than 0.1% of the total emissions, they have been classified as insignificant and no further assessment has been completed on these potential emission. The potential emissions from the vehicle exhaust and brake and tire wear were calculated using the Mobile6.2 Mobile Emission Factor Model. The potential emissions for PM2.5 are even less than the PM10 example provided above and therefore is also not included

in this assessment. Therefore, the potential emissions from vehicle exhaust and brake and tire wear can be concluded to be insignificant.

Other tailpipe/combustion emissions such as nitrogen oxides (NOx) and carbon monoxide (CO) can also be concluded to be insignificant based on the small volume of daily traffic at the landfill, and the significant distances to sensitive receptors. The potential concentrations of NOx and CO that a person might be expected to be exposed to near a municipal road would far exceed the concentrations of these compounds at the landfill boundary. Therefore, it may be concluded that NOx and CO emissions from the vehicles at the landfill are insignificant contributors to the background concentrations of these compounds.

The air contaminant of concern for this Site is particulate matter. Other air contaminants are expected to be insignificant. As previously discussed, potential tailpipe and brake and tire wear emissions from vehicles operating at the landfill are insignificant. Also, the estimated landfill gas production of only 200 cfm confirms that any potential off-site impacts of compounds in the gas, such as methane, would be insignificant.

Particulate is primarily produced by vehicle traffic on the landfill roads. The particulate matter that is of concern is based on the re-suspension of particulate matter from traffic on the roads. The tailpipe and brake and tire wear has been determined to be insignificant sources of particulate matter. The Ontario ambient air quality criterion for TSP is 120 µg/m^3 on a 24-hour basis. There are other particulate provincial and federal criteria for particulate less than 10 microns (PM-10) and particulate less than 2.5 microns (PM-2.5). These particulate emissions would also occur from vehicle traffic on the landfill roads.

It is GHD's experience that if one can show compliance with the TSP standard, a site with road traffic being the major source, then the PM 10 and PM2.5 concentrations will also be below criteria. However, for completeness, GHD has modeled the TSP, PM10 and PM2.5 emissions in the assessment of the alternatives.

The TSP, PM10 and PM2.5 emissions from the on-site roads were estimated based on the truck traffic estimates noted above and emissions factors from the United States Environmental Protection Agency (USEPA). Particulate off-site concentrations were estimated using the AERMOD air dispersion model which is an approved dispersion model under Ontario Regulation 419/05. The AERMOD model incorporates 5 years of meteorological data to determine the worst case air concentration. Therefore, the modeling results can be considered to be conservative. Four potential road layouts for different phases of the landfill were modeled.

GHD modelled four internal potential on-site haul road routes for each Alternative. Routes were modelled with the working face located in the four corners of the landfill (northeast, northwest, southeast, and southwest). These locations represent the worst case positions of the working face for potential receptors in the various directions, and results in the longest possible haul routes.

Based on preliminary models it was determined that the Site should pave the on-site roadway from the site gate to the entrance to the landfill. This would significantly reduce particulate emissions and potential impacts to the south and west of the Site. Therefore, the evaluation of the alternatives assumed that this section of on-site road would be paved.

The particulate modelling considered the estimated average and maximum number of trucks that would be operating at the landfill under the requested waste approval volume based on the assumptions noted above. An average of 25 trucks per day (carrying a total of 500 tonnes of waste) would equate to the annual waste volume requested, while a peak of approximately 50 trucks per day (carrying a total of 1,000 tonnes of waste) could operate at the landfill on a busy day. Therefore, GHD conducted particulate emission estimates and dispersion modelling assessments for both 25 trucks per day and 50 trucks per day for the three landfill expansion options.

Alternative Method 1

TSP, PM10 and PM2.5 from the Site was evaluated at the property boundary and all residential dwellings. The predicted worst case particulate impact at the property boundary for Alternative Method 1 is as follows:

- TSP – 25 trucks per day – 61.49 µg/m^3
- PM10 – 25 trucks per day – 32.28 µg/m^3
- PM2.5 – 25 trucks per day – 4.64 µg/m^3
- TSP – 50 trucks per day – 122.4 µg/m^3
- PM10 – 50 trucks per day – 64.18 µg/m^3
- PM2.5 – 50 trucks per day – 8.8 µg/m^3

The predicted maximum worst case particulate impact at the sensitive receptors for Alternative Method 1 is as follows:

- TSP – 25 trucks per day – 2.91 µg/m^3
- PM10 – 25 trucks per day – 2.31 µg/m^3
- PM2.5 – 25 trucks per day – 0.38 µg/m^3
- TSP – 50 trucks per day – 5.78 µg/m^3

- PM10 – 50 trucks per day – 4.56 µg/m^3
- PM2.5 – 50 trucks per day – 0.61 µg/m^3

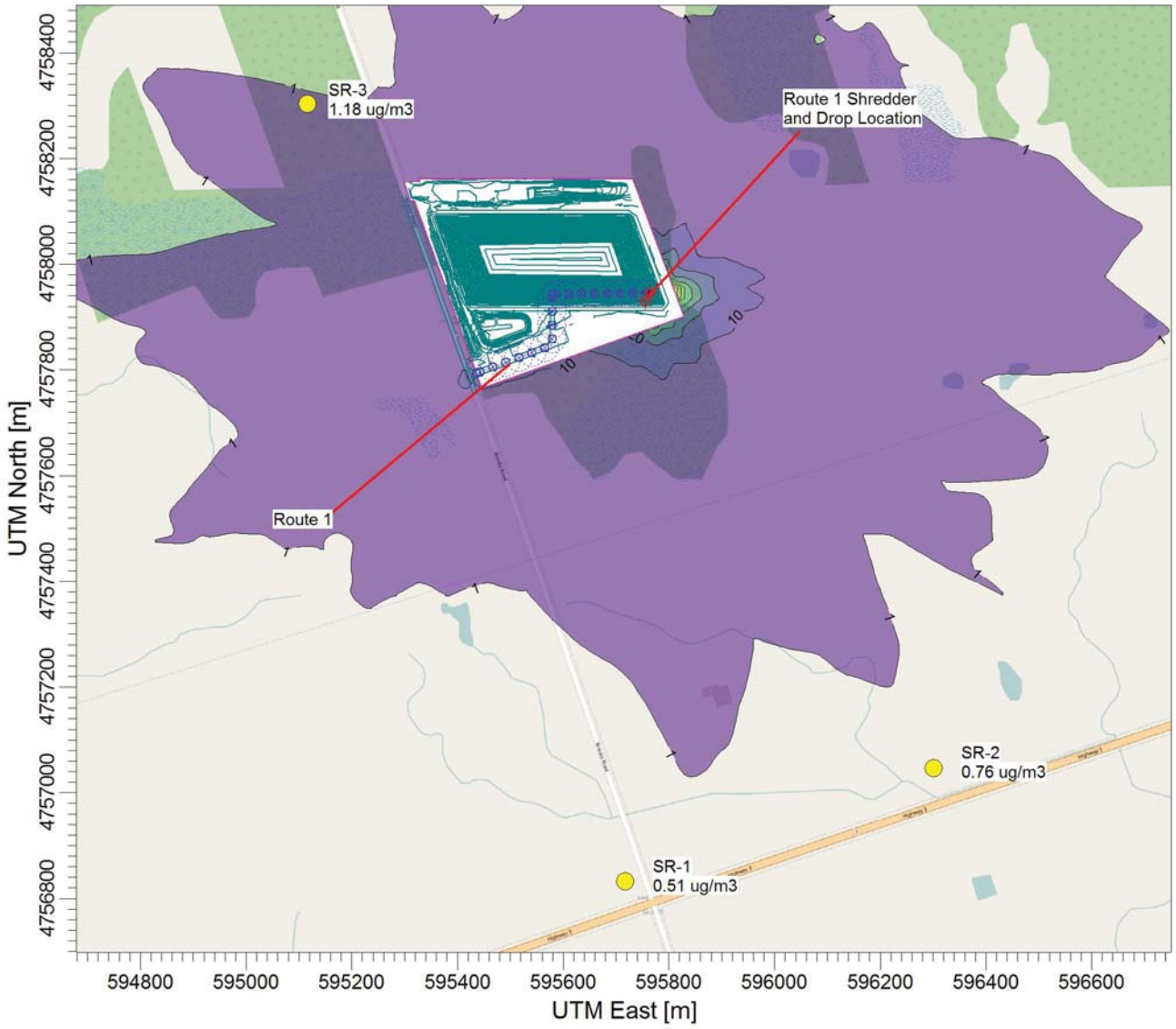
The MOECC ambient air quality criteria (AAQC) for TSP is 120 µg/m^3, 50 µg/m^3 for PM10, and 30 µg/m^3 for PM2.5. The 25 trucks per day scenario reflects anticipated average operations from the site (i.e., receipt of 500 tonnes of waste per day). During peak times there may be up to 50 trucks per day (carrying a total of 1,000 tonnes of waste).

The modelled concentration at the sensitive receptors during the normal and peak operations are all well below the MOECC AAQC for all particulate matter fractions. The modelled concentration at the property boundary for average operations at 25 trucks per day is well below the MOECC AAQC for all particulate matter fractions.

The modelled concentration at the property boundary for peak operations at 50 trucks per day is right at the AAQC for TSP and PM10. PM2.5 remains well below the MOECC AAQC. The air dispersion modelling for the peak scenario is a worst case scenario based on the worst case day during a five-year period and the truck routes, dumping, and shredding occurring at the worst case location on-Site.

The TSP worst case air quality contours for Alternative Method 1 are presented on **Figures 5.10** through **5.17**. These figures show the results of the model runs for the four possible truck routes for the disposal of waste in the four corners of the landfill, representing the worst case locations with respect to proximity to residential receptors and the travel length of roads for Alternative Method 1. The air quality contours for PM10 and PM2.5 are similar to the TSP air quality contours and have not been included.

Figure 5.10 Vertical Expansion Alternative 1 Air Quality Contours – 25 Trucks per Day – Truck Route 1 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT1 ug/m^3

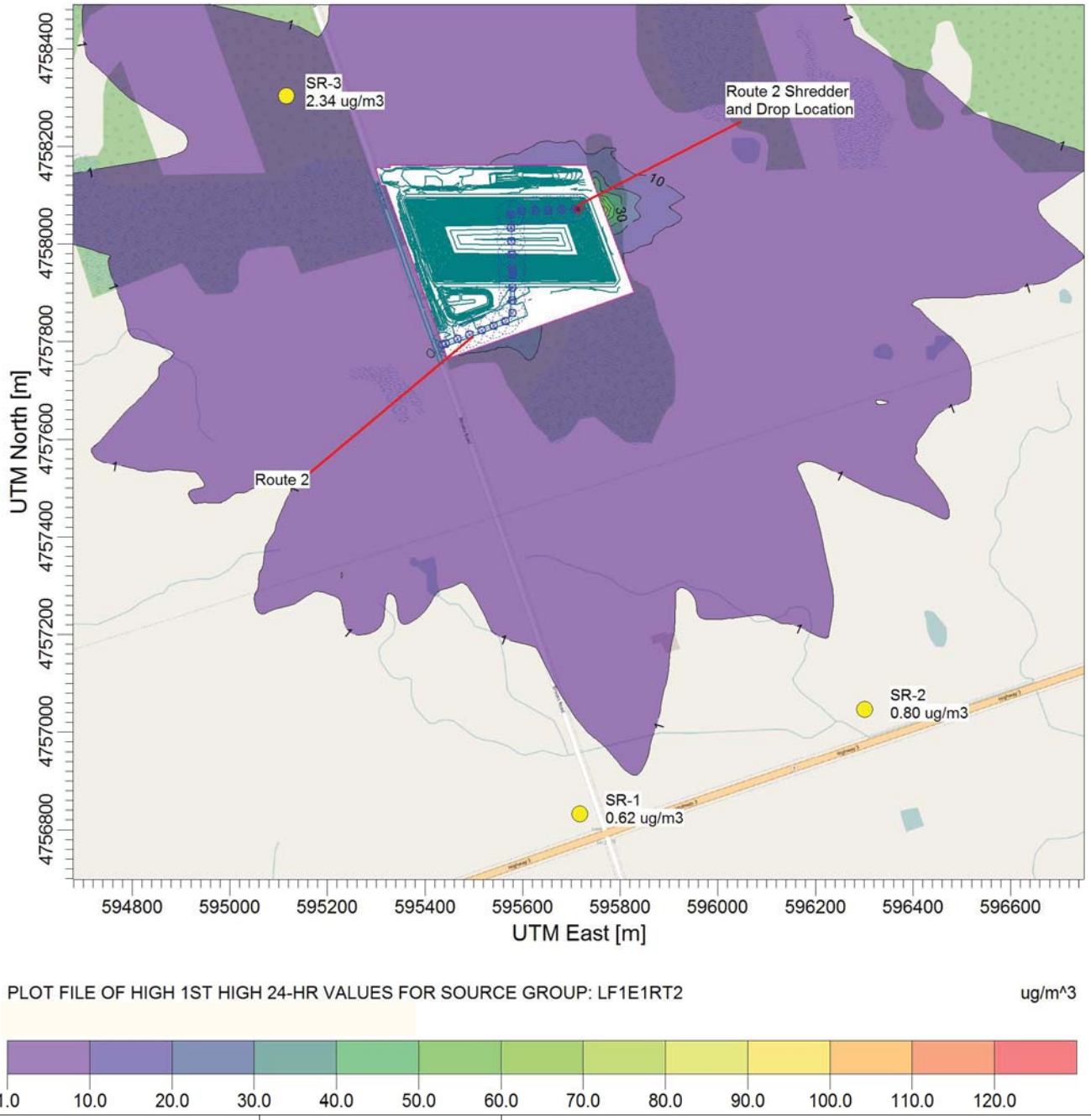
1.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0

COMMENTS:	SOURCES: **6**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 – 0.4 km)	
	MAX: **61.5 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

AERMOD View - Lakes Environmental Software

E:\18235_BrooksRoadLF\2016_12_December_figures\route1.isc

Figure 5.11 Vertical Expansion Alternative 1 Air Quality Contours – 25 Trucks per Day – Truck Route 2 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT2 ug/m^3

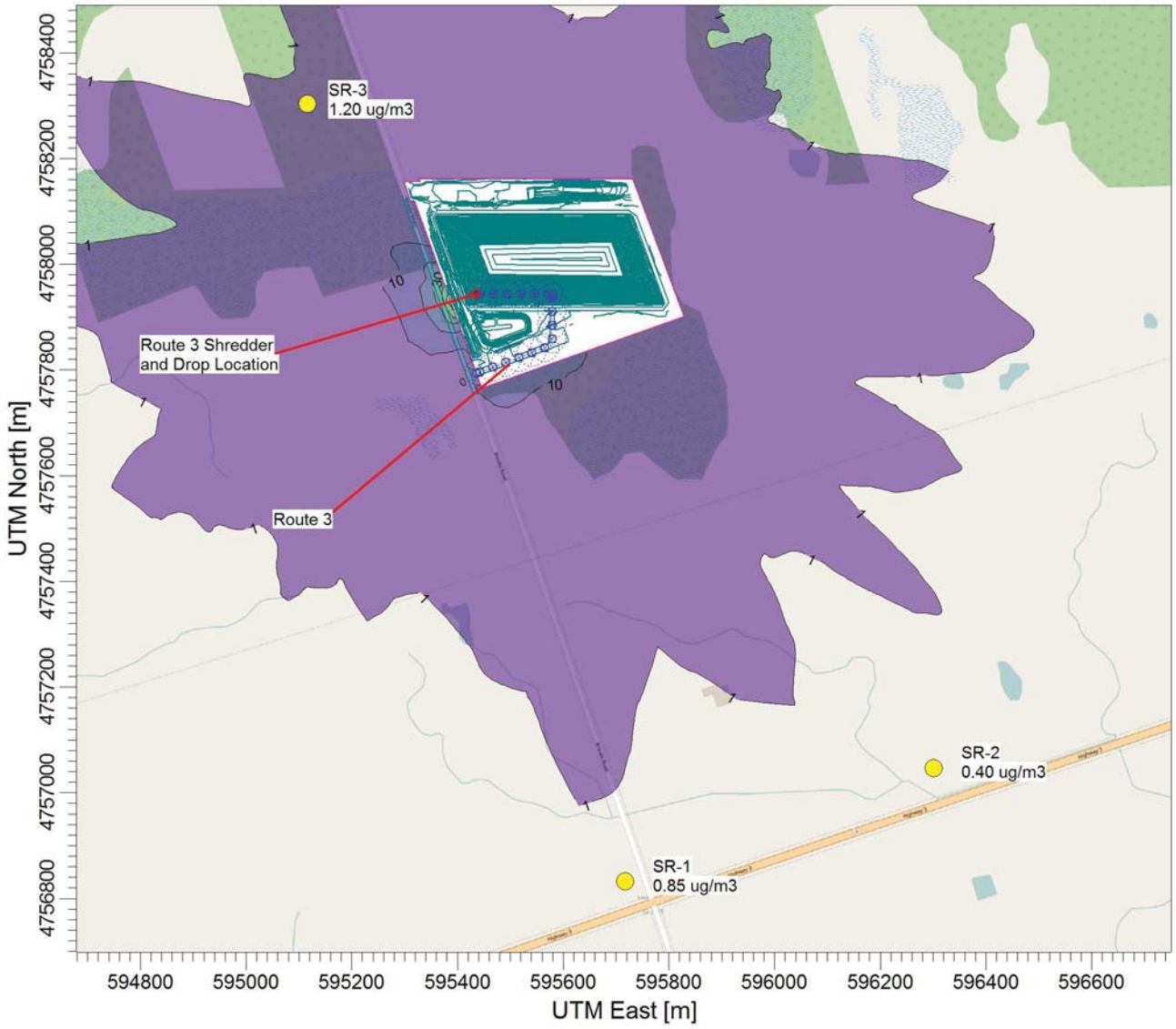
1.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0

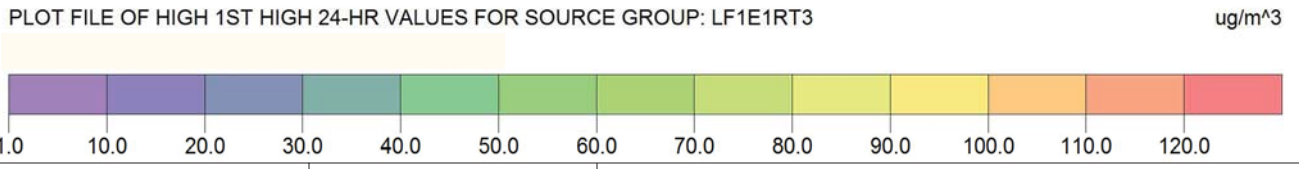
COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 — 0.4 km)	
	MAX: **54.5 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

AERMOD View - Lakes Environmental Software

E:\18235_BrooksRoadLF\2016_12_December_figures\route2.isc

Figure 5.12 Vertical Expansion Alternative 1 Air Quality Contours – 25 Trucks per Day – Truck Route 3 – 24 Hour Particulate Matter



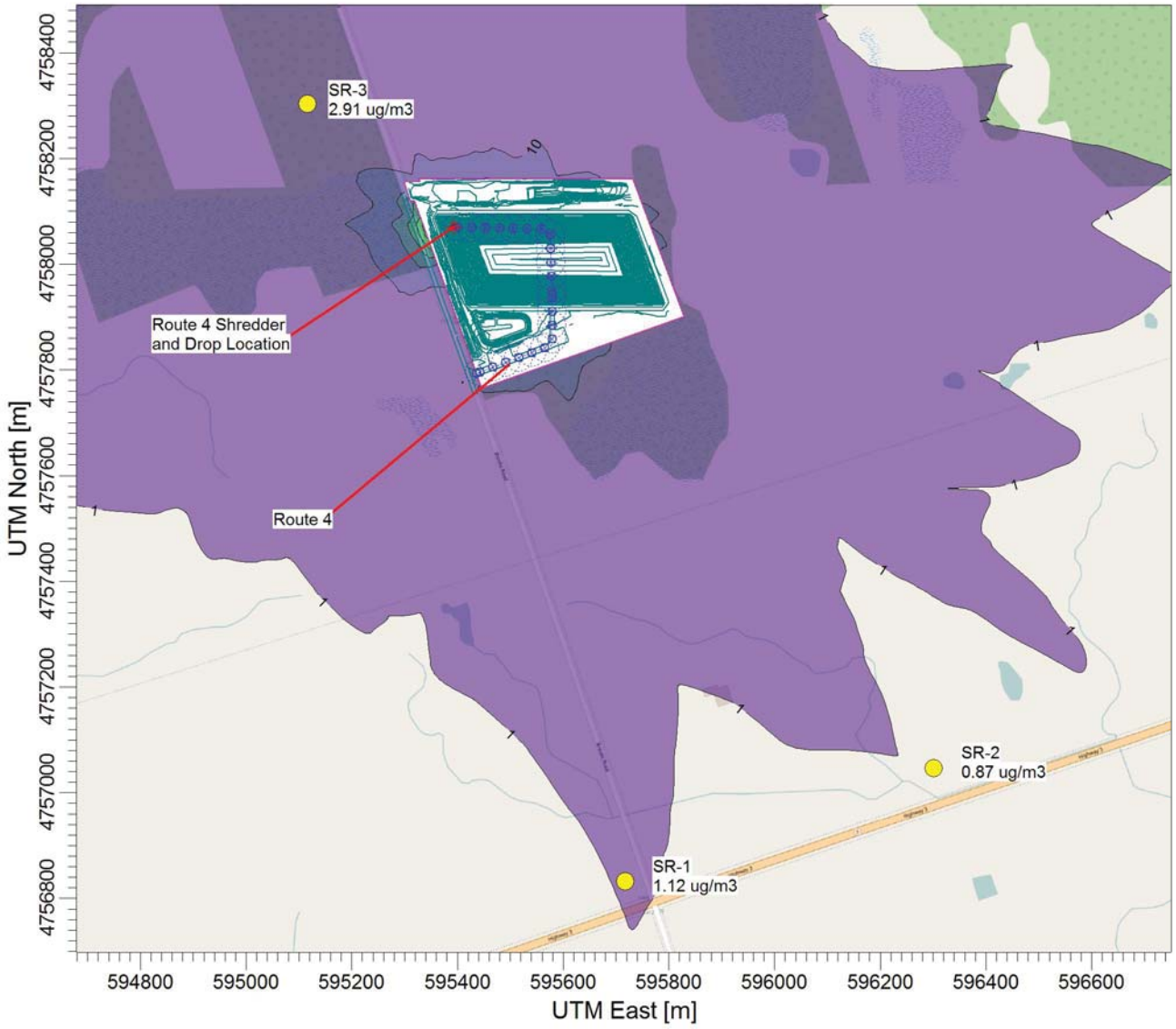


COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 — 0.4 km)	
	MAX: **51.2 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

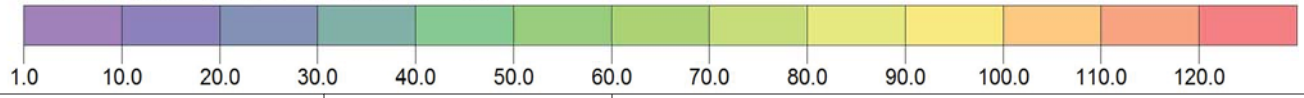
AERMOD View - Lakes Environmental Software

E:\18235_BrooksRoadLF\2016_12_December_figures\route3.isc

Figure 5.13 Vertical Expansion Alternative 1 Air Quality Contours – 25 Trucks per Day – Truck Route 4 – 24 Hour Particulate Matter



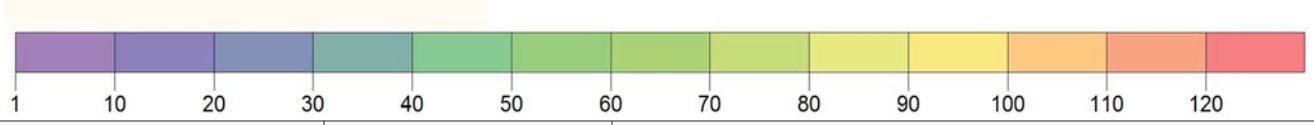
PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT4 ug/m^3



COMMENTS:	SOURCES:	COMPANY NAME:	
	5	Brooks Road Landfill, Haldimand County, Ontario	
	RECEPTORS:	MODELER:	
	3392	GHD	
	OUTPUT TYPE:	SCALE: 1:13,034	
	Concentration	0 0.4 km	
	MAX:	DATE:	PROJECT NO.:
	47.5 ug/m^3	12/5/2016	018235

Figure 5.14 Vertical Expansion Alternative 1 Air Quality Contours – 50 Trucks per Day – Truck Route 1 – 24 Hour Particulate Matter

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT1 ug/m^3



COMMENTS:	SOURCES: **6**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 — 0 — 0.5 km	
	MAX: **122.4 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

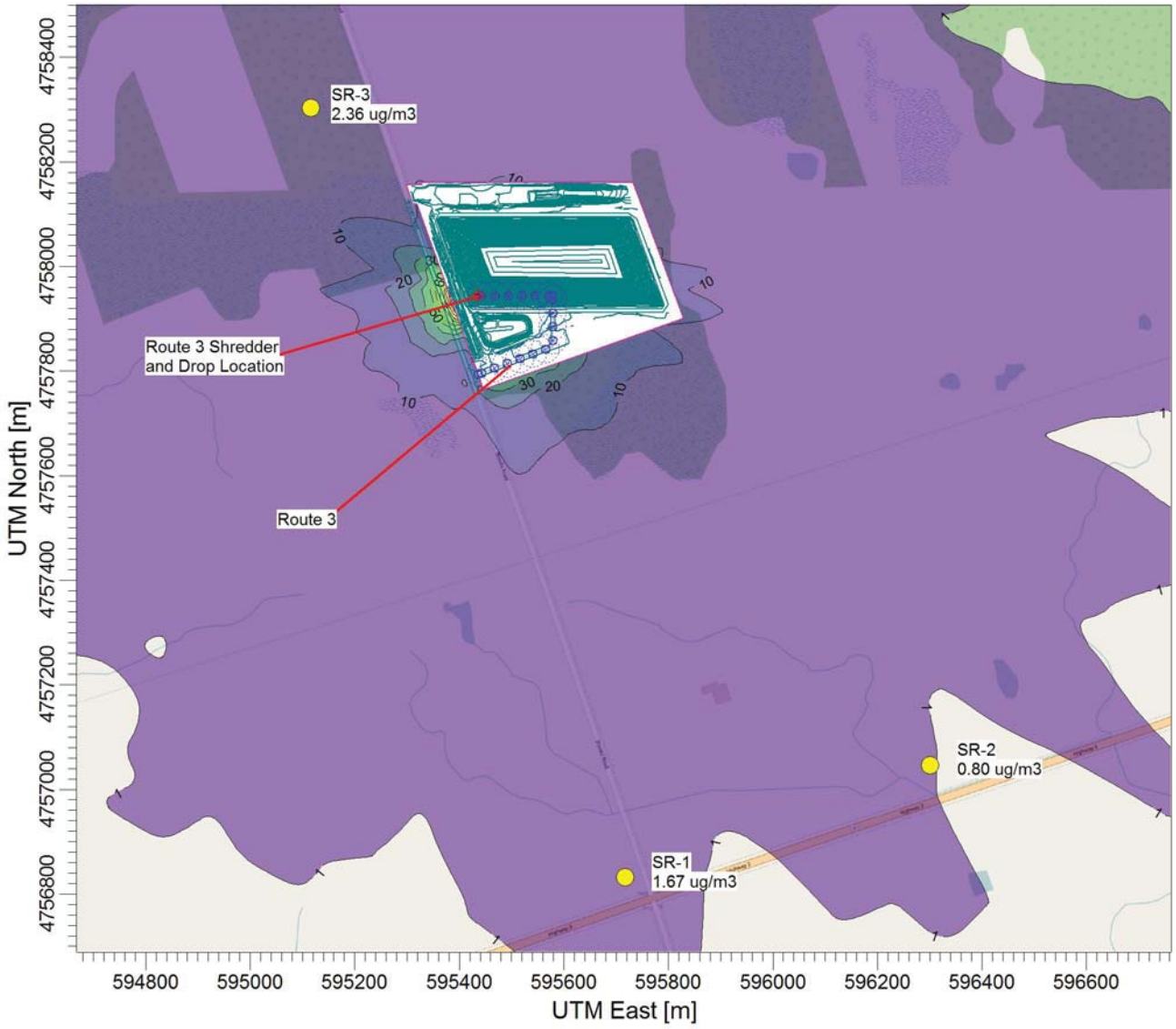
Figure 5.15 Vertical Expansion Alternative 1 Air Quality Contours – 50 Trucks per Day – Truck Route 2 – 24 Hour Particulate Matter

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT2 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 — 0.5 km)	
	MAX: **108.2 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

Figure 5.16 Vertical Expansion Alternative 1 Air Quality Contours – 50 Trucks per Day – Truck Route 3 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT3 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **102.3 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

AERMOD View - Lakes Environmental Software

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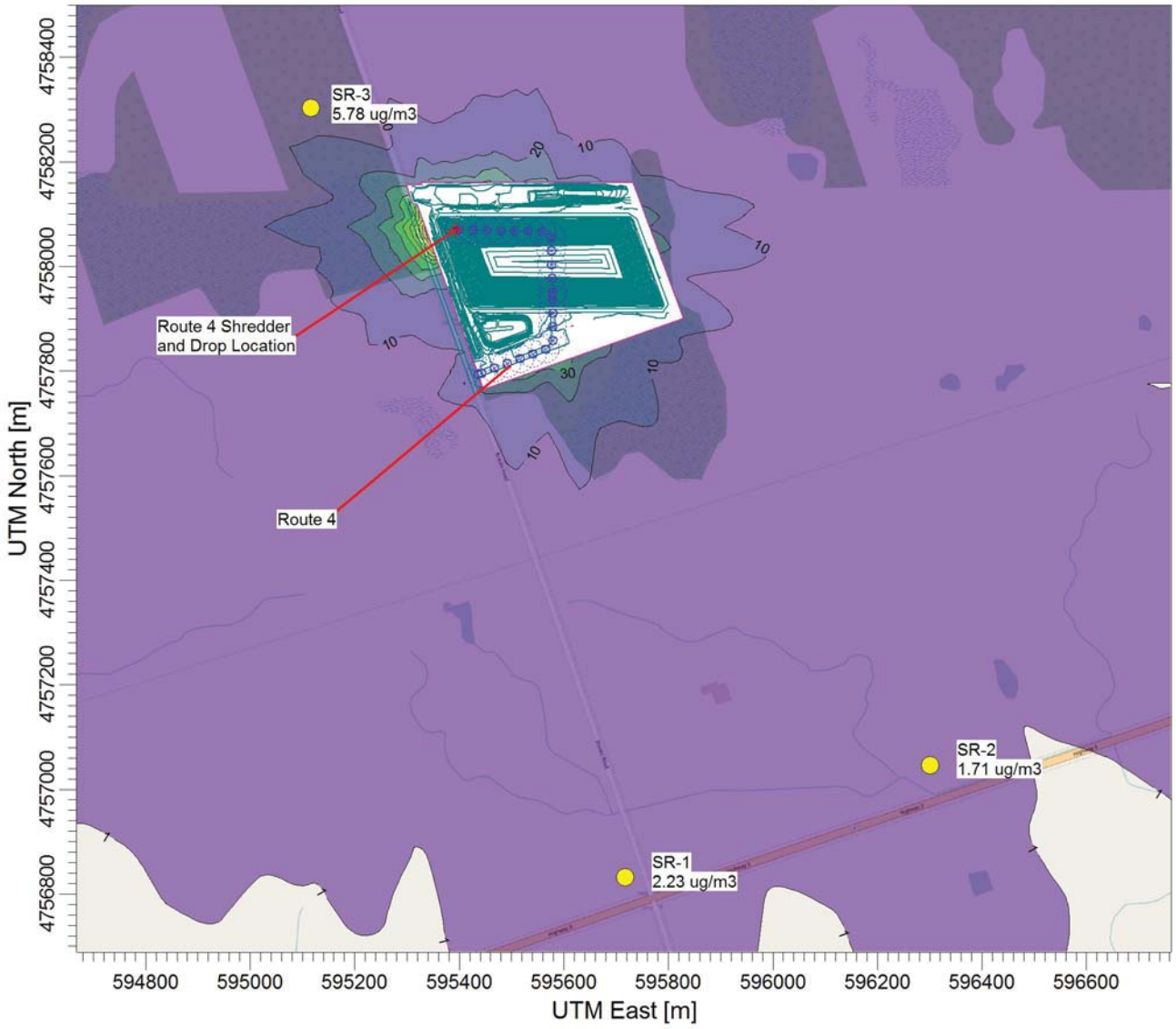
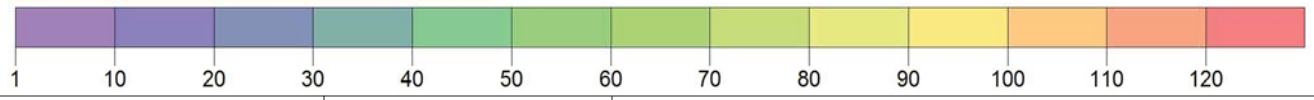
Figure 5.17 Vertical Expansion Alternative 1 Air Quality Contours – 50 Trucks per Day – Truck Route 4 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: LF1E1RT4 ug/m^3



COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **95.1 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

Alternative Method 2

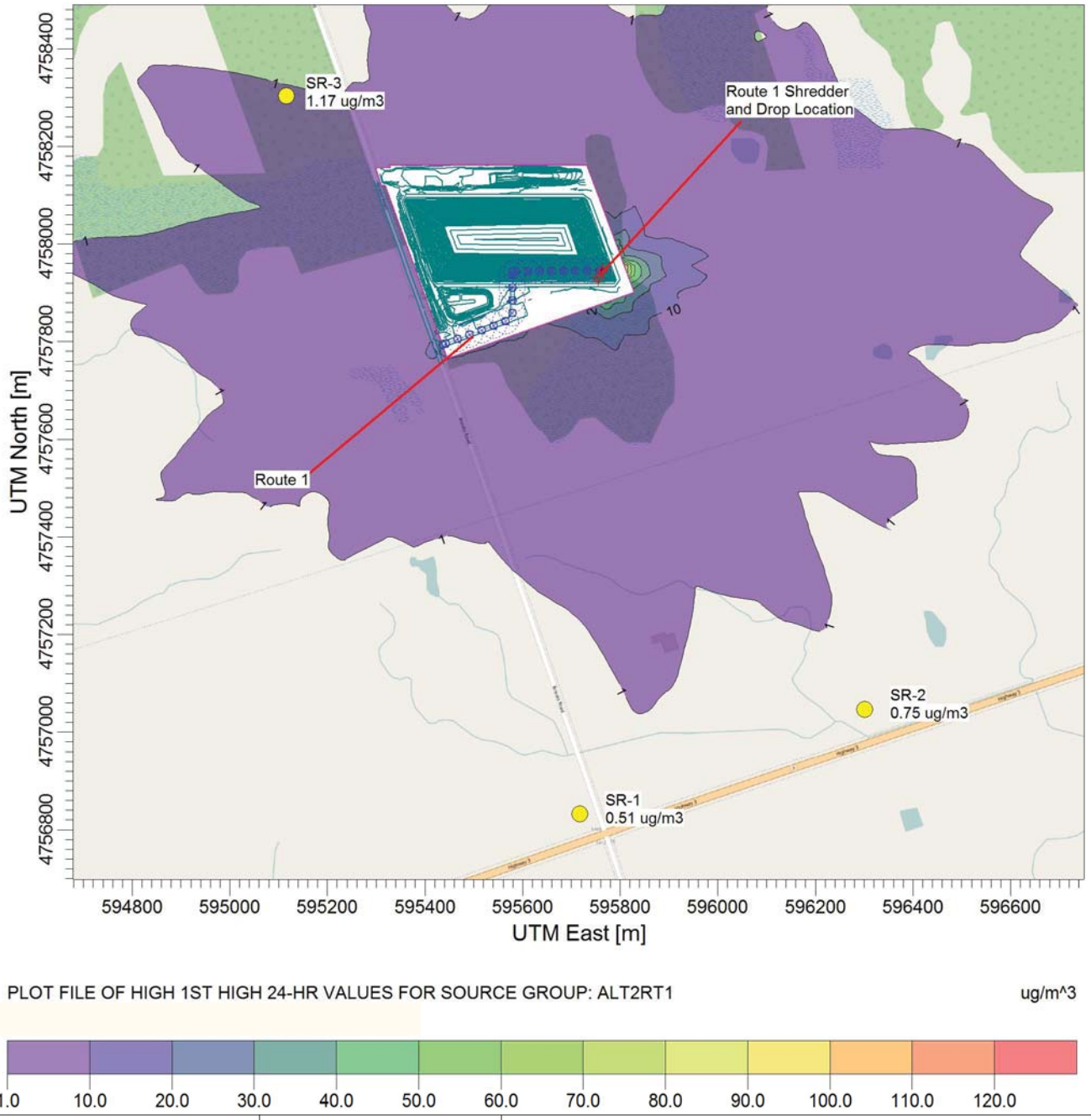
TSP, PM10 and PM2.5 from the Site was evaluated at the property boundary for Alternative Method 2. It was determined during the air dispersion modelling that Alternative Method 1 is the worst case scenario at the sensitive receptors. Therefore, no additional sensitive receptor modelling was completed for Alternative Method 2 or Alternative Method 3 as the particulate matter concentration at the sensitive receptors would be less than Alternative Method 1. The predicted worst case particulate impact at the property boundary for Alternative Method 2 is as follows:

- TSP – 25 trucks per day – 61.01 µg/m^3
- PM10 – 25 trucks per day – 32.06 µg/m^3
- PM2.5 – 25 trucks per day – 4.79 µg/m^3
- TSP – 50 trucks per day – 121.59 µg/m^3
- PM10 – 50 trucks per day – 63.74 µg/m^3
- PM2.5 – 50 trucks per day – 9.13 µg/m^3

The modelled concentration at the property boundary for average operations at 25 trucks per day is well below the MOECC AAQC for all particulate matter fractions.

The modelled concentration at the property boundary for peak operations at 50 trucks per day is right at the AAQC for TSP and PM10. PM2.5 remains well below the MOECC AAQC. The air dispersion modelling for the peak scenario is a worst case scenario based on the worst case day during a five-year period and the truck routes, dumping, and shredding occurring at the worst case location on-Site. The TSP worst case air quality contours for Alternative Method 2 are presented on **Figures 5.18** through **5.25**. These figures show the results of the model runs for the four possible truck routes for the disposal of waste in the four corners of the landfill, representing the worst case locations with respect to proximity to residential receptors and the travel length of roads for Alternative Method 2. The air quality contours for PM10 and PM2.5 are similar to the TSP air quality contours and have not been included.

Figure 5.18 Vertical Expansion Alternative 2 Air Quality Contours – 25 Trucks per Day – Truck Route 1 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT1 ug/m^3

1.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0

COMMENTS:	SOURCES: **6**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 — 0.4 km)	
	MAX: **61.0 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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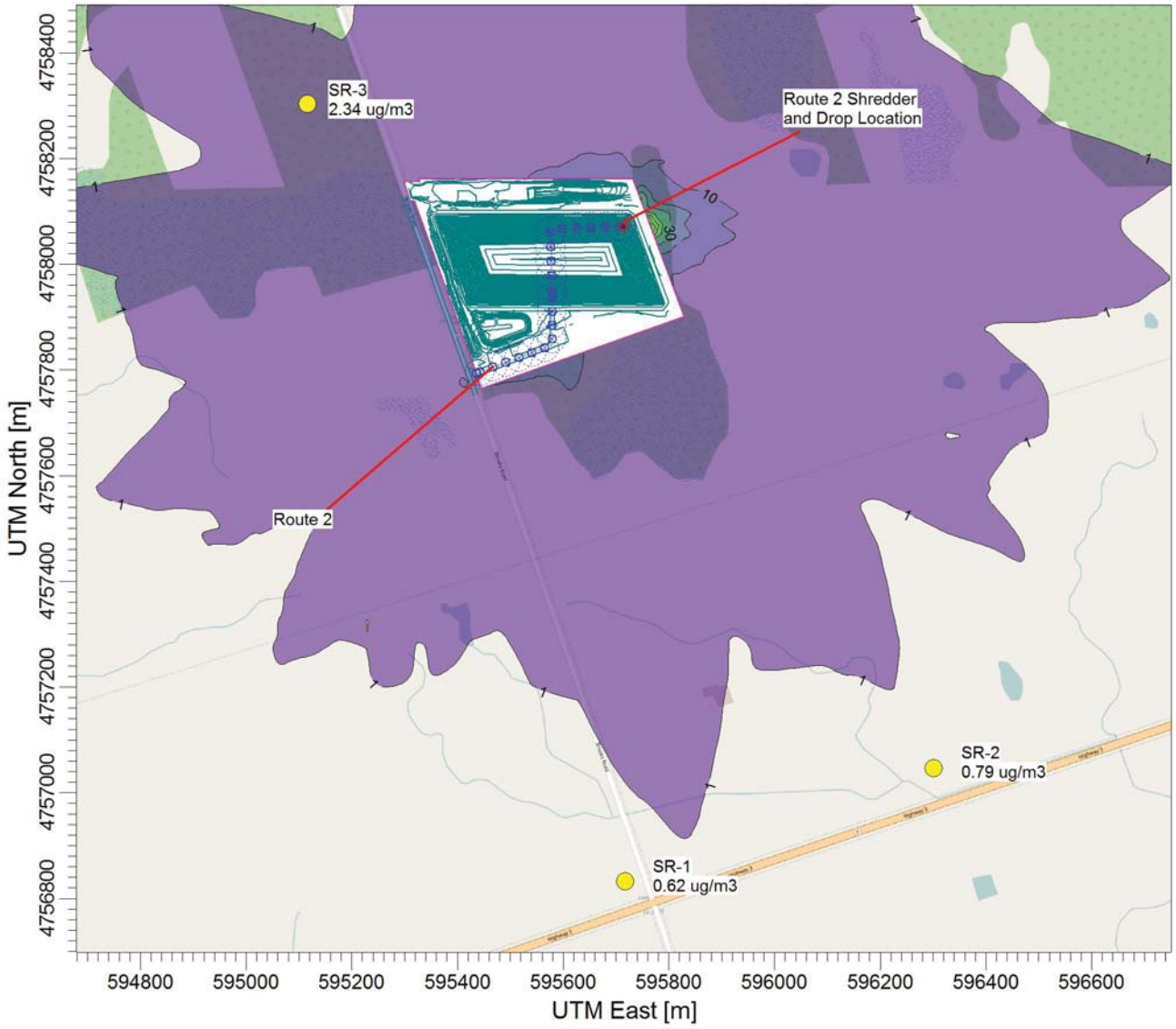
E:\18235_BrooksRoadLF\2016_12_December_figures\route4.isc

Figure 5.19 Vertical Expansion Alternative 2 Air Quality Contours – 25 Trucks per Day – Truck Route 2 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT2 ug/m^3

1.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 — 0.4 km)	
	MAX: **54.4 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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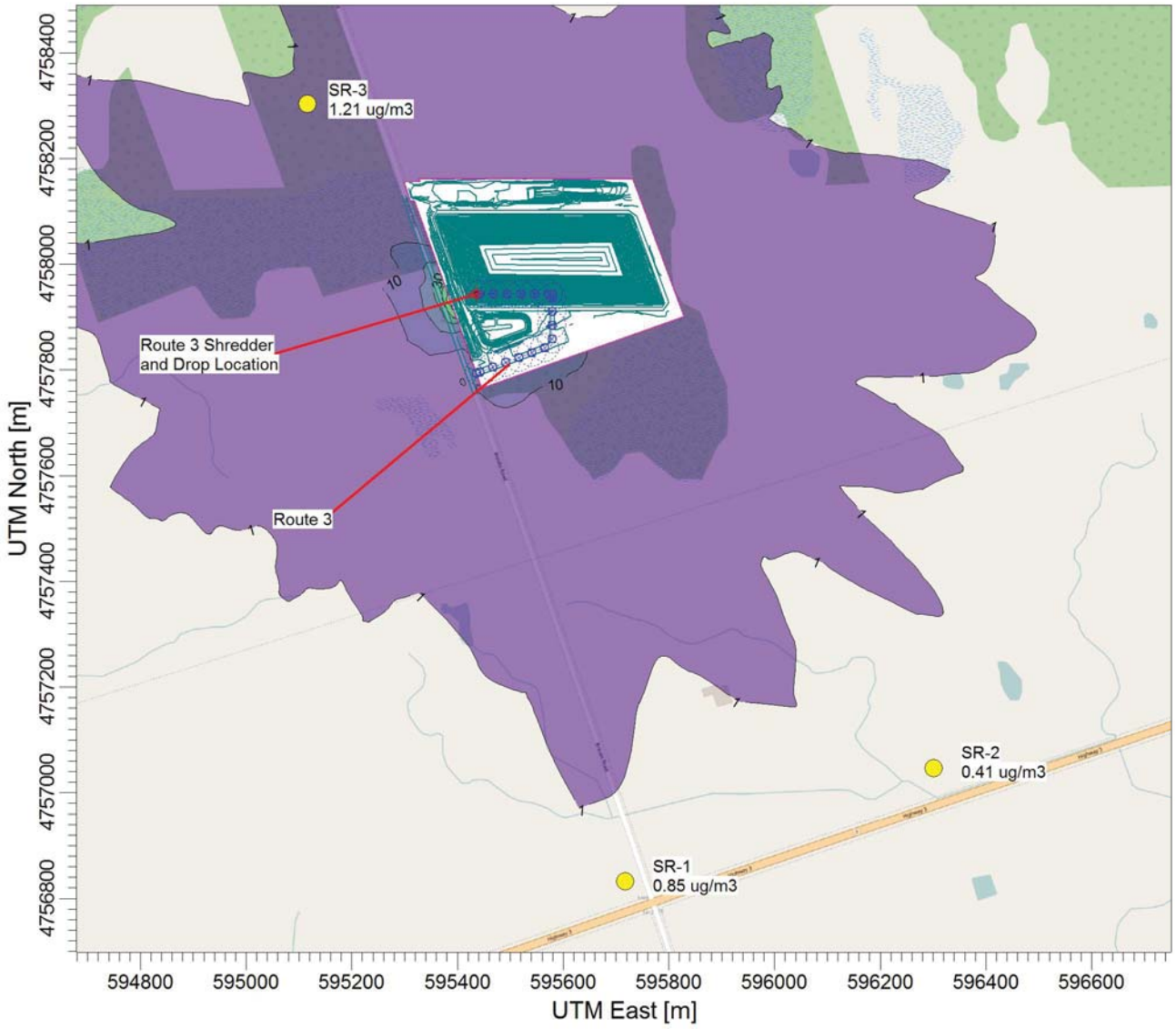
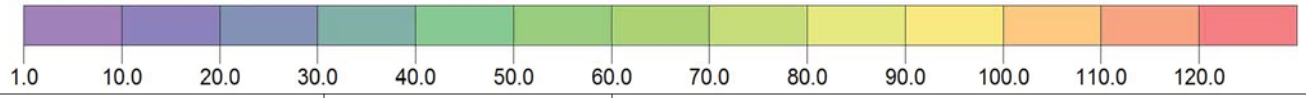
E:\18235_BrooksRoadLF\2016_12_December_figures\route2.isc

Figure 5.20 Vertical Expansion Alternative 2 Air Quality Contours – 25 Trucks per Day – Truck Route 3 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT3 ug/m^3



COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 — 0 — 0.4 km	
	MAX: **51.4 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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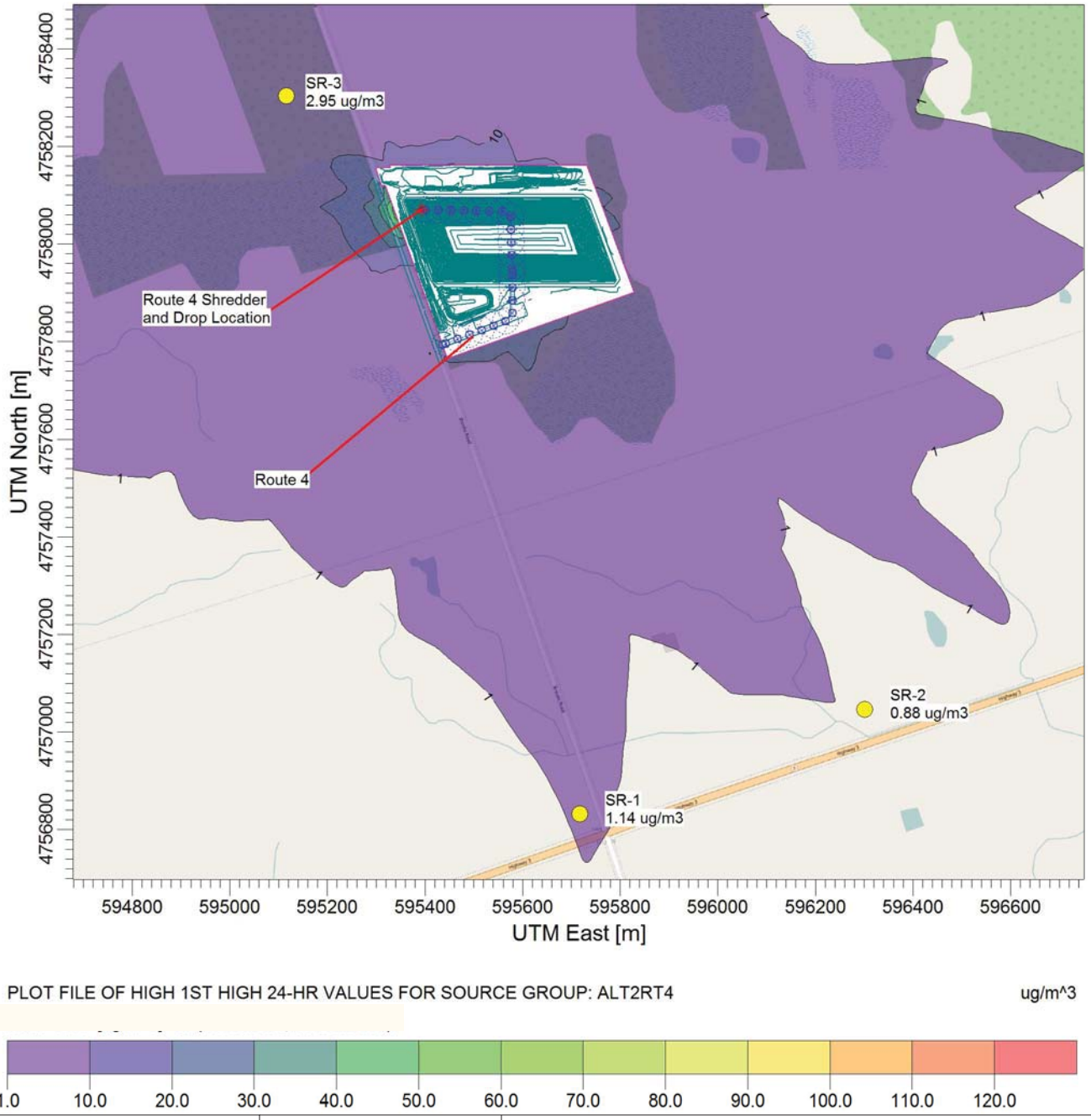
E:\18235_BrooksRoadLF\2016_12_December_figures\route3.isc

Figure 5.21 Vertical Expansion Alternative 2 Air Quality Contours – 25 Trucks per Day – Truck Route 4 – 24 Hour Particulate Matter



COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 — 0.4 km)	
	MAX: **47.9 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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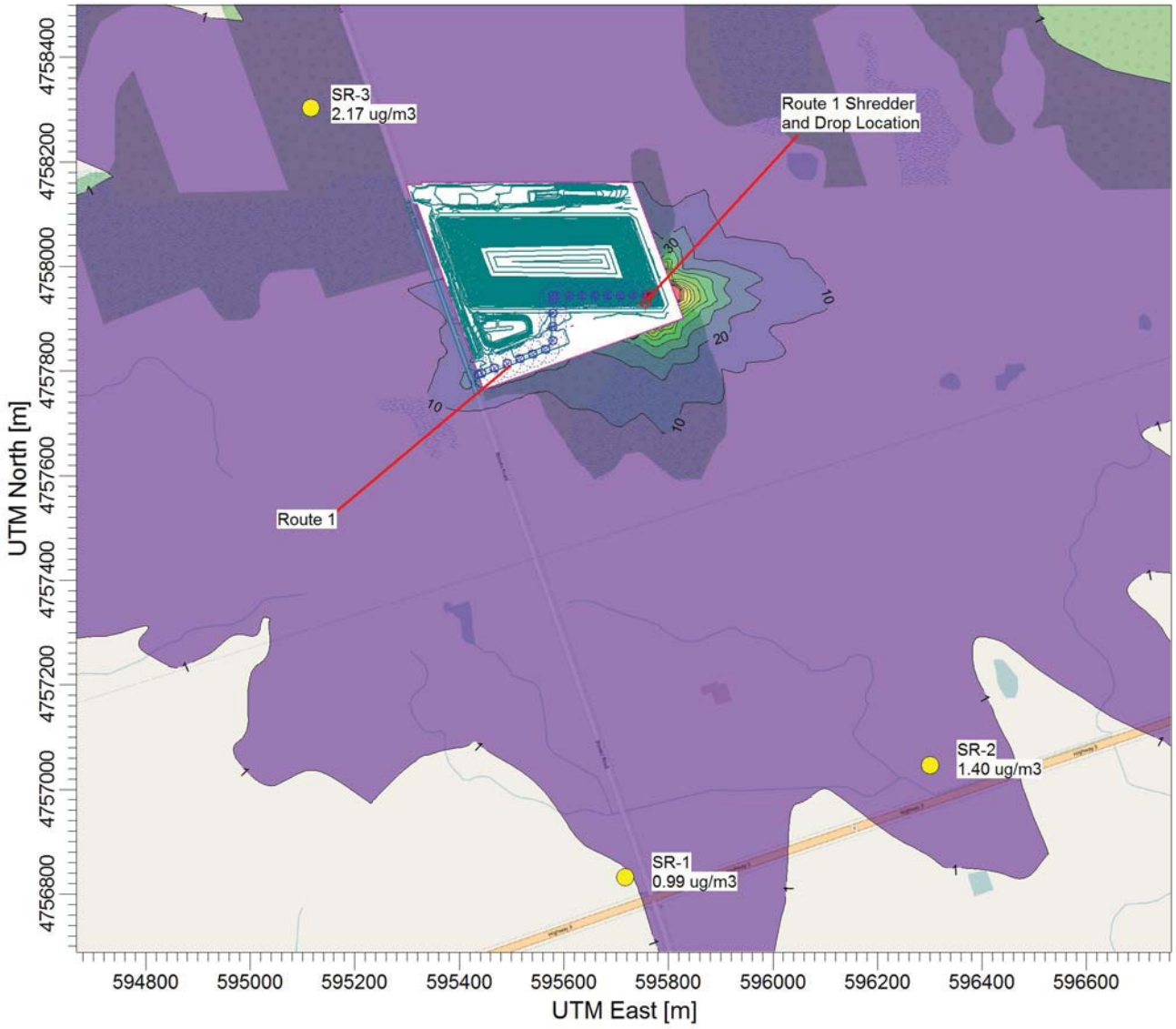
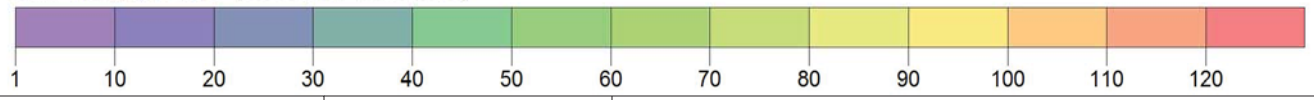
Figure 5.22 Vertical Expansion Alternative 2 Air Quality Contours – 50 Trucks per Day – Truck Route 1 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT1 ug/m^3



COMMENTS:	SOURCES: **6**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 0 0.5 km	
	MAX: **121.6 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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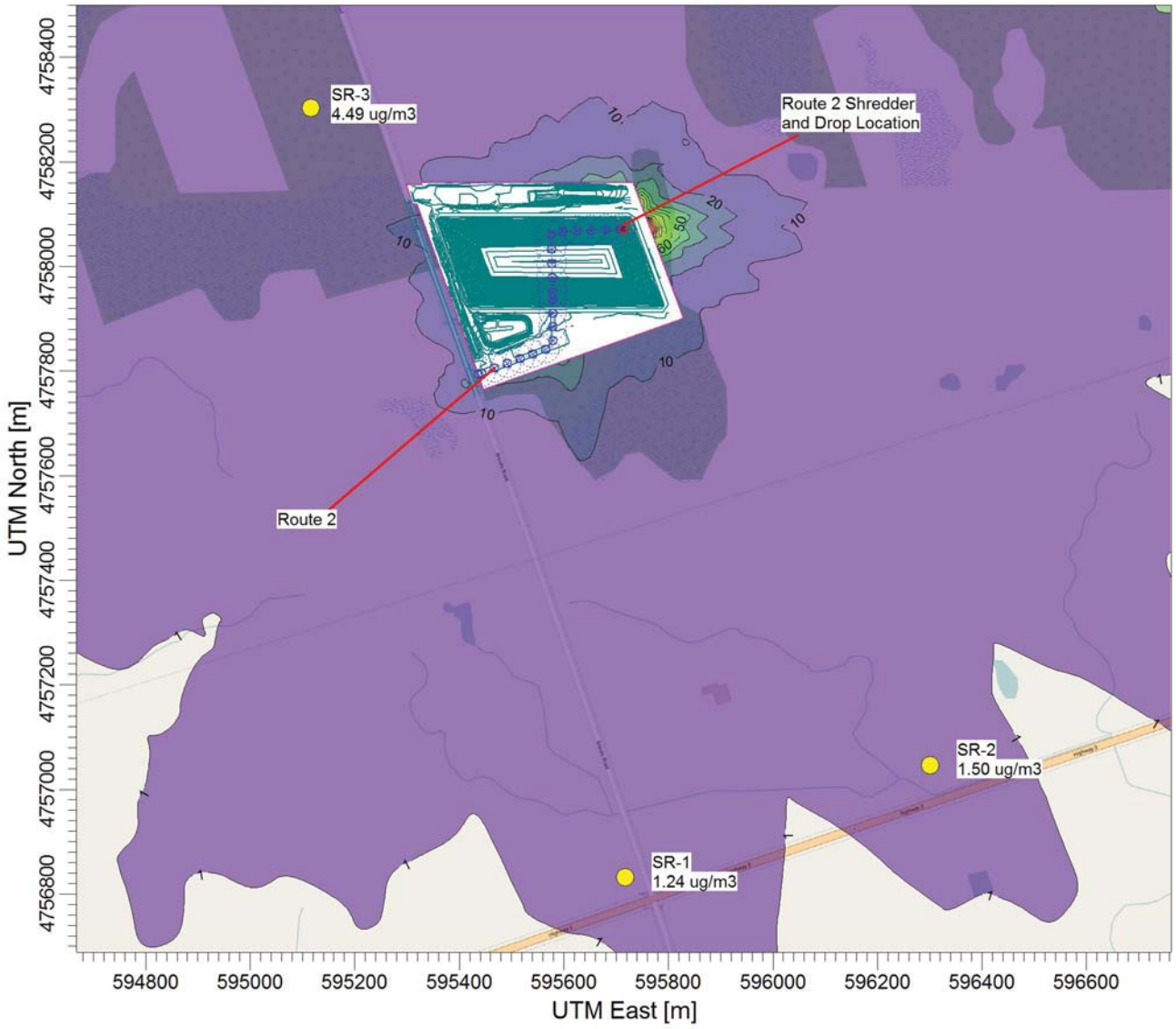
E:\18235_BrooksRoadLF\2016_12_December_figures\route4.isc

Figure 5.23 Vertical Expansion Alternative 2 Air Quality Contours – 50 Trucks per Day – Truck Route 2 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT2 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **108.2 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

Figure 5.24 Vertical Expansion Alternative 2 Air Quality Contours – 50 Trucks per Day – Truck Route 3 – 24 Hour Particulate Matter

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT3 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **102.7 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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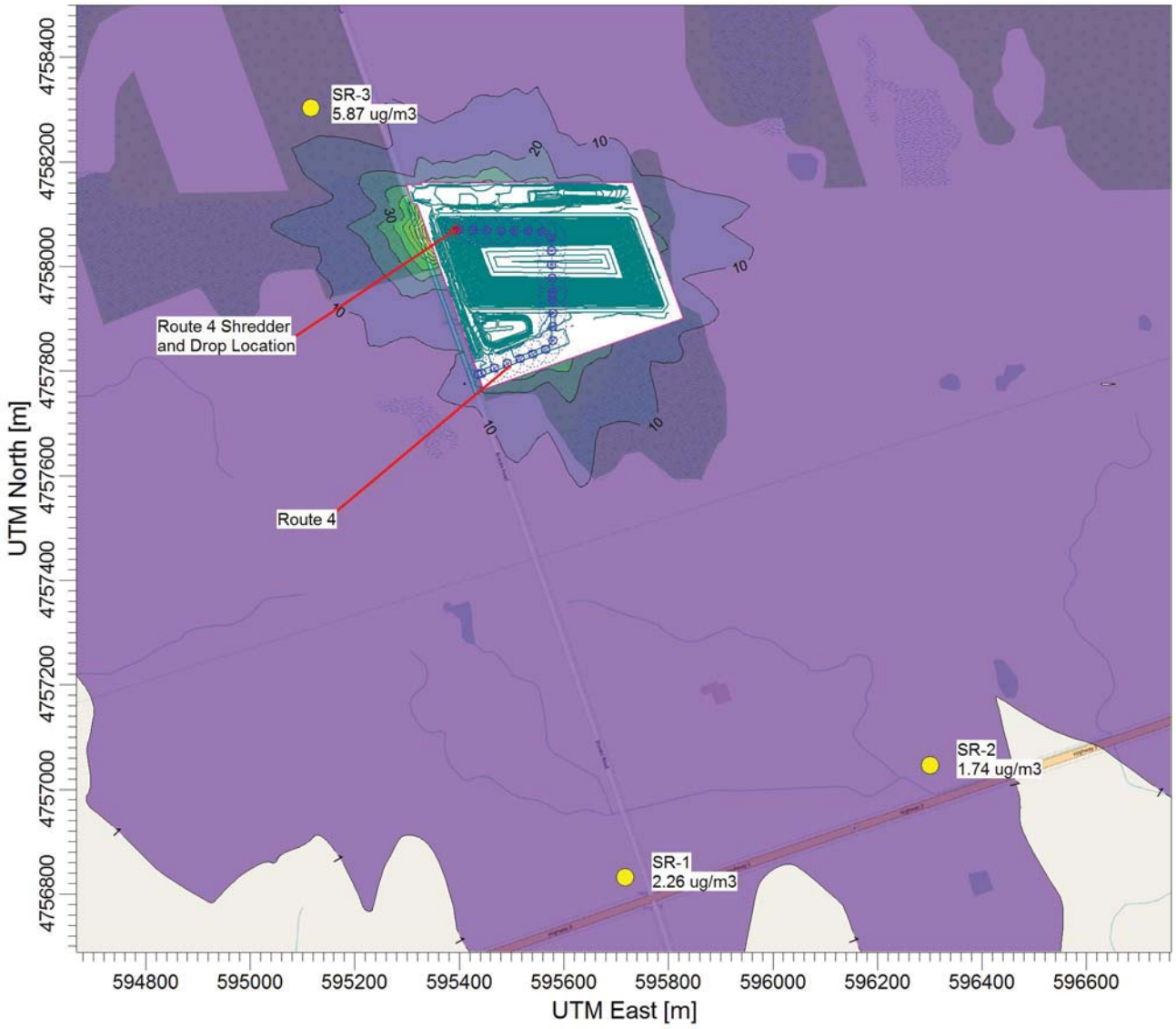
Figure 5.25 Vertical Expansion Alternative 2 Air Quality Contours – 50 Trucks per Day – Truck Route 4 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT2RT4 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **95.9 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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Alternative Method 3

TSP, PM10 and PM2.5 from the Site was evaluated at the property boundary for Alternative Method 3. It was determined during the air dispersion modelling that Alternative Method 1 is the worst case scenario at the sensitive receptors. Therefore no additional sensitive receptor modelling was completed for Alternative Method 2 or Alternative Method 3 as the particulate matter concentration at the sensitive receptors would be less than alternative 1. The predicted worst case particulate impact at the property boundary for Alternative Method 3 is as follows:

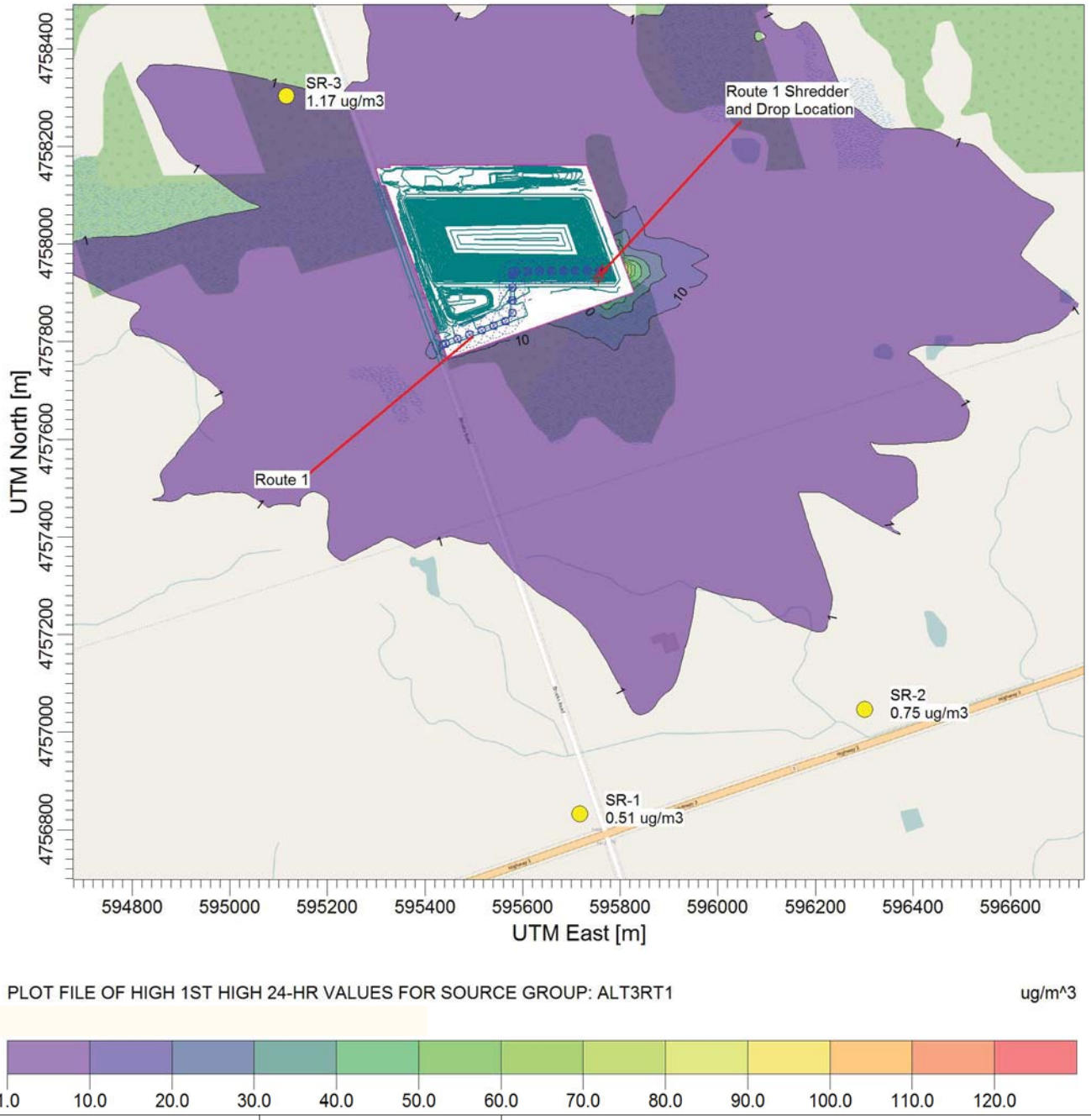
- TSP – 25 trucks per day – 61.13 µg/m^3
- PM10 – 25 trucks per day – 32.13 µg/m^3
- PM2.5 – 25 trucks per day – 4.80 µg/m^3
- TSP – 50 trucks per day – 122.00 µg/m^3
- PM10 – 50 trucks per day – 63.81 µg/m^3
- PM2.5 – 50 trucks per day – 9.14 µg/m^3

The modelled concentration at the property boundary for average operations at 25 trucks per day is well below the MOECC AAQC for all particulate matter fractions.

The modelled concentration at the property boundary for peak operations at 50 trucks per day is right at the AAQC for TSP and PM10. PM2.5 remains well below the MOECC AAQC. The air dispersion modelling for the peak scenario is a worst case scenario based on the worst case day during a five-year period and the truck routes, dumping, and shredding occurring at the worst case location on-Site.

The TSP worst case air quality contours for Alternative Method 3 are presented on **Figures 5.26** through **5.33**. These figures show the results of the model runs for the four possible truck routes for the disposal of waste in the four corners of the landfill, representing the worst case locations with respect to proximity to residential receptors and the travel length of roads for Alternative Method 3. The air quality contours for PM10 and PM2.5 are similar to the TSP air quality contours and have not been included.

Figure 5.26 Vertical Expansion Alternative 3 Air Quality Contours – 25 Trucks per Day – Truck Route 1 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT1 ug/m^3

1.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0

COMMENTS:	SOURCES: **6**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 – 0.4 km)	
	MAX: **61.1 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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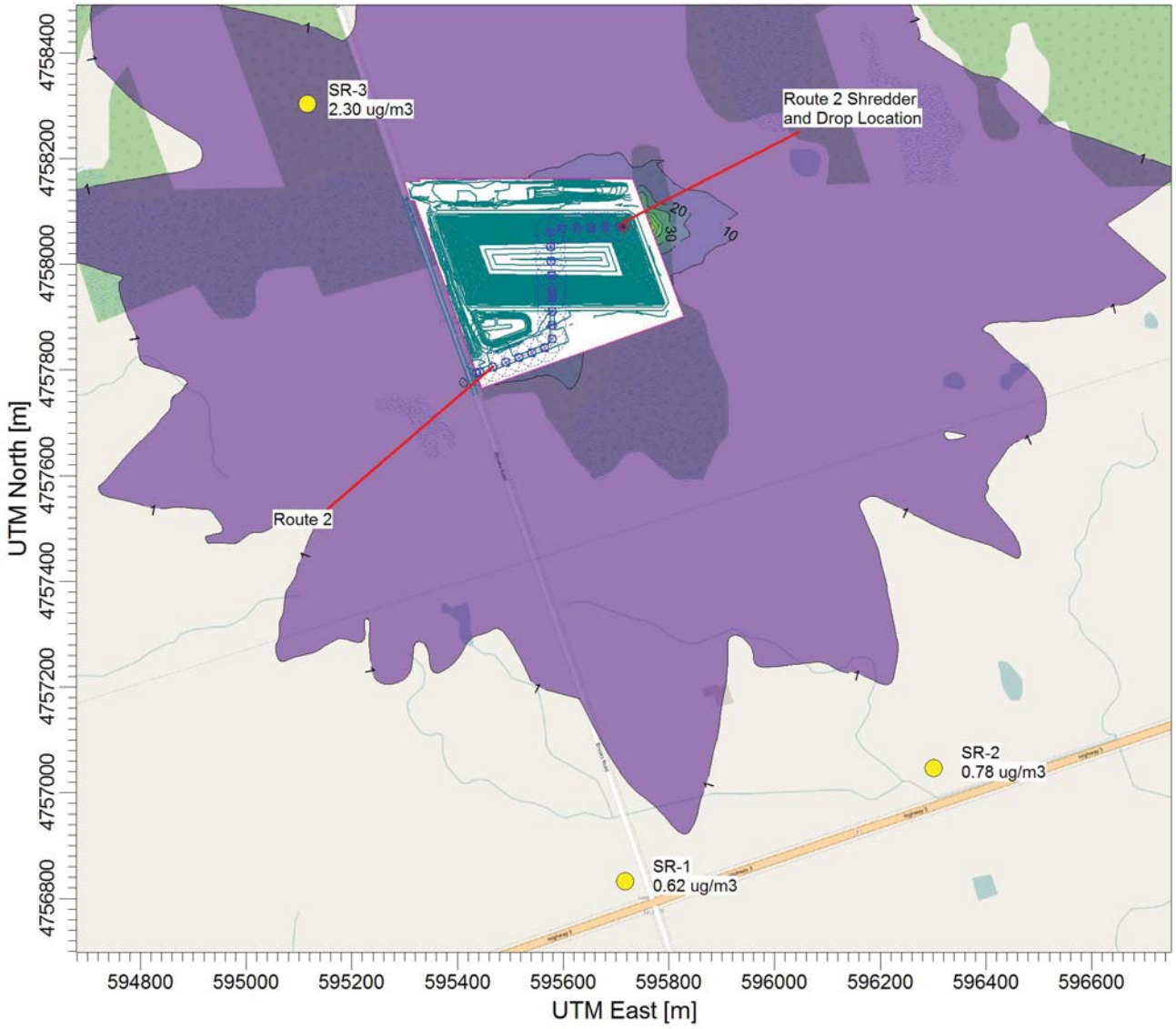
E:\18235_BrooksRoadLF\2016_12_December_figures\route1.isc

Figure 5.27 Vertical Expansion Alternative 3 Air Quality Contours – 25 Trucks per Day – Truck Route 2 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT2 ug/m^3

1.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 (0 — 0.4 km)	
	MAX: **54.0 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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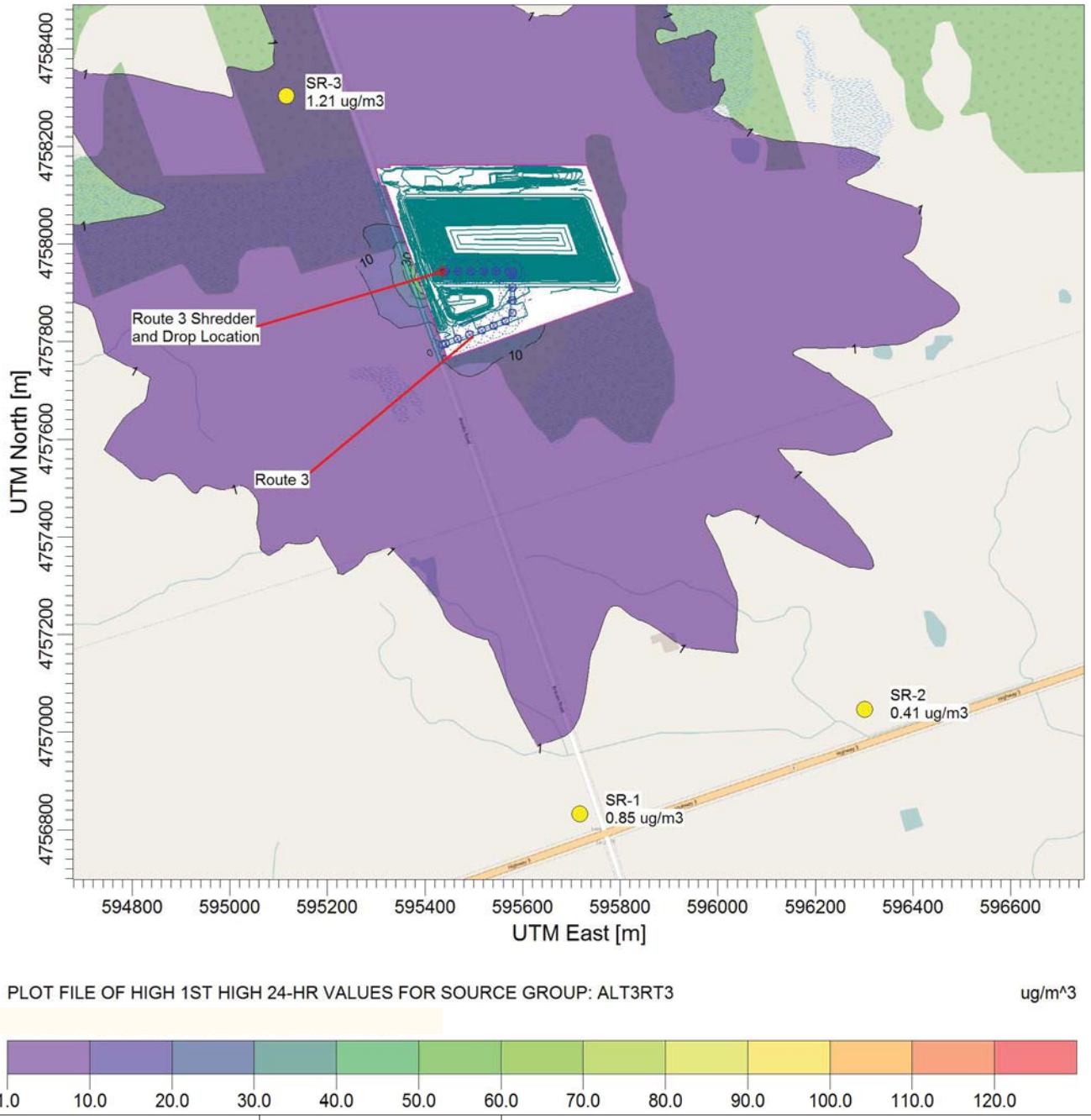
Figure 5.28 Vertical Expansion Alternative 3 Air Quality Contours – 25 Trucks per Day – Truck Route 3 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT3 ug/m^3

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,034 — 0 — 0.4 km	
	MAX: **51.4 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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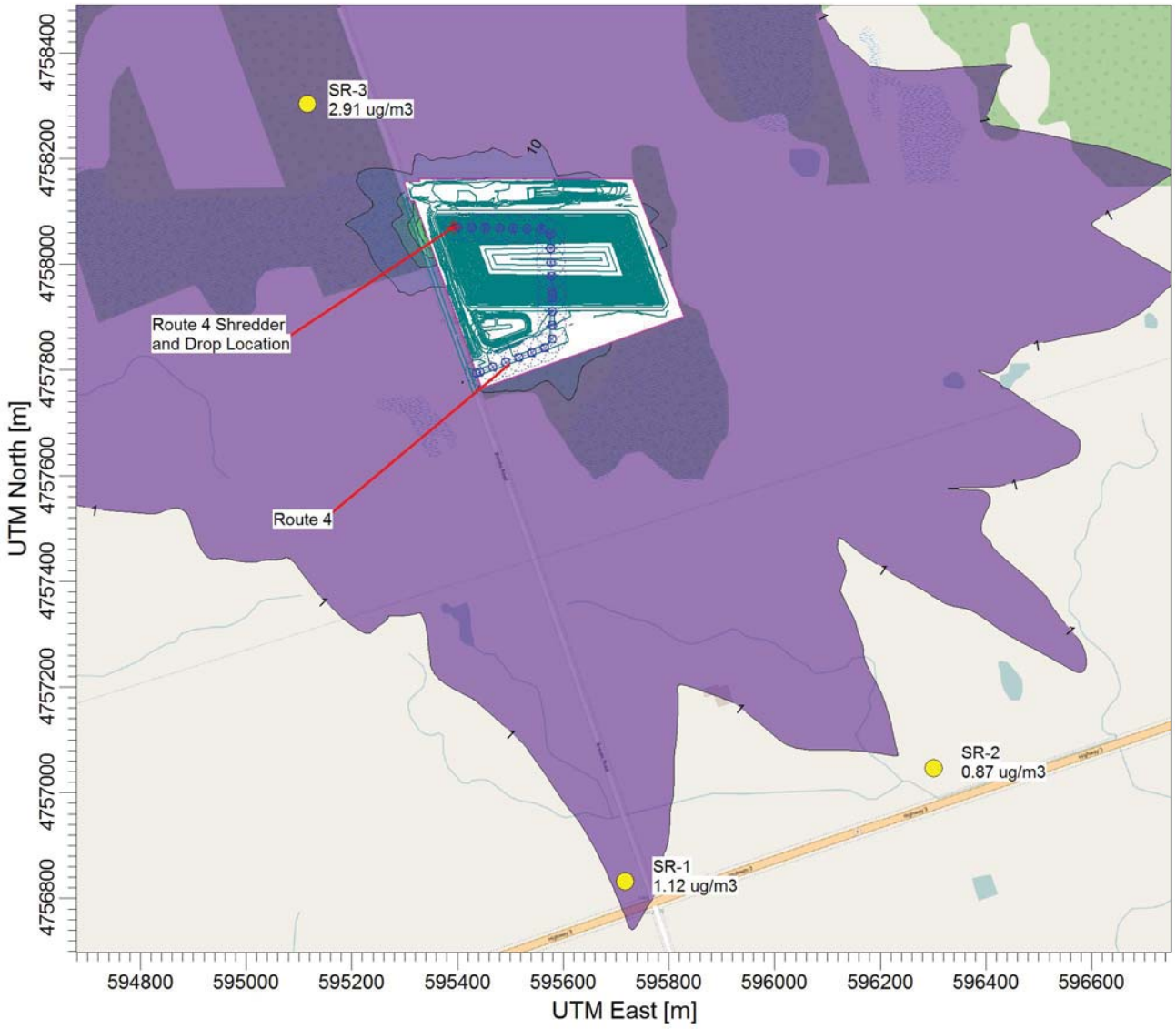
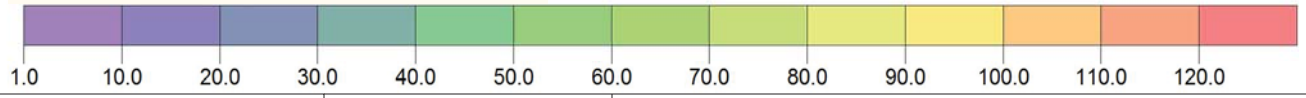
E:\18235_BrooksRoadLF\2016_12_December_figures\route3.isc

Figure 5.29 Vertical Expansion Alternative 3 Air Quality Contours – 25 Trucks per Day – Truck Route 4 – 24 Hour Particulate Matter

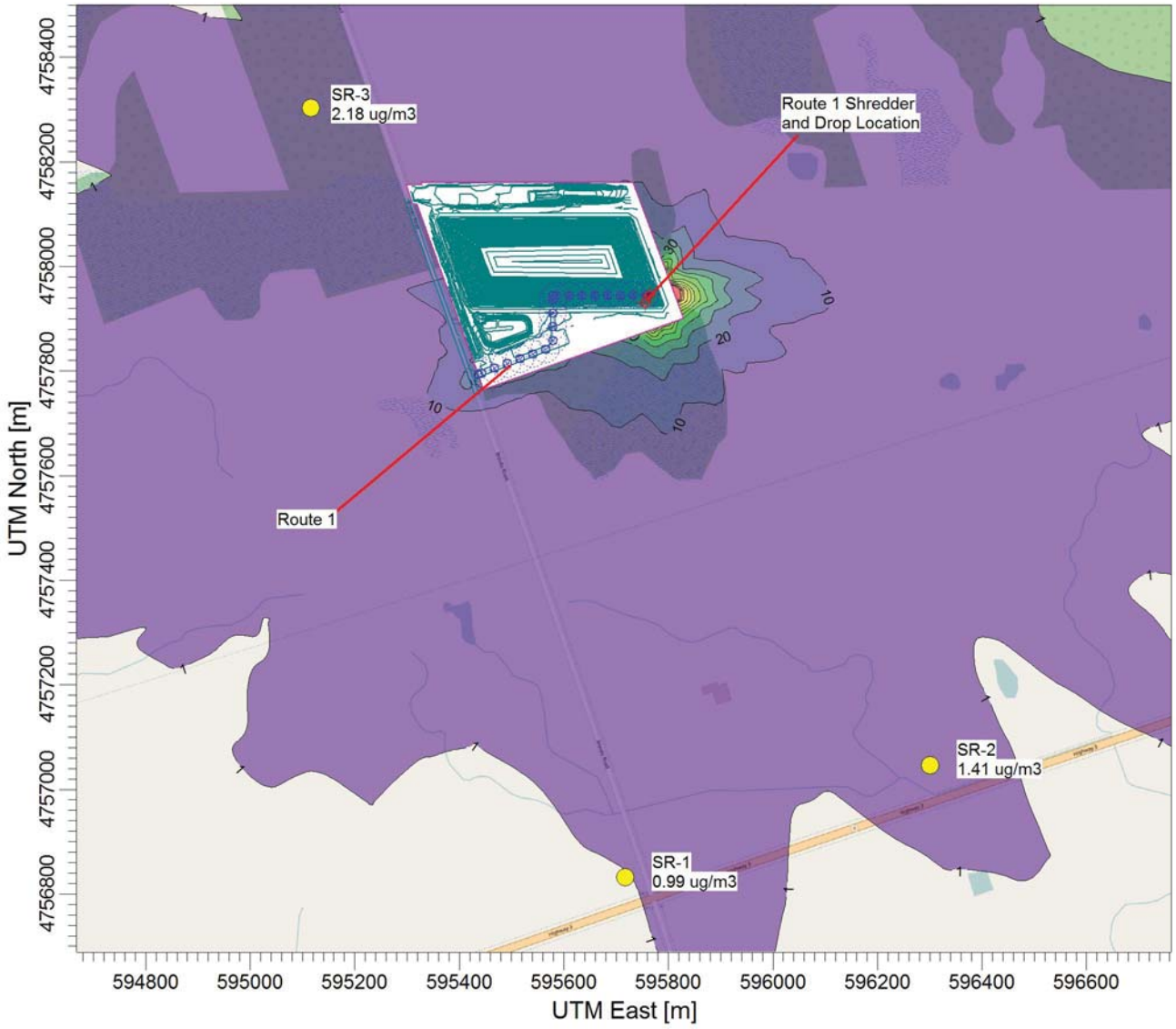


PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT4 ug/m^3

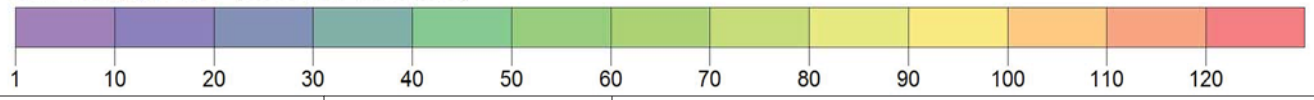


COMMENTS:	SOURCES:	COMPANY NAME:	
	5	Brooks Road Landfill, Haldimand County, Ontario	
	RECEPTORS:	MODELER:	
	3392	GHD	
	OUTPUT TYPE:	SCALE: 1:13,034	
	Concentration	0 0.4 km	
	MAX:	DATE:	PROJECT NO.:
	47.5 ug/m^3	12/5/2016	018235

Figure 5.30 Vertical Expansion Alternative 3 Air Quality Contours – 50 Trucks per Day – Truck Route 1 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT1 ug/m^3



COMMENTS:	SOURCES: **6**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 — 0 — 0.5 km	
	MAX: **122.0 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

Figure 5.31 Vertical Expansion Alternative 3 Air Quality Contours – 50 Trucks per Day – Truck Route 2 – 24 Hour Particulate Matter

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT2 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **107.4 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

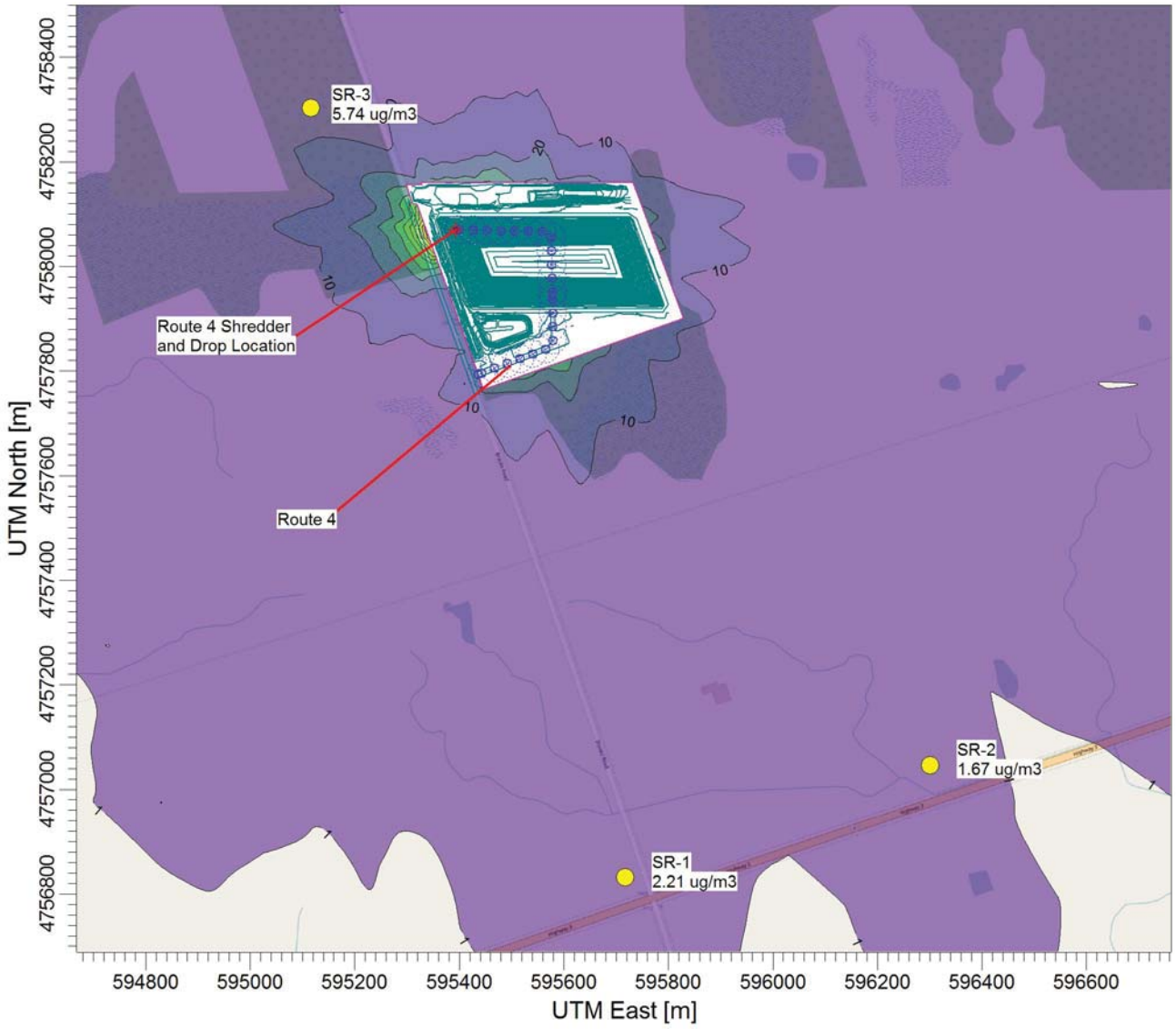
Figure 5.32 Vertical Expansion Alternative 3 Air Quality Contours – 50 Trucks per Day – Truck Route 3 – 24 Hour Particulate Matter

PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT3 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 (0 – 0.5 km)	
	MAX: **102.7 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

Figure 5.33 Vertical Expansion Alternative 3 Air Quality Contours – 50 Trucks per Day – Truck Route 4 – 24 Hour Particulate Matter



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALT3RT4 ug/m^3

1 10 20 30 40 50 60 70 80 90 100 110 120

COMMENTS:	SOURCES: **5**	COMPANY NAME: **Brooks Road Landfill, Haldimand County, Ontario**	
	RECEPTORS: **3392**	MODELER: **GHD**	
	OUTPUT TYPE: **Concentration**	SCALE: 1:13,174 — 0 — 0.5 km	
	MAX: **94.8 ug/m^3**	DATE: **12/5/2016**	PROJECT NO.: **018235**

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Air Quality & Odour Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

A Fugitive Dust Plan outlining Best Management Practices (BMP) will be developed and implemented to reduce roadway emission by a minimum of 90 percent. Controls capable of achieving this include watering and sweeping of roadways. This will reduce the particulate matter emissions on-Site to within the MOECC property boundary emission limit and all residential dwellings will be within the applicable air quality and odour emission limits.

Additionally, the Site currently implements several operational measures in order to reduce and/or mitigate odour impacts from the Site and they will continue to implement these throughout the vertical expansion. These efforts have proven to be successful as illustrated in the two separate odour analyses conducted by GHD in 2014 and provided in **Appendix E-1**. As part of Brooks Road Environmental's commitment to ensuring that odour complaints are minimized from the existing and proposed operations a standard operating procedure (SOP) will be developed. The purpose of the SOP will be to include odour mitigation measures that would be implemented to ensure that odour complaints are investigated and the condition that resulted in the odour complaint is mitigated.

Net Environmental Effects

Alternative Method 1

There is a potential for an air quality and odour impact off-site due to the + 20.69 m elevation change associated with Alternative Method 1 and in comparison to the Existing Conditions. Up to fourteen off-site residential dwellings could be affected. However, mitigation measures have been proposed in order to reduce and/or mitigate these impacts off-site. It is anticipated that with these controls in place, the odour and particulate concentrations at or past the property boundary of the Site will be well within the applicable emission limits.

Alternative Method 2

There is a potential for an air quality and odour impact off-site due to the + 22.54 m elevation change associated with Alternative Method 2 and in comparison to the Existing Conditions. Up to fourteen off-site residential dwellings could be affected. However, mitigation measures have been proposed in order to reduce and/or mitigate these impacts off-site. It is anticipated that with these controls in place, the odour and particulate concentrations at or past the property boundary of the Site will be well within the applicable emission limits.

Alternative Method 3

There is a potential for an air quality and odour impact off-site due to the + 23.17 m elevation change associated with Alternative Method 3 and in comparison to the Existing Conditions. Up to fourteen off-site residential dwellings could be affected. However, mitigation measures have been proposed in order to reduce and/or mitigate these impacts off-site. It is anticipated that with these controls in place, the odour and particulate concentrations at or past the property boundary of the Site will be well within the applicable emission limits.

5.3.1.1.2 Noise Net Effects

Noise General Assumptions

The Noise net effects assessment was carried out using both worst-case equipment and elevations. The worst-case equipment locations were selected based on proximity and elevated line-of-sight exposure to the off-site residential dwellings. The worst-case elevation was selected based on Landfill cell development and the corresponding topography detail.

Noise Potential Environmental Effects

Fourteen off-site residential dwellings will be potentially impacted from the existing Landfill activities. The predicted noise impact range is 40 to 55 dBA (rounded). POR5 is the most impacted at 55 dBA. All residential dwellings are below the 55 dBA noise limit.

From a potential noise impact exposure perspective, Alternative Methods 1, 2 and 3 are near identical and the difference in final landfill height is environmentally insignificant, as discussed below. However, the increased height will result in a potential change to the line-of-sight noise impact exposure for the fourteen off-site residential dwellings.

Alternative Method 1

There is a potential for an increased line-of-sight due to the + 20.69 m elevation change associated with Alternative Method 1 and in comparison to the Existing Conditions. Up to fourteen off-site residential dwellings will be affected.

Alternative Method 2

There is a potential for an increased line-of-sight due to the + 22.54 m elevation change associated with Alternative Method 2 and in comparison to the Existing Conditions. Up to fourteen off-site residential dwellings will be affected.

Alternative Method 3

There is a potential for an increased line-of-sight due to the + 23.17 m elevation change associated with Alternative Method 3 and in comparison to the Existing Conditions. Up to fourteen off-site residential dwellings will be affected.

Noise Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As all residential dwellings are below the 55 dBA noise limit, no specific mitigation measures are required. The implementation of BMPs, such as barriers and/or berms at Landfill perimeter and administrative controls that limit on-site landfilling activities will serve to minimize noise impacts from the Site.

Noise Net Environmental Effects

Alternative Method 1

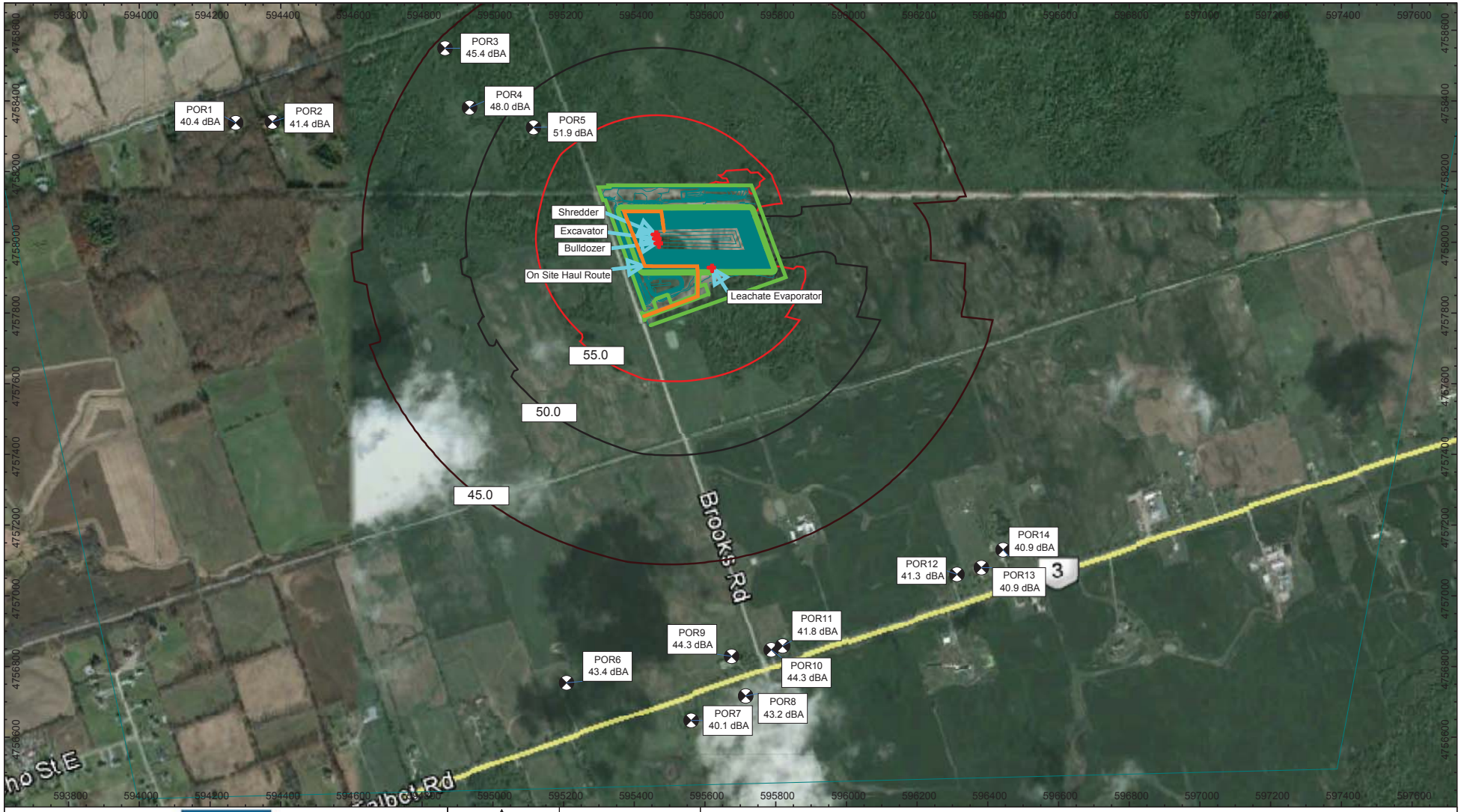
The predicted noise impact range is 40 to 52 dBA (rounded). POR5 is the most impacted at 52 dBA. The predicted noise impact range and the noise impact at critical POR5 is lower for Alternative Method 1 than the Existing Conditions. Noise contours for Alternative Method 1 are presented on **Figure 5.34**.

Alternative Method 2

The predicted noise impact range is 40 to 52 dBA (rounded). POR5 is the most impacted at 52 dBA. The predicted noise impact range and the noise impact at critical POR5 is lower for Alternative Method 2 than the Existing Conditions. Noise contours for Alternative Method 2 are presented on **Figure 5.35**.

Alternative Method 3

The predicted noise impact range is 40 to 52 dBA (rounded). POR5 is the most impacted at 52 dBA. The predicted noise impact range and the noise impact at critical POR5 is lower for Alternative Method 3 than the Existing Conditions. Noise contours for Alternative Method 3 are presented on **Figure 5.36**.



GHD

> 40 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB

BROOKS ROAD LANDFILL SITE VERTICAL CAPACITY EXPANSION ENVIRONMENTAL ASSESSMENT
HALIDMAND COUNTY, ONTARIO

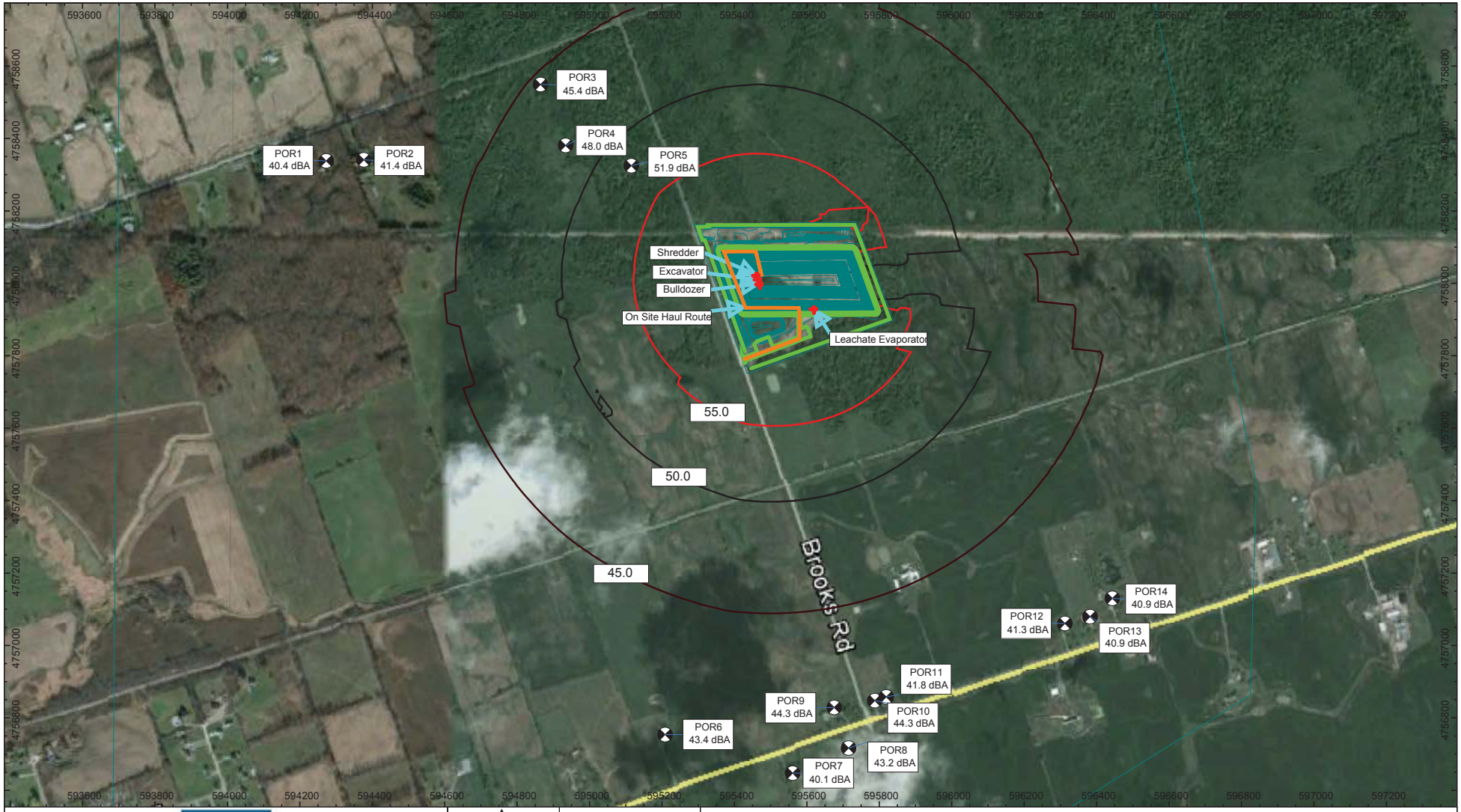
FIGURE 5.34
NOISE CONTOURS - VERTICAL EXPANSION ALTERNATIVE 1

GHD

> 40 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB

BROOKS ROAD LANDFILL SITE VERTICAL CAPACITY EXPANSION ENVIRONMENTAL ASSESSMENT
HALIDMAND COUNTY, ONTARIO

FIGURE 5.35
NOISE CONTOURS - VERTICAL EXPANSION ALTERNATIVE 2



GHD

> 40 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB

BROOKS ROAD LANDFILL SITE VERTICAL CAPACITY EXPANSION ENVIRONMENTAL ASSESSMENT
HALIDMAND COUNTY, ONTARIO

FIGURE 5.36
NOISE CONTOURS - VERTICAL EXPANSION ALTERNATIVE 3

5.3.1.2 Geology & Hydrogeology Net Effects

Geology & Hydrogeology General Assumptions

The principal assumption with respect to the net effects analysis for Geology and Hydrogeology is that leachate generation would not change from existing conditions. The landfill footprint would not change and the leachate collection system would maintain leachate levels as per the current design criteria.

Geology & Hydrogeology Potential Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As Alternative Methods 1, 2 and 3 are vertical expansions of the existing Brooks Road Landfill there would be no change to the landfill footprint. Leachate generation would not change from existing conditions and the leachate collection system would continue to maintain leachate levels as per the current design criteria. Consequently, there is no potential for effects on groundwater quality or flow characteristics for all three Alternative Methods.

Geology & Hydrogeology Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As there are no potential effects on groundwater quality or flow characteristics, no specific mitigation measures are required with respect to these indicators.

Geology & Hydrogeology Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

There are no net effects on groundwater quality or flow characteristics associated with Alternative Methods 1, 2 and 3.

5.3.1.3 Surface Water Resources Net Effects

Surface Water Resources General Assumptions

For the Surface Water Resources net effects analysis, the following assumptions were made:

- The landfill cap will be vegetated and no pollutants of any kind (i.e., pesticides, herbicides, fertilizers) will be applied to the cap once it has been fully vegetated.
- Only areas on the landfill cap are changing, no other area of the Site will change slopes or have its drainage significantly re-configured in any way.

- No surface water will ever come in contact with waste. Any surface water that infiltrates through the cap will be captured by the leachate collection system and treated.
- There will be no leachate seeps or exchange of surface water and leachate.

Surface Water Resources Potential Environmental Effects

The potential environmental effects associated with the three proposed vertical expansion alternatives are discussed below. One of these potential effects is the potential increase in soil loss due to increased slopes associated with the vertical expansion. As this potential effect is common to all three vertical expansion alternatives, the discussion on this potential effect is provided here.

A common way of estimating potential soil loss is by using the Universal Soil Loss Equation (USLE), which was developed for agricultural land use. The equation has several empirically based parameters that are ideally suited to agricultural practices; however, it has been widely adapted for use for landfill and other slope analysis. The USLE was used to estimate the average soil loss rate for the currently approved landfill under stabilized cover condition with a result of 0.73 tonnes/hectare/year (see **Appendix E-5** for the calculation details).

Stormwater management design for the landfill for the currently approved closure condition as well as the three vertical expansion alternatives includes several design elements that will help capture and retain the sediments on-Site with minimal off-Site impacts as follows:

- Construction quality control and inspections to ensure that the final cover is stabilized and has good vegetative cover, as this, while being important to erosion control, is also critically important for cap integrity
- Shallow graded vegetated perimeter swales – the perimeter swales are generally graded at 0.5% slope and have a trapezoidal shape and are vegetated – this will play a large role in capturing sediments and retaining them until maintenance is conducted
- Extended detention wet pond with enhanced level of treatment with a sediment forebay that was designed to maximize sediment removal (per MOECC 2003 Stormwater Management Planning and Design Manual) – i.e., longer than length required for settling velocity and dispersion, and wider than recommended guidelines
- Extended detention wet pond designed to provide greater than 24 hours of detention for the 25 mm storm to provide adequate settling time and downstream water quality improvements
- Extended detention wet pond designed to have a permanent pool in excess of the minimum requirement per MOECC design guidelines to store suspended solids

In addition, based on an average soil loss rate of approximately 4.6 tonnes/hectare/year for the three vertical expansion alternatives, we anticipate an approximate duration of 13 years (as presented in **Appendix E-5**) prior to requiring sediment removal from the wet pond, assuming all sediments are washed to the wet pond, which is a conservative assumption.

The operation, maintenance, and monitoring plan for the stormwater management infrastructure will include regular sediment level monitoring (recommended annually under stabilized post closure conditions) to estimate the portion of the permanent pool that is filled by sediment. Sediment removal activities will be planned once accumulation reaches approximately 1/3 of the available permanent pool volume. Sediment accumulation within the vegetated swales will be inspected regularly (recommended annually), and maintenance activities will be conducted if conveyance capacities are reduced significantly and/or if bare soil areas are present. These proposed inspection and maintenance activities will ensure that soil loss will not impair downstream receivers.

The discussion below is specific to each of the vertical expansion alternatives.

Alternative Method 1

Potential effects on surface water quality are:

- Increased erosion/soil loss due to steeper slopes

The estimated soil loss for Alternative Method 1 Vertical Expansion final closure stabilized conditions is 4.23 tonnes/hectare/year (results are included in **Appendix E-5**). This represents an increase in soil loss of approximately 3.50 tonnes/hectare/year compared to the currently approved landfill under stabilized cover condition, which is expected due to the increase in slopes with most other factors remaining the same. The soil loss, while estimated as being higher, is still lower than the typical accepted value of 6.7 tonnes/hectare/year. As described above, the proposed stormwater management controls will ensure that there are no detrimental impacts to the downstream receiver.
Potential effects on surface water quantity are:

- Increased runoff peak flows due to a steeper slope
- Increased runoff volumes due to a steeper slope

Hydrologic modelling was completed for Alternative 1 and the peak flows and runoff volume to the downstream receiver are similar to Alternative 2. There is no significant increase in runoff peak flow rates or volumes anticipated as a result of the proposed vertical expansion. **Table 5.4**,

below, provides a summary of the 100 year peak flows and total runoff volumes for all alternatives.

Table 5.4 Peak Flow and Runoff Volumes of 100-Year Post Closure Conditions

Alternative	Peak Flow (m^3/s)	Runoff Volume (m^3)
Alternative 1	502.6	9,184
Alternative 2	502.6	9,184
Alternative 3	503.8	9,174

Alternative Method 2

Potential effects on surface water quality are:

- Increased erosion/soil loss due to steeper slopes

The estimated soil loss for Alternative Method 2 Vertical Expansion final closure stabilized conditions is 4.27 tonnes/hectare/year (results are included in **Appendix E-5**). This represents an increase in soil loss of approximately 3.53 tonnes/hectare/year compared to the currently approved landfill under stabilized cover condition, which is expected due to the increase in slopes with most other factors remaining the same. The soil loss, while estimated as being higher, is still lower than the typical accepted value of 6.7 tonnes/hectare/year. As described above, the proposed stormwater management controls will ensure that there are no detrimental impacts to the downstream receiver.

Potential effects on surface water quantity are:

- Increased runoff peak flows due to a steeper slope
- Increased runoff volumes due to a steeper slope

Based on hydrologic modelling completed in the Stormwater Management Plan report for Alternative Method 2 there is no significant increase in runoff peak flow rates or volumes anticipated as a result of the proposed vertical expansion. A summary is provided in **Table 5.4**, above, showing the 100 year peak flows and total runoff volumes for all alternatives.

Alternative Method 3

Potential effects on surface water quality are:

- Increased erosion/soil loss due to steeper slopes

The estimated soil loss for Alternative Method 3 Vertical Expansion final closure stabilized conditions is 5.29 tonnes/hectare/year (results are included in **Appendix E-5**). This represents an increase in soil loss of approximately 4.56 tonnes/hectare/year compared to the currently approved landfill under stabilized cover condition, which is expected due to the increase in slopes with most other factors remaining the same. The soil loss, while estimated as being higher, is still lower than the typical accepted value of 6.7 tonnes/hectare/year. As described above, the proposed stormwater management controls will ensure that there are no detrimental impacts to the downstream receiver.

Potential effects on surface water quantity are:

- Increased runoff peak flows due to a steeper slope
- Increased runoff volumes due to a steeper slope

Hydrologic modelling was completed for Alternative 3 and the peak flows and runoff volume to the downstream receiver is similar to Alternative 2. There is no significant increase in runoff peak flow rates or volumes anticipated as a result of the proposed vertical expansion. A summary is provided in **Table 5.4**, above, showing the 100 year peak flows and total runoff volumes for all alternatives.

Surface Water Resources Mitigation Measures

Alternative Method 1

To mitigate the effects of an increase in runoff TSS concentrations and peak flow rates, an extended detention wet stormwater management pond was designed. The stormwater management pond was designed based on Alternative Method 2, which is expected to have similar runoff TSS concentrations and peak flows as Alternative Method 1. Since the stormwater management pond has already been designed to mitigate the effects of Alternative Method 2, no additional mitigation measures are needed beyond those incorporated into the design.

Alternative Method 2

To mitigate the effects of an increase in runoff TSS concentrations and peak flow rates, an extended detention wet stormwater management pond was designed. The stormwater management pond was designed based on Alternative Method 2. Since the stormwater management pond has already been designed to mitigate the effects of Alternative Method 2, no additional mitigation measures are needed beyond those incorporated into the design.

Alternative Method 3

To mitigate the effects of an increase in runoff TSS concentrations and peak flow rates, an extended detention wet stormwater management pond was designed. The stormwater management pond was designed based on Alternative Method 2, which is expected to have similar runoff TSS concentrations and peak flows as Alternative Method 3. Since the stormwater management pond has already been designed to mitigate the effects of Alternative Method 2, no additional mitigation measures are needed beyond those incorporated into the design.

Surface Water Resources Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

The stormwater management pond, as designed, will mitigate all water quality and quantity effects, and no net environmental effect is expected for Alternative Methods 1, 2, and 3.

5.3.1.4 Terrestrial & Aquatic Environment Net Effects

Terrestrial & Aquatic Environment Potential Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Many aspects of landfill activities will not change as a result of the vertical expansion. Buffer areas surrounding the limit of waste, stormwater management, and traffic conditions are expected to remain unchanged from existing to proposed conditions. As a result, no adverse environmental effects to the terrestrial and aquatic environment are expected as a result of the proposed vertical expansion.

Terrestrial & Aquatic Environment Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

No adverse environmental effects to the terrestrial and aquatic environment are expected as a result of the proposed vertical expansion; therefore no additional mitigation measures are recommended at this time.

There are a number of existing mitigation measures in place to dissuade wildlife access to the existing landfill Site and to prevent human/wildlife conflicts. Chain link fence is present around the perimeter of the property, which dissuades larger reptile and mammal access to the site. The silt fence along the north perimeter of the property, a higher risk area for wildlife access to the Site based on proximity to the Provincially Significant Wetland to the north, is an effective deterrent for small reptiles, mammals, and amphibian access to the Site. There are also very limited natural areas on the landfill Site itself and daily landfilling activities (e.g. noise, human

presence, heavy machinery) also provide deterrents for use of the Site by wildlife. Other operational practices (i.e., daily cover) further act to deter wildlife use of the Site.

General BMPs for continued operation of the landfill should include:

- Notify Site operators and delivery contractors of the presence of reptiles and amphibians in the surrounding areas. This includes visual identification tools for species at risk (SAR) common to the area.
- Any wildlife incidentally encountered during Site operation activities will not be knowingly harmed and will be allowed to move away from the area on its own if at all possible.
- In the event that an animal encountered during Site operation activities does not move from the area, or is injured, the Site Supervisor will be notified.
- In the event that the animal is a known or suspected SAR, the Site Supervisor will contact MNRF SAR biologists for advice.
- Silt fence is recommended to be added to all perimeter Site fencing as an enhanced effort to minimize human-wildlife interactions on Site.
- Erosion and sediment controls shall be maintained until all disturbed areas of the Site, including the pond and swales, have fully stabilized and vegetated areas have achieved 70 percent of the native background density of growth. The condition of all swales, culverts, vegetation, infiltration basin outlet, and outflow channels leading to the Brooks Road drainage ditch and off Site will be noted at regular intervals.

As this project suggests a continuation of the current land use and activity with no increase in footprint, and existing storm water management infrastructure is to be maintained with no changes to quantity of quality of discharge, monitoring of the wetland area adjacent to the Site is not recommended at this stage. Should changes to these elements be proposed, the need for long-term monitoring may be re-evaluated.

Terrestrial & Aquatic Environment Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As there are no proposed changes to the terrestrial or aquatic environment as a result of the proposed vertical expansion, no net effects to the natural environment are anticipated within the Study Areas.

5.3.2 Cultural Environment Net Effects

Cultural & Heritage Resources & Archaeological Resources Potential Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Alternative Methods 1, 2, and 3 are vertical expansions of the existing Brooks Road Landfill and would not require the development of any additional land beyond the existing landfill footprint. As such, there will be no loss of or disturbance to cultural and heritage resources or archaeological resources within the Local Study Area.

Cultural & Heritage Resources & Archaeological Resources Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As there are no potential effects on cultural and heritage resources or archaeological resources within the Local Study Area, no specific mitigation measures are required with respect to Archaeology and Cultural Heritage.

Cultural & Heritage Resources & Archaeological Resources Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

There are no net effects on cultural and heritage resources or archaeological resources associated with Alternative Methods 1, 2, and 3.

5.3.3 Built Environment Net Effects

5.3.3.1 Transportation Net Effects

5.3.3.1.1 Future Transportation Conditions

Methodology

Horizon Year

The vertical expansion of the capacity of the existing site is expected to be carried out in five to seven years, as per the ToR. For the purposes of the transportation analysis, build-out or horizon year scenarios of 2021 (i.e., five years from 2016, the year that the transportation analysis was prepared) and 2026 (i.e., ten years from 2016) were assumed. As noted in **Section 3.1**, the five to seven year planning period is expected to start in Fall 2017, following EA and ECA approvals.

Background Volume Growth Rate

In order to capture any expected background growth in traffic volumes at the study area intersections, a conservative compound annual growth rate of 2.0% has been adopted and will be utilized to forecast for 2021 and 2026 background traffic volumes.

Future Traffic Volumes

Forecasted 2021 and 2026 turning movement counts were projected at both the intersection of Highway 3 and Brooks Road and at the existing Brooks Road Landfill Site driveway during the weekday a.m., mid-day and p.m. peak periods and Saturday mid-day peak periods. This includes the existing truck traffic identified in **Section 4.5.1** (i.e., 17 inbound and 17 outbound trucks consisting of 12 walking floor trucks, 2 front end trucks, and 3 roll-offs plus another one or two trips for staff) corresponding to approximately 500 tonnes per day plus 16 site trucks per day as a result of the proposed vertical expansion conveying an additional 500 tonnes per day, for a peak fill rate of 1,000 tonnes per day. To provide a conservative and worst-case scenario analysis, all 16 of the daily truck trips associated with the vertical expansion were applied to each peak hour (i.e., all 16 would enter/exit the site within the peak hour) and assumed to all be walking floor trucks, which can handle 25 – 40 tonnes per load. The resulting weekday a.m., mid-day and p.m. peak hour as well as the Saturday peak hour volumes are summarized in **Figures 4.37** and **4.38** and **Tables 5.5** and **5.6**. The distribution of the 16 truck trips within the Local Study Area is based on existing turning movement patterns.

Figure 5.37 2021 Future Peak Hour Volume

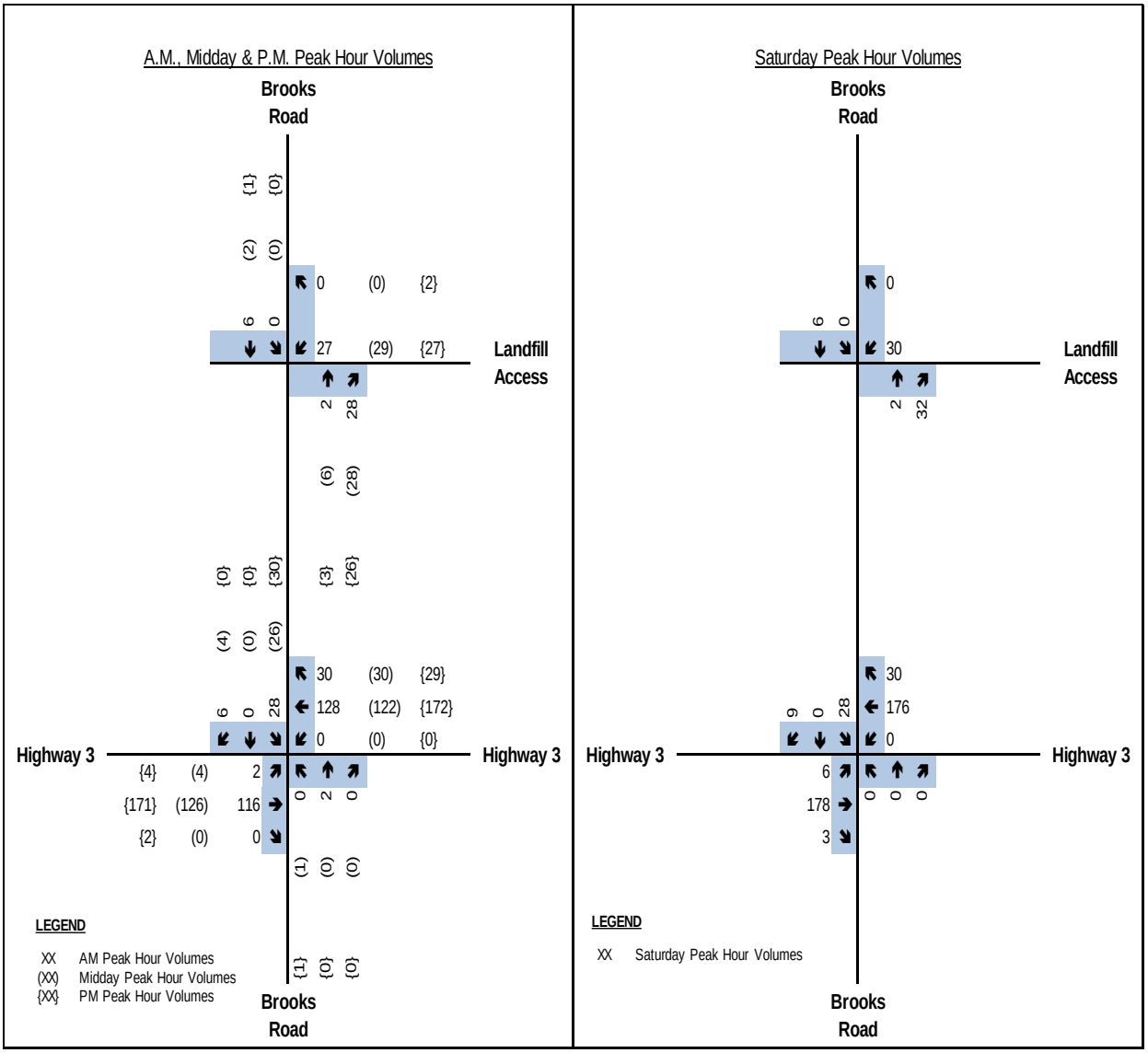


Table 5.5 2021 Future Peak Hour Volumes

Intersection	Direction		Existing Peak Hour Volumes (# of vehicles)			
			A.M.	Mid-day	P.M.	Sat.
Brooks Road & Brooks Road Landfill Site access	↓	through-traffic southbound along Brooks Rd	6	2	1	6
	↘	left turn from Brooks Rd southbound into Site	0	0	0	0
	↖	right turn from Site to Brooks Rd northbound	0	0	2	0
	↙	left turn from Site to Brooks Rd southbound	27	29	27	30
	↑	through-traffic northbound along Brooks Rd	2	6	3	2
	↗	right turn from Brooks Rd northbound into Site	28	28	26	32
Brooks Road & Highway 3	↙	right turn from Brooks Rd southbound to Hwy 3 westbound	6	4	0	9
	↓	through-traffic southbound along Brooks Rd	0	0	0	0
	↘	left turn from Brooks Rd southbound to Hwy 3 eastbound	28	26	30	28
	↗	left turn from Hwy 3 eastbound to Brooks Rd northbound	2	4	4	6
	→	through-traffic eastbound along Hwy 3	116	126	171	178
	↘	right turn from Hwy 3 eastbound to Brooks Rd southbound	0	0	2	3
	↖	right turn from Hwy 3 westbound to Brooks Rd northbound	30	30	29	30
	←	through-traffic westbound along Hwy 3	128	122	172	176
	↙	left turn from Hwy 3 westbound to Brooks Rd southbound	0	0	0	0
	↖	left turn from Brooks Rd northbound to Hwy 3 westbound	0	1	1	0
	↑	through-traffic northbound along Brooks Rd	2	0	0	0
	↗	right turn from Brooks Rd northbound to Hwy 3 eastbound	0	0	0	0

Figure 5.38 2026 Future Peak Hour Volumes

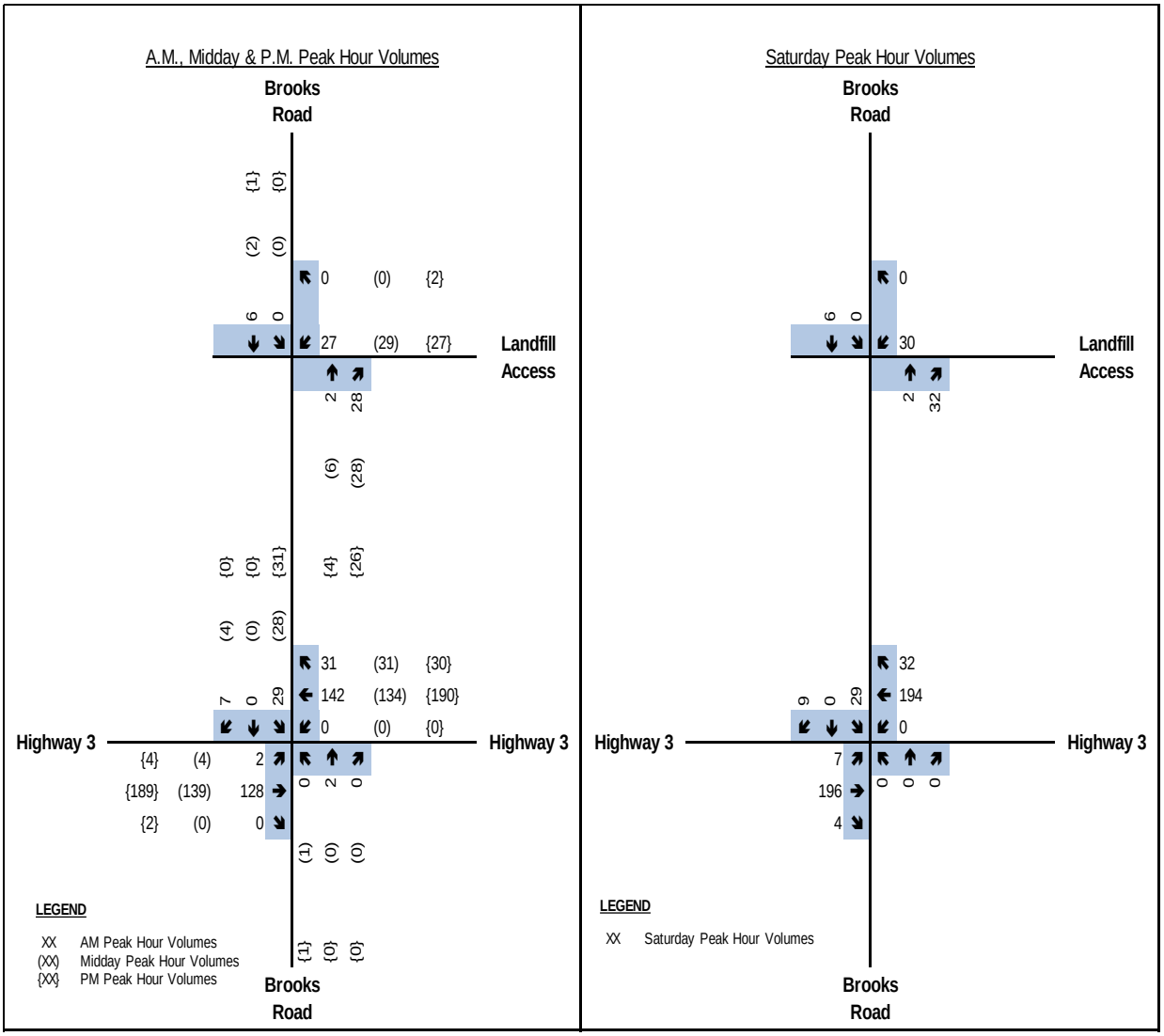


Table 5.6 2026 Future Peak Hour Volumes

Intersection	Direction		Existing Peak Hour Volumes (# of vehicles)			
			A.M.	Mid-day	P.M.	Sat.
Brooks Road & Brooks Road Landfill Site access	↓	through-traffic southbound along Brooks Rd	6	2	1	6
	↘	left turn from Brooks Rd southbound into Site	0	0	0	0
	↖	right turn from Site to Brooks Rd northbound	0	0	2	0
	↙	left turn from Site to Brooks Rd southbound	27	29	27	30
	↑	through-traffic northbound along Brooks Rd	2	6	4	2
	↗	right turn from Brooks Rd northbound into Site	28	28	26	32
Brooks Road & Highway 3	↙	right turn from Brooks Rd southbound to Hwy 3 westbound	7	4	0	9
	↓	through-traffic southbound along Brooks Rd	0	0	0	0
	↘	left turn from Brooks Rd southbound to Hwy 3 eastbound	29	28	31	29
	↗	left turn from Hwy 3 eastbound to Brooks Rd northbound	2	4	4	7
	→	through-traffic eastbound along Hwy 3	128	139	189	196
	↘	right turn from Hwy 3 eastbound to Brooks Rd southbound	0	0	2	4
	↖	right turn from Hwy 3 westbound to Brooks Rd northbound	31	31	30	32
	←	through-traffic westbound along Hwy 3	142	134	190	194
	↙	left turn from Hwy 3 westbound to Brooks Rd southbound	0	0	0	0
	↖	left turn from Brooks Rd northbound to Hwy 3 westbound	0	1	1	0
	↑	through-traffic northbound along Brooks Rd	2	0	0	0
	↗	right turn from Brooks Rd northbound to Hwy 3 eastbound	0	0	0	0

Capacity Analysis

As a measure of the capacity on the adjacent road network surrounding the Brooks Road Landfill at peak operations (i.e., 1,000 tonnes of material per day), both the Site access on Brooks Road and the stop controlled intersection of Brooks Road and Highway 3 were analyzed using the projected 2021 and 2026 peak turning movement volumes for the weekday a.m., mid-day, p.m. and Saturday peak hours. A summary of the capacity analysis using Synchro version 8 is summarized in the **Table 5.7** and **Table 5.8**.

As noted in **Section 4.5.1**, the first numbers in each cell refer to the Volume-to-Capacity Ratio (v/c ratio), which represents the sufficiency of an intersection to accommodate the vehicular demand. A v/c ratio less than 0.85 indicates that there is generally adequate capacity available and vehicles are not expected to experience significant queues and/or delays. As the v/c ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. Once the demand exceeds the capacity (i.e., a v/c ratio greater than 1.0), traffic flow is considered unstable and excessive delay and queuing is expected. The information contained in the bullets is the Level of Service (LOS) for each intersection. LOS represents the delay (i.e., the additional travel time experienced) at an intersection and ranges from A (0 to 10 second delay) to F (greater than 50 second delay). The number included after the LOS level indicates the delay in seconds.

Table 5.7 2021 Future Conditions Capacity Analysis at Peak Operations

Intersection	Movement v/c ratio (LOS) delay			
	A.M. Peak	Mid-Day Peak	P.M. Peak	Sat Peak
Brooks Road & Brooks Road Landfill Site access	WBLR[1] 0.03 • LOS A, 9 Sec.	WBLR 0.03 • LOS A, 9 Sec.	WBLR 0.03 • LOS A, 9 Sec.	WBLR 0.03 • LOS A, 9 Sec.
Brooks Road & Highway 3	EBLTR[2] 0.00 • LOS A, 1 Sec. NBLTR[3] 0.00 • LOS B, 11 Sec. SBLTR[4] 0.05 • LOS B, 11 Sec.	EBLTR 0.00 • LOS A, 1 Sec. NBLTR 0.00 • LOS B, 11 Sec. SBLTR 0.05 • LOS B, 11 Sec.	EBLTR 0.00 • LOS A, 1 Sec. NBLTR 0.00 • LOS B, 11 Sec. SBLTR 0.06 • LOS B, 12 Sec.	EBLTR 0.01 • LOS A, 1 Sec. NBLTR 0.00 • LOS A, 0 Sec. SBLTR 0.07 • LOS B, 12 Sec.

Notes:
1. Westbound left/right shared turn lane
2. Eastbound left/through/right shared turn lane
3. Northbound left/through/right shared turn lane
4. Southbound left/through/right shared turn lane

Table 5.8 2026 Future Conditions Capacity Analysis at Peak Operations

Intersection	Movement v/c ratio (LOS) delay			
	A.M. Peak	Mid-Day Peak	P.M. Peak	Sat Peak
Brooks Road & Brooks Road Landfill Site access	WBLR[1] 0.03 • LOS A, 9 Sec.	WBLR 0.03 • LOS A, 9 Sec.	WBLR 0.03 • LOS A, 9 Sec.	WBLR 0.03 • LOS A, 9 Sec.
Brooks Road & Highway 3	EBLTR[2] 0.00 • LOS A, 1 Sec. NBLTR[3] 0.00 • LOS B, 11 Sec. SBLTR[4] 0.05 • LOS B, 11 Sec.	EBLTR 0.00 • LOS A, 1 Sec. NBLTR 0.00 • LOS B, 11 Sec. SBLTR 0.05 • LOS B, 11 Sec.	EBLTR 0.00 • LOS A, 1 Sec. NBLTR 0.00 • LOS B, 12 Sec. SBLTR 0.06 • LOS B, 12 Sec.	EBLTR 0.01 • LOS A, 1 Sec. NBLTR 0.00 • LOS A, 0 Sec. SBLTR 0.07 • LOS B, 12 Sec.

Notes:
1. Westbound left/right shared turn lane
2. Eastbound left/through/right shared turn lane
3. Northbound left/through/right shared turn lane
4. Southbound left/through/right shared turn lane

Both intersections overall are expected to operate with minimal delay and substantial excess capacity under future 2021 and 2026 conditions. Individual movements at both study intersections are expected to operate with levels of service 'B' or better representing minimal delay, and volume-to-capacity (v/c) ratios not exceeding 0.08 representing substantial excess capacity, during the weekday a.m., mid-day, p.m. and Saturday mid-day peak hours.

The analysis of future 2021 and 2026 conditions under peak operations confirms no vehicle delay issues or capacity constraints at either study intersection, with the additional 16 site trucks per day as a result of the proposed vertical expansion being negligible.

Safety Analysis

Collision Analysis

Existing conditions collision analysis determined no indication that either Highway 3 in the vicinity of Brooks Road or Brooks Road north to the site has experienced significantly higher collision frequency than the historical average accident rate along Highway 3 in Haldimand County. It is expected the additional site traffic generated by the proposed vertical expansion will not deteriorate safety conditions.

Sight Line Analysis

Existing conditions sight line analysis determined the site entrance in its current location satisfies the sight distance requirements for trucks approaching and departing from the site. It

is expected the additional site traffic generated by the proposed vertical expansion can be safely accommodated by the existing site entrance.

Airport Operations

As noted in **Section 4.5.1**, there are no airports or aerodromes within the Local Study Area.

5.3.3.1.2 Transportation Net Effects Analysis

Transportation Potential Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As a result of no airports or aerodromes being situated within the Local Study Area, all three Alternative Methods are not expected to have any effect on airport operations.

Based on the Future Conditions traffic analysis undertaken, it is expected that all three proposed alternative methods will have a negligible transportation effect at the study area intersections and surrounding road network. Truck traffic associated with the proposed vertical expansion for all three Alternative Methods is not expected to adversely affect residents, businesses, institutions and movement of farm vehicles in the Local Study Area.

Transportation Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

No mitigation measures beyond those incorporated into the design are recommended for Alternative Methods 1, 2, and 3.

Transportation Net Environmental Effects

As no mitigation measures are recommended, the net environmental impacts for Alternative Methods 1, 2, and 3 from a transportation perspective are represented in the Future Transportation Conditions analysis undertaken.

5.3.3.2 Land Use Net Effects

Land Use General Assumptions

As noted above and in Section 2.3.3 of the CDR, it is assumed that the screening berm will be vegetated and/or additional on-Site plantings introduced, as required, in order to mitigate the potential impacts from a visual and noise standpoint. It is also assumed that the five to seven year planning period will start in Fall 2017, following EA and ECA approvals (see

Section 3.1). Assuming this Fall 2017 start date, should the planning period extend to seven years, the proposed vertical expansion would be completed in Fall 2024.

Land Use Potential Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Alternative Methods 1, 2, and 3 are vertical expansions of the existing Brooks Road Landfill and would not require the development of any additional land beyond the existing landfill footprint. As such, there will be no change to the current or planned future land uses within the Site and Local Study Areas. As Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, are listed as "Identified Trail Locations" in the Official Plan and "Proposed Special Use Routes" in the Haldimand County Trails Master Plan (2009), there is potential for landfill operations to result in nuisance-related effects to these recreational resources within 500 m of the landfill footprint during construction and operation. Similarly, there is potential for the two residences located within 500 m of the landfill footprint to experience nuisance-related effects during construction and operation of the landfill.

As stated in **Section 4.5.2**, MOECC's Guideline D-4[1] describes restrictions and controls on land use in the vicinity of operating and non-operating landfills, and includes a restriction on land within 30 m of the perimeter of a fill area. Under Guideline D-4, it is the responsibility of operators and/or owners of operating landfills to comply with the Environmental Protection Act and Ontario Regulation (O. Reg.) 347 (Waste Management) requirements for the control of adverse effects caused by these facilities. The onus is on both the land use development proponent to implement and monitor proper control measures associated with new, sensitive developments and the local municipal authority to ensure the implementation and monitoring of said control measures.

As noted in **Section 4.5.2**, Section 1.6.10.1 of the PPS 2014 states that *"waste management systems* need to be provided that are of an appropriate size and type to accommodate present and future requirements, and facilitate, encourage and promote reduction, reuse and recycling objectives." The proposed vertical capacity expansion of the Brooks Road Landfill is consistent with the PPS 2014 as the proposed planning period (five to seven years) is a function of the business procured by the owner and the rate at which waste is received (i.e., *appropriate size and type to accommodate present and future requirements)* and the material received at the Site is post diversion solid non-hazardous IC&I waste (i.e., *facilitate, encourage and promote reduction, reuse and recycling objectives*).

[1] D-4 Land Use On or Near Landfills and Dumps. MOECC, 1994.

Land Use Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As there are no potential effects to current or planned future land uses within the Site and Local Study Areas, no specific mitigation measures are required with respect to these indicators. Nuisance-related effects to off-Site recreational resources within 500 m of landfill footprint and the two residential properties within 500 m of the landfill footprint can be mitigated through the implementation of landfill BMPs (e.g., dust suppression, vermin control, etc.) by Brooks Road Environmental.

Land Use Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

The implementation of landfill BMPs is expected to result in low net environmental effects to the off-Site recreational resources and two residential properties within 500 m of the landfill footprint. There will be no net effects related to current or planned future land uses within the Site and Local Study.

5.3.3.3 Agriculture, Soils & Mining Net Effects

Agriculture, Soils & Mining Potential Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Alternative Methods 1, 2, and 3 are vertical expansions of the existing Brooks Road Landfill and would not require the development of any additional land beyond the existing landfill footprint. As such, there will be no loss of soil with agricultural capability. As there are 19 property parcels within the Local Study Area assessed as Farm Tax Rated, including two immediately adjacent to the Site boundary to the east and south, there is potential for landfill operations to result in nuisance related effects to surrounding cash crop agricultural operations. There is no potential for effects on active mining operations as there are none located within the Local Study Area.

Agriculture, Soils & Mining Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

As there are no potential effects on active mining operations and no loss of agricultural soil, no specific mitigation measures are required with respect to these indicators. Nuisance related effects to surrounding agricultural operations can be mitigated through the implementation of landfill BMPs (e.g., dust suppression, vermin control, etc.) by Brooks Road Environmental.

Agriculture, Soils & Mining Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

The implementation of landfill BMPs is expected to result in low net environmental effects to agricultural operations within the Local Study Area, including the two cash crop farms located immediately adjacent to the eastern and southern boundaries of the Site. There will be no net effects to active mining operations nor loss of soil with agricultural capability within the Local Study Area.

5.3.3.4 Site Design & Operation Net Effects

Site Design & Operations Potential Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Alternative Methods 1, 2, and 3 are vertical expansions of the existing Brooks Road Landfill and have the potential to increase complexity of Site infrastructure with respect to: final contours; stormwater management system; screening berms; leachate treatment facility; site access; and scale house facility. They also have the potential to limit operational flexibility with respect to: placement and grading of waste/cover material; management of leachate, stormwater, odour, and traffic; and the potential post-closure uses of the Site.

Site Design & Operations Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Potential effects associated with Alternative Methods 1, 2, and 3, will be mitigated through design as well as through the implementation of BMPs, such as:

- Tarping vehicles transporting waste to and around the Site, as required, to prevent litter from blowing out of the vehicle.
- Applying daily cover to exposed waste to confine light weight material.
- Ensuring that cover material is readily available to allow the working face to be fully covered at the end of each operating day.
- Minimizing the area of exposed waste at the working face.
- Adjusting the location of the working face, as required, to provide shelter from prevailing winds, if possible.
- Using portable litter fences around the working face to capture litter.
- Collecting litter on an as-needed basis, both from the Site and, if required, from the adjacent lands and roadway.
- Operating on-Site equipment in a manner such that noise impacts are minimized, wherever possible.

- Ensuring that all landfill construction equipment associated with the development, operation, or closure of the Site comply with the noise levels outlined in applicable MOECC guidelines and technical standards.
- Vegetating the berm on the western Site boundary and/or on-Site plantings, as required, to attenuate visual and noise impacts.
- Compacting waste immediately after placement and spreading.
- Vector and vermin are controlled, as required.
- Maintaining the comprehensive monitoring and maintenance program to address all aspects of landfill operation, including waste inspection and monitoring of landfill odour.
- Site haul roads are constructed to minimize mud trackout and dust mitigation measures are employed on an as-needed basis.

The implementation of such BMPS will result in low to no net effects to Site design and operations.

Site Design & Operations Net Environmental Effects

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Alternative Methods 1, 2, and 3 will all require minor changes to the final contours and Site grading/drainage, but will have little to no impact on the design and operation of the stormwater management pond, screening berms, leachate treatment facility, Site access, or scale house facility. Alternative Methods 1 and 3 would result in increases to the proposed waste and cover slopes and may limit post-closure uses of the Site; only Alternative Method 2 has waste and cover slopes that are consistent with the current design approved by the MOECC.

5.3.4 Socio-Economic Environment Net Effects

Social, Economic, & Aboriginal Communities General Assumptions

As noted in Section 5.1.1.3, it is assumed that the existing screening berm will be vegetated and/or additional on-Site plantings introduced, as required, in order to mitigate the potential impacts from a visual and noise standpoint.

Social, Economic, & Aboriginal Communities Potential Environmental Effects

Alternative Method 1

Eleven residential dwellings within the Local Study Area have the potential to be affected by Alternative Method 1. Alternative Method 1, at an increased height of approximately 10 m above the existing landfill at closure, would be partially visible from the agricultural areas to the

immediate west and southwest of the Site within the Local Study Area, but will be obscured from view when looking from the north, east and south within the Local Study Area due to the forested lands that surround those sides of the Site (see **Figure 5.39** for a visual rendering of Alternative Method 1 using Google Street View as seen from the corner of Brooks Road and Talbot Road/Highway 3 and **Figure 5.40** for a visual rendering of Alternative Method 1 using Google Street View as seen from Brooks Road near the former railroad tracks south of the Site). The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations and will continue services to waste disposal customers for the 5 to 7 year planning period.

Alternative Method 1 is a vertical expansion of the existing Brooks Road Landfill and would not require the development of any additional land beyond the existing landfill footprint. As such, there are no potential effects on the use of lands for traditional purposes associated with Alternative Method 1.

Figure 5.39 Visual Rendering of Alternative Method 1 Looking North Towards the Site at Brooks Road & Talbot Road/Highway 3

Figure 5.40 Visual Renderings of Alternative Method 1 Looking North Towards the Site on Brooks Road Near the Abandoned Railway to the South of the Site

Alternative Method 2

Eleven residential dwellings within the Local Study Area have the potential to be affected by Alternative Method 2. Alternative Method 2, at an increased height of approximately 12 m above the existing landfill at closure, would be partially visible from the agricultural areas to the immediate west and southwest of the Site within the Local Study Area, but will be obscured from view when looking from the north, east and south within the Local Study Area due to the forested lands that surround those sides of the Site (see **Figure 5.41** for a visual rendering of Alternative Method 2 using Google Street View as seen from the corner of Brooks Road and Talbot Road/Highway 3 and **Figure 5.42** for a visual rendering of Alternative Method 2 using Google Street View as seen from Brooks Road near the former railroad tracks south of the Site). The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations and will continue services to waste disposal customers for the 5 to 7 year planning period.

Alternative Method 2 is a vertical expansion of the existing Brooks Road Landfill and would not require the development of any additional land beyond the existing landfill footprint. As such, there are no potential effects on the use of lands for traditional purposes associated with Alternative Method 2.

Figure 5.41 Visual Rendering of Alternative Method 2 Looking North Towards the Site at Brooks Road & Talbot Road/Highway 3

Figure 5.42 Visual Renderings of Alternative Method 2 Looking North Towards the Site on Brooks Road Near the Abandoned Railway to the South of the Site

Alternative Method 3

Eleven residential dwellings within the Local Study Area have the potential to be affected by Alternative Method 3. Alternative Method 3, at an increased height of approximately 13 m above the existing landfill at closure, would be partially visible from the agricultural areas to the immediate west and southwest of the Site within the Local Study Area, but will be obscured from view when looking from the north, east and south within the Local Study Area due to the forested lands that surround those sides of the Site (see **Figure 5.43** for a visual rendering of Alternative Method 3 using Google Street View as seen from the corner of Brooks Road and Talbot Road/Highway 3 and **Figure 5.44** for a visual rendering of Alternative Method 3 using Google Street View as seen from Brooks Road near the former railroad tracks south of the Site). The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations and will continue services to waste disposal customers for the 5 to 7 year planning period.

Alternative Method 3 is a vertical expansion of the existing Brooks Road Landfill and would not require the development of any additional land beyond the existing landfill footprint. As such, there are no potential effects on the use of lands for traditional purposes associated with Alternative Method 3.

Figure 5.43 Visual Rendering of Alternative Method 3 Looking North Towards the Site at Brooks Road & Talbot Road/Highway 3

Figure 5.44 Visual Renderings of Alternative Method 3 Looking North Towards the Site on Brooks Road Near the Abandoned Railway to the South of the Site

Social, Economic, & Aboriginal Communities Mitigation Measures

Alternative Method 1, Alternative Method 2, & Alternative Method 3

Views of Alternative Method 1 from the west and southwest can be minimized by planting trees or shrubs on top of the berm along the western property boundary and/or introducing additional on-Site plantings, as required. Nuisance-related effects to the 11 residences within the Local Study Area during construction and operation will be managed through the implementation of BMPs (i.e., typical operating practices related to minimizing nuisance impacts including noise, litter, vectors, dust and odour), such as those noted in Section 5.3.3.4, above, by Brooks Road Environmental.

As there are no potential effects on the use of lands for traditional purposes associated with Alternative Method 1, no specific mitigation measures are required with respect to Aboriginal Communities. Consultation with Aboriginal Communities in the vicinity of the Brook Road Landfill Site will; however, continue throughout the EA process.

Social, Economic, & Aboriginal Communities Net Environmental Effects

Alternative Method 1

Eleven residential dwellings within the Local Study Area have the potential to be affected by Alternative Method 1. Views of the Site from surrounding areas to the west and southwest would be minimized by vegetating the screening berm along the western boundary of the Site and introducing additional plantings on the Site. The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations and will continue services to waste disposal customers for the 5 to 7 year planning period.

There are no net effects on the use of lands for traditional purposes associated with Alternative Method 1.

Alternative Method 2

Eleven residential dwellings within the Local Study Area have the potential to be affected by Alternative Method 2. Views of the Site from surrounding areas to the west and southwest would be minimized by vegetating the screening berm along the western boundary of the Site and introducing additional plantings on the Site. The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations and will continue services to waste disposal customers for the 5 to 7 year planning period.

There are no net effects on the use of lands for traditional purposes associated with Alternative Method 2.

Alternative Method 3

Eleven residential dwellings within the Local Study Area have the potential to be affected by Alternative Method 3. Views of the Site from surrounding areas to the west and southwest would be minimized by vegetating the screening berm along the western boundary of the Site and introducing additional plantings on the Site. The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations and will continue services to waste disposal customers for the 5 to 7 year planning period.

There are no net effects on the use of lands for traditional purposes associated with Alternative Method 3.

5.3.5 Net Effects Tables

The results of the net effects analyses carried out for each alternative method described in the sections above are summarized in **Table 5.9**, **Table 5.10**, and **Table 5.11**, below.

Table 5.9 Alternative Method 1 - Potential Environmental Effects, Mitigation Measures & Net Effects

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
NATURAL	Atmospheric Environment	Air Quality	Predicted off-Site point of impingement concentrations (µg/m^3) of indicator compounds	Potential air quality impact change due to increased elevation of + 20.69 m above the Existing Conditions.	Implement Fugitive Dust BMP to include controls such as watering and sweeping of roadways to allow for a minimum of 90% emission reduction	Reduced particulate matter emissions due to road traffic by a minimum of 90% Air quality property boundary maximum exposure less than ambient air quality criteria for TSP, PM10 and PM2.5 (Air quality property boundary maximum exposure of 61.49 µg/m^3 for TSP for normal operations)
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions.
		Odour	Predicted off-Site odour concentrations (µg/m^3 and odour units)	Potential odour impact change due to increased elevation of + 20.69 m above the Existing Conditions.	Maintain the operational measures currently in place to reduce/mitigate odour impacts from the Site during the vertical expansion	Reduced/maintained Site boundary odour concentrations and reduced odour complaints at off-Site locations
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions.
		Noise	Predicted off-Site noise level	Potential noise impact change due to increased elevation of + 20.69 m above the Existing Conditions that will affect line-of-sight noise impact exposure.	No mitigation measures are required. BMPs, such as barriers and/or berms at Landfill perimeter and administrative controls that limit on-site landfilling activities, will be implemented by Brooks Road Environmental, as required, to minimize noise impacts from the Site.	Potential change to the predicted off-site noise impact from the Existing Conditions.
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site noise impact due to the Landfill expansion based on the Existing Conditions.
	Geology & Hydrogeology	Groundwater Quality	Predicted effects to groundwater quality at property boundaries and off-Site	No potential effects to groundwater quality at property boundaries and off-Site.	No mitigation measures required.	No effects to groundwater quality at property boundaries and off-Site.
		Groundwater Flow	Predicted groundwater flow characteristics	No potential effects to groundwater flow characteristics.	No mitigation measures required.	No effects to groundwater flow characteristics.
	Surface Water Resources	Surface Water Quality	Predicted effects on surface water quality on-site and off-site	Based on the USLE, an increased slope would lead to increased soil loss due to erosion. The increase in soil loss would be minor as slope is only one of numerous factors that affect soil loss. The erosion would show up in stormwater runoff as slightly increased concentrations of TSS and TSS related pollutants.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to remove the excess TSS.	No effects on surface water quality on-site or off-site.
		Surface Water Quantity	Change in drainage areas	No significant increases in runoff peak flow rates or volumes compared to currently approved final closure conditions.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows.	No change in drainage areas.

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
			Predicted occurrence and degree of off-site effects	The stormwater management pond will attenuate runoff peak flow rates for all storm events modelled.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows to protect downstream receivers from potential changes in water quantity.	No off-site effects to surface water quantity.
	Terrestrial & Aquatic Environment	Terrestrial Ecosystems	Predicted impact on vegetation communities	As there is no proposed change to the footprint of waste or buffer areas, and no vegetation clearing is required as part of the proposed conditions, no change to vegetation communities within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to vegetation communities within the Site and Local Study Areas.
			Predicted impact on wildlife habitat	As there is no proposed change to the footprint of waste or buffer areas, and no vegetation clearing is required as part of the proposed conditions, no change to wildlife habitat within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to wildlife habitat within the Site and Local Study Areas.
			Predicted impact on vegetation and wildlife including rare, threatened or endangered species	As there is no proposed change to the footprint of waste or buffer areas, and traffic conditions are expected to remain the same as current conditions, no impact to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas is anticipated.	No specific mitigation measures required; however, BMPs will be implemented by Brooks Road Environmental for the protection of wildlife and SAR.	No net effects to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas.
		Aquatic Ecosystems	Predicted changes in water quality	As there are no proposed changes to stormwater discharge quality or quantity, no change to water quality within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to water quality within the Site and Local Study Areas.
			Predicted impact on aquatic habitat	As there are no proposed changes to stormwater discharge quality or quantity, no change to aquatic habitat within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to aquatic habitat within the Site and Local Study Areas.
			Predicted impact on aquatic biota	As there are no proposed changes to stormwater discharge quality or quantity, no impact to aquatic biota within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to aquatic biota within the Site and Local Study Areas.
CULTURAL	Archaeology & Cultural Heritage	Cultural & Heritage Resources	Cultural and heritage resources (built and landscapes) in the Local Study Area and predicted impacts on them	No potential loss of or disturbance to cultural and heritage resources within the Local Study Area.	No mitigation measures required.	No loss of or disturbance to cultural and heritage resources within the Local Study Area.
		Archaeological Resources	Archaeological resources in the Local Study Area and predicted impacts on them	No potential loss of or disturbance to archaeological resources within the Local Study Area.	No mitigation measures required.	No loss of or disturbance to archaeological resources within the Local Study Area.
BUILT	Transportation	Effects on Airport Operations	Bird strike hazard to aircraft in Local Study Area	No potential for bird strike hazard to aircraft in Local Study Area.	No mitigation measures required.	No bird strike hazard to aircraft in Local Study Area.
		Effects from Truck Transportation Along Access	Potential for traffic collisions	Minimal potential for traffic collisions in the Local Study Area.	No mitigation measures required.	Minimal potential for traffic collisions in Local Study Area.
			Disturbance to traffic operations	Negligible potential for disturbance to traffic operations in Local Study Area and wider road network.	No mitigation measures required.	Negligible disturbance to traffic operations in Local Study Area and wider road network.

Environmental Component	Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
	Roads	Potential road improvement requirements	No potential for road improvement requirements.	No mitigation measures required.	No road improvement requirements.
Land Use	Effects on Current and Planned Future Land Uses	Current land use	No change to the current land uses within the Site and Local Study Areas.	No mitigation measures required.	No change to the current land uses within the Site and Local Study Areas.
		Planned future land use	No potential effects on planned future land use within the Site and Local Study Areas.	No mitigation measures required.	No effects on planned future land use within the Site and Local Study Areas.
		Type(s) and proximity of off-Site recreational resources within 500 m of landfill footprint potentially affected	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation.	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.
		Type(s) and proximity of off-Site sensitive land uses (i.e., dwellings, churches, cemeteries, parks) within 500 m of landfill footprint potentially affected	2 residences are located within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation.	2 residences are located within 500 m of the landfill footprint.
Agriculture/ Soils & Mining	Effects on Soils and Existing Agricultural and Mining Operations	Predicted impacts on surrounding agricultural operations	Potential for nuisance related effects to surrounding agricultural operations resulting from landfill operations.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	Low net effects to surrounding agricultural operations.
		Type(s) and proximity of agricultural operations (i.e., organic, cash crop, livestock)	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate.
		Type(s) and proximity of mining operations	No potential effects on active mining operations as there are none located within the Local Study Area.	No mitigation measures required.	No effects on active mining operations within the Local Study Area.
		Soil classification	No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.	No mitigation measures required.	No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.
Site Design & Operations	Site Design & Operational Characteristics	Complexity of Site infrastructure	Increased complexity of final contours, stormwater management system, screening berms, leachate treatment facility, site access, or scale house facility.	Mitigation through design.	Minor changes to final contours and site grading/drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility.
		Operational flexibility	Limitations on placement and grading of waste/cover material; management of leachate, stormwater, odour, and traffic; potential post-closure uses.	BMPs will be implemented by Brooks Road Environmental to maximize operational flexibility.	Requires placement and grading of waste/cover with steeper slopes. Additional limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic.

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
SOCIO-ECONOMIC	Social	Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	• Final height at closure approximately 10 m above existing landfill. • Visible from agricultural areas to the immediate west and southwest of the Site within the Local Study Area. • No visibility from the north, east and south within the Local Study Area due to existing vegetation.	Screening berm to be vegetated and/or introduction of additional plantings on the Site to minimize views from agricultural areas to the west and southwest, as required.	Vegetating the screening berm and/or introducing additional plantings on the Site, as required, would minimize views of the Site from surrounding areas.
		Effects on Local Residents	Number of residences	11 residential dwellings within the Local Study Area.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	11 residential dwellings within the Local Study Area.
	Economic	Effects on/ Benefits to Local Community	Employment at site (number and duration)	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.	No mitigation measures required.	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.
			Opportunities to provide products or services	Continue services to waste disposal customers for the 5 to 7 year planning period.	No mitigation measures required.	Continue services to waste disposal customers for the 5 to 7 year planning period.
	Aboriginal Communities	Potential Effects on Aboriginal Communities	Potential effects on use of lands for traditional purposes	No potential effects on the use of lands for traditional purposes.	No mitigation measures required. Consultation with Aboriginal Communities will continue throughout the EA process.	No effects on the use of lands for traditional purposes.

Table 5.10 Alternative Method 2 - Potential Environmental Effects, Mitigation Measures & Net Effects

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
NATURAL	Atmospheric Environment	Air Quality	Predicted off-Site point of impingement concentrations (µg/m^3) of indicator compounds	Potential air quality impact change due to increased elevation of + 22.54 m above the Existing Conditions.	Implement Fugitive Dust BMP to include controls such as watering and sweeping of roadways to allow for a minimum of 90% emission reduction	Reduced particulate matter emissions due to road traffic by a minimum of 90% Air quality property boundary maximum exposure less than ambient air quality criteria for TSP, PM10 and PM2.5 (Air quality property boundary maximum exposure of 61.01 µg/m^3 for TSP during normal operations)
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions.
		Odour	Predicted off-Site odour concentrations (µg/m^3 and odour units)	Potential odour impact change due to increased elevation of + 22.54 m above the Existing Conditions.	Maintain the operational measures currently in place to reduce/mitigate odour impacts from the Site during the vertical expansion	Reduced/maintained Site boundary odour concentrations and reduced odour complaints at off-Site locations
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions.
		Noise	Predicted off-Site noise level	Potential noise impact change due to increased elevation of + 22.54 m above the Existing Conditions that will affect line-of-sight noise impact exposure.	No mitigation measures are required. BMPs, such as barriers and/or berms at Landfill perimeter and administrative controls that limit on-site landfilling activities, will be implemented by Brooks Road Environmental, as required, to minimize noise impacts from the Site.	Potential change to the predicted off-site noise impact from the Existing Conditions.
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site noise impact due to the Landfill expansion based on the Existing Conditions.
	Geology & Hydrogeology	Groundwater Quality	Predicted effects to groundwater quality at property boundaries and off-Site	No potential effects to groundwater quality at property boundaries and off-Site.	No mitigation measures required.	No effects to groundwater quality at property boundaries and off-Site.
		Groundwater Flow	Predicted groundwater flow characteristics	No potential effects to groundwater flow characteristics.	No mitigation measures required.	No effects to groundwater flow characteristics.
	Surface Water Resources	Surface Water Quality	Predicted effects on surface water quality on-site and offsite	Based on the USLE, an increased slope would lead to increase soil loss due to erosion. The increase in soil loss would be minor as slope is only one of numerous factors that affect soil loss. The erosion would show up in stormwater runoff as slightly increased concentrations of TSS and TSS related pollutants.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to remove the excess TSS.	No effects on surface water quality on-site or off-site.
		Surface Water Quantity	Change in drainage areas	No significant increases in runoff peak flow rates or volumes compared to currently approved final closure conditions.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows.	No change in drainage areas.

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
			Predicted occurrence and degree of off-site effects	The stormwater management pond will attenuate runoff peak flow rates for all storm events modelled.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows to protect downstream receivers from potential changes in water quantity.	No off-site effects to surface water quantity.
	Terrestrial & Aquatic Environment	Terrestrial Ecosystems	Predicted impact on vegetation communities	As there is no proposed change to the footprint of waste or buffer areas, and no vegetation clearing is required as part of the proposed conditions, no change to vegetation communities within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to vegetation communities within the Site and Local Study Areas.
			Predicted impact on wildlife habitat	As there is no proposed change to the footprint of waste or buffer areas, and no vegetation clearing is required as part of the proposed conditions, no change to wildlife habitat within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to wildlife habitat within the Site and Local Study Areas.
			Predicted impact on vegetation and wildlife including rare, threatened or endangered species	As there is no proposed change to the footprint of waste or buffer areas, and traffic conditions are expected to remain the same as current conditions, no impact to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas is anticipated.	No specific mitigation measures required; however, BMPs will be implemented by Brooks Road Environmental for the protection of wildlife and SAR.	No net effects to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas.
		Aquatic Ecosystems	Predicted changes in water quality	As there are no proposed changes to stormwater discharge quality or quantity, no change to water quality within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to water quality within the Site and Local Study Areas.
			Predicted impact on aquatic habitat	As there are no proposed changes to stormwater discharge quality or quantity, no change to aquatic habitat within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to aquatic habitat within the Site and Local Study Areas.
			Predicted impact on aquatic biota	As there are no proposed changes to stormwater discharge quality or quantity, no impact to aquatic biota within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to aquatic biota within the Site and Local Study Areas.
CULTURAL	Archaeology & Cultural Heritage	Cultural & Heritage Resources	Cultural and heritage resources (built and landscapes) in the Local Study Area and predicted impacts on them	No potential loss of or disturbance to cultural and heritage resources within the Local Study Area.	No mitigation measures required.	No loss of or disturbance to cultural and heritage resources within the Local Study Area.
		Archaeological Resources	Archaeological resources in the Local Study Area and predicted impacts on them	No potential loss of or disturbance to archaeological resources within the Local Study Area.	No mitigation measures required.	No loss of or disturbance to archaeological resources within the Local Study Area.
BUILT	Transportation	Effects on Airport Operations	Bird strike hazard to aircraft in Local Study Area	No potential for bird strike hazard to aircraft in Local Study Area.	No mitigation measures required.	No bird strike hazard to aircraft in Local Study Area.
		Effects from Truck Transportation Along Access	Potential for traffic collisions	Minimal potential for traffic collisions in the Local Study Area.	No mitigation measures required.	Minimal potential for traffic collisions in Local Study Area.
			Disturbance to traffic operations	Negligible potential for disturbance to traffic operations in Local Study Area and wider road network.	No mitigation measures required.	Negligible disturbance to traffic operations in Local Study Area and wider road network.

Environmental Component	Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
	Roads	Potential road improvement requirements	No potential for road improvement requirements.	No mitigation measures required.	No road improvement requirements.
Land Use	Effects on Current and Planned Future Land Uses	Current land use	No change to the current land uses within the Site and Local Study Areas.	No mitigation measures required.	No change to the current land uses within the Site and Local Study Areas.
		Planned future land use	No potential effects on planned future land use within the Site and Local Study Areas.	No mitigation measures required.	No effects on planned future land use within the Site and Local Study Areas.
		Type(s) and proximity of off-Site recreational resources within 500 m of landfill footprint potentially affected	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation.	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.
		Type(s) and proximity of off-Site sensitive land uses (i.e., dwellings, churches, cemeteries, parks) within 500 m of landfill footprint potentially affected	2 residences are located within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation.	2 residences are located within 500 m of the landfill footprint.
Agriculture/ Soils & Mining	Effects on Soils and Existing Agricultural and Mining Operations	Predicted impacts on surrounding agricultural operations	Potential for landfill operations to affect surrounding agricultural operations.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	Low net effects to surrounding agricultural operations.
		Type(s) and proximity of agricultural operations (i.e., organic, cash crop, livestock)	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate.
		Type(s) and proximity of mining operations	No potential effects on active mining operations as there are none located within the Local Study Area.	No mitigation measures required.	No effects on active mining operations within the Local Study Area.
		Soil classification	No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.	No mitigation measures required.	No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.
Site Design & Operations	Site Design & Operational Characteristics	Complexity of Site infrastructure	Increased complexity of final contours, stormwater management system, screening berms, leachate treatment facility, site access, or scale house facility.	Mitigation through design.	Minor changes to final contours and site grading/drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility.
		Operational flexibility	Limitations on placement and grading of waste/cover material; management of leachate, stormwater, odour, and traffic; potential post-closure uses.	BMPs will be implemented by Brooks Road Environmental to maximize operational flexibility.	No changes to proposed waste/cover slopes. Fewer limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic.

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
SOCIO-ECONOMIC	Social	Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	• Final height at closure approximately 12 m above existing landfill. • Visible from agricultural areas to the immediate west and southwest of the Site within the Local Study Area. • No visibility from the north, east and south within the Local Study Area due to existing vegetation.	Screening berm to be vegetated and/or introduction of additional plantings on the Site to minimize views from agricultural areas to the west and southwest, as required.	Vegetating the screening berm and/or introducing additional plantings on the Site, as required, would minimize views of the Site from surrounding areas.
		Effects on Local Residents	Number of residences	11 residential dwellings within the Local Study Area.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	11 residential dwellings within the Local Study Area.
	Economic	Effects on/ Benefits to Local Community	Employment at site (number and duration)	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.	No mitigation measures required.	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.
			Opportunities to provide products or services	Continue services to waste disposal customers for the 5 to 7 year planning period.	No mitigation measures required.	Continue services to waste disposal customers for the 5 to 7 year planning period.
	Aboriginal Communities	Potential Effects on Aboriginal Communities	Potential effects on use of lands for traditional purposes	No potential effects on the use of lands for traditional purposes.	No mitigation measures required. Consultation with Aboriginal Communities will continue throughout the EA process.	No effects on the use of lands for traditional purposes.

Table 5.11 Alternative Method 3 - Potential Environmental Effects, Mitigation Measures & Net Effects

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
NATURAL	Atmospheric Environment	Air Quality	Predicted off-Site point of impingement concentrations (µg/m^3) of indicator compounds	Potential air quality impact change due to increased elevation of + 23.17 m above the Existing Conditions.	Implement Fugitive Dust Best Management Plan to include controls such as watering and sweeping of roadways to allow for a minimum of 90% emission reduction	Reduced particulate matter emissions due to road traffic by a minimum of 90% Air quality property boundary maximum exposure less than ambient air quality criteria for TSP, PM10 and PM2.5 (Air quality property boundary maximum exposure of 61.13 µg/m^3 for TSP during normal operations)
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions.
		Odour	Predicted off-Site odour concentrations (µg/m^3 and odour units)	Potential odour impact change due to increased elevation of + 23.17 m above the Existing Conditions.	Maintain the operational measures currently in place to reduce/mitigate odour impacts from the Site during the vertical expansion	Reduced/maintained Site boundary odour concentrations and reduced odour complaints at off-Site locations
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions.
		Noise	Predicted off-Site noise level	Potential noise impact change due to increased elevation of + 22.54 m above the Existing Conditions that will affect line-of-sight noise impact exposure.	No mitigation measures are required. BMPs, such as barriers and/or berms at Landfill perimeter and administrative controls that limit on-site landfilling activities, will be implemented by Brooks Road Environmental, as required, to minimize noise impacts from the Site.	Potential change to the predicted off-site noise impact from the Existing Conditions.
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 existing off-site residential dwellings affected by the proposed Landfill expansion.		Up to 14 residences may experience a change in the predicted off-site noise impact due to the Landfill expansion based on the Existing Conditions.
	Geology & Hydrogeology	Groundwater Quality	Predicted effects to groundwater quality at property boundaries and off-Site	No potential effects to groundwater quality at property boundaries and off-Site.	No mitigation measures required.	No effects to groundwater quality at property boundaries and off-Site.
		Groundwater Flow	Predicted groundwater flow characteristics	No potential effects to groundwater flow characteristics.	No mitigation measures required.	No effects to groundwater flow characteristics.
	Surface Water Resources	Surface Water Quality	Predicted effects on surface water quality on-site and offsite	Based on the USLE, an increased slope would lead to increase soil loss due to erosion. The increase in soil loss would be minor as slope is only one of numerous factors that affect soil loss. The erosion would show up in stormwater runoff as slightly increased concentrations of TSS and TSS related pollutants.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to remove the excess TSS.	No effects on surface water quality on-site or off-site.
		Surface Water Quantity	Change in drainage areas	No significant increases in runoff peak flow rates or volumes compared to currently approved final closure conditions.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows.	No change in drainage areas.

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
			Predicted occurrence and degree of off-site effects	The stormwater management pond will attenuate runoff peak flow rates for all storm events modelled.	No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows to protect downstream receivers from potential changes in water quantity.	No off-site effects to surface water quantity.
	Terrestrial & Aquatic Environment	Terrestrial Ecosystems	Predicted impact on vegetation communities	As there is no proposed change to the footprint of waste or buffer areas, and no vegetation clearing is required as part of the proposed conditions, no change to vegetation communities within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to vegetation communities within the Site and Local Study Areas.
			Predicted impact on wildlife habitat	As there is no proposed change to the footprint of waste or buffer areas, and no vegetation clearing is required as part of the proposed conditions, no change to wildlife habitat within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to wildlife habitat within the Site and Local Study Areas.
			Predicted impact on vegetation and wildlife including rare, threatened or endangered species	As there is no proposed change to the footprint of waste or buffer areas, and traffic conditions are expected to remain the same as current conditions, no impact to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas is anticipated.	No specific mitigation measures required; however, BMPs will be implemented by Brooks Road Environmental for the protection of wildlife and SAR.	No net effects to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas.
		Aquatic Ecosystems	Predicted changes in water quality	As there are no proposed changes to stormwater discharge quality or quantity, no change to water quality within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to water quality within the Site and Local Study Areas.
			Predicted impact on aquatic habitat	As there are no proposed changes to stormwater discharge quality or quantity, no change to aquatic habitat within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to aquatic habitat within the Site and Local Study Areas.
			Predicted impact on aquatic biota	As there are no proposed changes to stormwater discharge quality or quantity, no impact to aquatic biota within the Site and Local Study Areas is anticipated.	No mitigation measures required.	No net effects to aquatic biota within the Site and Local Study Areas.
CULTURAL	Archaeology & Cultural Heritage	Cultural & Heritage Resources	Cultural and heritage resources (built and landscapes) in the Local Study Area and predicted impacts on them	No potential loss of or disturbance to cultural and heritage resources within the Local Study Area.	No mitigation measures required.	No loss of or disturbance to cultural and heritage resources within the Local Study Area.
		Archaeological Resources	Archaeological resources in the Local Study Area and predicted impacts on them	No potential loss of or disturbance to archaeological resources within the Local Study Area.	No mitigation measures required.	No loss of or disturbance to archaeological resources within the Local Study Area.
BUILT	Transportation	Effects on Airport Operations	Bird strike hazard to aircraft in Local Study Area	No potential for bird strike hazard to aircraft in Local Study Area.	No mitigation measures required.	No bird strike hazard to aircraft in Local Study Area.
		Effects from Truck Transportation Along Access	Potential for traffic collisions	Minimal potential for traffic collisions in the Local Study Area.	No mitigation measures required.	Minimal potential for traffic collisions in Local Study Area.
			Disturbance to traffic operations	Negligible potential for disturbance to traffic operations in Local Study Area and wider road network.	No mitigation measures required.	Negligible disturbance to traffic operations in Local Study Area and wider road network.

Environmental Component	Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
	Roads	Potential road improvement requirements	No potential for road improvement requirements.	No mitigation measures required.	No road improvement requirements.
Land Use	Effects on Current and Planned Future Land Uses	Current land use	No change to the current land uses within the Site and Local Study Areas.	No mitigation measures required.	No change to the current land uses within the Site and Local Study Areas.
		Planned future land use	No potential effects on planned future land use within the Site and Local Study Areas.	No mitigation measures required.	No effects on planned future land use within the Site and Local Study Areas.
		Type(s) and proximity of off-Site recreational resources within 500 m of landfill footprint potentially affected	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation.	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.
		Type(s) and proximity of off-Site sensitive land uses (i.e., dwellings, churches, cemeteries, parks) within 500 m of landfill footprint potentially affected	2 residences are located within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation.	2 residences are located within 500 m of the landfill footprint.
Agriculture/ Soils & Mining	Effects on Soils and Existing Agricultural and Mining Operations	Predicted impacts on surrounding agricultural operations	Potential for landfill operations to affect surrounding agricultural operations.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	Low net effects to surrounding agricultural operations.
		Type(s) and proximity of agricultural operations (i.e., organic, cash crop, livestock)	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate.
		Type(s) and proximity of mining operations	No potential effects on active mining operations as there are none located within the Local Study Area.	No mitigation measures required.	No effects on active mining operations within the Local Study Area.
		Soil classification	No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.	No mitigation measures required.	No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.
Site Design & Operations	Site Design & Operational Characteristics	Complexity of Site infrastructure	Increased complexity of final contours, stormwater management system, screening berms, leachate treatment facility, site access, or scale house facility.	Mitigation through design.	Minor changes to final contours and site grading/drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility.
		Operational flexibility	Limitations on placement and grading of waste/cover material; management of leachate, stormwater, odour, and traffic; potential post-closure uses.	BMPs will be implemented by Brooks Road Environmental to maximize operational flexibility.	Requires placement and grading of waste/cover with steeper slopes and a bench. Additional limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic.

Environmental Component		Evaluation Criteria	Indicator	Potential Effects	Mitigation Measures	Net Effects
SOCIO-ECONOMIC	Social	Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	• Final height at closure approximately 13 m above existing landfill. • Visible from agricultural areas to the immediate west and southwest of the Site within the Local Study Area. • No visibility from the north, east and south within the Local Study Area due to existing vegetation.	Screening berm to be vegetated and/or introduction of additional plantings on the Site to minimize views from agricultural areas to the west and southwest, as required.	Vegetating the screening berm and/or introducing additional plantings on the Site, as required, would minimize views of the Site from surrounding areas.
		Effects on Local Residents	Number of residences	11 residential dwellings within the Local Study Area.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	11 residential dwellings within the Local Study Area.
	Economic	Effects on/ Benefits to Local Community	Employment at site (number and duration)	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.	No mitigation measures required.	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.
			Opportunities to provide products or services	Continue services to waste disposal customers for the 5 to 7 year planning period.	No mitigation measures required.	Continue services to waste disposal customers for the 5 to 7 year planning period.
	Aboriginal Communities	Potential Effects on Aboriginal Communities	Potential effects on use of lands for traditional purposes	No potential effects on the use of lands for traditional purposes.	No mitigation measures required. Consultation with Aboriginal Communities will continue throughout the EA process.	No effects on the use of lands for traditional purposes.

5.4 Comparative Evaluation & Identification of the Preferred Alternative Solution

The comparative evaluation of the three Alternative Methods was carried out first by each individual indicator, then evaluation criteria, followed by environmental component, as detailed in **Section 5.2**, above, in order to arrive at a Preferred Alternative Solution. The results of the comparative evaluation by environmental component are summarized in the paragraphs below and in **Table 5.12**.

Air quality and odour impact predictions are within applicable limits for all three Alternative Methods. Although the off-Site air quality impact predictions are near identical for all three alternatives, Alternative Method 2 has the lowest property boundary concentration followed by Alternative Method 3 then Alternative Method 1. Therefore, from a potential air quality perspective, Alternative Method 2 ranks 1st, Alternative Method 3 ranks 2nd, and Alternative Method 1 ranks 3rd. From a potential odour impact exposure perspective, Alternative Methods 1, 2 and 3 are identical.

All three Alternative Methods will have a low net effect on the predicted off-Site noise level with a noise impact exposure range from 40 dBA to 52 dBA for each. The number of potentially affected off-Site receptors and extent of effect is identical for all three Alternative Methods, with POR5 being impacted the most at 52 dBA (which is a -3 dBA reduction from the existing condition). For all 14 off-Site receptors within the Local Study Area, the net sound level change associated with each Alternative Method is 3 dBA or lower, which is recognized as environmentally and acoustically insignificant and; therefore, the net effects are considered low. As such, there is no distinction between the Alternative Methods in relation their effects on Noise within the Local Study Area and; therefore, all rank the same.

There are no anticipated net effects in terms of the Site geology or hydrogeology resulting from the three vertical expansion alternatives reviewed; therefore, from a Geology and Hydrogeology perspective, all three Alternative Methods are equally ranked.

In terms of Surface Water Resources, all three Alternative Methods may result in increased erosion/soil loss, runoff peak flow rates and/or runoff volumes due to steeper slopes. The increase is soil loss would be minor as slope is only one of numerous factors that affect soil loss. The erosion would show up in stormwater runoff as slightly increased concentrations of TSS and TSS related pollutants (e.g., metals entrained in the soil). Based on hydrologic modelling, there is no significant increase in runoff peak flow rates or volumes with steeper landfill slopes. Therefore, each of the three Alternative Methods proposed is equal in that none are anticipated to affect surface water quality or quantity for downstream receivers.

As all three Alternative Methods are vertical expansions of the landfill, thereby maintaining the existing landfill footprint, and existing criteria for operations and quality of discharge from the Site are identical under all evaluated Alternative Methods, there is no distinction between the Alternatives in terms of their effects on the terrestrial and aquatic environment. Therefore, all three Alternative Methods rank in first place as they would all result in no Net Effects to the Terrestrial and Aquatic environment.

There are no net effects associated with any of the proposed Alternative Methods in relation to cultural and heritage resources and archaeological resources. As such, there is no distinction between the alternatives in relation to their effects on Archaeology and Cultural Heritage within the Local Study Area and, therefore, all alternatives rank the same.

As all three Alternative Methods are expected to generate an equal number of additional site trucks per day, from a Transportation perspective, there is no distinction between the three Alternative Methods. Concerning the effects on airport operations, no net effect is expected as a result of any airports or aerodromes not being situated within the Local Study Area. Concerning the truck transportation effects along access roads, minimal effects are expected. There is an expected minimal impact on traffic safety, an expected negligible impact on traffic operations, and no potential road improvements are required or recommended. As such, all three Alternative Methods are acceptable, and equally preferred, based on the Transportation environmental component ranking.

From a Land Use perspective, all three of the Alternative Methods are preferred as they would all result in no effects to current or planned future land use as well as low effects to off-Site recreational resources and the two residences within 500 m of the landfill footprint.

There are no net effects associated with any of the proposed Alternative Methods in relation to mining operations and loss of soil with agricultural capability. Similarly, with the implementation of BMPS, low net effects to surrounding agricultural operations, including the two neighbouring cash crop farms, are anticipated for all three alternatives. As such, there is no distinction between the alternatives in relation to their effects on Agriculture, Soils and Mining within the Local Study Area and, therefore, all alternatives rank the same.

All of the proposed Alternative Methods will result in low to no net effects from a Site Design & Operations perspective. Alternative Method 2 is slightly preferred as the waste/cover slopes will be consistent with the currently approved MOECC design.

From a Social environment perspective, Alternative Method 1 is slightly preferred as its final height will be lower than those of the other two Alternatives by 2 to 3 m.

All three of the Alternative Methods are preferred with respect to the Economic environment as they will result in identical positive benefits to local community.

From an Aboriginal Community perspective, all three of the Alternative Methods are preferred. There will be no effects on the use of land for traditional purposes associated with any of the alternatives.

In Summary, based on the results of the comparative evaluation, as described above and in **Table 5.12**, below, there is no substantial difference between the three Alternative Methods with respect to odour, noise, geology, hydrogeology, surface water resources, terrestrial and aquatic environment, cultural and heritage resources, archaeological resources, transportation, land use, agriculture, soils, mining, or economics. While Alternative Method 1 is slightly preferred from a visual perspective, as its final height will be lower than those of the other two Alternatives by 2 to 3 m, the Preferred Alternative Solution for the Brooks Road Landfill Site Vertical Capacity Expansion is Alternative Method 2 for the following reasons:

- Air quality property boundary maximum exposure for TSP during normal operations is 61.01 µg/m^3 (as compared to 61.49 µg/m^3 and 61.13 µg/m^3 for Alternative Methods 1 and 3, respectively)
- Final contours are simplified and consistent with the currently approved MOECC design and operational flexibility is increased from a site design and operations perspective, as comparted to Alternative Methods 1 and 3

Table 5.12 Comparative Evaluation

Environmental Component		Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
NATURAL	Atmospheric Environment	Air Quality	Predicted off-Site point of impingement concentrations ($\mu g/m^3$) of indicator compounds	Air quality property boundary maximum exposure of 61.49 $\mu g/m^3$ for TSP (less than ambient air quality criteria) for normal operations. **LOW NET EFFECTS**	Air quality property boundary maximum exposure of 61.01 $\mu g/m^3$ for TSP (less than ambient air quality criteria)for normal operations. **LOW NET EFFECTS**	Air quality property boundary maximum exposure of 61.13 $\mu g/m^3$ for TSP (less than ambient air quality criteria)for normal operations. **LOW NET EFFECTS**
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions. **LOW NET EFFECTS**	Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions. **LOW NET EFFECTS**	Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions. **LOW NET EFFECTS**
			Criteria Ranking:	**3rd Least Preferred**	**1st Most Preferred**	**2nd Less Preferred**
			Criteria Rationale:	From a potential air quality TSP impact exposure perspective, Alternative Methods 1, 2 and 3 are nearly identical. However, Alternative Method 2 has the lowest property boundary concentration, and is therefore most preferred, followed by Alternative Method 3 (less preferred), then Alternative Method 1 (least preferred).		
		Odour	Predicted off-Site odour concentrations ($\mu g/m^3$ and odour units)	Reduced/maintained Site boundary and off-Site odour concentrations. **LOW NET EFFECTS**	Reduced/maintained Site boundary and off-Site odour concentrations. **LOW NET EFFECTS**	Reduced/maintained Site boundary and off-Site odour concentrations. **LOW NET EFFECTS**
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses and institutions)	Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions. **LOW NET EFFECTS**	Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions. **LOW NET EFFECTS**	Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions. **LOW NET EFFECTS**
			Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
			Criteria Rationale:	From a potential odour impact exposure perspective, Alternative Methods 1, 2 and 3 are identical; therefore, there is no substantial difference between them.		
		Noise	Predicted off-Site noise level	Noise impact exposure ranges from 40 dBA to 52 dBA, which is below the 55 dBA noise limit. **LOW NET EFFECT**	Noise impact exposure ranges from 40 dBA to 52 dBA, which is below the 55 dBA noise limit. **LOW NET EFFECT**	Noise impact exposure ranges from 40 dBA to 52 dBA, which is below the 55 dBA noise limit. **LOW NET EFFECT**
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Net sound level change for 14 off-Site receptors is 3 dBA or lower[12]: • 10 residences = 0 to + 1 dBA change • 1 residence = 2 dBA change • 3 residences = 2 to 3 dBA noise reduction • POR5 = 52 dBA (-3 dBA reduction from existing condition) • POR7 = 40 dBA (+ 2 dBA increase from existing condition) **LOW NET EFFECT**	Net sound level change for 14 off-Site receptors is 3 dBA or lower[1]: • 10 residences = 0 to + 1 dBA change • 1 residence = 2 dBA change • 3 residences = 2 to 3 dBA noise reduction • POR5 = 52 dBA (-3 dBA reduction from existing condition) • POR7 = 40 dBA (+ 2 dBA increase from existing condition) **LOW NET EFFECT**	Net sound level change for 14 off-Site receptors is 3 dBA or lower[1]: • 10 residences = 0 to + 1 dBA change • 1 residence = 2 dBA change • 3 residences = 2 to 3 dBA noise reduction • POR5 = 52 dBA (-3 dBA reduction from existing condition) • POR7 = 40 dBA (+ 2 dBA increase from existing condition) **LOW NET EFFECT**

[2] A net sound level change of 0 to 3 dBA is recognized as environmentally and acoustically insignificant.

Environmental Component	Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	There is no substantial difference between the alternatives in terms of their predicted off-Site noise levels and the number of off-Site receptors potentially affected.		
	Environmental Component Ranking:		**3rd Least Preferred**	**1st Most Preferred**	**2nd Less Preferred**
RATIONALE			**From a potential air quality, odour, and noise impact exposure perspective, Alternative Methods 1, 2 and 3 are nearly identical. However, Alternative Method 2 has the lowest property boundary TSP concentration, and is therefore most preferred, followed by Alternative Method 3 (less preferred), then Alternative Method 1 (least preferred)followed by Alternative Method 3, then Alternative Method 1.**		
Geology & Hydrogeology	Groundwater Quality	Predicted effects to groundwater quality at property boundaries and off-Site	No effects to groundwater quality at property boundaries and off-Site. **NO NET EFFECTS**	No effects to groundwater quality at property boundaries and off-Site. **NO NET EFFECTS**	No effects to groundwater quality at property boundaries and off-Site. **NO NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	All three alternatives would result in no effects to groundwater quality at property boundaries and off-Site. As such, there is no substantial difference between them.		
	Groundwater Flow	Predicted groundwater flow characteristics	No effects to groundwater flow characteristics. **NO NET EFFECTS**	No effects to groundwater flow characteristics. **NO NET EFFECTS**	No effects to groundwater flow characteristics. **NO NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	All three alternatives would result in no effects to groundwater flow characteristics; therefore, there is no substantial difference between them.		
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
RATIONALE			**There is no substantial difference between the alternatives in relation to their effects on groundwater quality and flow characteristics.**		
Surface Water Resources	Surface Water Quality	Predicted effects on surface water quality on-site and offsite	No effects on surface water quality on-site or off-site. **NO NET EFFECTS**	No effects on surface water quality on-site or off-site. **NO NET EFFECTS**	No effects on surface water quality on-site or off-site. **NO NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	No on-site or off-site effects on surface water quality associated with any of the three alternative methods. As such, there is no substantial difference between them.		
	Surface Water Quantity	Change in drainage areas	No change in drainage areas. **NO NET EFFECTS**	No change in drainage areas. **NO NET EFFECTS**	No change in drainage areas. **NO NET EFFECTS**
		Predicted occurrence and degree of off-site effects	No off-site effects to surface water quantity. **NO NET EFFECTS**	No off-site effects to surface water quantity. **NO NET EFFECTS**	No off-site effects to surface water quantity. **NO NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	No effects on surface water quantity associated with any of the three alternative methods. As such, there is no substantial difference between them.		
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
RATIONALE			**There is no substantial difference between the three alternative methods with respect to surface water quality and quantity.**		
Terrestrial & Aquatic Environment	Terrestrial Ecosystems	Predicted impact on vegetation communities	No predicted changes to vegetation communities within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to vegetation communities within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to vegetation communities within the Site and Local Study Areas. **NO NET EFFECT**
		Predicted impact on wildlife habitat	No predicted changes to wildlife habitat within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to wildlife habitat within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to wildlife habitat within the Site and Local Study Areas. **NO NET EFFECT**

Environmental Component	Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
		Predicted impact on vegetation and wildlife including rare, threatened or endangered species	No predicted changes to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas. **NO NET EFFECT**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	There is no substantial difference between the alternatives in terms of their effects on the terrestrial environment, as they would all result in no net effects to the terrestrial environment.		
	Aquatic Ecosystems	Predicted changes in water quality	No predicted changes to water quality within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to water quality within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to water quality within the Site and Local Study Areas. **NO NET EFFECT**
		Predicted impact on aquatic habitat	No predicted changes to aquatic habitat within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to aquatic habitat within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to aquatic habitat within the Site and Local Study Areas. **NO NET EFFECT**
		Predicted impact on aquatic biota	No predicted changes to aquatic biota within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to aquatic biota within the Site and Local Study Areas. **NO NET EFFECT**	No predicted changes to aquatic biota within the Site and Local Study Areas. **NO NET EFFECT**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	There is no substantial difference between the alternatives in terms of their effects on the aquatic environment, as they would all result in no net effects to the aquatic environment.		
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
	RATIONALE		**There is no substantial difference between the three alternative methods with respect to the terrestrial and aquatic environment.**		
CULTURAL	Archaeology & Cultural Heritage	Cultural & Heritage Resources	Cultural and heritage resources (built and landscapes) in the Local Study Area and predicted impacts on them	No loss of or disturbance to cultural and heritage resources within the Local Study Area. **NO NET EFFECTS**	No loss of or disturbance to cultural and heritage resources within the Local Study Area. **NO NET EFFECTS**	No loss of or disturbance to cultural and heritage resources within the Local Study Area. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
			Criteria Rationale:	All three alternatives are preferred as they would all result in no loss or disturbance to cultural and heritage resources within the Local Study Area.		
		Archaeological Resources	Archaeological resources in the Local Study Area and predicted impacts on them	No loss of or disturbance to archaeological resources within the Local Study Area. **NO NET EFFECTS**	No loss of or disturbance to archaeological resources within the Local Study Area. **NO NET EFFECTS**	No loss of or disturbance to archaeological resources within the Local Study Area. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
			Criteria Rationale:	There is no substantial difference between the alternatives, as they would all result in no loss or disturbance to archaeological potential within the Local Study Area.		
		Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
	RATIONALE			**There is no substantial difference between the three alternative methods in relation to their effects on cultural and heritage resources and archaeological potential within the Local Study Area.**		

	Environmental Component	Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
BUILT	Transportation	Effects on Airport Operations	Bird strike hazard to aircraft in Local Study Area	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st** **No Substantial Difference**	**Tied for 1st** **No Substantial Difference**	**Tied for 1st** **No Substantial Difference**
			Criteria Rationale:	There is no substantial difference between the alternatives as, they would all result in no effects to bird strike hazards to aircraft.		
		Effects from Truck Transportation Along Access Roads	Potential for traffic collisions	Minimal potential for traffic collisions in Local Study Area. **LOW NET EFFECTS**	Minimal potential for traffic collisions in Local Study Area. **LOW NET EFFECTS**	Minimal potential for traffic collisions in Local Study Area. **LOW NET EFFECTS**
			Disturbance to traffic operations	Negligible disturbance to traffic operations in Local Study Area and wider road network. **LOW NET EFFECTS**	Negligible disturbance to traffic operations in Local Study Area and wider road network. **LOW NET EFFECTS**	Negligible disturbance to traffic operations in Local Study Area and wider road network. **LOW NET EFFECTS**
			Potential road improvement requirements	No road improvements required. **NO NET EFFECT**	No road improvements required. **NO NET EFFECT**	No road improvements required. **NO NET EFFECT**
			Criteria Ranking:	**Tied for 1st** **No Substantial Difference**	**Tied for 1st** **No Substantial Difference**	**Tied for 1st** **No Substantial Difference**
			Criteria Rationale:	There is no substantial difference between the alternatives, as they would all result in a minimal impact on traffic safety and a negligible impact on traffic operations in the Local Study Area and surrounding road network. There are no road improvements required.		
		Environmental Component Ranking:		**Tied for 1st** **No Substantial Difference**	**Tied for 1st** **No Substantial Difference**	**Tied for 1st** **No Substantial Difference**
	RATIONALE			**There is no substantial difference between the three alternative methods in terms of their effects on airport operations and from truck transportation along access roads. All three alternatives would equally result in minimal impacts to traffic safety, have a negligible impact on traffic operations in the Local Study Area and surrounding road network, and would not require any potential road improvements.**		
	Land Use	Effects on Current and Planned Future Land Uses	Current land use	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**
			Planned future land use	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**
			Type(s) and proximity of off-Site recreational resources within 500 m of landfill footprint potentially affected	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**

Environmental Component	Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
		Type(s) and proximity of off-Site sensitive land uses (i.e., dwellings, churches, cemeteries, parks) within 500 m of landfill footprint potentially affected	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
RATIONALE			**There is no substantial difference between the alternatives in terms of their effects on current and planned future land uses, as they would all result in no effects to current or planned future land use and low effects to off-Site recreational resources and the two residences within 500 m.**		
Agriculture/ Soils & Mining	Effects on Soils and Existing Agricultural and Mining Operations	Predicted impacts on surrounding agricultural operations	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**
		Type(s) and proximity of agricultural operations (i.e., organic, cash crop, livestock)	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**
		Type(s) and proximity of mining operations	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**
		Soil classification	No loss of soil with agricultural capability. **NO NET EFFECTS**	No loss of soil with agricultural capability. **NO NET EFFECTS**	No loss of soil with agricultural capability. **NO NET EFFECTS**
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
RATIONALE			**There is no substantial difference between the alternatives with respect to soils and existing agricultural and mining operations within the Local Study Area.**		
Site Design & Operations	Site Design & Operational Characteristics	Complexity of Site infrastructure	Minor changes to final contours and site grading/ drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility. **LOW NET EFFECTS**	Minor changes to final contours and site grading/ drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility. **LOW NET EFFECTS**	Minor changes to final contours and site grading/ drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility. **LOW NET EFFECTS**
		Operational flexibility	Requires placement and grading of waste/cover with steeper slopes. Additional limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic. **LOW NET EFFECTS**	No changes to proposed waste/cover slopes. Fewer limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic. **LOW NET EFFECTS**	Requires placement and grading of waste/cover with steeper slopes and a bench. Additional limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic. **LOW NET EFFECTS**
	Environmental Component Ranking:		**2nd Less Preferred**	**1st Most Preferred**	**3rd Least Preferred**
RATIONALE			**While low net effects are anticipated for all alternatives, Alternative Method 2 is most preferred from a Site Design & Operations perspective as a result of its simplified final contours and increased operational flexibility.**		

Environmental Component		Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
SOCIO-ECONOMIC	Social	Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	View of the Site from surrounding areas can be minimized by vegetating the screening berm and/or introducing additional plantings on-Site, as required. **LOW NET EFFECTS**	View of the Site from surrounding areas can be minimized by vegetating the screening berm and/or introducing additional plantings on-Site, as required **LOW NET EFFECTS**	View of the Site from surrounding areas can be minimized by vegetating the screening berm and/or introducing additional plantings on-Site, as required **LOW NET EFFECTS**
			Criteria Ranking:	**1st Most Preferred**	**2nd Less Preferred**	**3rd Least Preferred**
			Criteria Rationale:	Although views of all three alternatives can be minimized by vegetating the screening berm and/or introducing additional plantings on-Site, as required, Alternative Method 1 is slightly preferred from a visual impact perspective as it will have the lowest height at final closure (approx. 10 m above the existing landfill versus 12 m and 13 m for Alternative Methods 2 and 3, respectively).		
		Effects on Local Residents	Number of residences	11 residential dwellings within the Local Study Area. **LOW NET EFFECTS**	11 residential dwellings within the Local Study Area. **LOW NET EFFECTS**	11 residential dwellings within the Local Study Area. **LOW NET EFFECTS**
			Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
			Criteria Rationale:	There is no substantial difference between the alternatives in terms of the number of residential dwellings potentially affected within the Local Study Area.		
		Environmental Component Ranking:		**1st Most Preferred**	**2nd Less Preferred**	**3rd Least Preferred**
	RATIONALE			**While there is no distinction between the alternatives in terms of the number of residential dwellings within the Local Study Area, Alternative 1 is most preferred from a Social perspective as it will have the lowest height at final closure (10 m above the existing landfill versus 12 m and 13 m for Alternative Methods 2 and 3, respectively).**		
	Economic	Effects on/ Benefits to Local Community	Employment at site (number and duration)	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**
			Opportunities to provide products or services	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**
		Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
	RATIONALE			**There is no substantial difference between the alternatives in relation to their positive effects on employment at the site and opportunities to provide products or services.**		
	Aboriginal Communities	Potential Effects on Aboriginal Communities	Potential effects on use of lands for traditional purposes	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**
		Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
	RATIONALE			**There is no substantial difference between the alternatives in relation to their effects on the use of lands for traditional purposes within the Local Study Area.**		

Environmental Component	Evaluation Criteria	Indicator	Alternative Method 1 Net Effects	Alternative Method 2 Net Effects	Alternative Method 3 Net Effects
OVERALL RANKING			**2nd Less Preferred**	**1st Most Preferred**	**3rd Least Preferred**
OVERALL RATIONALE			There is no substantial difference between the three Alternative Methods from a Geology & Hydrogeology, Surface Water Resources, Terrestrial & Aquatic Environment, Archaeology & Cultural Heritage, Transportation, Land Use, Agriculture/Soils & Mining, Economic, and Aboriginal Community perspective. From a potential air quality, odour, and noise impact exposure perspective, Alternative Methods 1, 2 and 3 are nearly identical. However, Alternative Method 2 has the lowest property boundary TSP concentration, and is therefore most preferred, followed by Alternative Method 3 (less preferred), then Alternative Method 1 (least preferred). While low net effects are anticipated for all alternatives, Alternative Method 2 is most preferred from a Site Design & Operations perspective as a result of the simplified final contours and increased operational flexibility. Although views of all three alternatives will be minimized by vegetating the screening berm and/or introducing additional plantings on-Site, Alternative Method 1 is slightly preferred from a visual impact perspective as it will have the lowest height at final closure (approximately 10 m above the existing landfill versus 12 m and 13 m for Alternative Methods 2 and 3, respectively). Therefore, it is concluded that **Alternative Method 2** ranks marginally higher than the other two alternatives assessed and will be carried forward as the Preferred Alternative Method for the Brooks Road Landfill Site Vertical Capacity Expansion EA.		

5.5 Contaminating Lifespan

The contaminating life span (CLS) of a landfill can be defined as "the period of time during which the landfill will produce contaminants at levels that could have unacceptable impact if they were discharged into the surrounding environment" (MOECC, 1988). As such, the CLS defines the period of time that monitoring and maintenance will be required following closure of the landfill. The CLS of a landfill will depend on many factors, including:

- Peak and Average Contaminant Concentration in Leachate
- Dry Density of Waste
- Maximum Waste Thickness
- Contaminant Percentage in Waste
- Average Rate of Infiltration
- Target Contaminant Concentration

Generally, an increase in the mass of any given contaminant within the landfill will increase the CLS. For landfills with a leachate collection system which removes leachate for subsequent treatment, increased infiltration (and therefore increased leachate generation) will reduce the CLS , since there is greater opportunity for contaminants to be leached out and removed from the landfill (Rowe, 1990).

Modeling

Previous investigations have indicated that the CLS for the Brooks Road Landfill Site is less than 25 years. Further analysis was undertaken as part of this EA to determine the effects of the proposed vertical expansion designs on the Site's CLS.

The CLS for the Site was modeled using two different approaches for four different design conditions (i.e., existing approved design, and the three vertical expansion options). The models are described as follows:

Revised GHD Model – simulation of contaminant transport utilizing the one-dimensional 1DTRANSEN model as outlined in the Hydrogeologic Performance Assessment (HPA) (GHD, 2002). In order to simplify the model and to provide a security factor to the simulation results, no attenuation factors (such as physical, chemical, and biological processes including adsorption, biodegradation, cation and anion exchange, filtration, and precipitation), which commonly occur between the clayey soils and the leachate constituents, were incorporated into the simulation. As such, the Revised GHD Model represents a conservative estimate of CLS.

Revised Rowe Model – Rowe (1991) examined the issue of leachate strength decrease for conservative contaminant species (e.g., chloride) where the decrease in strength is essentially due to dilution (i.e., no biological breakdown or precipitation) as water infiltrated through the waste with time. This model was used to validate the results of the Revised GHD Model. This model was utilized for three scenarios, as follows:

- Scenario A: Maximum observed chloride concentration in leachate and average chloride percentage in waste.
- Scenario B: Average observed chloride concentration in leachate and average chloride percentage in waste.
- Scenario C: Maximum observed chloride concentration in leachate and maximum chloride percentage in waste.

Scenario C represents the worst case conditions, whereas Scenarios A and B represent conditions that could be more realistically expected.

Results

As shown in **Table 5.13**, the CLS for each design is 17.40 years utilizing the Revised GHD Model. This result is expected, as this model uses a set number for the decay constant, while the initial and target chloride concentrations remain the same for all designs.

Table 5.10 indicates that the CLS varies significantly when calculated using the Revised Rowe Model, which utilizes a variable decay function that is determined using design parameters such as area, volume, waste density, mass of contaminant, and infiltration rate.

Table 5.13 Contaminating Life Span Values

Design	Revised GHD Model	Revised Rowe Model		
		Scenario A	Scenario B	Scenario C
Existing Approved Design	17.40	27.74	31.55	44.38
Alternative Method 1	17.40	43.16	49.09	69.79
Alternative Method 2	17.40	45.98	52.29	73.56
Alternative Method 3	17.40	46.95	53.40	75.12

Under the Revised Rowe Model, Scenario C represents the worst case conditions, whereas Scenarios A and B represent conditions that could be more realistically expected at the Site. The Existing Approved Design and the vertical expansion options (i.e., Alternative Methods 1, 2, and 3) all had CLS values in excess of 25 years.

All of the vertical expansion options resulted in CLS values that are higher than those of the Existing Approved Design. This is primarily due to the increased waste thickness (i.e., higher peak elevations), and as such, a higher reference height of leachate. While Alternative Method 1 exhibits the lowest CLS values, CLS values for Alternative Methods 2 and 3 are within a 6 year range across all scenarios.

The increased CLS relative to the Existing Approved Design associated with all of the vertical expansion options will necessitate a longer period of monitoring and maintenance following closure of the landfill, and will increase the amount of financial assurance required for the Site.

5.6 Assessment of Leachate Treatment Alternatives

The leachate management approach approved under the previous Certificate of Approval (C. of A.) No. A110302 for the Site involved the collection and haulage of leachate by tanker truck for disposal at an off-Site licensed liquid waste disposal facility. The Site currently operates under Amended ECA No. 1907-99NSF2, which pertains to the establishment of an on-Site leachate collection, transmission, storage, and disposal system. Leachate from the Site continues to be transported by tanker truck to an off-Site licensed liquid industrial waste disposal facility.

In accordance with the ECA, an on-Site leachate treatment system is currently being designed and constructed. On-Site treatment will be accomplished through a batch leachate treatment system with a rated capacity of 30 m^3/day and peak daily flow of 60 m^3/day. Construction of the system is nearly complete, with final commissioning and testing of the system anticipated for winter 2017. Following this, treated leachate that meets the ECA requirements will be discharged to the roadside ditch that runs along the east side of Brooks Road.

Since there are no significant changes expected to the quantity or quality of leachate that require treatment as a result of the proposed vertical expansion alternatives, and since the leachate treatment facility has been sized to accommodate existing leachate volumes as well as future volumes associated with the expansion, no changes are anticipated to be required to the approved on-Site leachate treatment system currently being established.

The assessment of long-term treatment alternatives for leachate generated at the Brooks Road Landfill Site was previously carried out under a report entitled "Leachate Management Plan, Assessment of Alternatives" (Conestoga-Rovers & Associates, 2007). This document served as a starting point for the Project Team to develop and analyze leachate treatment alternatives as part of the proposed undertaking.

5.6.1 Identified Leachate Treatment Alternatives

Various leachate management alternatives were identified for the Site and were evaluated using an assessment method that considered engineering, environmental, economic and social criteria for each alternative. The alternative approaches, including the currently approved approach, that were identified for the long-term management of leachate at the Site were as follows:

- **Alternative 1**: Off-Site Treatment:
  - Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility
  - Alternative 1b: Pre-treatment (on-Site) with transport by tank truck to municipal waste water treatment plant (WWTP)
  - Alternative 1c: Pre-treatment (on-Site) with transport via direct forcemain connection to municipal sanitary sewer (Cayuga WWTP)
- **Alternative 2:** On-Site Treatment: Full on-Site (biological) treatment facility

5.6.1.1 Alternative 1 – Off-Site Treatment

In addition to leachate treatment at an off-Site licensed private liquid industrial waste disposal facility, leachate treatment by a municipal (public) WWTP is also a commonly used leachate management approach. As noted above, there are three alternatives primarily associated with off-Site treatment of leachate as follows:

- Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility
- Alternative 1b: Pre-treatment (on-Site) with transport by tank truck to municipal (WWTP))
- Alternative 1c: Pre-treatment (on-Site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)

Alternative 1a involves the loading of tank trucks from the leachate loading facility at the Site and transport to a licensed liquid industrial waste disposal facility. There are a number of private licensed liquid industrial waste haulage and disposal companies that can service the Site.

Alternative 1b is identical to Alternative 1a, except that it would also involve the construction and operation of an on-Site pre-treatment system prior to the loading of pre-treated leachate in to tank trucks for transportation to, and unloading at, a Haldimand County WWTP as opposed to a private disposal facility. There are several municipal WWTPs within reasonable trucking distance of the Site in Haldimand County.

Alternative 1c would involve the construction of an on-Site pre-treatment system, pump station and buried forcemain to convey pre-treated leachate from the Site directly to the Haldimand County sanitary sewer system. Given the location of the Site, the only practical forcemain option would involve connection to the sanitary sewer system and WWTP that services the Town of Cayuga.

It should be noted that the requirement for on-Site pre-treatment to allow discharge to a Haldimand County WWTP is stipulated under Haldimand County Sewer Use Bylaw 215/02 (assuming the leachate that will be generated at the Site will contain constituents that will exceeded the discharge criteria as set out in the Bylaw). It is suspected, however, that it may be possible to negotiate an exemption and surcharge agreement with the County in lieu of performing on-Site pre-treatment, depending on the actual characteristics of the leachate. As an exemption and surcharge agreement in lieu of on-Site pre-treatment is not provided for under the Bylaw, and would require special consideration and approval by Haldimand County, the assessment of alternatives involving the County WWTPs presented was based on the provision of on-Site pre-treatment.

It is further noted that Haldimand County indicated that the existing WWTPs within the County do not currently have sufficient capacity to accept the projected leachate volumes from the Brooks Road Landfill Site. Regardless, for the alternatives involving treatment at a County WWTP, it was assumed for the purposes of the evaluation that capacity to accept leachate from the Brooks Road Landfill Site would be available in the future.

5.6.1.2 Alternative 2 – On-Site Treatment: Full On-Site (Biological) Treatment Facility

On-Site treatment would involve the establishment of an on-site treatment system capable of treating the collected leachate to allow discharge of the treated effluent directly to the natural environment. Treatment processes consisting of aerobic or anaerobic biological processes, together with physical, and/or chemical treatment methods sequenced to collectively treat the array of leachate contaminants have been used to treat leachate at many landfill sites. An on-Site biological treatment system is typically designed to treat the site-specific characteristics of the leachate generated to allow for discharge of the treated effluent off site. The treated effluent can be discharged to surface (ditch or water body) or subsurface (groundwater). In the case of the Brooks Road Landfill Site, discharge of treated effluent to the subsurface would not be practical due to the very low hydraulic conductivity of the surrounding geologic conditions (Haldimand Clay Plane).

5.6.2 Evaluation of the Leachate Treatment Alternatives

An evaluation of the leachate management alternatives was undertaken via the following steps to identify a preferred alternative:

- Step 1 – Confirm Evaluation Criteria and Indicators/Measures
- Step 2 – Undertake the Net Effects Analysis & Carry out the Comparative Evaluation

This methodology is identical to that used to evaluate the vertical expansion alternatives, except that the results of the net effects analysis and comparative evaluation are presented as a combined step (and table).

The criteria selected to evaluate the leachate management alternatives as part of the EA were based on the criteria used to evaluation the vertical expansion alternatives, but modified to reflect the evaluation that was completed in 2007 to identify the Site's currently approved leachate treatment system. The evaluation criteria and indicators are provided in the leachate management alternatives comparative evaluation table below (**Table 5.14**).

With a list of evaluation criteria established, they were applied to each of the leachate management alternatives through a net effects analysis to determine the net positive or negative environmental effects, and then a Reasoned Argument or Trade-off method was carried out using this information to determine a preferred leachate management alternative. The results of the net effects analysis and comparative evaluation are provided in **Table 5.14**, below.

Table 5.14 Leachate Treatment Alternatives Comparative Evaluation

Environmental Component		Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
NATURAL	Atmospheric Environment	Air Quality	Change in air quality	Haulage of leachate by tank truck has the potential to impact air quality. **MODERATE NET EFFECTS**	Haulage of leachate by tank truck has the potential to impact air quality. **MODERATE NET EFFECTS**	The on-site pre-treatment with forcemain to sanitary sewer may have minor, temporary effects on air quality during construction and little or no effects during long-term operation. **LOW NET EFFECTS**	The on-site treatment facility may have minor, temporary effects on air quality during construction and little or no effects during long-term operation. **LOW NET EFFECTS**
			Predicted effects of air contaminants	Haulage of leachate by tank truck would introduce atmospheric contaminants through the generation of dust and burning of fossil fuels during truck operation over the long term. **MODERATE NET EFFECTS**	Emissions from leachate pre-treatment process that would require ECA. Haulage of leachate by tank truck would introduce atmospheric contaminants through the generation of dust and burning of fossil fuels during truck operation over the long term. **MODERATE NET EFFECTS**	Emissions from leachate pre-treatment process that would require ECA. **LOW NET EFFECTS**	Emissions from leachate pre-treatment process that would require ECA. **LOW NET EFFECTS**
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 residences may experience a change in the predicted off-Site air quality impact due to haulage of leachate by tank truck. **MODERATE NET EFFECTS**	Up to 14 residences may experience a change in the predicted off-Site air quality impact due to haulage of leachate by tank truck. **MODERATE NET EFFECTS**	No off-Site effects predicted. **NO NET EFFECTS**	No off-Site effects predicted. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**
			Criteria Rationale:	**Alternatives 1c and 2 are preferred as there are no to low net effects related to air quality during long-term operations.**			
		Odour	Predicted nuisance odour emissions	Low as odour control equipment will be installed on the on-site leachate holding tank. **LOW NET EFFECTS**	Low as there is no open storage of leachate and the on-Site pre-treatment facility would consist of enclosed buildings with no open tanks or lagoons. **LOW NET EFFECTS**	Low as there is no open storage of leachate and the on-Site pre-treatment facility would consist of enclosed buildings with no open tanks or lagoons. **LOW NET EFFECTS**	Low as the on-Site treatment facility would contain only treated leachate and consist of enclosed buildings with no open tanks or lagoons. **LOW NET EFFECTS**
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses and institutions)	No off-Site effects predicted. **NO NET EFFECTS**	No off-Site effects predicted. **NO NET EFFECTS**	No off-Site effects predicted. **NO NET EFFECTS**	No off-Site effects predicted. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
			Criteria Rationale:	**There is no substantial difference between the alternatives as there are no to low net effects predicted for odour for each.**			
		Noise	Change in existing background noise levels	Long-term increases in noise levels from tank truck traffic during long-term operation. **MODERATE NET EFFECTS**	Minor noise impacts during the short-term construction period for the pre-treatment facility; however long-term increases in noise levels from tank truck traffic during long-term operation. **MODERATE NET EFFECTS**	Minor noise impacts during the short-term construction period; however no noise impacts are expected from the pre-treatment facility during long-term operation. **LOW NET EFFECTS**	Minor noise impacts during the short-term construction period; however no noise impacts are expected from the treatment facility during long-term operation. **LOW NET EFFECTS**
			Number of off-Site receptors potentially affected (residential properties, public facilities, businesses, and institutions)	Up to 14 residences may experience a change in noise levels due to tank truck traffic during long-term operation. **MODERATE NET EFFECTS**	Up to 14 residences may experience a change in noise levels due to tank truck traffic during long-term operation. **MODERATE NET EFFECTS**	No off-site effects predicted. **NO NET EFFECTS**	No off-site effects predicted. **NO NET EFFECTS**

Environmental Component	Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
		Criteria Ranking:	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**
		Criteria Rationale:	**Alternatives 1c and 2 are preferred as there are no to low net effects predicted for noise.**			
	Environmental Component Ranking:		**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**
RATIONALE			**Alternatives 1c and 3 are preferred from an Atmospheric perspective because they have no to low net effects on off-site receptors relating to air, odour, and noise.**			
Geology & Hydrogeology	Groundwater Quality	Change in groundwater quality	Collected leachate stored in a holding tank on-site and hauled off-site via tank truck to a licensed liquid industrial waste facility for disposal, therefore no potential for leachate contact with groundwater. **NO NET EFFECTS**	On-site pre-treatment facility enclosed and only pre-treated leachate stored in facility prior to transport by tank truck, therefore no potential for leachate contact with groundwater. **NO NET EFFECTS**	On-site pre-treatment facility enclosed and only pre-treated leachate stored in facility prior to transport via forcemain, therefore no potential for leachate contact with groundwater. **NO NET EFFECTS**	Leachate treated in an enclosed on-site treatment facility and treated leachate that meets the ECA requirements is discharged to the roadside ditch, therefore no potential for leachate contact with groundwater. **NO NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	**There is no substantial difference between the alternatives as there are no net effects predicted for groundwater quality.**			
	Groundwater Flow	Predicted groundwater flow characteristics	No potential recharge of treated effluent to the local groundwater regime. **NO NET EFFECTS**	No potential recharge of treated effluent to the local groundwater regime. **NO NET EFFECTS**	No potential recharge of treated effluent to the local groundwater regime. **NO NET EFFECTS**	Portion of treated effluent is recharged into the local groundwater regime. **LOW (POSITIVE) NET EFFECTS**
		Criteria Ranking:	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**1st Most Preferred**
		Criteria Rationale:	**Although Alternatives 1a, 1b, and 1c will have no net effects on groundwater flows or levels, Alternative 2 is preferred as groundwater will be recharged using treated effluent.**			
	Environmental Component Ranking:		**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**1st Most Preferred**
RATIONALE			**Alternative 2 is preferred because groundwater will be recharged with treated effluent.**			
Surface Water Resources	Surface Water Quality	Predicted effects on surface water quality on-site and off-site	Leachate treated at a licensed liquid industrial waste disposal facility prior to discharge. Therefore, no potential leachate contact with surface water. **NO NET EFFECTS**	Leachate pre-treated on-Site to Haldimand County Sewer Use Bylaw 215/02 standards prior to discharge to a municipal WWTP via a tank truck. **LOW NET EFFECTS**	Leachate pre-treated on-Site to Haldimand County Sewer Use Bylaw 215/02 standards prior to discharge to a municipal sanitary sewer via a forcemain. **LOW NET EFFECTS**	Leachate treated at an on-Site treatment facility and treated effluent discharged to the Brooks Road ditch. ECA required for discharge to receiving watercourse. Assumes assimilative capacity of surface water (Brooks Road ditch and Norton's Creek) will be affected by effluent discharge (i.e., quality). **MODERATE NET EFFECTS**
		Criteria Ranking:	**1st Most Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**3rd Least Preferred**
		Criteria Rationale:	**Alternatives 1a is preferred as there is no anticipated effect to surface water quality.**			
	Surface Water Quantity	Change in drainage areas	No change in drainage areas. **NO NET EFFECTS**	No change in drainage areas. **NO NET EFFECTS**	No change in drainage areas. **NO NET EFFECTS**	No change in drainage areas. **NO NET EFFECTS**

Environmental Component	Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
		Predicted occurrence and degree of off-site effects	No off-site release of leachate. **NO NET EFFECTS**	No off-site release of leachate. **NO NET EFFECTS**	No off-site release of leachate. **NO NET EFFECTS**	ECA would be required for discharge to receiving watercourse. Assumes assimilative capacity of surface water (Brooks Road ditch and Norton's Creek) will be affected by effluent discharge (i.e., quality) **MODERATE NET EFFECTS**
		Criteria Ranking:	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**	**2nd Less Preferred**
		Criteria Rationale:	**Alternatives 1a, 1b, and 1c are preferred as there are no net effects to surface water quantity.**			
	Environmental Component Ranking:		**1st Most Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**3rd Least Preferred**
RATIONALE			**Alternatives 1a is preferred from a surface water resources perspective as it does not impact surface water quality or quantity.**			
Terrestrial & Aquatic Environment	Terrestrial Ecosystems	Predicted impact on vegetation communities	No removal of vegetation (no additional on-site construction required). **NO NET EFFECTS**	No removal of vegetation for construction of an on-site pre-treatment building. **NO NET EFFECTS**	No removal of vegetation for construction of an on-site pre-treatment building and forcemain. Potential for removal of vegetation during construction of the forcemain (would be contained within existing road right of ways). **LOW NET EFFECTS**	No removal of vegetation for construction of an on-site treatment building. **NO NET EFFECTS**
		Predicted impact on wildlife habitat	Potential to disturb wildlife habitat as a result of haulage of leachate by tank truck during long-term operation. **LOW NET EFFECTS**	Potential to disturb wildlife habitat as a result of haulage of leachate by tank truck during long-term operation. **LOW NET EFFECTS**	Potential disturbance to wildlife habitat off-site due to vegetation removal during the short-term forecemain construction period. **LOW NET EFFECTS**	No disturbance to wildlife habitat. **NO NET EFFECTS**
		Predicted impact on vegetation and wildlife including rare, threatened or endangered species	Potential effects to wildlife including rare, threatened or endangered species due to tank truck operation **LOW NET EFFECTS**	Potential effects to wildlife including rare, threatened or endangered species due to tank truck operation **LOW NET EFFECTS**	Potential impacts to vegetation, wildlife including rare, threatened, or endangered species due to removal of vegetation during construction of the forcemain (would be contained within existing road right of ways). **LOW NET EFFECTS**	No impacts to vegetation, wildlife including rare, threatened, or endangered species due to removal of vegetation. **NO NET EFFECTS**
		Criteria Ranking:	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**3rd Least Preferred**	**1st Most Preferred**
		Criteria Rationale:	**Alternative 2 is preferred as there would be no removal of vegetation or wildlife habitat.**			
	Aquatic Ecosystems	Predicted changes in water quality	Leachate treated at a licensed liquid industrial waste disposal facility prior to discharge. Therefore, no potential leachate contact with surface water. **NO NET EFFECTS**	Leachate pre-treated on-site to Haldimand County Sewer Use Bylaw 215/02 standards prior to discharge to a municipal WWTP via a tank truck. **LOW NET EFFECTS**	Leachate pre-treated on-site to Haldimand County Sewer Use Bylaw 215/02 standards prior to discharge to a municipal sanitary sewer via a forcemain. **LOW NET EFFECTS**	Leachate treated at an on-site treatment facility and treated effluent discharged to the Brooks Road ditch. ECA would be required for discharge to receiving watercourse. Assumes assimilative capacity of surface water (Brooks Road ditch and Norton's Creek) will be affected by effluent discharge (i.e., quality). **MODERATE NET EFFECTS**
		Predicted impact on aquatic habitat	No predicted changes to aquatic habitat within the Site and Local Study Areas. **NO NET EFFECTS**	No predicted changes to aquatic habitat within the Site and Local Study Areas. **NO NET EFFECTS**	No predicted changes to aquatic habitat within the Site and Local Study Areas. **NO NET EFFECTS**	Assumes assimilative capacity of surface water (Brooks Road ditch and Norton's Creek) will be affected by effluent discharge (i.e., quality) **LOW NET EFFECTS**

Environmental Component		Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
			Predicted impact on aquatic biota	No predicted changes to aquatic biota within the Site and Local Study Areas. **NO NET EFFECTS**	No predicted changes to aquatic biota within the Site and Local Study Areas. **NO NET EFFECTS**	No predicted changes to aquatic biota within the Site and Local Study Areas. **NO NET EFFECTS**	Assumes assimilative capacity of surface water (Brooks Road ditch and Norton's Creek) will be affected by effluent discharge (i.e., quality) **LOW NET EFFECTS**
			Criteria Ranking:	**1st Most Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**3rd Least Preferred**
			Criteria Rationale:	**Alternative 1a preferred as it would result in no net effects to the aquatic environment.**			
		Environmental Component Ranking:		**1st Most Preferred**	**Tied for 2nd Less Preferred**	**3rd Least Preferred**	**Tied for 2nd Less Preferred**
	RATIONALE			**Alternative 1a is preferred because it does not impact the aquatic ecosystem and has no to low net effects related to the terrestrial ecosystem.**			
CULTURAL	Archaeology & Cultural Heritage	Cultural & Heritage Resources	Cultural and heritage resources (built and landscapes) in the Local Study Area and predicted impacts on them	No loss of or disturbance to cultural and heritage resources within the Local Study Area. **NO NET EFFECTS**	No loss of or disturbance to cultural and heritage resources within the Local Study Area. **NO NET EFFECTS**	Potential for loss of or disturbance to cultural and heritage resources within the Local Study Area during construction of the forcemain. **LOW NET EFFECTS**	No loss of or disturbance to cultural and heritage resources within the Local Study Area. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**	**2nd Less Preferred**	**Tied for 1st Most Preferred**
			Criteria Rationale:	**Alternatives 1a, 1b and 2 are preferred as there is no potential for loss of or disturbance to cultural and heritage resources.**			
		Archaeological Resources	Archaeological resources in the Local Study Area and predicted impacts on them	No loss of or disturbance to archaeological resources within the Local Study Area. **NO NET EFFECTS**	No loss of or disturbance to archaeological resources within the Local Study Area. **NO NET EFFECTS**	Potential for loss of or disturbance to archaeological resources within the Local Study Area during construction of the forcemain. **LOW NET EFFECTS**	No loss of or disturbance to archaeological resources within the Local Study Area. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**	**2nd Less Preferred**	**Tied for 1st Most Preferred**
			Criteria Rationale:	**Alternatives 1a, 1b and 2 are preferred as there is no potential for loss of or disturbance to archaeological resources.**			
		Environmental Component Ranking:		**Tied for 1st Most Preferred**	**Tied for 1st Most Preferred**	**2nd Less Preferred**	**Tied for 1st Most Preferred**
	RATIONALE			**Alternatives 1a, 1b and 2 are preferred as there is no potential for loss of or disturbance to cultural, heritage or archaeological resources.**			
BUILT	Transportation	Effects on Airport Operations	Bird strike hazard to aircraft in Local Study Area	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**	No bird strike hazard to aircraft in Local Study Area. **NO NET EFFECTS**
			Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
			Criteria Rationale:	**There is no substantial difference between the alternatives as they would all result in no effects to bird strike hazards to aircraft.**			
		Effects from Truck Transportation Along Access Roads	Potential for traffic collisions	Higher risk of trucking accident occurring due to haulage of leachate by tank truck during operations. **HIGH NET EFFECTS**	Temporary potential for trucking accidents during the construction period. Higher risk of trucking accident occurring due to haulage of leachate by tank truck during operations. **HIGH NET EFFECTS**	Temporary potential for trucking accidents during the construction period. **LOW NET EFFECTS**	Temporary potential for trucking accidents during the construction period. **LOW NET EFFECTS**

Environmental Component	Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
		Potential for off-site leachate spills	Potential for minor release of untreated leachate due to a trucking accident. **LOW NET EFFECTS**	Potential for minor release of partially treated leachate due to a trucking accident. **LOW NET EFFECTS**	Potential for minor release of partially treated leachate due to a break in the forcemain. **LOW NET EFFECTS**	No off-site truck haulage. **NO NET EFFECTS**
		Disturbance to traffic operations	Potential for effects to existing traffic operations during operations. **LOW NET EFFECTS**	Potential for effects to existing traffic operations during operations. **LOW NET EFFECTS**	No off-site truck haulage. **NO NET EFFECTS**	No off-site truck haulage. **NO NET EFFECTS**
		Potential road improvement requirements	No road improvements required. **NO NET EFFECT**	No road improvements required. **NO NET EFFECT**	No road improvements required. **NO NET EFFECT**	No road improvements required. **NO NET EFFECT**
		Criteria Ranking:	**Tied for 3rd Least Preferred**	**Tied for 3rd Least Preferred**	**2nd Less Preferred**	**1st Most Preferred**
		Criteria Rationale:	**Alternative 2 is preferred as there is low potential for traffic collisions and no potential for off-site leachate spills, disturbance to traffic operations, or road improvement requirements.**			
	Environmental Component Ranking:		**3rd Less Preferred**	**4th Least Preferred**	**2nd More Preferred**	**1st Most Preferred**
RATIONALE			**Alternative 2 is preferred from a transportation perspective as it would result in no effects to bird strike hazards to aircraft, there is low potential for traffic collisions and no potential for off-site leachate spills, disturbance to traffic operations, or road improvement requirements.**			
Land Use	Effects on Current and Planned Future Land Uses	Current land use	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**	No change to the current land uses within the Site and Local Study Areas. **NO NET EFFECTS**
		Planned future land use	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**	No effects on planned future land use within the Site and Local Study Areas. **NO NET EFFECTS**
		Type(s) and proximity of off-Site recreational resources within 500 m of landfill footprint potentially affected	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**	Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint. **LOW NET EFFECTS**
		Type(s) and proximity of off-Site sensitive land uses (i.e., dwellings, churches, cemeteries, parks) within 500 m of landfill footprint potentially affected	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**	2 residences are located within 500 m of the landfill footprint. **LOW NET EFFECTS**
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
RATIONALE			**There is no substantial difference between the alternatives, as they would all result in no effects to current or planned future land use and low effects to off-Site recreational resources and the two residences within 500 m.**			
Agriculture/ Soils & Mining	Effects on Soils and Existing Agricultural and	Predicted impacts on surrounding agricultural operations	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**	Low net effects to surrounding agricultural operations. **LOW NET EFFECTS**

Environmental Component		Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
		Mining Operations	Type(s) and proximity of agricultural operations (i.e., organic, cash crop, livestock)	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**	19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate. **LOW NET EFFECTS**
			Type(s) and proximity of mining operations	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**	No effects on active mining operations within the Local Study Area. **NO NET EFFECTS**
			Soil classification	No loss of soil with agricultural capability. **NO NET EFFECTS**	No loss of soil with agricultural capability. **NO NET EFFECTS**	No loss of soil with agricultural capability. **NO NET EFFECTS**	No loss of soil with agricultural capability. **NO NET EFFECTS**
		Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
	RATIONALE			**There is no substantial difference between the alternatives, as they would all result in low effects to surrounding agricultural operations and no effects to mining operations or soil classification.**			
	Site Design & Operations	Site Design & Operational Characteristics	Availability of Infrastructure	Several licensed liquid industrial waste treatment facilities are within a reasonable trucking distance to the Site that would have sufficient capacity to accept leachate from the Site. **NO NET EFFECTS**	Leachate pre-treated on-site to Haldimand County Sewer Use Bylaw 215/02 standards prior to discharge to a municipal WWTP via a tank truck. None of the existing WWTP's within Haldimand County have sufficient capacity to accept leachate from the Site. **MODERATE NET EFFECTS**	Leachate pre-treated on-site to Haldimand County Sewer Use Bylaw 215/02 standards prior to discharge to a municipal sanitary sewer via a forcemain. While a municipal sanitary sewer system is located within a reasonable distance for connection by forcemain, none of the existing WWTP's within Haldimand County have sufficient capacity to accept leachate from the Site. **MODERATE NET EFFECTS**	Leachate treated at the on-site treatment facility. Require provincial approval under Section 53 of the *Ontario Water Resources Act* for construction and operation of the on-site leachate treatment facility. **NO NET EFFECTS**
			Change in Leachate Characteristics (quantity and quality)	Change in leachate quantity may be accommodated by an increase in the number of tanker loads and utilization of more than one disposal facility, if required. Possible to treat the leachate to acceptable quality standards. **MODERATE NET EFFECTS**	On-site pre-treatment facility designed to accept a maximum anticipated leachate generation rate. Therefore, the on-site pre-treatment facility may not be able to accommodate a change in leachate quantity. Possible to treat the leachate to acceptable quality standards. **MODERATE NET EFFECTS**	On-site pre-treatment facility designed to accept a maximum anticipated leachate generation rate. Therefore, the on-site pre-treatment facility may not be able to accommodate a change in leachate quantity. Possible to treat the leachate to acceptable quality standards. **MODERATE NET EFFECTS**	On-site treatment facility designed to accept a maximum anticipated leachate generation rate. Therefore, the on-site -treatment facility may not be able to accommodate a change in leachate quantity. Possible to treat the leachate to acceptable quality standards. **MODERATE NET EFFECTS**
		Environmental Component Ranking:		**Tied for 1st Most Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 1st Most Preferred**
	RATIONALE			**Alternatives 1a and 2 preferred from a Site Design & Operations perspective as the infrastructure required is readily available for both alternatives.**			
SOCIO-ECONOMIC	Social	Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	No change in current views expected. **NO NET EFFECTS**	Pre-treatment facility will be located in the vicinity of other Site buildings. View of on-site facilities from surrounding areas will be minimized by vegetating the existing screening berm and/or introducing additional on-Site plantings. **LOW NET EFFECTS**	Pre-treatment facility will be located in the vicinity of other Site buildings. View of on-site facilities from surrounding areas will be minimized by vegetating the existing screening berm and/or introducing additional on-Site plantings. **LOW NET EFFECTS**	Treatment facility will be located in the vicinity of other Site buildings. View of on-site facilities from surrounding areas will be minimized by vegetating the existing screening berm and/or introducing additional on-Site plantings. **LOW NET EFFECTS**
			Criteria Ranking:	**1st Most Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**
			Criteria Rationale:	**Alternative 1a is preferred as no pre-treatment or treatment facility is required on-site that would negatively affect landscape and views.**			

Environmental Component	Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
	Effects on Local Residents/General Public	Number of residences	11 residential dwellings within the Local Study Area. **LOW EFFECTS**	11 residential dwellings within the Local Study Area. **LOW EFFECTS**	11 residential dwellings within the Local Study Area. **LOW NET EFFECTS**	11 residential dwellings within the Local Study Area. **LOW NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	**There is no substantial difference between the alternatives in terms of the number of residential dwellings within the Local Study Area. All alternatives rank the same.**			
	Environmental Component Ranking:		**1st Most Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**	**Tied for 2nd Less Preferred**
RATIONALE			**Alternative 1a is preferred as no pre-treatment or treatment facility is required on-site that would negatively affect landscape and views.**			
Economic	Effects on the Estimated Lifecycle Costs Considerations	Estimated total life cycle costs (including capital costs, operation and maintenance costs and discharge fees) for a 20 year period	High capital operation and maintenance costs and high discharge fee. High estimated total 20-year net present value cost (~$19.8 mil.). **HIGH NET EFFECTS**	Low capital operation and maintenance costs and low discharge fee. Low estimated total 20-year net present value cost (~$6.2 mil.). **LOW NET EFFECTS**	Low capital operation and maintenance costs and low discharge fee. Low estimated total 20-year net present value cost (~$6.1 mil.). **LOW NET EFFECTS**	Low operation and maintenance costs and low discharge fee. Low estimated total 20-year net present value cost (~$4.5 mil.). **LOW NET EFFECTS**
		Criteria Ranking:	**4th Least Preferred**	**3rd Less Preferred**	**2nd More Preferred**	**1st Most Preferred**
		Criteria Rationale:	**Alternative 2 is preferred from an estimated total life cycle costs perspective as it has the lowest total 20-year present value cost.**			
	Effects on/ Benefits to Local Community	Employment at the site (number and duration)	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**	Continue to employ 6 persons for the duration of Site operations. **MEDIUM (POSITIVE) NET EFFECTS**
		Opportunities to provide products or services	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**	Continue services to customers for waste disposal for the 5 to 7 year planning period. **MEDIUM (POSITIVE) NET EFFECTS**
		Criteria Ranking:	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
		Criteria Rationale:	**There is no substantial difference between the alternatives in relation to their positive effects on employment at the site and opportunities to provide products or services.**			
	Environmental Component Ranking:		**4th Least Preferred**	**3rd Less Preferred**	**2nd More Preferred**	**1st Most Preferred**
RATIONALE			**While there is no substantial difference between the alternatives in relation to their positive effects on employment at the site and opportunities to provide products or services, Alternative 2 is preferred from an Economic perspective as it has the lowest total 20-year present value cost.**			
Aboriginal Communities	Potential Effects on Aboriginal Communities	Potential effects on use of lands for traditional purposes	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**	No effects on the use of lands for traditional purposes. **NO NET EFFECTS**
	Environmental Component Ranking:		**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**	**Tied for 1st No Substantial Difference**
RATIONALE			**There is no substantial difference between the alternatives in relation to their effects on the use of lands for traditional purposes within the Local Study Area.**			

Environmental Component	Evaluation Criteria	Indicator	Alternative 1a: Transport by tank truck to licensed liquid industrial waste disposal facility	Alternative 1b: Pre-treatment (on-site) with transport by tank truck to municipal (WWTP)	Alternative 1c: Pre-treatment (on-site) with transport via forcemain to municipal sanitary sewer (Cayuga WWTP)	Alternative 2: Full on-site (biological) treatment facility
OVERALL RANKING			**2nd More Preferred**	**4th Least Preferred**	**3rd Less Preferred**	**1st Most Preferred**
OVERALL RATIONALE			**There is no substantial difference between the alternatives from a Land Use, Agriculture/ Soils & Mining and Aboriginal Community perspective.** **From a Geology & Hydrogeology, Transportation, and Economic perspective Alternative 2 is preferred as groundwater will be recharged with treated effluent; it would result in no effects to bird strike hazards to aircraft, there is low potential for traffic collisions and no potential for off-site leachate spills, disturbance to traffic operations, or road improvement requirements; and has the lowest total 20-year present value cost.** **Alternatives 2 and 1a are preferred from a Site Design & Operations perspective as the infrastructure required is readily available for both alternatives.** **Alternatives 2 and 1c are preferred from an Atmospheric perspective because they have no to low net effects on off-site receptors relating to air, odour, and noise.** **Alternatives 2, 1a and 1b are preferred from an Archaeology and Cultural Heritage perspective as there is no potential for loss of or disturbance to cultural, heritage or archaeological resources.** **Therefore, it is concluded that Leachate Treatment Alternative 2 be carried forward as the Preferred Alternative Method for Leachate Treatment as part of the Brooks Road Landfill Vertical Capacity Expansion EA.**			

5.6.2.1 Preferred Leachate Management Alternative

The results of the comparative evaluation identified the on-Site treatment facility (Alternative 2) as being the Preferred Leachate Treatment Alternative for the long term. Alternative 2 ranked the highest in the comparative evaluation and also had the lowest 20-year net present value cost.

From a Geology & Hydrogeology, Transportation and Economic perspective Alternative 2 ranked first above all other alternatives. From a Site Design & Operations perspective Alternative 2 tied for first place with Alterative 1a as the infrastructure required is readily available for both alternatives. From an Atmospheric perspective Alternatives 2 tied for first place with Alternative 1c because they both have no to low net effects on off-site receptors relating to air, odour, and noise. From an Archaeology and Cultural Heritage perspective Alternative 2 tied for first place with Alternatives 1a and 1b as there is no potential for loss of or disturbance to cultural, heritage or archaeological resources associated with any of these three alternatives. All four Alternatives came in first place from a Land Use, Agriculture/ Soils & Mining and Aboriginal Community perspective.

Based on the comparative evaluation presented in **Table 5.14**, above, Leachate Treatment Alternative 2 will be carried forward as the Preferred Alternative Method for Leachate Treatment as part of the Brooks Road Landfill Vertical Capacity Expansion EA.

5.7 Description of the Preferred Undertaking

This subsection provides a description of Alternative Method 2 as the Preferred Alternative for vertical expansion in combination with Alternative 2 (on-Site treatment facility) as the Preferred Alternative for leachate management which, together, comprise the Preferred Undertaking.

Since the designs presented in the CDR for the Alternative Methods were developed beyond the level of detail typically prepared for the conceptual design stage, the design for the Preferred Alternative for vertical expansion was not advanced further, save for inputs provided by the Technical Discipline Leads in order to avoid or minimize environmental impacts. These recommended design mitigation measures are provided in **Table 5.15**, below.

Table 5.15 Design Mitigation Measures for the Preferred Alternative

Environmental Component	Recommended Design Mitigation Measure	Resulting Net Effect
Air Quality & Odour	Pave the road from the landfill entrance up to the point the trucks enter the main part of the landfill (~224 m)	Reduced particulate matter emissions due to road traffic
Surface Water Resources	Construction of the Permanent Stormwater Management System as outlined in the Stormwater Management Plan (GHD, September 2013)	No net environmental effect
Leachate Management	Construction of the on-Site leachate treatment system as outlined in ECA No. 1907-99NSF2	No net environmental effect

5.7.1 Existing Operations

As described in **Section 4.0**, current activities at the Brooks Road Landfill include landfilling of up to 500 tonnes per day of post-diversion IC&I waste and contaminated soil. The Site may receive waste from 7 am to 5 p.m., Monday to Friday, and 7 a.m. to 1 p.m. on Saturdays, and is accessed from Brooks Road via a driveway located approximately 30 m north of the south Site boundary. All Site traffic is from the south (Highway 3 eastbound or westbound onto Brooks Road). Construction of the stormwater management system for the Site is currently underway and consists of a perimeter ditch around the outside of the landfill footprint and a wet detention stormwater management pond in the southwest corner of the site, complete with inlet structure, forebay, outlet structure, and emergency bypass structure. All leachate is currently transported by tanker truck to an off-Site licensed liquid industrial waste disposal facility; however, an on-Site leachate treatment system is currently being designed and constructed (see **Section 5.6**).

5.7.2 Final Slopes & Landfill Height

The Preferred Alternative for vertical capacity expansion (Alternative Method 2) consists of 4H to 1V (25%) side slopes to a crest elevation of 221.0 m AMSL. The top (peak) slope is 20H to 1V (5%) with a maximum peak elevation of 221.5 m AMSL. The elevations and slopes given are for the top of final cover.

5.7.3 Buffer Areas

The regulatory requirements specify a 100 m wide buffer area between the limit of the waste footprint and the site boundary, but allow this to be reduced to 30 m if it is shown to be appropriate based on a site specific assessment (e.g., if the buffer provides adequate space for vehicle movements, ancillary facilities, and ensures that potential effects from the landfill

operation do not have unacceptable impacts outside of the site). Approved buffer areas have already been established around the perimeter of the waste fill area, and will not be altered as a result of vertically expanding the final contours. The approved buffer areas for the Preferred Undertaking include 30 m buffers between the western and eastern limits of waste and the western and eastern property lines; a 35 m to 158 m buffer between the southern limit of waste and the southern property line; and a 71 m buffer between the northern limit of waste and the property line.

5.7.4 Service Area

The current service area for the Brooks Road Landfill is Ontario-wide and, as such, an Ontario-wide service area is also requested for the vertical capacity expansion. It is; however, expected that waste will primarily be received from Haldimand County and the surrounding areas.

5.7.5 Waste Capacity Requirements

The proposed vertical expansion of the capacity of the Brooks Road Landfill is based on Brooks Road Environmental's assessment that there is a viable business case to receive up to 150,000 tonnes per year of waste over a five to seven year planning period. The airspace corresponding to this expansion is estimated at 421,000 m^3, which includes waste, daily cover, and interim cover. Waste will be placed higher than the currently approved peak elevation, requiring additional lifts of waste and placement of daily cover material. As noted in **Section 3.1**, a volumetric calculation, using a (potential) vertical expansion of 4:1 slope to show total airspace and subtracting the currently approved capacity, was undertaken to arrive at 421,000 m^3. Assuming a density of 1 tonne per cubic metre of air space consumed for the landfill waste, there is potential capacity for 421,000 tonnes. A five to seven year planning period has been provided for as the amount of waste received tends to fluctuate year over year. Ultimately, the landfill will not exceed 421,000 m^3 (total), nor will it exceed 151,000 tonnes for any given year.

5.7.6 Waste Quantities & Characteristics

No change to the acceptable waste types is proposed as part of the vertical expansion. Brooks Road Environmental anticipates receiving up to 151,000 tonnes of waste per year over a five to seven year planning period, consisting of post-diversion IC&I waste and contaminated soil.

5.7.7 Site Entrance & Facilities

No changes are proposed to the Site entrance, scale facility, or administration/maintenance buildings as part of the vertical expansion. As noted above, the Site is currently accessed from

Brooks Road via a driveway located approximately 30 m north of the south Site boundary. On-Site haul roads will be paved with asphalt to reduce particulate matter emissions, but the flow of landfill traffic will remain unchanged.

5.7.8 Stormwater Management

As noted above, construction of the stormwater management system for the existing Site is currently underway and consists of a perimeter ditch around the outside of the landfill footprint and a wet detention stormwater management pond in the southwest corner of the site, complete with inlet structure, forebay, outlet structure, and emergency bypass structure. The stormwater management system for the Site was designed to provide water quality and water quantity control of surface water runoff.

The stormwater management system is designed to attenuate peak flows up to the Regional storm event. The drainage ditches were further sized, at a minimum, to accommodate the peak flow from a 3-hour duration, 25-year storm.

Given that the proposed vertical expansion would not alter the existing landfill footprint, the drainage area serviced by the existing (currently under construction) stormwater management system will not differ significantly as a result of the vertical expansion. There is no significant increase expected to runoff peak flow rates or volumes as a result of the proposed vertical expansion. Minor adjustments may be required to the grading and alignment of the perimeter drainage ditches, but no changes are proposed to the approved stormwater management pond.

5.7.9 Leachate Treatment

Since there are no significant changes expected to the quantity or quality of leachate that require treatment as a result of the proposed vertical expansion, and since the approved leachate treatment facility has been sized to accommodate existing leachate volumes as well as future volumes associated with the expansion, no changes are anticipated to be required to the approved on-Site leachate treatment system currently being established in accordance with ECA No. 1907-99NSF2.

Preferred Method

The preferred leachate treatment system for the Brooks Road Landfill Site is full (biological) treatment at an on-Site facility. An on-site leachate treatment system for the Site is currently being constructed. The site will utilize a batch leachate treatment system with a rated capacity of 30 m^3/day and peak daily flow of 60 m^3/day. Treated leachate that meets ECA requirements will be discharged to the roadside ditch that runs along the east side of Brooks Road.

Contingency & Emergency Method

As a contingency in an emergency situation, should the on-site leachate treatment facility require shut-down for maintenance for a period of time, the leachate will be held and pumped and trucked to a licensed liquid industrial waste disposal facility.

5.7.10 Landfill Gas Management

Given that the total expanded capacity of the landfill will be 1,045,065 m^3, it does not meet the minimum threshold under O. Reg. 232/98 (1.5 million m^3) that would require mandatory collection of landfill gas. Further, given that the anticipated types of waste to be accepted will consist primarily of non-hazardous IC&I wastes, there will be insufficient landfill gas produced to warrant collection.

To confirm the above, methane generation modelling analysis was completed for the Brooks Road Landfill and the proposed vertical capacity expansion and documented in a memo (see **Appendix F**). Modelling used an average annual waste quantity calculated based on actual Site waste disposal numbers for the period October 8, 2009 through October 9, 2016. A waste acceptance rate (WAR) of 75,500 tonnes per year (half of the maximum annual waste acceptance rate) was assumed for future years (starting in 2017) until the landfill design capacity is reached for both the Existing Landfill (approximately 624,065 tonnes assuming a density of 1 tonne per cubic meter) and the proposed vertical expansion (approximately 421,000 tonnes assuming a density of 1 tonne per cubic meter). The landfill accepts mostly construction/demolition waste (approximately 53 percent) and inert material (approximately 30 percent). Waste composition for future years was assumed to be consistent with the 2009 through 2016 waste composition. Without a landfill gas collection and control system, peak methane emissions from the Brooks Road Landfill (in 2024) are estimated to be approximately 809 tonnes of methane (approximately 20,224 tonnes CO2e). Converting to units of standard cubic feet per minute (scfm), the maximum methane generation rate is approximately 80.5 scfm (in 2024).

The methane generation modelling analysis memo also presents the impacts associated with the operation of a gas collection and control system. The environmental, economic and energy impacts were evaluated for the installation of a gas collection and control system at the Brooks Road Landfill. This evaluation assumed that the only feasible control option is an open/utility flare, since the Site does not generate enough landfill gas to support an enclosed flare.

Environmental Impacts

In an open/utility flare, landfill gas is burned in the elevated flare tip located at the top of a gas flare stack (the flame is commonly open at the top of the gas flare stack). Due to the open flame, this type of flare system can be a source of noise. Also, the radiant heat from open flame renders some areas in the vicinity of the stack unsuitable for the installation of some equipment.

Energy Impacts

An active landfill gas collection system would require the operation of a blower system. In addition, the open flare would require a fuel source for startup. An active collection and control system would also require much more monitoring and maintenance, which would result in more vehicle traffic to and from the Site. All of the aforementioned items would be a source of greenhouse gas (GHG) emissions which would partially offset any methane reduction that is achieved by a gas collection and control system.

Economic Impacts

The total annual cost for the operation of a gas collection and control system is estimated to be $333,712 per year. The average annual methane emission reduction for the period of 2019-2048 is estimated to be 7,060 tonnes CO2e per year. Therefore, the cost effectiveness with this option is estimated to be $47 per tonne CO2e reduced. Typically, the threshold for determining if a project is cost effective is in the range of $3-$15 per tonne CO2e reduced (for GHG). Based on current pricing under Western Climate Initiative eligible entries, the price point for carbon exchange under Ontario's regulatory Cap-and-Trade system is envisioned to be in the $12-$15/tonne CO2e range. Therefore, the operation of a gas collection and control system at the Brooks Road Landfill is not considered to be cost-effective.

Discussion

As noted above, the landfill accepts mostly construction/demolition waste and inert material, which contain a very low amount of degradable organic content (DOC) when compared with higher organic materials such as bulk waste and food waste. Therefore, the landfill is not expected to generate a large amount of methane emissions as a typical municipal solid waste landfill would. It should be noted that the Brooks Road Landfill did accept waste prior to 2009; however, detailed waste records for years prior to 2009 are unavailable. Therefore, it is more conservative to start the modelling analysis in 2009 using a fixed design capacity of 624,065 tonnes for the existing Landfill. By employing a fixed design capacity of 624,065 tonnes, the waste is assumed to be deposited in the landfill sooner than it actually was, which is a conservative assumption, since newer waste is expected to produce more gas than older waste. As such, the numbers in this modelling analysis are expected to be slightly inflated.

Based on the low level of methane generation at the Brooks Road Landfill and the negative environmental, energy and economic factors associated with a landfill gas collection and control system, it is concluded that the operation of such a system is not feasible.

5.7.11 Vertical Expansion Development

Since the Preferred Alternative represents a vertical expansion of the existing landfill, no construction of additional base liner system is required. The MOECC has set standards for landfill liners and collection and treatment of leachate. In accordance with O. Reg. 232/98, the geomembrane liner component is assumed to have a 150 year service life as part of the primary landfill liner. The standard design allows for on-going collection of leachate until the point in time that if the liner does fail, there would not be any harm to the environment.

Adjustments to the staging of waste placement, application of daily cover, and construction of final cover will be made as required to accommodate the additional five to seven years of landfill life expectancy.

5.7.12 Landfill Operations

O. Reg. 232/98 requires that landfills be designed and operated to ensure that nuisance impacts are minimized, and also requires that the proponent prepare a report describing all aspects of the operation as well as maintenance procedures that will be followed. The detailed updated Site Design and Operations Report will be prepared as part of the ECA amendment application, following EA approval.

The proposed operation of the expanded Brooks Road Landfill will be as follows:

- Vehicles transporting waste to and around the Site will be tarped, as required, to prevent litter from blowing out of the vehicle.
- Daily cover will be applied to exposed waste to confine light weight material.
- Cover material will be readily available to allow the working face to be fully covered at the end of each operating day.
- The area of exposed waste at the working face will be minimized.
- The location of the working face will be adjusted, as required, to provide shelter from prevailing winds, if possible.
- Portable litter fences will be utilized around the working face to capture litter.
- Litter will be collected on an as-needed basis, both from the Site and, if required, from the adjacent lands and roadway.

- On-Site equipment will be operated in a manner such that noise impacts are minimized, wherever possible.
- All landfill construction equipment associated with the development, operation, or closure of the Site will comply with the noise levels outlined in applicable MOECC guidelines and technical standards.
- To attenuate visual and noise impacts, the berm on the western Site boundary will be vegetated and/or on-Site plantings will be implemented, as required.
- Waste will be compacted immediately after placement and spreading.
- Vector and vermin will be controlled, as required.
- The comprehensive monitoring and maintenance program to address all aspects of landfill operation, including waste inspection and monitoring of landfill odour will be maintained.
- Site haul roads will be constructed to minimize mud trackout and dust mitigation measures will be employed on an as-needed basis.

5.7.13 Landfill Traffic

Traffic volumes for the Preferred Undertaking will average approximately 16 vehicles per day (assuming all are walking floor trucks, which can handle 25 – 40 tonnes per load), although this value will vary depending on Site operations and construction scheduling. The average vehicles per day volume was calculated based on a minimum five year planning period, and 302 operating days per year. Traffic associated with the vertical expansion includes trucks hauling waste and haulage of construction materials for daily, interim, and final cover.

5.7.14 Site Closure & End Use

Site closure will follow the completion of the vertical capacity expansion of the Brooks Road Landfill to the approved final contours. Closure activities include final cover construction (approximate quantity of final cover needed is 37,475 m^3 of compacted fine grain soil and 9,369 m^3 of topsoil), removal of roads that are not required in the post closure period, removal of the scalehouse, and implementation of a long-term monitoring and maintenance program. The closure plan will be developed as part of ECA amendment.

Site end use will be determined by Brooks Road Environmental in consultation with the local community and other stakeholders. Potential end uses may include public open space (e.g., park) that could accommodate various passive or active recreational activities, or a restricted access open space.

Ongoing landfill monitoring and maintenance requirements will need to be incorporated into end use planning. Specific considerations will include but are not limited to:

- Access to leachate systems for ongoing operations, maintenance and monitoring
- Access to environmental monitoring locations
- Prevention of public access to operational or monitoring areas
- Impact of potential end use activities on the Site's leachate or surface water controls

5.8 Impact Assessment of the Preferred Undertaking

Following the confirmation of the Preferred Undertaking (i.e., Alternative Method 2 as the Preferred Alternative for vertical expansion in combination with Alternative 2 (on-Site treatment facility) as the Preferred Alternative for leachate management), a detailed impact assessment of the Preferred Undertaking was carried out. The purpose of the detailed impact assessment is to confirm the potential environmental effects associated with the implementation of the Preferred Undertaking; mitigation or compensation measures required to address potential adverse environmental effects; and any remaining net effects following the application of mitigation and/or compensation measures, as identified during the assessment of Alternative Methods.

As indicated in **Table 5.16**, 'No' to 'Low' net effects are anticipated across all environmental components considered for the implementation of the Preferred Alternative. Net effects for all environmental components are listed in **Table 5.16** along with a summary of associated mitigation measures.

Table 5.16 Preferred Undertaking – Potential Environmental Effects, Mitigation Measures & Net Effects

Environmental Component/Criteria		Potential Effects	Mitigation Measures	Net Effects
NATURAL	Air Quality	Air quality property boundary maximum exposure of 61.01 µg/m^3 for TSP for normal operations.	The following mitigation measures have already been considered in the detailed impact assessment: • Water and sweep roadways to allow for a minimum of 75% emission reduction • Pave the road from the landfill entrance up to the point the trucks enter the main part of the landfill (~224 m) The following are recommended additional mitigation measures that may be undertaken as part of the Fugitive Dust BMP Plan: • Watering suppressants on working faces, unpaved interim cover area roads, construction surfaces, etc. • Progressive vegetation seeding on surface areas • Limit traffic movement on exposed surface areas • Speed control of on-site traffic	Further reduced particulate matter impacts
		Up to 14 residences may experience a change in the predicted off-site air quality impact due to the Landfill expansion based on the Existing Conditions.		Further reduced particulate matter impacts
	Odour	Reduced/maintained Site boundary odour concentrations and reduced odour complaints at off-Site locations	Maintenance of the following operational measures currently in place to reduce/mitigate odour impacts from the Site during the vertical expansion have already been considered in the detailed impact assessment: • Daily odour monitoring • Minimize exposed waste through the application of cover material • Reduce the amount of leachate through off-Site disposal • Application of odour control granules and liquid spray • Upgrade the on-Site leachate treatment facility • Community outreach to identify any impacts at neighbouring residences Development of an SOP to include odour mitigation measures that would be implemented to ensure that odour complaints are investigated and the condition that resulted in the odour complaint is mitigated. The following are recommended additional mitigation measures that may be undertaken as part of the Odour BMP: • Maintain the leachate collection system under negative pressure • Minimize the size of the working face • Daily covering of the working face	Further reduced odour impacts
		Up to 14 residences may experience a change in the predicted off-site odour impact due to the Landfill expansion based on the Existing Conditions.		Further reduced odour impacts
	Noise	Noise impact exposure ranges from 40 dBA to 52 dBA, which is below the 55 dBA noise limit.	The following are recommended additional mitigation measures that may be undertaken as part of the Noise BMP: • Maintain barriers and/or berms at Landfill perimeter • Implement administrative controls that limit on-site landfilling activities • Maintenance to keep landfill equipment performing within acceptable noise limits	Further reduced noise impacts
		Net sound level change for 14 off-Site receptors is 3 dBA or lower[3]: • 10 residences = 0 to + 1 dBA change • 1 residence = 2 dBA change • 3 residences = 2 to 3 dBA noise reduction • POR5 = 52 dBA (-3 dBA reduction from existing condition) • POR7 = 40 dBA (+ 2 dBA increase from existing condition)		Further reduced noise impacts

[3] A net sound level change of 0 to 3 dBA is recognized as environmentally and acoustically insignificant.

Environmental Component/Criteria			Potential Effects	Mitigation Measures	Net Effects
	Geology & Hydrogeology	Groundwater Quality	No effects to groundwater quality at property boundaries and off-Site.	No mitigation measures required.	No impacts to groundwater quality at property boundaries and off-Site.
		Groundwater Flow	No effects to groundwater flow characteristics.	No mitigation measures required.	No impacts to groundwater flow characteristics.
	Surface Water Resources	Surface Water Quality	No effects on surface water quality on-site or off-site.	The following mitigation measures have already been considered in the detailed impact assessment: • Continued operation of the stormwater management pond to remove excess TSS and attenuate peak flows to protect downstream receivers from potential changes in water quantity • Construction of the Permanent Stormwater Management System as outlined in the Stormwater Management Plan (GHD, September 2013) (currently underway)	No impacts to surface water quality on-site or off-site.
		Surface Water Quantity	No change in drainage areas.		No change in drainage areas.
			No off-site effects to surface water quantity.		No off-site impacts to surface water quantity.
	Terrestrial Ecosystems		No effects to vegetation communities within the Site and Local Study Areas.	No mitigation measures required.	No impacts to vegetation communities within the Site and Local Study Areas.
			No effects to wildlife habitat within the Site and Local Study Areas.	No mitigation measures required.	No impacts to wildlife habitat within the Site and Local Study Areas.
			No effects to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas.	No specific mitigation measures required. BMPs will be implemented by Brooks Road Environmental for the protection of wildlife and SAR.	No impacts to vegetation or wildlife (including rare, threatened, or endangered species) within the Site and Local Study Areas.
	Aquatic Ecosystems		No effects to water quality within the Site and Local Study Areas.	No mitigation measures required.	No impacts to water quality within the Site and Local Study Areas.
			No effects to aquatic habitat within the Site and Local Study Areas.	No mitigation measures required.	No impacts to aquatic habitat within the Site and Local Study Areas.
			No effects to aquatic biota within the Site and Local Study Areas.	No mitigation measures required.	No impacts to aquatic biota within the Site and Local Study Areas.
CULTURAL	Cultural & Heritage Resources		No potential loss of or disturbance to cultural and heritage resources within the Local Study Area.	No mitigation measures required.	No impacts to cultural and heritage resources within the Local Study Area.
CULTURAL	Archaeological Resources		No potential loss of or disturbance to archaeological resources within the Local Study Area.	No mitigation measures required.	No impacts to archaeological resources within the Local Study Area.
BUILT	Transportation	Effects on Airport Operations	No potential for bird strike hazard to aircraft in Local Study Area.	No mitigation measures required.	No bird strike hazard to aircraft in Local Study Area.
BUILT		Effects from Truck Transportation Along Access Roads	Minimal potential for traffic collisions in the Local Study Area.	No mitigation measures required.	Minimal potential for traffic collisions in Local Study Area.
BUILT			Negligible potential for disturbance to traffic operations in Local Study Area and wider road network.	No mitigation measures required.	Negligible disturbance to traffic operations in Local Study Area and wider road network.
BUILT			No potential for road improvement requirements.	No mitigation measures required.	No road improvement requirements.
BUILT	Effects on Current and Planned Future Land Uses		No change to the current land uses within the Site and Local Study Areas.	No mitigation measures required.	No change to the current land uses within the Site and Local Study Areas.
BUILT			No potential effects on planned future land use within the Site and Local Study Areas.	No mitigation measures required.	No impacts on planned future land use within the Site and Local Study Areas.

Environmental Component/Criteria			Potential Effects	Mitigation Measures	Net Effects
			Official Plan indicates "Identified Trail Locations" and the Haldimand County Trails Master Plan (2009) identifies "Proposed Special Use Routes" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, within 500 m of the landfill footprint.	BMPs will be implemented by Brooks Road Environmental to manage nuisance-related effects during construction and operation. Vegetating the screening berm and/or introducing additional plantings on-Site, as required, will reduce the visual and noise effects for surrounding recreational resources and residences.	Surrounding recreational resources remain; however, mitigation measures applied will minimize nuisance effects.
			2 residences are located within 500 m of the landfill footprint.		Surrounding sensitive land uses remain; however, mitigation measures applied will minimize nuisance effects.
	Effects on Soils and Existing Agricultural and Mining Operations		Potential for landfill operations to affect surrounding agricultural operations. 19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation. Vegetating the screening berm and/or introducing additional plantings on-Site, as required, will reduce the visual and noise effects for surrounding agricultural operations.	Surrounding agricultural operations remain; however, mitigation measures applied will minimize nuisance effects.
			No potential effects on active mining operations as there are none located within the Local Study Area.	No mitigation measures required.	No impacts on active mining operations within the Local Study Area.
			No loss of soil with agricultural capability. All onsite lands are considered to be disturbed and are not rated under the Canada Land Inventory.	No mitigation measures required.	No loss of soil with agricultural capability.
	Site Design & Operational Characteristics		Increased complexity of final contours, stormwater management system, screening berms, leachate treatment facility, site access, or scale house facility.	Mitigation through Detailed design as part of the Amended Site Design and Operations (D&O) Report for the Amended ECA.	Minor changes to final contours and site grading/drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility.
			Limitations on placement and grading of waste/cover material; management of leachate, stormwater, odour, and traffic; potential post-closure uses.	BMPs will be implemented by Brooks Road Environmental to maximize operational flexibility. Further details will be provided as part of the Amended Site D&O Report for the Amended ECA.	No changes to proposed waste/cover slopes. Fewer limitations on potential post-closure uses. Low net effects on the management of leachate, stormwater, odour, and traffic.
SOCIO-ECONOMIC	Social	Visual Impact of Facility	• Final height at closure approximately 12 m above existing landfill. • Visible from agricultural areas to the immediate west and southwest of the Site within the Local Study Area. • No visibility from the north, east and south within the Local Study Area due to existing vegetation.	Screening berm to be vegetated and/or implementation of additional plantings on-Site, as required, to minimize views from agricultural areas to the west and southwest.	Vegetating the screening berm and/or implementing additional plantings on-Site, as required, would minimize views of the Site from surrounding areas.
		Effects on Local Residents	11 residential dwellings within the Local Study Area.	BMPs will be implemented by Brooks Road Environmental to manage nuisance related effects during construction and operation.	Residences within the Local Study Area remain; however, mitigation measures applied will minimize nuisance effects.
	Economic	Effects on/ Benefits to Local Community	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.	No mitigation measures required.	The Brooks Road Landfill Site will continue to employ 6 persons for the duration of Site operations.
			Continue services to waste disposal customers for the 5 to 7 year planning period.	No mitigation measures required.	Continue services to waste disposal customers for the 5 to 7 year planning period.
	Potential Effects on Aboriginal Communities		No potential effects on the use of lands for traditional purposes.	No mitigation measures required. Consultation with Aboriginal Communities will continue throughout the EA process.	No impacts to use of lands for traditional purposes.

5.8.1 Cumulative Effects on the Environment

During the ToR, Brooks Road Environmental committed to including a discussion of the cumulative effects of the landfill on the environment. As the assessment of cumulative environmental effects is not required as part of the provincial EA process, Brooks Road Environmental consulted and reviewed examples of how to approach cumulative effects as part of the federal EA process, as described in the Canadian Environmental Agency's Operational Policy Statement[4] and the Cumulative Effects Assessment Practitioners Guide[5].

Cumulative environmental effects are defined as effects that are likely to result from the proposed project in combination with other projects or activities that have been or will be carried out within the foreseeable future. The cumulative effects assessment completed for this project focused on the resultant net effects of the preferred undertaking combined with the other planned and approved or reasonably foreseeable projects in the Local Study Area. The Project Team reviewed existing land use documents (i.e., Official Plan, development applications, etc.) and determined that there were no existing of future projects/activities within the Study Area that may interact with the Brooks Road Environmental site, over the 5-7 year planning period. However, there are future traffic conditions on local roads (i.e., Highway 3) that were reviewed and analysed that may have the potential to interact.

Forecasted 2021 and 2026 turning movement counts were projected at both the intersection of Highway 3 and Brooks Road and at the existing Brooks Road Landfill Site driveway during the weekday a.m., mid-day and p.m. peak periods and Saturday mid-day peak periods. This includes the additional 16 site trucks per day as a result of the proposed vertical expansion (assuming all are walking floor trucks, which can handle 25 – 40 tonnes per load). To provide a conservative and worst-case scenario analysis, all 16 of the daily new truck trips were applied to each peak hours (all 16 new daily truck trips would enter/exit the site within the peak hour) to determine their interaction and potential future cumulative effect. The resulting weekday a.m., mid-day and p.m. peak hour as well as the Saturday peak hour volumes are summarized in **Figures 5.37** and **5.38**, above.

As a measure of the capacity on the adjacent road network surrounding the Brooks Road Landfill at peak operations (i.e., 1,000 tonnes of material per day), both the Site access on Brooks Road and the stop controlled intersection of Brooks Road and Highway 3 were analyzed

[4] Canadian Environmental Assessment Agency, 2015. Operational Policy Statement - Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012. Last accessed July 5, 2016. Available at: http://www.ceaa.gc.ca/default.asp?lang=En&n=1DA9E048-1

[5] Canadian Environmental Assessment Agency, 1999. Cumulative Effects Assessment Practitioners' Guide. Last accessed July 5, 2016. Available at: http://www.ceaa-acee.gc.ca/Content/4/3/9/43952694-0363-4B1E-B2B3-47365FAF1ED7/Cumulative_Effects_Assessment_Practitioners_Guide.pdf

using the projected 2021 and 2026 peak turning movement volumes for the weekday a.m., mid-day, p.m. and Saturday peak hours. A summary of the capacity analysis using Synchro version 8 is summarized in **Table 5.5** and **Table 5.6**, above.

Both intersections overall are expected to operate with minimal delay and substantial excess capacity under future 2021 and 2026 conditions. Individual movements at both study intersections are expected to operate with levels of service 'B' or better representing minimal delay, and volume-to-capacity (v/c) ratios not exceeding 0.08 representing substantial excess capacity, during the weekday a.m., mid-day, p.m. and Saturday mid-day peak hours.

The analysis of future 2021 and 2026 conditions under peak operations confirms no vehicle delay issues or capacity constraints at either study intersection, with the additional 16 site trucks per day as a result of the proposed vertical expansion being negligible.

A cumulative effects assessment considers other sources of air emissions in the area of the site and background ambient air quality. There are no significant off-site sources of air emissions within the study area, other than local road traffic.

There is no MOECC or Environment Canada air monitoring station located near the site. However, the MOECC West Hamilton air monitoring station was used as a source of local particulate ambient air data. This station is approximately 40 km from the landfill and is impacted by many other sources in Hamilton and is likely providing much higher particulate ambient air quality data than would be representative near the landfill.

The West Hamilton air monitoring station has an average PM2.5 concentration of 8.04 µg/m^{3}and a 98 percentile concentration of 21.49 µg/m^3, from 2009 to 2014. The West Hamilton air monitoring station does not report PM10 or TSP concentrations. The predicted PM2.5 concentrations at the residential receptors from the proposed landfill operations, when added to the background PM2.5 concentrations, would not result in an exceedance of the PM2.5 AAQC of 30 µg/m^3. The maximum cumulative effect from site activities and the West Hamilton air data is 22.10 µg/m^3 during the peak operation scenario (assumed for the air quality analysis to be 50 garbage trucks per day weighing 40 tonnes when entering the site and 20 tonnes when exiting the site carrying a total of 1,000 tonnes of waste). This is below the MOECC AAQC of 30 µg/m^3.

The cumulative effects at the property line for PM2.5 was also completed based on the 2009 to 2014 PM2.5 data from the West Hamilton air monitoring station. During daily average operations (assumed for the air quality analysis to be 25 garbage trucks per day weighing 40 tonnes when entering the site and 20 tonnes when exiting the site carrying a total of 500 tonnes per day) the maximum predicted PM2.5 concentration at the property boundary is

26.29 µg/m^3, or 87.6% of the MOECC AAQC. During the peak operating scenario (i.e., 50 garbage trucks) the maximum predicted PM2.5 concentration at the property boundary is 30.63 µg/m^3. This value is equal to the MOECC AAQC. Using the average PM2.5 concentration from the West Hamilton monitoring station for the peak operating scenario (50 garbage trucks) the maximum predicted PM2.5 concentration at the property boundary is 17.18 µg/m^3. It should be noted that the use of the West Hamilton air monitoring station, the use of the 98th percentile value, and the modelling parameters (meteorological data, route length, location of drop operations) are all worst case scenarios that are not expected to occur simultaneously and provide a conservative estimate of the cumulative effects at the property boundary and sensitive receptors.

Based on the above and the context of the operation of this Site in conjunction with a lack of other reasonably foreseeable Projects/activities in the area, the Site is not likely to cause significant adverse cumulative environmental effects.

Following closure and the post-closure period, the Site will exist as a stable, slightly elevated, vegetation-covered mound in the local landscape. There are no major water bodies (e.g., rivers, lakes, ponds, dam-created reservoirs, etc.) within the Local Study Area; however, the North Cayuga Wetland Complex, a provincially significant landscape feature, is present within the Local Study Area. The cumulative effects of past, present and future landfilling activities on this feature are described below.

The creation of the landfill Site in 1959 would have resulted in the modification of the surrounding natural landscape, including the North Cayuga Wetland Complex. Since 1959, the Site has gone from being a rural "dump" (i.e., non-engineered, unlined, waste disposal pits) to a modern engineered and operated waste management facility/landfill. Since the inception of the landfill to its current use, suitable habitat on-Site for species utilizing the wetland complex has progressively reduced. The former CSR rail bed forms a hydrological divide between the landfill and the portion of the wetland complex to the north of the Site, and has since the first Site landfilling activities. This former CSR rail bed has been used in recent years, and continues to be used for clay stockpiling. This forms the north side buffer between the active landfilling to the south and the North Cayuga Wetland Complex to the north. Permanent erosion and sediment control measures are in place at the north toe of slope (e.g., heavy duty silt fence and vegetative buffer) under current conditions, mitigating physical cumulative impacts to the wetlands to the north as a result of Site activities.

Under the proposed conditions, this area would remain as a buffer between the active landfilling to the south and the North Cayuga Wetland Complex to the north, and; therefore, cumulative environmental impacts to the north wetlands are further mitigated.

As outlined in Section 5.7.8, Site stormwater is managed in isolation from leachate. Leachate is being removed and disposed of off-Site, while stormwater is collected and passed through a wet pond before discharging attenuated run-off to the south-southeast. Given that the stormwater management system currently being installed is designed to attenuate peak flows up to the Regional storm event, and the drainage ditches are further sized, at a minimum, to accommodate the peak flow from a 3-hour duration, 25-year storm, impacts to the portion of the North Cayuga Wetland Complex located east and south of the Site are anticipated to be limited. Furthermore, there is no significant increase expected to runoff peak flow rates or volumes as a result of the proposed vertical expansion. As there is no proposed change from past to present stormwater discharge quality or quantity and Site operations will continue to meet the design criteria of the on-Site ponds, there are no off-Site cumulative impacts to water features anticipated as a result of continued operation, including to the North Cayuga Wetland Complex, specifically those portions of the complex that are adjacent to the east and south of the Site. Furthermore, the landfill footprint will not change as part of proposed conditions, and landfilling activities will continue to occur within the footprint approved by the CofA (now ECA) issued in 1980, including amendments approved by the MOECC in 1980, 2002, 2004, 2005, 2007, 2011, 2012, and 2013.

Detailed post-closure plans for the landfill, which are to be developed at a later date, may include opportunities for ecological enhancement, including re-establishing linkages for terrestrial species which may be using the adjacent wetland complex through the use of final grading contours and restoration plantings.

Therefore, post-closure, the Site is not likely to cause significant adverse cumulative environmental effects.

5.8.2 Climate Change Considerations

5.8.2.1 Historical Climate and Climate Trends

Southern Ontario has a humid continental climate influenced by the Great Lakes with warm summers and no dry season. Cayuga, Ontario is located in Haldimand County, near the north shore of Lake Erie. The Great Lakes moderate the effects of the weather of the surrounding areas. The region experiences warm humid summers, moderate temperatures in the spring and fall with higher precipitation rates and cold winters.

The historical temperature and precipitation volumes were obtained using data from the closest climate station to the Brooks Road Environmental Landfill; the Hagersville Station and

wind was assessed using data form the closest climate station with the information regarding wind speed available; Hamilton A Station.

Temperature

Regional baseline climate data (climate normal data) were obtained from Environment Canada (EC). The closest EC climate station to the Brooks Road Landfill with 30-year climate normal data from 1981 to 2010 available is the Hagersville Station (climate ID 6133120) approximately 22 km north-west of the Brooks Road Landfill Site (EC 2016). The Hagersville Station is located at latitude 42.58 N, longitude 80.04 W (Elevation: 221 m). The temperature data for the Hagersville Station are provided in **Table 5.17**. However the Hagersville Station only has temperature data from 1985 to 2004 for the 30-year timeframe from which EC reports climate normal data. The annual mean temperature is estimated as 8.4 ˚C. The mean summer high temperature is 20.3˚C for August, while the winter mean low temperature is -4.5˚C in January. The lowest extreme minimum temperature was in January of 1994 at -26.5^{o}C, and the highest extreme maximum was in July of 1988 at 38.5^{o}C (**Table 5.18**).

Table 5.17 Mean Temperature Profiles from 1985 to 2004 at Hagersville Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Average (°C)	-4.5	-4.0	0.7	7.1	13.5	18.7	21.4	20.3	16.1	9.7	4.0	-1.8	8.4
Daily Maximum (°C)	-0.9	-0.1	5.1	12.2	19.1	24.4	27.0	25.8	21.4	14.3	7.5	1.4	13.1
Daily Minimum (°C)	-8.1	-7.9	-3.7	1.9	7.8	13.0	15.7	14.8	10.8	5.1	0.4	-5.0	3.7

Note:
[1] Source: EC 1981 to 2010 Canadian Climate Normals (climate ID: 6133120)

Table 5.18 Minimum and Maximum Temperature Extremes

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Extreme Maximum (°C)	15.0	18.0	25.5	30.5	32.5	35.5	**38.5**	36.5	33.5	28.5	20.0	18.0	15.0
Year	1995	2000	1998	1990	1987	1988	**1988**	2001	2002	1995	1987	1998	1995
Extreme Minimum (°C)	**-26.5**	-26.0	-22.0	-11.0	-2.5	2.0	4.5	4.0	-2.0	-6.0	-14.0	-23.0	**-26.5**
Year	**1994**	1994	2003	1995	1986	1998	2001	1986	1993	1988	2000	1993	**1994**

Note:
[1] Source: EC 1981 to 2010 Canadian Climate Normals (climate ID: 6133120)

Precipitation

The mean climate normal monthly precipitation data are provided in **Table 5.19**. The Hagersville Station only has precipitation data available from 1981 to 2004, for the 30-year timeframe from which EC reports climate normal data. The mean annual average precipitation is 956.2 mm. Approximately 90 percent of the total precipitation was in the form of rain and 10 percent as snowfall. The extreme daily participation amounts are shown form 1950 to 2000 (**Table 5.20**). The highest rainfall experienced was 87.4 mm in 1977 and the highest snowfall experienced was 45.7 cm in 1950.

Table 5.19 Mean Monthly Precipitation Profiles from 1981 to 2004 at Hagersville Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation (mm)	59.6	49.9	67.8	84.6	86.7	83.4	100.3	82.9	91.7	83.4	94.3	71.7	956.2
Rainfall (mm)	34.3	30.4	50.8	80.5	86.6	83.4	100.3	82.9	91.7	83.0	88.0	50.9	862.7
Snowfall (cm)	25.3	19.6	17.0	4.1	0.2	0.0	0.0	0.0	0.0	0.4	6.3	20.8	93.6

Note:
[1] Source: EC 1981 to 2010 Canadian Climate Normals (climate ID: 6133120)

Table 5.20 Extreme Daily Precipitation at Hagersville Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Extreme Daily Precipitation (mm)	37.6	43.7	46.7	38.9	47.5	80.0	78.4	82.6	64.6	**87.4**	78.0	40.4	37.6
Year	1954	1954	1954	1959	1969	1968	1988	1952	1977	1977	1999	1990	1954
Extreme Daily Rainfall (mm)	37.6	43.2	46.7	38.9	47.5	80.0	78.4	82.6	64.6	**87.4**	77.0	40.4	37.6
Year	1954	1954	1954	1959	1969	1968	1988	1952	1977	1977	1985	1990	1954
Extreme Daily Snowfall (cm)	25.4	17.8	27.9	10.2	3.0	0.0	0.0	0.0	0.0	6.0	**45.7**	23.0	25.4
Year	1966	1957	1954	1957	1989	1948	1948	1948	1948	1993	1950	1992	1966

Note:
[1] Source: EC 1981 to 2010 Canadian Climate Normals (climate ID: 6133120)

Rainfall Intensity Duration Frequency (IDF) data for 2010 were obtained from the Ontario Ministry of Transportation's (MTO) IDF Curve Look-up for the site at latitude 42.97, longitude -79.82 (**Table 5.21)**. The maximum estimated amount of rain is 130 mm for a 100-year 24 hour storm event (MTO, 2016). It should be noted that the information presented in **Table 5.21** is not a prediction of the future, but an estimation of the probability of a storm occurring within a certain time period (return period) for a certain duration and the intensity of that storm based on statistical analysis of pas data.

Table 5.21 Extreme Daily Precipitation at Hagersville Station

Return Period (year)	Rainfall Depth (mm) by Storm Duration								
	5 min	10 min	15 min	30 min	1 hr	2 hr	6 hr	12 hr	24 hr
2	10.8	13.3	15.0	18.5	22.8	28.1	39.1	48.2	59.3
5	14.2	17.6	19.8	24.4	30.1	37.1	51.6	63.6	78.3
10	16.5	20.4	23.0	28.3	34.9	43.0	59.8	73.7	90.8
25	19.4	23.9	27.0	33.3	41.0	50.5	70.3	86.6	106.7
50	21.5	26.5	30.0	36.9	45.5	56.1	78.0	96.1	118.4
100	23.7	29.2	32.9	40.6	50.0	61.6	85.7	105.6	130.1

Source:
MTO IDF Curve Look-up for Brook Road Environmental Landfill site (latitude 42.97, longitude -79.82)

Wind

The speed of the monthly maximum gust obtained from 2000 to 2010 data from Hamilton A Station (climate ID: 6153194) are representative of those that typically occur in much of Ontario and are presented in **Table 5.22** (EC 2016b). Predominate wind comes from the west (36 percent of the time), south west (13 percent of the time), and east (12 percent of the time)[6] (Weatherspark 2012). In winter, typically there are more high-speed winds coming mainly from the west. The average maximum gust speed was the highest in December, which was approximately 78 km/h. Winds are the lowest in the summer months; the lowest average maximum gust speed was in August, which was approximately 60 km/h. In the summer, the southwestern component is the strongest, with roughly 17 percent of the wind coming from the southwest (Weatherspark, 2012).

[6] Based on historical records from Hamilton RBG CS Station (climate ID: 6153301) from 2005 to 2012.

Table 5.22 The Average Observed Speed of the Max Gust from Hamilton A Station from 2000 to 2010

Month	Observed Average Speed of Max Gust (2000-2011) (km/h)
January	71.00
February	75.27
March	74.64
April	77.09
May	71.55
June	66.64
July	67.09
August	60.18
September	71.55
October	71.45
November	73.18
December	77.82
Source: EC Historical Data (climate ID: 6153194)	

The historical climate and climate trends described above were used to identify any possible climate change risks of concern for the construction, operation, closure, and post closure stages of the landfill.

5.8.2.2 Climate Change Considerations

Climate change, as it may affect or be affected by the Proposed Undertaking, was considered as part of the Brooks Road Landfill Site Vertical Capacity Expansion EA. While not currently approved, the MOECC has prepared a draft *Guide: Consideration of Climate Change in Environmental Assessment in Ontario* (the Guide), which was posted to the Environmental Registry (EBR) after the Draft Brooks Road Landfill Vertical Expansion EA. However, the guide was consulted in preparation of this report, in particular the Guide was reviewed when addressing the potential climate risks to key infrastructure components at the landfill site.

Greenhouse Gas Emissions

Methane gas (CH_4), considered to be the key GHG contributing most to climate change, is a major component of gas generated from municipal solid waste landfills, accounting for

approximately 50 to 70 percent by volume. Carbon dioxide (CO_2), another gas contributing to climate change, makes up most of the remaining volume, for a total of up to 99 percent.[7]

Landfills generate gas primarily as a result of the biodegradation of organic materials in the waste mass. The rate of gas generation, the quantity of gas generated and the rate of emission of those gasses from a landfill vary, depending on several factors, including: the type, amount and, age of biodegradable material in the waste mass; the available moisture in the waste mass; and the density and homogeneity of the waste mass. Landfill gas generation generally peaks following the end of the active landfilling, and diminishes over time as the biodegradable material in the waste mass is used up.

Effect of the Undertaking on Climate Change

The Brooks Road Landfill receives primarily post-diversion IC&I waste, and very little waste containing organics such as municipal solid waste (MSW). As a result, the potential to produce methane and other GHGs is significantly lower than a MSW landfill of the same size. Any gas produced at the Site migrates to the surface and dissipates into the atmosphere; there is currently no landfill gas collection system in place, nor is one required under O. Reg. 232/98 and the "Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfill Sites" (MOECC, 2012). While neither the regulation nor the Guideline specifically mentions climate change *per se*, the regulation does address the generation and control of landfill gas. Section 15.(1) of the O. Reg. 232/98 states that:

> "15.(1) *A person shall not establish a new landfilling site or increase the total waste disposal volume of an existing landfilling site unless a written report has been prepared respecting the design of facilities for the collection, and for the burning or use, of landfill gas generated by the site during site operation and following site closure.*
>
> *(2) Subsection (1) applies only if a new landfilling site is being established with a total waste disposal volume of more than 1.5 million cubic metres or the total waste disposal volume of an existing landfilling site is being increased to more than 1.5 million cubic metres.*"

Based on the GHG modeling that has been conducted, the low level of methane generation at the Brooks Road Landfill and the negative environmental, energy and economic factors associated with a gas collection and control system, it has been demonstrated that the operation of a landfill gas collection system is not feasible. See **Sections 5.1.1.6 and 5.7.10** of the EA Report for additional information.

[7] McBean, E.A., Rovers, F.A. and Farquhar, G.J.: "Solid Waste Landfill Engineering and Design". Prentice Hall PTR. Englewood Cliffs, NJ. 1995. Pages 96 & 97 and Table 5.9.

Upon closure, the landfill will be sealed with a clay cap. This will significantly reduce the already low amount of GHGs released by the landfill. During post-closure each year the landfill will release less and less GHG emissions.

Mitigation

In order to minimize or offset the effects of the Undertaking on climate change, in particular to reduce the GHG emissions associated with the construction, operation, closure and post-closure stages of the landfill mitigation measures will be implemented. The MOECC Guide defines mitigation as "The use of measures or actions to avoid or reduce greenhouse gas emissions, to avoid or reduce effects on carbon sinks, or to protect, enhance, or create carbon sinks" (MOECC 2016, Page 40). Mitigation measures include actions such as utilizing different technologies and construction materials.

Mitigation measures and BMPs to reduce the Undertaking's effect on the environment will be determined and implemented at the onset of each stage of the landfill. Possible BMP/ mitigation measures for the four stages of the landfill include:

- Implement and enforce an anti-idling policy for all vehicles and machinery on site during the construction stage
- Try to use materials that have a lower carbon footprint and a long lifespan
- Enforce an anti-idling policy for all vehicles on site during the operation stage
- Reduce the size of the uncovered/working area
- Capping the landfill
- Plant additional vegetation to create a carbon sink

Effect of Climate Change on the Undertaking

As noted in **Section 1.0** of the EA Report, the timeframe for the Undertaking – the operational phase (i.e., active waste disposal) is planned to be approximately five to seven years. Since the operational phase of the landfill expansion is only five to seven years it is too short to be significantly affected by climate change. However, as noted in **Table 5.13**, post-closure monitoring and site care can be up to an additional 53 years[8]. During this time there is a possibility that changes in temperature and precipitation could potentially affect post-closure activities and infrastructure.

[8] Under current MOECC regulations and policies relating to landfill closure and post-closure care a closed landfill site must be monitored (e.g., groundwater, surface water and overall physical condition) until such time as sampling results fall below regulated standards. During that time, waste continues to settle, leachate and landfill gas generation decline until they essentially cease, and the site becomes naturally re-vegetated.

Key potential effects of climate change that may occur during the Undertaking may include:

- Increasing frequency of unusually high or low daily temperature extremes.
- Long-term increasing or decreasing mean annual temperatures and/or precipitation.
- Increasing or decreasing frequency of storm events (e.g., rainfall, snowfall, extreme wind).

Extreme and adverse weather could affect the day-to-day operation of the Site. As an example, an increase in storm events could affect the facilities and systems that have been engineered for the Site as part of the Undertaking, such as the stormwater management system. The potential impacts are considered to be "low" or "nil". "Low" indicates that the effect may cause a minor impact on the site operation or the site design/features that rely on the component. "Nil" indicates that no effect is projected due to the potential change. **Table 5.23**, below, summarizes these potential adverse effects of climate change on the construction, operation, closure, and post-closure care lifespan of the Undertaking.

Table 5.23 Estimated Sensitivity of the Undertaking to Potential Climate Change Effects[9]

Climate Parameters	Landfill Stage				Explanation
	Construction[10]	Operation[11]	Closure[12]	Post-Closure[13]	
Mean Temperature	NIL	NIL	NIL	NIL	A slight change in mean temperature will not impact landfill operations. Landfill operations are successfully conducted in areas with significantly higher/lower mean and extreme temperatures.
Frequency and/or Severity of Extreme Temperature	LOW	LOW	LOW	NIL	
Total Annual Rainfall	LOW	LOW	LOW	LOW	A slight change in annual precipitation will not impact landfill operations. Landfill operations are successfully conducted in areas with significantly higher/lower annual precipitation.
Total Annual Snowfall	LOW	LOW	LOW	LOW	

[9] Table modified from: "Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners" (Federal-Provincial-territorial Committee on Climate Change, November 2003).

[10] Excavation and grading of new waste cells; placement and grading of final cover on closed cells.

[11] Placement, grading, and compaction of waste during life of each active cell.

[12] Placement and grading of final cover on remaining active areas of waste area, decommissioning of ancillary Site facilities.

[13] Monitoring of surface water and groundwater, observation, and repair (as necessary) of closed Site conditions (e.g., erosion, vegetation re-planting, etc.).

Climate Parameters	Landfill Stage				Explanation
	Construction[10]	Operation[11]	Closure[12]	Post-Closure[13]	
Frequency and/ or Severity of Precipitation and Weather Extremes	LOW	LOW	LOW	LOW	The landfill components have been designed to accommodate a Regional storm event. The Site has sufficient area to increase the stormwater works to accommodate larger storms. The system is designed to return to normal operating conditions within two days.
Soil Moisture & Groundwater	LOW	LOW	LOW	LOW	These items relate to potential weather changes Landfill operations are successfully conducted in areas with significantly different weather conditions.
Evaporation Rate	LOW	LOW	LOW	LOW	
Wind Velocity	LOW	LOW	LOW	NIL	

The following provides additional information in support of the above noted potential effects:

- The construction stage may be impacted by changes in weather patterns. These are generally considered to be low, since construction periods are short duration events and, therefore, it is possible to minimize potential climate change effects related to rainfall, storms, temperature, and moisture by managing the overall construction schedule so that construction does not occur during periods beyond the typical/normal range for these parameters.
- The landfill operations stage may be impacted by changes in weather patterns and, in particular, storm events. During and after storm events, portions of the waste disposal area may not be accessible. If climate change effects are noted, alternate operating locations can be developed that could be used during extreme events, if required. Typically, during the initial period of landfill cell filling, in the event of a wet period, a second disposal area higher up on the landfill (and therefore dryer) will be available. Depending on the potential climate change effect, landfill operations have the flexibility to be altered to reflect site and weather conditions.
- Closure impacts relate to impacts to the vegetated cover. Depending on the potential impact, an adjustment to the vegetation cover type (i.e., grasses) may be required in order to adapt to changing weather and climate conditions.
- Post-Closure care impacts are similar to closure impacts and mainly concern vegetation cover. Re-seeding or natural regeneration of the vegetation cover will occur over the post-closure care period.

Although, as stated above, the stage with the greatest potential to be affected by climate change is the post-closure stage as the duration of the other stages are so short, the severity of potential impacts to the landfill's management infrastructure components due to climate change were determined for all stages. The results of the evaluation are displayed in **Table 5.24.**

A slight change in mean temperature and frequency and/or severity of extreme temperatures will have little or no impact to any landfill component during construction through to post-closure. A slight change in annual precipitation and frequency and/ or severity of precipitation and weather extremes does not have the potential to cause any severe damage to any of the landfill components, except the leachate management system and the stormwater system during closure and post-closure. However, the leachate and stormwater management systems have been designed to accommodate a Regional storm event, sized for up for a rainfall depth of 212 mm, which is much greater than the historical daily maximum precipitation amount of 87.4 mm (**Table 5.20**) and the rainfall depth estimated for the 100-year storm event for the Brooks Road Landfill of 130 mm (**Table 5.21**). The leachate and stormwater management systems and are designed to return to normal operating conditions within two days. There is also a slight potential for the berms to be impacted through erosion and impact to vegetation cover due to an increase in intensity and frequency of precipitation events. Changes to soil moisture and groundwater, evaporation rate and wind velocity as a result of changes to temperature and precipitation will have little to no impact to the landfill components during any stage of the landfill. There is a slight potential for an increase in wind velocity, changes to soil moisture and evaporation rates to lead to issues with erosion and vegetation establishment on the final cover during post-closure affecting the quality of surface water runoff.

Table 5.24 Potential Severity of Climate Impacts on Components of the Waste Management Infrastructure

Climate Parameters	Waste Management Infrastructure Components					Explanation
	Berms	Geotextile Liner	Leachate Management System	Storm water System	Waste Piles	
Mean Temperature	NIL	NIL	NIL	NIL	NIL	A slight change in mean temperature will not impact landfill components. The landfill components listed function successfully in areas with significantly
Frequency and/or Severity of Extreme Temperature	NIL	NIL	LOW	LOW	NIL	

Climate Parameters	Waste Management Infrastructure Components					Explanation
	Berms	Geotextile Liner	Leachate Management System	Storm water System	Waste Piles	
						higher/lower mean and extreme temperatures.
Total Annual Rainfall	LOW	NIL	LOW	LOW	NIL	A slight variation in annual precipitation will not impact the landfill components. The landfill components listed function successfully in areas with significantly higher/lower annual precipitation.
Total Annual Snowfall	NIL	NIL	LOW	LOW	NIL	
Frequency and/ or Severity of Precipitation and Weather Extremes	LOW	NIL	LOW	LOW	LOW	The landfill components have been designed to accommodate a Regional storm event. The Site has sufficient area to increase the stormwater works to accommodate larger storms. The system is designed to return to normal operating conditions within two days
Soil Moisture & Groundwater	LOW	NIL	NIL	NIL	NIL	These items relate to potential weather changes, the listed landfill components function successfully in areas with significantly different weather conditions.
Evaporation Rate	NIL	NIL	NIL	LOW	NIL	
Wind Velocity	LOW	NIL	NIL	NIL	LOW	

Current landfill site design and regulations anticipate these kinds of impacts and require a variety of engineering design considerations to mitigate them (e.g., the stormwater collection system and stormwater management pond are engineered to the 100-year storm capacity; the D&O Report sets out Site management requirements; and Municipal health and safety procedures govern the activities of Site operators during adverse weather events).

Monitoring of groundwater and surface water is currently carried out for the Site, and a report summarizing these results and other Site conditions is submitted to the MOECC annually. These measures mitigate the kinds of potential extreme adverse effects and events noted above; longer-term, more gradual changes are managed through regulatory changes and adaptive management by Brooks Road Environmental.

As such, it is considered that a change in climate within the vicinity of the Site will have no appreciable adverse effect on the Undertaking or on any waste management infrastructure components. Furthermore it is anticipated that climate change will not have an effect on the Undertaking during the construction and operation stages due to the short timeframe of the stages.

Adaptation

Brooks Road Environmental has undertaken additional analysis to determine what adaptation measures may be required for the site. Adaptation will be focused on addressing effects of climate change on the Undertaking.

The MOECC's Guide defines adaptation as "The process of adjustment in the built and natural environments in response to actual or expected climate change and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects" (MOECC 2016, Page 38). Although it was determined climate change will have no appreciable adverse effects on the proposed Undertaking identification of possible adaptation measures was undertaken to increase both the project's and the local ecosystem's resilience to climate change.

To increase the project's and the local ecosystem's resilience to climate change, the project's and local ecosystem's vulnerability to climate change need to be reduced. The degree of vulnerability is associated with unpredictability of climate change. The unpredictability of climate change increases over time. Therefore the stage with the greatest vulnerability (e.g., most likely to be impacted by climate change) is the stage that occurs over a long period of time, which is post-closure. As such resources will be focused on employing adaption measures upon closure of the landfill to ensure the landfill is resilient to climate change during the 53 year post-closure stage.

Adaptation measures will be aimed at strengthening and increasing the resilience of the landfill cover and leachate management system. Such measures could include:

- Choosing vegetation known, to withstand erosion and climatic stressors such as extreme heat, drought tolerance, and flood resistance
- Planting additional vegetation every five to ten years
- Modification of existing stormwater management ponds, if necessary

The above is by no means a comprehensive list and additional adaption measures will be considered upon closure of the site.

As required by Section 31 of the O. Reg. 232/98 a Closure Report is to be created two years before the anticipated closure date of a landfill or when 90 percent of the waste disposal volume is reached. In addition to detailing the activities for post-closure care the Closure Report will state the commitments to climate change adaptation and how they will be implemented. Emerging technologies and current climate projections will be reviewed during the development of the adaptation measures in the Closure Report.

In addition, the development of BMP Plans (discussed in **Section 7.2)** will be prepared such that they can flexible enough to adapt to a changing climate.

5.9 Advantages & Disadvantages of the Undertaking

In accordance with the approved ToR, the advantages and disadvantages to the environment of the Preferred Undertaking are summarized in **Table 5.25**, below. The advantages and disadvantages are based on the net effects described above and on the rationale for the undertaking described in **Section 3.0** of the EA Report. The proposed vertical capacity expansion, with specific mitigation and impact management programs in place, will have low and acceptable net effects on all environmental components and the facility construction and operation will have a positive economic impact in the community.

Table 5.25 Advantages and Disadvantages of the Preferred Undertaking

Environmental Component	Advantages	Disadvantages
Air Quality & Odour	• Reduced/maintained Site boundary and off-Site odour concentrations.	• Up to 14 residences may experience a change in the predicted off-site air quality and odour levels, however, with appropriate mitigation measures, the effects will be negligible.

Environmental Component	Advantages	Disadvantages

Noise	• Noise impact exposure range is below the 55 dBA noise limit.	• Net sound level change for 14 off-Site receptors is 3 dBA or lower[1]:
		  • 10 residences = 0 to + 1 dBA change
		  • 1 residence = 2 dBA change
		  • 3 residences = 2 to 3 dBA noise reduction
		  • POR5 = 52 dBA (-3 dBA reduction from existing condition)

Geology & Hydrogeology	• No effects to groundwater quality at property boundaries and off-Site. • No effects to groundwater flow characteristics.	• There are no disadvantages to Geology & Hydrogeology.
Surface Water Resources	• Hydrologic modelling completed in the Stormwater Management Plan report shows that the stormwater management pond will attenuate runoff peak flow rates for all storm events modelled. • No effects on surface water quality on-site or off-site. • No change in drainage areas. • No off-site effects to surface water quantity.	• No specific mitigation measures required beyond the continued operation of the stormwater management pond to attenuate peak flows to protect downstream receivers from potential changes in water quantity.
Terrestrial & Aquatic Environment	• As there is no proposed change to the footprint of waste or buffer areas, no vegetation clearing is required as part of the proposed conditions, and traffic conditions are expected to remain the same as current conditions, no changes to vegetation communities, wildlife habitat, and vegetation and wildlife (including rare, threatened or endangered species) within the Site and Local Study Areas are anticipated. • As there are no proposed changes to stormwater discharge quality or quantity, no changes to water quality, aquatic habitat, and aquatic biota within the Site and Local Study Areas are anticipated.	• Potential for some species to access the site, however, BMPs will be implemented by Brooks Road Environmental for the protection of wildlife and SAR.

Environmental Component	Advantages	Disadvantages
Archaeology & Cultural Heritage	• No loss of or disturbance to cultural and heritage resources and archaeological resources within the Local Study Area.	• There are no disadvantages to the Archaeology and Cultural Heritage.
Transportation	• No road improvements required. • No bird strike hazard to aircraft in Local Study Area.	• Minimal potential for traffic collisions in Local Study Area.
Land Use	• No change to the current land uses within the Site and Local Study Areas. • No effects on planned future land use within the Site and Local Study Areas.	• BMPs will be implemented to manage nuisance related effects during construction and operation for the two residences and "Identified Trail Locations" on Brooks Road and the abandoned railway to south of the Site, parallel to Highway 3, located within 500 m of the Site.
Agriculture/Soils & Mining	• No effects on active mining operations within the Local Study Area. • No loss of soil with agricultural capability. • 19 farm tax rated property parcels within the Local Study Area, including 2 cash crop farms immediately adjacent to the Site boundary to the east and south will continue to operate.	• BMPs will be implemented to manage nuisance related effects during construction and operation resulting in low net effects to surrounding agricultural operations.
Site Design & Operations	• No changes to proposed waste/cover slopes. • Fewer limitations on potential post-closure uses. • Low net effects on the management of leachate, stormwater, odour, and traffic.	• Minor changes to final contours and site grading/drainage, with little to no impact on the stormwater management pond, screening berms, leachate treatment facility, site access, or scale house facility.
Socio-Economic	• Views of the Site from surrounding areas can be minimized by vegetating the screening berm and/or introducing additional on-Site plantings, as required. • Continue to employ 6 persons for the duration of Site operations. • Continue services to customers for waste disposal for the 5 to 7 year planning period. • No effects on the use of land for traditional purposes.	• Site will be partially visible from agricultural areas to the west and southwest.