8. Net Effects Assessment of the Preferred Alternative

This section of the EA Study Report includes a summary of the net effects assessment for the Preferred Alternative (Alternative Method 1), an assessment of cumulative effects, climate change considerations, and advantages and disadvantages of the Preferred Alternative.

8.1 Net Effects Assessment Summary for the Preferred Alternative

A summary of the assessment of the environmental effects of the Preferred Alternative, Alternative Method 1, is presented in **Table 8-1**. This information is summarized from **Section 6.2**.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Natural Environment					
Atmospheric Environment					
Air Quality	• Predicted off-site point of impingement air concentrations of indicator compounds	• Key design considerations are related to the geometry of the proposed Stage 4 area including the relocation of the existing compost curing pad in the northwest area of Stage 4 and the access road to be constructed around the northern end of the Stage 4 area. • The northwest area of Stage 4 is larger for Alternative Method 1 with the access road also being located more to the northwest resulting in slightly more elevated ground-level concentrations to the northwest of the EOWHF. • The existing LFG collection system will be expanded to Stages 3B and 4 as cells reach capacity and are closed. • Other existing operations are expected to remain relatively unchanged and are consistent between the two (2) alternative methods. • The EOWHF's existing Fugitive Dust Management Plan is expected to be effectively implemented for all current and future operations in order to manage and mitigate the potential fugitive dust emissions from the sites transportation and operational sources.	• The off-site ground-level concentrations of 114 contaminants of concern were compared against MOECC POI and Jurisdictional Screening Level (JSL) limits and the results indicate that all were within the relevant standards with the exceptions of: nitrogen oxides, particulate matter, PM_{10} and $PM_{2.5}$. • Modelling results indicate that potential exceedances of the standards for nitrogen oxides, particulate matter, PM_{10} and $PM_{2.5}$ are primarily due to haul truck traffic on facility roads and are expected to occur primarily in the area immediately adjacent to the southern and western property lines. • There are no significant differences (<10%) between the cumulative concentrations of nitrogen oxides at any averaging period, for existing conditions and Alternative Method 1 at the point of maximum impact. • There is a 10% and 18% (24-hour and 1-hour averaging periods) increase in the cumulative concentration of nitrogen oxides at the nearest	• No additional mitigation measures are expected to be necessary under normal operating conditions.	• It is expected that there will be an increase of 18%, 30%, and 38% (depending on the averaging period) in off-site ground-level concentrations of LFG-related contaminants of concern at the location of maximum existing off-site concentrations, and an increase of 35% and 74% (depending on the averaging period) at the nearest residential receptor to the northwest relative to existing conditions • Ground-level concentrations are expected to be within the relevant MOECC POI limits for all contaminants of concern with the exceptions of: nitrogen oxides, particulate matter, PM_{10} and $PM_{2.5}$. These exceedances are primarily due to haul truck traffic on facility roads. • Exceedances of the relevant standards are expected to be limited to the area immediately adjacent to the facility property line and so

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			receptors between existing conditions and Alternative Method 1. • The cumulative concentrations (24-hour averaging period) of particulate matter, PM_{10} and $PM_{2.5}$ are predicted to increase by 17%, 17% and 12% respectively over the existing conditions at the point of maximum impact and by 69%, 68% and 21% respectively over the existing conditions at the nearest receptors. • The predicted cumulative concentrations of particulate matter are expected to exceed the relevant (24-hour averaging period) standard approximately 0.1% of the time at the nearest receptors. • The cumulative concentrations of contaminants emitted as fugitive LFG from the site will be increased by 18%, 30%, and 38% (annual, 24-hour and 1-hour /10-minute averaging periods) over existing conditions. It is expected that all of these contaminants will be within the relevant standards. • The modelled ground-level concentrations at the nearest residential receptor to the northwest of the facility is expected to increase by approximately 35% and 74% (1		infrequent at nearby receptors that their impact can be considered negligible. • It is expected that there will be no significant increase (<10%) in the off-site ground level concentrations of nitrogen oxides relative to the existing conditions at the location of maximum off-site concentrations. • It is expected that there will be increases of 17%, 17% and 12% respectively in the off-site ground-level concentrations (24-hour averaging period) of particulate matter, PM_{10} and $PM_{2.5}$ at the location of maximum off-site concentrations and an increase of 69%, 68% and 21% respectively at the nearest receptor. • Exceedances of the (1-hour averaging period) standard for nitrogen oxides at the nearest receptor are expected to increase in frequency from 0% of the time to 0.03% of the time. • Exceedances of the (24-hour averaging period) standards for particulate matter, PM_{10} and $PM_{2.5}$ are

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			hour and 24-hour averaging periods) over existing conditions.		expected to increase in frequency from 60% of the time to 64% of the time at the point of maximum impact. • Exceedances of the (24-hour averaging period) standards for particulate matter are expected to increase in frequency from 0% of the time to 0.1% of the time at the nearest receptor.
	• Number of off-site receptors potentially affected (residential properties, public facilities, businesses/farms, institutions)	• AERMOD dispersion modelling was used to predict the ground-level POI concentrations of contaminants at receptors within approximately 5 km of the EOWHF. • A total of 82 individual receptors (residential and commercial properties) were identified within the model to represent the nearest and most potentially-affected residences. • The EOWHF's existing Fugitive Dust Management Plan is expected to be effectively implemented for all current and future operations in order to manage and mitigate the potential fugitive dust emissions from the sites transportation and operational sources.	• The private residences on Concession No. 7 are expected to be most affected by the expanded landfilling operations with contaminant ground-level concentrations increasing up to 74% over existing conditions. • The frequency of exceedances of MOECC POI limits for nitrogen oxides at the nearest receptor is expected to increase from 0% of the time under existing conditions to 0.03% of the time (1-hour averaging period). The frequency of exceedances of particulate matter at the nearest receptor is expected to increase from 0% of the time for existing conditions to 0.1% of the time; no exceedances for PM_{10} or $PM_{2.5}$ were noted at the nearest receptor. • Cumulative monitoring and	• No additional mitigation measures are expected to be necessary under normal operating conditions.	• No substantial difference is expected in the number of off-site receptors potentially affected.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			modelling of facility emissions indicate that there will be infrequent (<0.1% of the time) exceedances of MOECC POI limits for nitrogen oxides and particulate matter at the nearest receptor location. • The businesses along Lafleche Rd. just to the east of the facility are expected to be the most affected by the LFG combustion related contaminants of concern. Modelled facility emissions indicate that there will be no exceedances of MOECC POI limits at this location.		
Odour	• Predicted off-site odour concentrations (µg/m³ and odour units)	• Key design considerations are primarily related to the geometry of the proposed Stage 4 area including the L-shaped extension of the Stage 4 area towards the northeast corner of the EOWHF. • The maximum modelled ground-level concentrations for all odour modelling scenarios occur to the southwest of the EOWHF. • Other existing operations are expected to remain relatively unchanged • The EOWHF's existing Odour Management Plan is expected to be effectively implemented for all current and future operations in order to manage and mitigate the potential odorous emissions from the operations on site.	• The off-site ground-level concentrations of 18 contaminant of concern (including odour) were compared against MOECC POI limits, JSL odour-based standards, and existing conditions. The results indicate that Alternative Method 1 will result in a net increase of 0.3% in the maximum modelled ground-level concentration of odour (annual and 1-hour / 10-minute averaging periods) and 30% to 38% increase in odorous contaminants of concern (24-hour and 1-hour / 10-minute averaging periods) over existing conditions at the location of the maximum off-site ground-level	• No additional mitigation measures are expected to be necessary under normal operating conditions.	• It is expected that there will be an increase of 30% to 38% (depending on the averaging period) in the maximum off-site concentrations of odorous compounds of concern, an increase of 3% in the maximum off-site concentrations of odour at the most affected receptor to the east of Highway 138, and an increase of 1.5% in the maximum off-site concentrations of odour at the nearest residential receptor on Concession 7 relative to existing conditions. • Concentrations of odorous

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			concentrations. It should e noted that all odorous contaminants were within the relevant standards with the exception of odour, which only applies at sensitive receptors. • The modelled ground level concentration of odour at the most affected receptor to the east of Highway 138 is expected to increase by 3% over existing conditions. This is expected to result in exceedances of the 1 OU/m³ standard approximately 0.6% of the time, which is consistent with existing conditions. • Concentrations of odour (OU) at the nearest residential receptor on Concession 7 are expected to increase by 1.5% with exceedances of the 1 OU/m³ standard approximately 0.3% of the time, which is consistent with existing conditions. • Under normal operations, there are negligible off-site odour concentrations from the EOWHF 99.4% of the time and therefore, there are no significant potential effects anticipated.		contaminants are expected to be within the relevant MOECC odour-based POI limits at all receptor locations within the off-site study area. • Under normal operating conditions, negligible off-site odour impacts from the EOWHF are anticipated 99.4% of the time.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	• Number of off-site receptors potentially affected (residential properties, public facilities, businesses/farms, institutions).	• AERMOD dispersion Modelling was used to predict the ground-level POI concentrations of contaminants at the receptors identified within the off-site study area. • A total of 82 individual receptors (residential and commercial properties) were identified within the model to represent the nearest and most potentially-affected residences. • The EOWHF's existing Odour Management Plan is expected to be effectively implemented for all current and future operations in order to manage and mitigate the potential odorous emissions from the operations on site.	• The private residences on Concession No. 7 are expected to be most affected by the increase in odorous contaminants of concern due to expanded landfilling operations with ground-level concentrations increasing by approximately 35% and 74% (1-hour and 24-hour averaging periods) over existing conditions. • The receptors to the east of Highway 138 are expected to experience increases in concentrations of other odorous compounds of concern of 12% and 35% (1 hour and 24 hour averaging periods) over existing conditions. • Modelled EOWHF emissions indicate that there will be no exceedances of Ministry POI Limits for the odorous contaminants of concern.	• No additional mitigation measures are expected to be necessary under normal operating conditions.	• No substantial difference is expected in the number of off-site receptors potentially affected.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects

Noise	Predicted site-related noise levels (dBA)	• Aside from relocation into the area of the new stage, existing EOWHF sources of noise emissions will remain unchanged.
		• All other landfill stages are closed with no landfilling activities occurring.
		• In a worst-case hour, the off-site study area is influenced by the following noise sources:
		  • 2 landfill compactors;
		  • 2 bulldozers;
		  • 2 loaders;
		  • 1 articulating dump truck;
		  • 1 excavator;
		  • 1 water truck (2 movements)
		  • 33 haul trucks (66 movements); and
		  • 1 bird banger impulse.
		• Representative noise specifications were used for all mobile equipment (listed above).
		• The worst-case location for landfilling activities was assessed.
		• Final (near closure) landfill topography as the worst-case elevations was assessed.
		• Equipment is maintained to prevent excessive noise emissions.
		• An anti-idling policy is in place on the site.
			Predicted maximum cumulative daytime noise impact is 54 dBA at the closest POR, below the MOECC's 55 dBA sound level limit for landfill operations.
			
			Predicted maximum impulse noise is 70 dBAI at the closest POR, meeting the MOECC's 70 dBAI sound level limit for impulsive noise.
				The potential effects are at or below the allowable limits; therefore, no mitigation measures are required.	PORs will experience a minor increase in noise levels resulting from landfilling activities at the EOWHF, but below the MOECC noise limits. Landfilling activity may be audible at times, during lulls in background sound levels.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Number of off-site receptors potentially affected (residential properties, public facilities, businesses/farms, institutions)	• Two PORs (residential properties) located within the off-site study area to the northwest of the landfill.	Two PORs within off-site study area are at or below the MOECC's applicable regulatory sound level limits.	No additional mitigation required. Continue annual noise monitoring program.	Noise levels at all PORs within off-site study area are at or below the MOECC's applicable regulatory sound level limits.
Geology and Hydrogeology					
Groundwater Quality	Predicted effects to groundwater quality at property boundaries and off-site.	• The desiccated clay layer is 'healed' when saturated and may be considered to have the same hydraulic conductivity as the underlying marine silty clay of 4.4 x 10^{-10} m/sec.	• Predicted maximum chloride concentration in the receiving bedrock aquifer is 95.6 mg/L after 3,900 years, and is below the regulatory limit of 170 mg/L at the north property boundary.	• None required (beyond the in-design mitigation measures included in the CDR).	• The predicted maximum chloride concentration in the receiving bedrock aquifer at the northern property boundary is 95.6 mg/L after 3,900 years, which is above the background concentration of 89 mg/L, but below the regulatory limit of 170 mg/L.
Groundwater Quantity	Predicted groundwater flow characteristics.	• The desiccated clay layer is 'healed' when saturated and may be considered to have the same hydraulic conductivity as the underlying marine silty clay of 4.4 x 10^{-10} m/sec.	• Normally there is an upward gradient. The presence of the leachate locally generates a temporary downward gradient. The low hydraulic conductivity of the marine silty clay impedes flow to the extent that the increase in flux to the bedrock is negligible. Therefore, no effect is anticipated.	• None required (beyond the in-design mitigation measures included in the CDR).	• No net effects are anticipated. Normally there is an upward gradient. The presence of the leachate locally generates a temporary downward gradient. The low hydraulic conductivity of the marine silty clay impedes flow to the extent that the increase in flux to the bedrock is negligible.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Environment					
Surface Water Quality	Predicted effects on surface water quality on-site	• Pond 1 wet storage volume of 3,800 m^3 [a] • Pond 2 wet storage volume of 1,650 m^3 [a] • Pond 7 wet storage volume of 2,100 m^3 [a] • Northeast pond wet storage volume of 10,800 m^3 [b] • Northwest pond wet storage volume of 14,250 m^3 [b]	• Increased sediment loading in on-site surface water runoff	• Confirm detailed design of on-site surface water quantity control storage and conveyance is appropriately sized to remove 80% of TSS. • Sedimentation ponds need maintenance to enable proper quality control.	• Surface water quality meets MOECC monitoring requirements and trigger concentration criteria specified in ECA (Industrial Sewage Works, Section III) prior to release off-site. • Increase in TSS, but no net effects since water quality is treated with the ponds by providing sufficient detention prior to discharge.
	Predicted effects on the surface water quality off-site.	• With existing conditions, some short term impacts were observed during leachate discharge however these were quickly attenuated and no substantial, long term downstream impacts were found. • The LTF discharge is subject to effluent contaminant limits and no substantial change to the contaminant concentrations entering the Fraser Drain is expected.	• Because the receiving water body is a moving system, effects to surface water quality during discharge are expected to minimal. • Considering that effluent concentrations will remain the same at discharge, the landfill expansion is not expected to result in substantial changes to off-site surface water quality.	• Complete ECA amendment for compliance of the proposed increase in total leachate volume to be treated. • Implement proposed run-off and leachate controls. • Continue existing monitoring program.	• No substantial effects are expected to off-site water quality considering effluent contaminant concentrations are still limited to the effluent discharge limits currently in place.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Surface Water Quantity	Change in drainage areas	• Drainage area is maintained to 1.9 km² • All cells are closed, capped, covered and do not allow any infiltration, which increases the global imperviousness of the site. • Total landfill coverage: 1.1 km²	• Potential increase in runoff volume and peak flow rate to the site outlet	• Confirm detailed design of on-site surface water quantity control storage and conveyance is appropriately sized to meet the site operational practice.	• Increase in total surface water quantity volume, but no net effects since peak flows to the site outlet are controlled with the ponds within the predevelopment conditions values up to a 100-year return period.
	Predicted occurrence and degree of off-site impacts	• Pond 1 active storage volume of 7,500 m³ [a] • Pond 2 active storage volume of 6,350 m³ [a] • Pond 7 active storage volume of 5,650 m³ [a] • Perimeter channel can convey a 100-yr storm event [a] • Northeast pond active storage volume of 18,450 m³ [b] • Northwest pond active storage volume of 11,000 m³ [b] • Northwest corner outlet flow rate as per predevelopment conditions	• Potential increase in runoff volume and peak flow rate to the site outlet	• Confirm detailed design of on-site surface water quantity control storage and conveyance is appropriately sized to meet the site operational practice.	
Ecological Environment					
Terrestrial Ecosystems	Predicted impact on vegetation communities	• No significant vegetation communities were found in the on-site or off-site study areas. • The construction and operation of Alternative Method 1 will take place within the existing on-site study area. • The northeast corner of the site is predominantly classified as thicket	• The construction of Stage 4 of Alternative Method 1 will require the removal of approximately 2.9 ha (20%) of the treed swamp in the northeast corner of the site (**Figure 6-6**). • The construction of the northeast SWM pond will require the removal of	• None required.	The construction of Alternative Method 1 will result in the removal of approximately 3.18 ha (22%) of the treed swamp in the northeast corner of the site and the loss of native species.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		swamp (SWT), with two pockets of red maple organic deciduous swamp (SWD6-1), and is largely dominated by invasive glossy buckthorn species. • A portion of the north-eastern edge of the treed swamp (0.28 ha) will be converted to use as an SWM pond. • The construction of the northwest SWM pond will occur in an area that is very disturbed, with all the peat and topsoil having been removed to clay substrate. • Alternative Method 1 will continue to use established operating procedures currently in place at the EOWHF, including controls for noise, dust and litter.	approximately 0.28 ha (2%) of the treed swamp in the northeast corner of the site (**Figure 6-6**). • Loss of native species. • No disturbance to off-site Moose Creek wetland, including the locally significant woodland.		
	Predicted impact on wildlife habitat	• The construction and operation of Alternative Method 1 will take place within the existing on-site study area. The built-up area at the south end of the site adjacent to the Moose Creek wetland will not be altered. • The northeast corner of the site is predominantly classified as thicket swamp (SWT), with two pockets of red maple organic deciduous swamp (SWD6-1), and is largely dominated by invasive buckthorn species. • A portion of the north-eastern edge of the treed swamp will be converted to use as an SWM pond. • The construction of the northwest	On-site Habitat • Loss of approximately 3.18 ha (22%) of the treed swamp in the northeast corner of the site (foraging habitat, and habitat for area-sensitive birds). • No changes to existing ponds or berms (amphibian habitat). • Addition of amphibian habitat via new SWM ponds. • Increased disturbance to habitat within treed swamp (e.g., noise, dust, litter). • No change to raptor overwintering habitat, as presence is induced by presence of gulls and other avian prey species on site.	• Avoid vegetation clearing during peak nesting season (April 15 to August 15).	*On-site Habitat* • Loss of 3.18 ha (22%) of bird habitat • Addition of amphibian habitat in SWM ponds. • Minimal potential for increased disturbance. *Off-site Habitat* • No net effects identified.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		SWM pond will occur in an area that is very disturbed, with all the peat and topsoil had been removed to clay substrate. • Alternative Method 1 will continue to use established operating procedures currently in place at the EOWHF, including controls for noise, dust and litter. *On-site Habitat* • Existing wildlife usage of the site is considered minimal. • The existing ponds around the perimeter of the EOWHF and the berm to the east of the site provide habitat for amphibians. • The treed swamp on site provides interior habitat for area-sensitive birds (American redstart). • Field areas on property but outside expansion area provide habitat for area sensitive birds: savannah sparrow; northern harrier; and upland sandpiper. The berm along the east edge of the site provides foraging habitat. Existing ponds around the perimeter of the EOWHF provide habitat for amphibians. • No on-site habitat for Canada warbler, eastern wood pewee, and snapping turtle. • No nesting habitat on-site for bobolink, meadowlark, common nighthawk, bank swallow or woodthrush. • Potential on site nesting habitat for	*Off-site Habitat* • No direct effect on off-site wildlife habitat, movement corridors or habitat linkages. Construction will take place on-site. • No indirect effects on off-site habitat, movement corridors or habitat linkages. The increase in noise levels within 1 km of the site are not expected to be noticeable (**Supporting Document 3-3**). Existing noise, dust and litter controls will remain in place. EOWHF traffic volumes will remain within currently-approved levels.		

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		barn swallow is limited to buildings. No nests found. • Potential foraging habitat on site for common nighthawk, barn swallow and bank swallow. • Raptor overwintering use, as requested by MNRF, present but artificial due to presence of gulls, landfill waste and other avian prey species on site. No significant areas of field habitat present. • On-site study area habitat not suitable for whip-poor-will nesting, as they nest in upland forests and not in deciduous swamps or thicket swamps as found in the on-site study area. *Off-site Habitat* • The Moose Creek Wetland, located to the south of the site in the off-site study area, contains a deer wintering yard. • Whip-poor-will nesting habitat may be present in Moose Creek wetland complex to the south in the off-site study area (greater than 500 m from proposed expansion area). • Wood thrush habitat is located in the off-site study area to the southwest of the site. • Habitat may be present in the Moose Creek wetland for Canada warbler, eastern wood pewee and snapping turtle.			

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted impact on vegetation and wildlife including rare, threatened or endangered species	• The treed swamp in the northeast corner of the site is largely dominated by invasive glossy buckthorn species. • None of the plants observed in the on-site or off-site study areas are significant on a national or provincial level. • No regionally-rare or endangered vegetation species were found within the on-site or off-site study areas. • No butternut were found in the on-site or off-site study areas. • Five breeding birds were recorded in the off-site study area that are considered significant nationally or provincially: bobolink; eastern wood pewee; barn swallow; bank swallow; and wood thrush. • The MNRF had suggested the following species as possible: eastern meadowlark, barn swallow, bobolink, short-eared owl, and common nighthawk within the on-site or off-site study area. • Two (2) regionally rare bird species were identified on site: the rusty blackbird (migrant); and the dark-eyed junco (migrant). • Four (4) area sensitive bird species were identified in the on-site and off-site study area: American redstart; savannah sparrow; northern harrier; and upland sandpiper. • No mammals were found in the on-site study area.	• The construction of Stage 4 of Alternative Method 1 will require the removal of approximately 2.9 ha (20%) of the treed swamp in the northeast corner of the site. • The construction of the northeast SWM pond will require the removal of approximately 0.28 ha (2%) of the treed swamp in the northeast corner of the site. • Indirect effects to wildlife through removal of on-site habitat (area sensitive birds, and foraging habitat (common nighthawk, barn swallow, bank swallow). • Indirect effects to wildlife through increased disturbance to habitat within treed swamp (Community 2 and 9) (e.g., noise, dust, litter). • Indirect positive effect on wildlife through the introduction of new amphibian habitat via new SWM ponds. • No effects on vegetation and wildlife in the off-site study area, as there are no direct or indirect effects to off-site wildlife habitat. • Regionally rare species were migrants and not nesting on site or off-site; therefore, no direct effects anticipated.	• Avoid vegetation clearing during peak nesting season (April 15 to August 15). • Conduct clearing and grading of treed swamp area outside of the amphibian breeding and early life stage development window (typically from snow-melt to mid-summer).	• Minimal effect due to loss of 3.18 ha (22%) of bird habitat. The treed swamp on site provides interior habitat for area-sensitive birds, and will continue to be of an appropriate size to support these species. Migrating blackbirds that use forested habitat will still have habitat on site. • Addition of amphibian habitat via SWM ponds. • Minimal potential for increased disturbance to on-site wildlife.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Aquatic Ecosystems	Predicted changes in water quality	• SWM ponds will be constructed to avoid increasing flood risks and protect water quality. • The surface water quality downstream of the EOWHF has not been affected to a significant or adverse degree by treated effluent discharge from the LTF, and the effluent complies with the existing ECA. • Alternative Method 1 will result in 66,900 m³/year of discharge to the Fraser Drain above the approved ECA; however, the effluent is discharging into a transient system and no effect on surface water quality is anticipated. • Lower rainfall and the use of water from the SWM ponds for on-site dust suppression have resulted in infrequent SWM pond discharge since 2010; as a result, there is very minimal discharge year over year. • Detailed design of on-site surface water quantity control storage and conveyance will be appropriately sized to remove 80% of TSS. • The Fraser Drain will have sufficient time to mitigate any contaminants (in this case primarily by advection with additional diffusion and dispersion playing a role) prior to the next discharge event.	• No additional effects on surface water quality are anticipated above existing conditions. Site discharges will continue to meet ECA requirements.	• Annual ECA compliance monitoring is on-going.	No additional effects to surface water quality anticipated.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted impact on aquatic habitat	• The Moose Creek Wetland, located to the south of the site in the off-site study area, contains locally significant fish spawning and nursery habitat; however, it is located upstream of the site. • No critical habitat for aquatic Species at Risk or sensitive spawning habitat was identified within the on-site or off-site study areas. • SWM ponds will be constructed to avoid increasing flood risks and protect water quality. Discharge peak flows will be at or below pre-development conditions. • The EOWHF site's sole outfall is located in the north-western portion of the site, which discharges in the Fraser Drain. The expansion will not result in changes to the site outfall. • Alternative Method 1 will result in 66,900 m^3/year of discharge to the Fraser Drain above the approved ECA[c]. Based on the volumes, additional discharge will not affect downstream aquatic habitat provided it meets the ECA discharge requirements and annual monitoring is conducted as per the ECA. • No additional effects to surface water quality are anticipated (see above). • No in-water works proposed. • No alteration to off-site watercourses proposed.	• No potential effects on aquatic habitat are anticipated.	• Annual ECA compliance monitoring for water quality is on-going.	No net effects to aquatic habitat predicted.

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Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Predicted impact on aquatic biota including rare, threatened or endangered species	• SWM ponds will be constructed to avoid increasing flood risks and protect water quality. Discharge peak flows will be at or below pre-development conditions. • The EOWHF site's sole outfall is located in the north-western portion of the site, which discharges in the Fraser Drain. The expansion will not result in changes to the site outfall. • No critical habitat for aquatic Species at Risk or sensitive spawning habitat was identified within the on-site or off-site study areas. • Alternative Method 1 will result in 66,900 m^3/year of discharge to the Fraser Drain above the approved ECA. Based on the volumes, additional discharge will not affect downstream aquatic biota provided it meets the ECA discharge requirements and annual monitoring is conducted as per the ECA. • No provincially and/or nationally rare species were documented within the on-site or off-site study areas.	• No potential effects on aquatic biota are anticipated.	• Annual ECA compliance monitoring for water quality is on-going.	No net effects to aquatic biota predicted.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Socio-Economic Environment					
Economic					
Economic effects on/benefits to local community	Employment at site (number and duration)	• The EOWHF is a major employer in the Township of North Stormont. • Approximately 90% of the EOWHF's employees reside in the United Counties of Stormont, Dundas and Glengarry (including Cornwall); approximately 10% reside in the United Counties of Prescott and Russell. • No additional employment positions will be created as a result of the EOWHF landfill expansion. • The site is expected to operate for an additional 5 to 10 years.	• Beneficial effect from extended duration of employment for an additional 5 to 10 years	• None required	• Beneficial effect from extended duration of employment for an additional 5 to 10 years
	Opportunities to provide products or services	• GFL contributes approximately $10 million annually to the local economy through the procurement of local goods and services. • The site is expected to operate for an additional 5 to 10 years.	• Beneficial effect of continued provision of cost-effective and environmentally-secure waste management services to municipalities and businesses across Eastern Ontario for an additional 5 to 10 years • Beneficial effect from an additional $50 million to $100 million contributed to the local economy through the procurement of local goods and services	• None required	• Beneficial effect of continued provision of cost-effective and environmentally-secure waste management services to municipalities and businesses across Eastern Ontario for an additional 5 to 10 years • Beneficial effect from an additional $50 million to $100 million contributed to the local economy through the procurement of local goods and services

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
Social					
Effects on local community	Number of residents	• No additional residences have been constructed within the off-site study area. • No additional residents affected by the EOWHF landfill within the off-site study area.	• No potential effect to number of residents	• None required	• No net effects to the number of residents
	Predicted changes to use of property	• Residents and their use of property can be affected through disturbance from noise, dust, odour, litter, vectors and vermin, and changes to the visual landscape. • No changes to traffic volumes beyond currently-approved levels or changes to waste haul routes are anticipated. • GFL employs a variety of proactive measures to minimize nuisance effects related to noise, dust, odour, litter, and vectors and vermin as outlined in **Section 5.3.8.6**. • The site's operating hours will remain unchanged and no additional large equipment will be required for Alternative Method 1. • The working face of the landfill will continue to be minimized to reduce litter generation and reduce the presence of vectors and vermin. • GFL will continue to provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community. • Alternative Method 1 will not result in an increase to landfill height.	• No potential effect on residents and their use of property from noise. The predicted maximum cumulative daytime noise impact for Alternative Method 1 at the closest residence is 54 dBA, which is still below the MOECC's 55 dBA sound level limit for landfill operations and is not expected to be noticeable. • No potential effect on residents and their use of property from dust. Changes in dust levels are not expected to be noticeable. • Alternative Method 1 will result in a small increase in off-site odour concentrations; however, the concentrations are less than regulatory limits, and are unlikely to result in a change in use of property. • No potential effect on residents and their use of property from litter. Existing litter control measures have proven effective. • No potential effect on residents and their use of property from	• GFL will continue to implement the odour control measures outlined in **Section 5.3.8.6**, and provide prompt attention to nuisance complaints to mitigate any adverse effects to the surrounding community.	• No net effects on residents and their use of property

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
			vectors and vermin. Existing vector and vermin control measures have proven effective. • No potential effect on residents and their use of property from changes to the visual landscape. Alternative Method 1 will not result in changes to the visual landscape.		
Visual Impact of Facility	Predicted changes in perceptions of landscapes and views	• The EOWHF is relatively unobtrusive and has a low profile; it is difficult to see the landfill. • Alternative Method 1 will not result in an increase to landfill height.	• No potential effect on the visual landscape	• None required	• No net effects on the visual landscape
Cultural Environment					

Cultural heritage resources	Cultural heritage resources (built and landscapes) on-site and in vicinity and predicted impacts on them	• Two cultural heritage resources are located within the off-site study area:
		  • a farmscape (CHL 1); and
		  • a residence (BHR 1)
		• No cultural heritage resources are identified within the on-site area
		• The construction and operation of Alternative Method 1 will take place within the existing on-site study area
		• Construction and staging will be suitably planned and undertaken to avoid impacts to identified cultural heritage resources
		• No changes to the landfill height, site infrastructure, general operational practices, on-site equipment, traffic volumes, or waste haul routes anticipated as a
			• No potential direct or indirect effects on cultural heritage resources as no cultural heritage resources are located within the on-site area, and there will be no changes to the landfill height, site infrastructure, general operational practices, on-site equipment, traffic volumes, or waste haul routes	• None required	• No net effects on cultural heritage resources

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		result of Alternative Method 1			
Archaeological resources	Archaeological resources on-site and in vicinity and predicted impacts on them	• The Stage 1 Archaeological Assessment (1999) determined that there is no archaeological potential within the boundaries of the existing site, including the proposed Stage 3B and Stage 4 expansion areas • The construction and operation of Alternative Method 1 will take place within the existing on-site study area	• No potential effects on archaeological resources as no archaeological resources are present within the on-site study area	• None required	• No net effects on archaeological resources
Built Environment					
Transportation					
Effects from truck transportation along access roads	Disturbance to traffic operations	• Operations are expected to remain unchanged in terms of origins and destinations of trucks as well as haul routes (no changes to waste haul routes are anticipated as a result of the EOWHF landfill expansion). • Site traffic generation is expected to increase nominally considering the site is currently accepting approximately 83% of its permitted yearly tonnage (as of 2015). It is assumed that the waste receipt limit of 755,000 tonnes per year is reached and that the 85th percentile site traffic volumes (excluding employee traffic) scale up proportionally to the annual tonnage. • The expansion is not anticipated to generate additional measurable	• Additional 10 vehicles, 6 vehicles, and 4 vehicles are projected to enter the EOWHF landfill during the weekday AM, PM and Saturday midday peak hours, respectively. • Addition of up to 66, 38, and 26 two-way trips during the weekday AM and PM, and Saturday midday peak hours, respectively, assuming that inbound trips are equal to outbound trips.	• None required	There are no net effects on the transportation component of the Built Environment: • All study intersections will operate well, with LOS 'C' or better, and with residual capacity. • There are no operational concerns at any study intersections as a result of the EOWHF landfill expansion. • No road network improvements are necessary. • The addition of left-turn lanes along Highway 138 is not warranted. • There are no substantial safety concerns based on a review of Highway 138

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		traffic related to construction due to the nature of the on-site soil materials and their suitability for utilization as the base liner and for cover material. Additional soil requirements for cover are included in the projected vehicle trips presented in the table. • Employee traffic volumes remain unchanged and do not occur during peak hours. • During the peak hour of adjacent street traffic, inbound traffic volumes are equal to outbound traffic volumes. • There will be no changes to on-site times (less than 30 minutes) and weigh scale times (less than 3 minutes). • Hourly, daily, and seasonal patterns remain stable. • The breakdown of vehicle types and average vehicle loads remain stable. • GFL will continue to support the minimization of environmental impacts associated with GHG emissions through reducing the number of waste related trucks hauling material long distances. • No planned road network improvements are identified within the off-site study area. The MTO is currently undertaking an EA for Highway 138 from Highway 417 southward; however, the MTO indicated that there are no impacts expected to the on-site or off-site			accident rates.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		study areas. • No background developments were identified for inclusion in the effects assessment by the MTO, the United Counties of Prescott and Russell, or the United Counties of Stormont, Dundas, and Glengarry.			
Current and Planned Future Land Use					
Effects on current and planned future land uses	• Current land use • Planned land use	• The construction and operation of Alternative Method 1 will take place within the existing on-site study area. • Waste management systems are a permitted land use in “Rural District” areas. • The proposed expansion of the landfill to the north side of the existing EOWHF is consistent with the policies of the Official Plan. • The proposed expansion of the existing EOWHF conforms to the Provincial Policy Statement. • No changes in land use are proposed in the off-site study area. • Site is currently zoned to permit the landfill expansion in accordance with the boundaries of Alternative Method 1. • No changes in infrastructure will be required. • There are no woodlands, wetlands or remaining ANSI features in the on-site or off-site study areas.	• No potential effects on current or planned land use	• None required	• No net effects on current or planned land use

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	Type(s) and proximity of off-site recreational resources within 1 km of a landfill footprint potentially affected	• No recreational resources are located within the on-site and off-site study areas.	• No potential effects to off-site recreational resources	• None required	• No net effects on off-site recreational resources
	Type(s) and proximity of off-site sensitive land uses (e.g., dwellings, churches, parks) within 1 km of a landfill footprint potentially affected	• No sensitive land uses such as churches, parks, or schools within the on-site or off-site study areas. • Two residences are located within the off-site study area; approximately 700 m and 950 m to the west of the on-site study area, which are outside of the 200 m buffer area. • Alternative Method 1 will continue to use established operating procedures currently in place at the EOWHF for the management of leachate, dust, litter, odour (LFG), noise, and vectors and vermin. • No changes to traffic volumes beyond currently-approved levels or changes to waste haul routes.	• No potential effects on off-site sensitive land uses	• None required	• No net effects on off-site sensitive land uses
Aggregate Extraction and Agricultural					
Aggregate resources	Presence of known or identified aggregate resources and the predicted impact of impairment of their use due to the proposed	• No known aggregate resources located within the on-site study area or the off-site study area.	• No potential effects on aggregate resources	• None required	• No net effects on aggregate resources

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
	footprint, construction and operation on-site				
Effects on agricultural land	• Current land use • Predicted impacts on surrounding agricultural operations • Type(s) and proximity of agricultural operations (e.g., organic, cash crop, livestock)	• Lands adjacent to site in the off-site study area used for sod farming (east), peat extraction (south and west), and cash crop agriculture (north and west). • The construction and operation of Alternative Method 1 will take place within the existing on-site study area, and there will be no physical disturbance to agricultural resources as a result of construction. • Alternative Method 1 will continue to use established operating procedures currently in place at the EOWHF for the management of leachate, dust, litter, and vectors and vermin, and will maximize the use of existing site infrastructure. • No additional dust is anticipated on surrounding agricultural lands due to traffic.	• No potential effects on agricultural land	• None required	• No net effects on agricultural land
Design and Operations					
Site design and operational characteristics	Complexity of site infrastructure	Footprint • Expansion area of 40.3 ha (Stages 3B and 4). • Increased imperviousness of the site requiring additional surface water management to maintain quantity and quality requirements. Cells construction	• Despite being able to utilize most of the existing site infrastructure (leachate treatment system, surface water ponds, ditches, LFG Facility, etc.), Alternative Method 1 will require new surface water ponds. • Relocation of the compost	• Additional surface water ponds will be constructed to control the surface water quality and quantity. • Additional	• No net effects: Complexity of site infrastructure will be low considering similarities with the previous design and construction techniques.

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		• Construction of temporary ditches to reroute stormwater around the excavation during construction. • Removal of top soil. • Excavation to the base grades. • Construction and compaction of approximately 3.5 m high perimeter containment berms. • Construction of necessary drainage features in accordance with the SWM plan and tie in temporary ditching. • Relocation of compost curing pad and storage piles. Leachate collection and treatment • Leachate generated by the cells will be collected by a 500 mm drainage with a geotextile at the base and a protective layer on top to minimize the potential for clogging. • Leachate will then be collected by a leachate collection system (leachate collection piping, header and sumps for each cell). Leachate collection pipe lengths of approximately 200 m (for cells 1 to 8). • Leachate will be pumped by forcemain and to the existing Leachate Treatment System. LFG collection system • LFG generated by the cells will be collected by LFG vertical wells and by a LFG collection system. • The LFG will be routed to the existing IC engines to produce	curing pad will affect the available land between Stage 4 and the leachate holding ponds. • The volume of leachate to be treated will increase. • Need for specialized equipment to clean the leachate collection piping (200 m). • Final cover will need preventive maintenance for potential erosion of the protective soils.	volume of leachate will be treated by the existing LTF, which has sufficient capacity to treat leachate generated by Alternative Method 1. • The leachate piping will be cleaned using specialized equipment. • Final cover will be inspected annually and maintenance performed as required. • Establish and maintain contingency measures to address any potential unexpected occurrences related to the leachate collection system, landfill liner, leachate treatment facility, stormwater	

Table 8-1. Net Effects Assessment for the Preferred Alternative – Alternative Method 1

Evaluation Criteria	Indicator	Key Design Considerations and Assumptions	Potential Effects	Mitigation Measures	Net Effects
		electricity. • A second enclosed flare will be installed to manage additional gas volumes and/or as a contingency in the event the four existing IC engines are not operating. Final Cover • The final cover will be a low-permeability design that includes a geomembrane, protective soils and vegetation.		management system or the lateral migration of LFG.	
	Operational flexibility	• An appropriate level of flexibility has been provided in the Conceptual Design to allow for minor adaptations at the detailed design phase.	• Operational flexibility maximized for Alternative Method 1.	• None required	• Operational flexibility maximized for Alternative Method 1.

Notes:
[a] Volumes based on conceptual drawings (JFSA, 2016).
[b] Volumes are proposed and described in the CDR (**Supporting Document 2**).
[c] The approved volume of treated effluent discharge in the ECA is 200,000 m³/year; however, this reflects the maximum approved volume. Existing annual treated effluent discharge volumes are below this limit. The volume indicated for Alternative Method 1 is the maximum predicted increase in volume over the approved ECA.

8.2 Cumulative Effects on the Environment

Cumulative effects are defined as those effects that are likely to result from the project in combination with other past, present and reasonably foreseeable projects or activities. The cumulative effects assessment focused on the net effects of the Preferred Alternative (Alternative Method 1), presented in **Section 8.1**, combined with the potential effects from other projects in the immediate area.

The net effects for the Preferred Alternative, outlined in **Table 8-1**, relate to air quality, odour, noise, vegetation communities, wildlife habitat, wildlife, and economics. The net effects take the existing EOWHF operations and other past and existing projects into account as part of the existing conditions; consequently, the focus of the cumulative effects assessment is on planned and future projects.

The EOWHF is located within a predominantly agricultural area. As per the Official Plan, the majority of the off-site study area is designated as "agricultural resource lands" with some "rural district" areas located to the south of the site (SDG, 2017). The land within 1 km of the site is used for agricultural purposes, and there are no known aggregate resources in the vicinity of the site. As noted in **Section 4.3.5.2**, the Township of North Stormont passed Zoning By-law 40-2015 to limit new incompatible land uses (e.g., dwellings) within 200 m of active or closed waste disposal sites[24].

No planned or future projects, including road network improvements, have been identified in the vicinity of the EOWHF. The MTO is currently undertaking an EA for Highway 138[25] from Highway 417 southward; however, the MTO indicated that there are no impacts expected to the on-site and off-site study areas for the EOWHF Landfill Expansion EA. Consequently, the net effects presented in **Table 8-1** represent the cumulative effects for the Preferred Alternative.

8.3 Climate Change Considerations

Climate change considerations for the alternative methods are discussed in **Section 5.5**, including the effect of climate change on the conceptual design, the effect of the design on climate change, and the effects of the *Waste Free Ontario Act*. The effect of the Preferred Alternative on climate change and the effect of climate change on the Preferred Alternative are discussed below with consideration of the MOECC guidance document "Considering climate change in the environmental assessment process" (MOECC, 2017).

On-going changes to the global climate related to increased emissions and concentrations of greenhouse gases in the atmosphere are addressed in the conceptual design for the EOWHF landfill expansion, both in adapting to changes in climate and for the mitigation of greenhouse gas emissions. This has been addressed primarily by evaluating the impact of increased intensity of storm events, potential impacts to leachate generation associated with higher temperatures and increased intensity of rainfall events and snowmelt, assessing LFG generation rates and designing the

[24] The 200 m buffer was maintained as per a decision by the Ontario Municipal Board in 2000, which reduced the buffer/influence area from the proposed 500 m to 200 m.

[25] http://highway138study.ca/

expanded LFG management system to optimize collection efficiency to mitigate atmospheric emissions.

Ontario's annual emission rate for GHG's is approximately 143,000,000 tonnes CO_2e with approximately 8,500,000 tonnes CO_2e coming from solid waste landfills. The Preferred Alternative for the facility expansion would contribute approximately 3% of Ontario's solid waste related GHG emissions and approximately 0.2% of the total GHG emissions from Ontario.

The total GHG emission rate for Canada is approximately 732,000,000 tonnes CO_2eq with approximately 56,000,000 tonnes CO_2e generated from solid waste and other sources. The current, existing facility contributes approximately 0.5% of Canada's solid waste related GHG emissions, or approximately 0.04% of the country's total GHG emissions.

8.3.1 Effect of the Preferred Alternative on Climate Change

The EOWHF's impact on climate change is most directly linked to the fugitive emissions of LFG as it is approximately 50% methane, a potent GHG, as well as to the carbon dioxide emissions from the combustion of the LFG.

The existing approvals allow for an LFG Plant that will ultimately consist of eight IC engines, an air compressor, three LFG blowers, three chiller skids and one enclosed flare. Under normal operating conditions, LFG collected at the site is directed to the existing IC engines, which run at maximum capacity for optimal energy generation. Existing capacity includes four (4) Jenbacher IC engines capable of generating up to 4.2 MW of power with a total system capacity of 2,485 m^3/h-LFG. The LFG collection system will be installed as soon as two cells are filled with waste and will be connected to the LFG Plant. A collection efficiency of 75% is assumed, which is the typical efficiency of collection systems at MSW landfills[26].

Excess LFG beyond what the internal combustion engines can consume is directed to the enclosed flares for destruction. This will occur when one or more of the engines are out of service, or when there is surplus gas with all engines running at full capacity (maximum capacity of 5,400 m^3/h-LFG).

The 25% of LFG generated by the decomposition of materials within the landfill which is not collected by the LFG collection system is expected to escape the site as fugitive emissions from the subsoil across the site. These emissions are expected to be approximately proportional to the volume of waste landfilled over time and are expected to increase by approximately 51% over existing conditions based on the maximum projected LFG generation rate. The progressive placement of the final, low-permeability cover will help control fugitive LFG releases.

Mitigation is built into the Preferred Alternative in the form of the proposed LFG collection and combustion systems. The LFG management system at the EOWHF will cover the landfill expansion area for the Preferred Alternative, as the existing gas collection system

[26] United States Environmental Protection Agency. "AP 42, Fifth Edition, Volume I Chapter 2: Solid Waste Disposal. Section 2.4.4.2: Controlled Emissions" https://www3.epa.gov/ttn/chief/ap42/ch02/index.html.

will be expanded and improved with additional combustion and destruction capacity being installed to handle the additional gas generation rates. Using a similar collection approach (via vertical extraction wells connected by piping laterals to a header pipe system), the well network will be vacuumed using blowers and gas will be removed from the landfilled waste as filling and the placement of interim and final covers progresses. The gas will be utilized for power generation or flared if the rate of gas extraction exceeds the engine's capacity.

The worst case gas generation rate for the Preferred Alternative was calculated using the LFG Emissions Model[27] (LandGEM) tool. The worst case maximum projected generation rate of 11,090 m^3/h at site capacity and assumed collection efficiency of 75% results in 2,773 m^3/h of LFG fugitive releases from the landfill with the remaining 8,318 m^3/h collected and combusted in the gas to energy plant engines or flares.

As the annual rate of LFG generation increases, so does the annual rate of LFG collection. The maximum LFG collection is expected to occur at the end of Stage 4, with a total of 6,238 m^3/h. Once filling begins in cells 7 and 8 of Stage 4, the current flare will not have sufficient capacity to process (burn) all of the collected LFG in the event of a shutdown of all four (4) installed IC engines. Therefore, in addition to the flare, at least two (2) of the four (4) IC engines will need to be kept running at all times in order to process all of the LFG collected at the site. A second enclosed flare will be installed to manage additional gas volumes and/or as a contingency in the event the four existing IC engines are down.

No further landfilling will occur in Stage 4 after the approved landfill contours have been reached, which will result in a gradual decrease in LFG generation. Incorporating a flexible geomembrane in the cover design significantly reduces migration through the cover system, increasing the collection efficiency of the gas collection system.

There is also potential for methane production in the landfill to decrease over time as a result of the Province's proposed organics disposal ban under Bill 151, *Waste-Free Ontario Act*. The current schedule is for the proposed organics disposal ban to come into effect by 2022. In this case, the landfill will generate less LFG from the final cells in Stage 4 decreasing the overall contribution of fugitive and combustion emissions from the EOWHF.

8.3.2 Effect of Climate Change on the Preferred Alternative

Increased severity of storm events; more intense rainfall events, and reduced snow cover over the long term are the most likely and relevant results of climate change on the design of the Preferred Alternative. The potential impacts are largely limited to the design of the SWM infrastructure requiring an increased volume for detention and sedimentation ponds, as well as additional erosion protection as more intense storm events result in higher flow velocities in ditches and swales and at discharge points.

The changes in extreme weather events due to climate change are of particular relevance in the design and water management infrastructure. Surface water design elements for the expansion need to address the requirement to divert or control surface water coming onto the site; control runoff discharging from the site; and to control

[27] https://www3.epa.gov/ttncatc1/dir1/landgem-v302-guide.pdf.

erosion, sedimentation and flooding. O. Reg. 232/98 design requirements for SWM include:

- external diversion channels, ditches and conveyance structures to be sized to accommodate the peak flow generated from the higher of the 100-year design storm or the prevailing Regional Storm Event (e.g., Hurricane Hazel, Timmins or other historically observed maximum event);
- internal drainage ditches, storm sewers and conveyance structures to be sized to accommodate the peak flow generated from a 25-year design storm;
- a continuous overland flow route and/or ditch drainage system sized to convey the peak flow generated from the higher of the 100-year design storm or the prevailing Regional Storm Event;
- water quality enhancement features (i.e., sedimentation ponds) of non-contaminated storm water to be designed to temporarily treat/store the runoff volume generated from a 4-hour, 25 mm storm event; and
- surface water quantity controls (i.e., peak flow reduction) of non-contaminated storm water to be designed to temporarily store the runoff volume generated from storm events up to the higher of the 24-hour, 100-year design storm or the prevailing Regional Storm event, at or below the existing condition peak flows, such that there is no appreciable change in the potential for flooding and/or erosion in the watercourses receiving surface water discharges.

The design of the Preferred Alternative addresses the MOECC design criteria for approval for an ECA under the OWRA, in addition to the landfill-specific requirements in O. Reg. 232/98. To assess the design of the SWM system, the following was used:

- Rainfall data: Environment Canada updated IDF curves, 2014 revision;
- Rain gauge station: Ottawa CDA (6105978);
- Quantity control design storms: 24-hour SCS Type II for the 1:2, 1:10 year and 1:100 year return periods;
- Climate change: total precipitation volume is increased by 18% (recommendation based on Quebec MDDELCC's guidance document: "Manuel de conception des ouvrages municipaux de gestion des eaux pluviales", 2017).

Additional storage areas were designed to be added to the existing SWM system to satisfy quantity and quality requirements for the Preferred Alternative. The enhanced surface management system consists of five wet ponds and a perimeter ditch. The existing system already consists of three ponds and a perimeter ditch. The proposed SWM system therefore includes two new wet ponds with a total capacity of 54,500 m^3 (25,050 m^3 of permanent pool, and 29,450 m^3 of extended volume).

The proposed locations of these additional ponds are along the perimeter of the EOWHF landfill property and are designed as an enlargement of the existing perimeter ditch. The proposed northwest pond is located north of Stage 4 and along the west boundary of the site extending to the outfall in the northwest corner. The proposed northeast pond wraps

around the northeast corner of the site and is aligned along the north and east boundary of the landfill property.

For stormwater quality control, the wet ponds have been designed to provide 'Enhanced' (Level 1) of protection (i.e., 80% long-term suspended solid removal) and to meet the SWM design requirements of the MOECC's Stormwater Management Planning and Design (MOECC Manual). In accordance with MOECC guidelines, water quality storage requirements are based on impervious levels. In ultimate conditions, the imperviousness of the EOWHF site is evaluated to approximately 85%, which corresponds to a volumetric water quality criteria of 250 m^3/ha.

For stormwater quantity control, the wet ponds have been designed to temporarily store the runoff volume generated by storm events up to the 24-hour, 100-year design storm and maintain discharge peak flows at or below the predevelopment conditions.

The design of the leachate collection system is not affected by meteorological changes associated with climate change, as the potential impact to infiltration rates and the resulting rate of leachate generation is expected to be negligible once Stages 3B and 4 will be completed. Incorporation of a geomembrane in the final cover system will further reduce infiltration compared to a generic clay cover system required to meet the minimum requirements set out in O. Reg. 232/98. However, during the active phases, the leachate collection system will be affected by meteorological changes. The design of the leachate collection system and the treatment plant for the Preferred Alternative addresses the requirement associated with those changes.

The Preferred Alternative will be operational for approximately 5 to 10 years, which is not long enough to see substantial changes in rainfall patterns resulting from climate change. Once the landfill reaches its approved capacity, it will be closed and capped resulting in a decrease in the leachate volumes generated and requiring subsequent treatment.

8.4 Advantages and Disadvantages of the Preferred Alternative

In accordance with the ToR, a description of the advantages and disadvantages of the Preferred Alternative is provided in **Table 8-2**. The differences in the potential environmental effects remaining following the implementation of potential mitigation/management measures (i.e., net effects, provided in **Section 8.1**) were used to identify and compare the advantages and disadvantages of each alternative method. Overall, the advantages of the Preferred Alternative are greater than the disadvantages.

Table 8-2. Advantages and Disadvantages of the Preferred Alternative

Environmental Component	Evaluation Criteria	Advantages	Disadvantages
Natural Environment			
Atmospheric Environment	Air Quality	• The maximum ground-level concentrations were modelled to be within the relevant MOECC POI limits for all contaminants of concern at all off-site locations	• The Preferred Alternative will result in an increase of 35% and 74% (for 1-hour and 24-hour averaging periods, respectively) in the modelled concentrations

Table 8-2. Advantages and Disadvantages of the Preferred Alternative

Environmental Component	Evaluation Criteria	Advantages	Disadvantages
		with the exceptions of nitrogen oxides, particulate matter, PM_{10}, and $PM_{2.5}$; however, the exceedance for nitrogen oxides and particulate matter is very infrequent at the nearest receptors and is primarily related to fugitive emissions from mobile sources. • No exceedances for PM_{10} or $PM_{2.5}$ were noted at the nearest receptor. • Existing dust management practices are expected to be sufficient to mitigate potential particulate matter based exceedances. • Exceedances of the relevant standards are expected to be limited to the area immediately adjacent to the facility property line and so infrequent at nearby receptors that their impact can be considered negligible. • No additional off-site receptors will be affected.	of contaminants of concern at the nearest receptors (residential) to the northwest of the EOWHF relative to existing conditions; however, these concentrations are within the relevant MOECC POI or other limits for all contaminants of concern with the exceptions of nitrogen oxides, particulate matter, PM_{10}, and $PM_{2.5}$.
	Odour	• The maximum ground-level concentrations were modelled to be within the relevant MOECC POI limits for all contaminants of concern at all off-site locations. • No additional off-site receptors will be affected.	• It is expected that there will be an increase of 30% to 38% (depending on the averaging period) in the maximum off-site concentrations of odorous compounds of concern, an increase of 3% in the maximum off-site concentrations of odour at the most affected receptor to the east of Highway 138, and an increase of 1.5% in the maximum off-site concentrations of odour at the nearest residential receptor on Concession 7 relative to existing conditions.
	Noise	• Noise levels resulting from landfilling activities will be below the MOECC noise limits. • No additional off-site receptors will be affected.	• Receptors will experience a minor increase in noise levels resulting from landfilling activities (approximately 1 dBA). Landfilling activity may be audible at times, during lulls in background sound levels.
Geology and Hydrogeology	Groundwater Quality	• No net effect.	• No appreciable disadvantages given the low vertical hydraulic conductivity of the saturated marine silty clay underlying the
	Groundwater Quantity	• No net effect.	

Table 8-2. Advantages and Disadvantages of the Preferred Alternative

Environmental Component	Evaluation Criteria	Advantages	Disadvantages
			site.
Surface Water Environment	Surface Water Quality	• Surface water quality will meet MOECC requirements and criteria specified in ECA (Industrial Sewage Works, Section III) prior to release off-site. • No net effects to off-site surface water quality, as effluent contaminant concentrations will be limited to the effluent discharge limits currently in place. • No net effects resulting from increased TSS due to sufficient detention time provided by SWM ponds.	• No disadvantages to on-site or off-site surface water quality are anticipated.
	Surface Water Quantity	• No net effects, as peak flows to the site outlet will be controlled with the ponds within the pre-development conditions values up to a 100-year return period.	• No disadvantages to receiving watercourses are anticipated.
Ecological Environment	Terrestrial Ecosystems	• Addition of amphibian habitat in SWM ponds on-site. • Minimal potential for increased disturbance to wildlife and wildlife habitat on-site. • The treed swamp on site will continue to be of an appropriate size to support area-sensitive birds. • Migrating blackbirds that use forested habitat will still have habitat on site. • No net effects to off-site wildlife or wildlife habitat.	• Removal of approximately 3.18 ha (22%) of the treed swamp in the northeast corner of the site and the loss of native species. • Loss of 3.18 ha bird habitat on-site.
	Aquatic Ecosystems	• No net effects.	• No disadvantages to aquatic ecosystems are anticipated.
Socio-Economic Environment			
Economic	Economic Effects on / Benefits to Local Community	• The site is expected to operate for an additional 5 to 10 years. • Extended duration of employment for an additional 5 to 10 years. • Continued provision of cost-effective and environmentally-secure waste management services to municipalities and businesses across Eastern Ontario for an additional 5 to 10 years. • An additional $50 million to	• No disadvantages to economics are anticipated.

Table 8-2. Advantages and Disadvantages of the Preferred Alternative

Environmental Component	Evaluation Criteria	Advantages	Disadvantages
		$100 million contributed to the local economy through the procurement of local goods and services.	
Social	Effects on Local Community	• The site's operating hours will remain unchanged and no additional large equipment will be required. • No changes to traffic volumes beyond currently-approved levels or changes to waste haul routes are anticipated. • No net effects to number of residents. • No net effects on residents and their use of property.	• No disadvantages from a local community perspective are anticipated.
	Visual Impact of Facility	• No increase to landfill height.	• No disadvantages from a visual impact perspective are anticipated.
Cultural Environment			
Cultural Environment	Cultural Heritage Resources	• No effects on cultural heritage resources.	• No disadvantages to cultural heritage resources anticipated.
	Archaeological Resources	• No effects on archaeological resources.	• No disadvantages to archaeological resources anticipated.
Built Environment			
Transportation	Effects from Truck Transportation along Access Roads	• No changes to waste haul routes are anticipated. • Site traffic generation is expected to increase nominally. • No additional measurable traffic related to construction. • No changes to on-site times and weigh scale times, employee traffic volumes or patterns, or the breakdown of vehicle types and average vehicle loads. • No operational concerns at any study intersections as a result of the EOWHF landfill expansion. • No road network improvements are necessary. • No addition of left-turn lanes along Highway 138. • No substantial traffic safety concerns.	• No disadvantages to transportation are anticipated.
Current and Planned Future Land Use	Effects on Current and Future Land Uses	• Conforms to Provincial Policy Statement. • Consistent with the Official Plan.	• No disadvantages to current and planned land uses anticipated.

Table 8-2. Advantages and Disadvantages of the Preferred Alternative

Environmental Component	Evaluation Criteria	Advantages	Disadvantages
		• No zoning by-law amendments required. • No effects on woodlands, wetlands, ANSI features, recreational resources, or sensitive land uses.	
Aggregate Extraction and Agricultural	Aggregate Resources	• No effects on aggregate resources.	• No disadvantages to aggregate resources anticipated.
	Effects on Agricultural Land	• No effects on agricultural land.	• No disadvantages to agricultural land anticipated.
Design and Operations	Site Design and Operational Characteristics	• No net effects: Complexity of site infrastructure will be low considering similarities with the previous design and construction techniques. • Operational flexibility maximized.	• No disadvantages to design and operations are anticipated.