EXECUTIVE SUMMARY

ES1. Introduction

This document is the Environmental Assessment Report (EA Report) for the environmental assessment (EA) of the proposed expansion of the Biggars Lane Landfill (also referred to as the Project herein) by the County of Brant (County). This is an Individual EA completed under the *Environmental Assessment Act* (*EAA*), *1990*.

The Biggars Lane Landfill (also referred to as the Site herein), which is licensed to operate under Environmental Compliance Approval # A100301 dated October 2005 and amendments, is located at 128 Biggars Lane, in the County of Brant. The landfill facility comprises a 11.1 hectare (ha) area for disposal within a 91.18 ha site. The estimated fill rate is 19,000 tonnes per year. The total approved airspace for landfilling is currently 730,000 cubic metres (m^3). The Biggars Lane Landfill is approved to accept solid non-hazardous municipal (residential, industrial, commercial and institutional) waste generated within the County of Brant. The existing major site components at the Biggars Lane Landfill include: licensed waste disposal area (approved existing landfill footprint), public drop-off and recycling facility, stormwater management (SWM) ponds, and access roads.

Based on a number of studies, the County concluded that it would run out of approved available landfill disposal capacity at the Biggars Lane Landfill by the year 2021. The County undertook a Solid Waste Disposal Future Needs Study in 2010/2011, which concluded that the preferred alternative to address future solid waste disposal needs was to develop new disposal capacity at the Biggars Lane Landfill. This would provide waste disposal capacity to meet the County's needs until the year 2050.

To respond to this need, the County commenced work in 2012 on a Terms of Reference (ToR), which is the first step in Ontario's EA process. The ToR, which represented Phase 1 of the Project was completed in March 2014 by Stantec Consulting Ltd. and was approved by the Minister of Environment and Climate Change[1] on May 15, 2015. Phase 2 of the Project consisted of activities carried out in accordance with the approved ToR, which comprise the initial portion of the EA including: alternative methods of landfill expansion, comparative evaluation criteria, technical work plans for environmental assessment study components and monitoring strategy. The results of these Phase 2 activities provided the basis to proceed with Phase 3 of the Project, which consists of completion of the EA (including the list of project commitments) and obtaining *EAA* approval for the landfill expansion. R.J. Burnside & Associates Limited (Burnside) has facilitated Phase 3 of the Project on behalf of the County.

[1] In July 2018, the Province of Ontario restructured the *Ministry of the Environment and Climate Change* (MOECC) to create the *Ministry of the Environment, Conservation and Parks* (MECP). For the purpose of this report, both are the same ministry.

Three study areas have been established for this EA: the Regional, Local and Site Study Areas. The Regional Study Area encompasses the County of Brant but does not include the City of Brantford, Six Nations of the Grand River (Six Nations), or the Mississaugas of the New Credit First Nation (MNCFN). The Local Study Area for the EA extends approximately 500 m in all directions beyond the County-owned lands at the Biggars Lane Landfill. The Site Study Area includes the County-owned lands at the Biggars Lane Landfill located in the south part of Lot 1, 2nd Range East of Mount Pleasant Road in the County of Brant (formerly Township of Brantford).

ES2. Terms of Reference

An EA is a planning study that assesses environmental effects, advantages and disadvantages of a proposed undertaking. The environment is considered in broad terms to include the natural, social, cultural, and economic aspects of the environment. The first step in the Ontario's individual EA process is to develop a ToR, which provides the framework for the preparation of the EA. A ToR was developed by the County, submitted to the Ontario Ministry of the Environment and Climate Change (now Ontario Ministry of the Environment, Conservation and Parks (MECP))[2] and approved by the Minister on May 15, 2015.

As noted in the approved ToR, the County indicated that it was proceeding with the EA under subsection 6(2)(c) and 6.1(3) of the *EAA*, which allows the proponent to 'focus' the EA. Three areas were 'focused' as part of the ToR process:

1. The assessment of 'alternatives to';

2. The assessment of 'alternative methods' for landfill expansion; and

3. The scope of studies to be completed during the EA.

As part of the approval of the ToR, MECP also identified the need to complete an assessment of 'alternative methods' for landfill gas (LFG) collection.

[2] On June 29, 2018, the Ministry of the Environment and Climate Change (MOECC) changed its name to Ministry of the Environment, Conservation and Parks (MECP). All references to this Ministry in this EA Report are noted as MECP, except when citing documents that were published prior to the name change. In some cases, there are citations of older Ministry documents, when the name was Ministry of the Environment (MOE) or Ministry of the Environment and Energy (MOEE).

ES3. Purpose

In accordance with the approved ToR, the purpose of the undertaking is:

> *"to allow the County to meet their solid waste disposal needs until 2050 after the existing approved disposal area at the Biggars Lane Landfill reaches capacity in approximately 2021."*

ES4. Environmental Assessment Methodology

Following the approach described in the approved ToR, the EA was undertaken in ten (10) steps as described below. Additional details about each step are further described in Section 2.0 of this EA report.

1. Describe the service area waste disposal needs for the minimum planning period ending in 2050.

2. Develop criteria to be used in the evaluation of the 'alternative methods'.

3. Develop design concepts for 'alternative methods' for expanding the existing Biggars Lane Landfill.

4. Carry out the studies required to address the environment and evaluation criteria.

5. Describe the environment(s) potentially affected by the proposed undertaking.

6. Using the evaluation criteria identified in Step 2, carry out an evaluation of the 'alternative methods' for the proposed undertaking and identify the impacts to the environment.

7. Identify the preferred 'method'.

8. Identify measures that may be necessary to prevent, change or mitigate possible environmental effects of the preferred 'method'.

9. Prepare a description of the environmental advantages and disadvantages of the preferred 'method' based on net effects following mitigation. The assessment of net effects will include effects associated with the construction, operations and any closure/post closure periods of the preferred 'method'.

10. Prepare monitoring and contingency plans to remedy the environmental effects.

ES5. Consultation

Consultation with the public, Indigenous communities, review agencies and organizations were ongoing throughout the EA process in accordance with the

consultation plan described in the approved ToR. A variety of consultation events and activities were used. The consultation events were designed to facilitate engagement of potentially interested persons in the progress of the EA.

The consultation activities carried out during the EA included:

- Circulation of Notices to property owners within approximately 1 km of the Site Study Area;
- Circulation of Notices to seven Indigenous communities with potential interest in the Project including follow-up calls with Indigenous communities following circulation of Notices to confirm receipt and level of interest in the Project;
- Circulation of Notice to 35 review agencies and organizations (federal, provincial, municipal governments, conservation authority, local school boards and utilities);
- Circulation of Notices to individuals that signed in at project Public Information Centres (PICs);
- Notices published in local newspapers;
- Notices on the County's website (https://www.brant.ca/en/resident-services/Solid-Waste-Environmental-Assessment.aspx);
- Posting of EA documents on the County's website;
- Hosting of four PICs;
- Approximately eight telephone calls between County of Brant and the MECP;
- Meetings with Six Nations and MNCFN; and
- Letters sent to all Indigenous communities on the Project Contact List to inform them of planned field work assignments and invite representatives from their communities to observe field work.
- Indigenous community observation of field studies as follows:
  - MNCFN (182 hours of field monitor observation);
  - Haudenosaunee Development Institute (132 hours of field monitor observation);
  - Huron-Wendat Nation (51 hours of field monitoring observation).

The consultation activities are described in Section 3.0 of this EA Report with complete documentation provided in Volume VI (Record of Consultation).

ES6. Alternative Methods

'Alternative methods' are the different ways that the proposed expansion of the Biggars Lane Landfill could be implemented. In accordance with the approved ToR, three (3) evaluations of 'alternative methods' were conducted including:

- 'Alternative methods' to achieve the expansion of the Biggars Lane Landfill;
- 'Alternative methods' to collect landfill gas (LFG);
- 'Alternative methods' for the treatment and disposal of leachate.

As three separate evaluations of 'alternative methods' were conducted as part of this EA, the following terminology is used within this EA Report to distinguish these 'alternative methods':

- 'Alternative methods' to achieve the expansion of the Biggars Lane Landfill are herein referred to as 'Alternative Methods';
- 'Alternative methods' to collect LFG are herein referred to as 'LFG Collection Options'; and
- 'Alternative methods' for the treatment and disposal of leachate are herein referred to as 'Leachate Treatment and Disposal Options'.

Four Alternative Methods were considered as part of this EA and are summarized in Section ES6.1.

Five LFG Collection Options were considered as a part of this EA and are summarized in Section ES6.2.

Five Leachate Treatment and Disposal Options were considered as a part of this EA and are summarized in Section ES6.3.

ES6.1. Alternative Methods for Landfill Expansion

Four Alternative Methods were considered as part of this EA and are summarized below.

Alternative Method 1 involves the construction of a 15.1 ha landfill footprint west of the existing landfill footprint using a engineered low permeability final cover (without a low permeability base liner and leachate collection system) design approach. A separation distance of 280 m between the south side of the disposal area and the south property boundaries is maintained. The maximum height of this expansion is about 12 to 13 m above existing ground surface. The shallow excavation to form the base of the landfill will involve a combination of cutting and filling, with a net soil surplus of about 92,000 m^3 available for daily cover and other Site requirements.

Alternative Method 2 involves the construction of a 14.3 ha landfill footprint west of the existing landfill footprint using an engineered base containment approach (liner). The maximum height of this expansion is about 14 to 15 m above the existing ground surface. The shallow excavation to form the base of the landfill will involve a combination of cutting and filling, with a net soil surplus of about 66,000 m^3 available for daily cover and other Site requirements.

Alternative Method 3 involves the construction of two separate landfill footprints, one 10.9 ha footprint west of the existing landfill footprint and one 4.7 ha footprint east of the existing landfill footprint. An engineered low permeability final cover (without low permeability base liner and leachate collection system) would be used. Since Alternative Method 3 provides a portion of the expanded footprint on the east side of the

landfill property, future landfilling operations can occur on the part of the property that is most distant from the closest off-Site receptors. The maximum heights of the west and east landfill footprints are about 12 to 13 m and 8 to 9 m, respectively, above the existing ground surface. The shallow excavation to form the base of the landfill cells will involve a combination of cutting and filling, with a net soil surplus of about 41,000 m^3 available for daily cover and other Site requirements.

Alternative Method 4 involves the construction of two separate landfill footprints, one 11.7 ha footprint west of the existing landfill footprint and one 8.2 ha footprint east of the existing landfill footprint. An engineered base containment (liner) design will be used to enlarge the footprint area and maximize the airspace on the east side of the landfill property, thereby allowing as much of the future landfilling operations to occur on the part of the property that is most distant from the closest off-Site receptors. The maximum height of the west and east landfill footprints are about 12 m above the existing ground surface. The shallow excavation to form the base of the landfill cells will involve a combination of cutting and filling, with a net soil surplus of about 78,000 m^3 available for daily cover and other Site requirements.

ES6.2. Landfill Gas Collection Options

Five LFG Collection Options were considered as part of this EA and are summarized below. In the review of the LFG Collection Options, all Alternative Methods were considered.

LFG Collection Option 1 considered was “do nothing” which simply allows the natural process of LFG movement way from the waste mound. This option does not meet the requirements of Ontario Regulation (O.Reg.) 232/98.

LFG Collection Option 2 considered the use of “passive venting”, which involves installation of a system to intercept the LFG before it reaches the atmosphere. Once intercepted, the passive venting system provides a preferential (easier) pathway for the LFG to escape the site. This option does not meet the requirements of O.Reg. 232/98.

LFG Collection Option 3 considered the use of an “active horizontal collection trench”. The use of an active collection system involves installation of a system that uses extraction equipment to draw LFG through the pipe network placed over the LFG collection area. The extraction equipment is basically an industrial vacuum that lowers the pressure in the collection pipes below atmospheric pressure. Once captured, the collection network directs the LFG to equipment for combustion or use.

LFG Collection Option 4 considered the use of an “active vertical collection trench”. A vertical extraction well system uses the same extraction, piping and combustion or use equipment described above (LFG Collection Option 3). A vertical extraction well is typically installed after waste filling has been completed for an area, often while final

cover is being placed. Vertical extraction wells can be extended if required due to continued filling in an area.

LFG collection Option 5 considered the use of "a combination of active horizontal collection trenches and active vertical extraction wells". Typically, this combination system uses trenches to collect LFG while landfill operations are underway, which is particularly helpful at large landfills (much larger than the Biggars site) where an area may be filled in many lifts (layers) before closure cover is applied. When final closure cover is ready to be installed for an area, vertical extraction wells are added.

ES6.3. Leachate Treatment and Disposal Options

Based on the evaluation of Alternative Methods (which is discussed further in Section ES.8), the Preferred Method was determined to be Alternative Method 2. Since Alternative Method 2 includes an engineering base containment (liner) system with leachate collection, an evaluation of Leachate Treatment and Disposal Options for Alternative Method 2 was completed in accordance with the ToR. Five Leachate Treatment and Disposal Options were considered as part of this EA and are summarized below.

Leachate Treatment and Disposal Option 1 considered the use of the County-owned Paris Water Pollution Control Plant (WPCP). The distance between the Biggars Lane Landfill and the Paris WPCP (120 Race Street in the Town of Paris) is approximately 20 km. The Paris WPCP has an approved rated capacity of 7,056 m^3/d. The system consists of an extended aeration sewage treatment plant with primary treatment, aerobic aeration tanks, phosphorus removal, and disinfection followed by discharge to the Grand River. The Paris WPCP utilizes a three-stage aerobic digestion process and a dewatering centrifuge. Dewatered aerobic sludge is transferred to the biosolids storage facility located at the closed Paris landfill (40 Railway Street, Paris). The biosolids are then removed and utilized on agricultural land as a conditioning agent.

Leachate Treatment and Disposal Option 2 considered use of the County-owned St. George WPCP. The distance between the Biggars Lane Landfill and the St. George WPCP (located at 43 Victor Boulevard in St. George) is approximately 27 km. The St. George WPCP has an approved rated capacity of 1,300 m^3/d. Main plant processes include grit removal, comminution, aeration, coagulant feed system for phosphorous removal, secondary clarification, disinfection by chlorine, tertiary media filtration, and aerobic sludge digestion. The effluent receiving stream is an unnamed tributary of Fairchild Creek.

Leachate Treatment and Disposal Option 3 considered the combined used of the County's Paris and St. George Water Pollution Control Plants.

Leachate Treatment and Disposal Option 4 considered the establishment of a full on-Site leachate treatment system. On-Site treatment would require the construction of sewage works on the landfill site to treat the collected leachate to a quality appropriate for discharge. Leachate quality, and discharge limits help determine the size and type of treatment system required.

Leachate Treatment and Disposal Option 5 considered the use of out-of-County Sewage Treatment Plant(s). The municipalities adjacent to County of Brant were contacted through letters to inquire about the potential capacity at their wastewater treatment plants to handle the estimated hydraulic and organic loading from the expanded Biggars Lane Landfill. At the time of preparation of this report, formal response has only been received from Haldimand County, Norfolk County and Oxford County.

- Haldimand County indicated that their Dunnville and Hagersville WWTPs are unable to treat additional leachate due to the small size of the plants and limitations specified within their Environmental Compliance Approvals.
- Norfolk County indicated that their two wastewater treatment plants (Simcoe and Port Rowan) can provide 100 m^3/d of capacity each (200 m^3/d combined) to handle leachate from Biggars Lane Landfill. Considering the estimated leachate flows this option is considered as a combined treatment of the leachate at both facilities.
- Oxford County indicated that they could currently receive 60 to 80 m^3/d of leachate from the Biggars Lane Landfill on an emergency basis, but not on a permanent, regular basis as proposed to support the Biggars Lane Landfill expansion.

ES7. Description of the Environment Potentially Affected

Section 5.0 of this EA Report presents a compilation of studies to characterize the existing environment that could potentially be affected by the proposed undertaking. In accordance with the comparative assessment criteria and indicators outlined in the Phase 2 Report and further refined in Phase 3 of the EA, there are nine (9) environmental components (listed below), which were then subdivided into 15 sub-components (e.g., the atmosphere component includes air quality and noise sub-components).

- Geology, Hydrogeology, and Surface Water
- Stormwater
- Natural Ecosystems
- Atmospheric Environment
- Transportation
- Land Use / Agricultural / Visual Environments
- Economic Environment
- Technical and Operational Considerations
- Cultural Heritage Resources and Archaeology

ES7.1. Geology, Hydrogeology and Surface Water

Shallow groundwater on the Site primarily flows in a south direction toward the unnamed creek. There are two groundwater divides within the Site Study Area, onegroundwater divide across the north edge of the Site causes groundwater in the northwest corner to flow northward and the other groundwater divide in northeast corner and east side of the Site causes groundwater to flow eastward. Current monitoring data indicates landfill impact in the shallow groundwater at the southeast corner of the landfill footprint. Monitoring has not shown any landfill impact in the unnamed creek or off-Site.

The main surface water feature in the Local Study Area is the southern unnamed creek (referred to as 'unnamed creek' herein). It flows from northwest to southeast, briefly crossing the southern property boundary of the Site Study Area east of Hagan Road.

ES7.2. Stormwater

Stormwater runoff in the area generally drains in a south to southeast direction, to the unnamed creek flowing northwest to southeast through the south portion of the Site Study Area. The west and east regions drain respectively to the west and east of the central region. The central region includes the existing landfill footprint and associated SWM ponds (identified as the South and West Ponds). According to information supplied by the County, a perimeter road and ditching were constructed around the landfill footprint in 2016 to carry external overland flow. Flow from the new ditching was directed to either the South Pond or the West Pond. The South Pond also receives runoff from the final capped portions of the existing landfill and ultimately from the entire capped existing landfill. The runoff is retained and tested in the South Pond prior to discharging to the southern unnamed creek. The West Pond was constructed to control runoff from fields northwest of the landfill footprint discharging into the Pond and into the southern unnamed creek. These ponds provide capacity for the 1:100-year storm event and protect downstream water quality.

The Site Study Area lies between two unnamed creeks that flow east and north to the Grand River. The main surface water feature in the Local Study Area is the southern unnamed creek (referred to as 'unnamed creek' herein). It flows from northwest to southeast, briefly crossing the southern property boundary of the Site Study Area east of Hagan Road. The creek and much of the Site Study Area between the existing landfill footprint and the creek is regulated by the Grand River Conservation Authority (GRCA). The proposed landfill expansion areas are outside of the GRCA's regulated limits.

ES7.3. Natural Environment

A total of 20 ecosite polygons of 18 different ecosite types are found in the Site Study Area. All of the communities identified are considered to be relatively common in Ontario, including both upland and wetland, and natural and cultural vegetation habitats.

Four bird species listed as either provincially and/or federally significant were observed in the Site Study Area during breeding bird surveys: Eastern Wood-pewee (*Contopus virens*) (Special Concern), Bobolink (Threatened), Bank Swallow (*Riparia riparia*) (Threatened) and Barn Swallow (*Hirundo rustica*) (Threatened).

Five different amphibian species were identified during the surveys: Green Frog (*Lithobates clamitans*), American Toad (*Anaxyrus americanus*), Spring Peeper (*Pseudacris crucifer*), Gray Treefrog (*Hyla versicolor*), and Northern Leopard Frog (*Lithobates pipiens*). All of these species are ranked as S5 (Secure) in Ontario and are considered common and widespread in the province.

Two species of turtles were confirmed in the Site Study Area: Midland Painted Turtle (*Chrysemys picta*) (S4) and Snapping Turtle (*Chelydra serpentine*) (Special Concern). One species of snake, Eastern Garternsake (*Thamnophis sirtalis*) (S5), was confirmed in the Site Study Area.

Two bat species designated as Endangered under the *Endangered Species Act (ESA), 2007* were confirmed in the Site Study Area during the 2017 bat acoustic surveys: Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*Myotis septontrionalis*).

A total of 24 Lepidoptera species and 29 Odonata species were recorded in the Site Study Area. One Lepidoptera species, Monarch (*Danaus plexippus*), is listed as Special Concern under the *ESA*, provincially ranked as S2S3 in Ontario and is considered imperiled / vulnerable. One Odonata species, Unicorn Clubtail (*Arigomphus villosipes*), is provincially ranked as S3 and is considered vulnerable due to a restricted range. According to the Natural Heritage Information Centre (NHIC) (2017), Unicorn Clubtail is a highly local species restricted in Canada to southern Ontario. Much of these sites are ponds in heavily urbanized areas or in muddy ponds, creeks and rivers.

Direct fish habitat was identified in the unnamed creek within the Site Study Area. The fish presence survey identified a number of common cool and warm water fish species throughout this creek. Based on the species that were identified during the fish presence survey, the unnamed creek is characterized as providing a warm to cool water thermal regime.

No records of Provincially Significant Wetlands (PSW) were found for the Site Study Area or within the Local Study Area. The MNRF confirmed the presence of a permanent evaluated Locally Significant Wetland Complex (East Oakland Swamp) that is located adjacent to the Site Study Area (at closest location south of Biggars Lane near the Site entrance).

A total of three confirmed and six candidate provincially Significant Wildlife Habitats (SWH) were identified in the Study Area and are associated with the wetland, woodland, and/or cultural meadow / thicket communities present on-Site.

ES7.4. Atmospheric Environment

The MECP and National Air Pollution Surveillance (NAPS) stations in close proximity to the Local and Site Study Areas were reviewed to select the most representative background concentration for Site. A summary of the 90th percentile, maximum and average background concentration values from these monitoring stations is provided in Table 4 of the Air Quality Impact Assessment Report (see Volume II, Appendix D of this EA Report). These values represent the existing ambient air quality conditions that were used as a point of comparison.

The assessment of noise, focused on predicting changes in the noise levels as sensitive receptors or Points of Reception (POR). The existing noise levels at each POR are a combination of on-Site sources (including landfill equipment and traffic at the site) and off-Site sources (local road traffic). Table 3.3 of the Noise Impact Assessment Report (see Volume II, Appendix E of this EA Report) shows the modelled values for existing noise levels from off-Site and on-Site noise sources.

ES7.5. Transportation Environment

Existing traffic conditions were assessed at the primary intersections and roadways that provide a connection for traffic travelling between the arterial roads and the Landfill. All intersections and roadways reviewed are forecast to have acceptable traffic operations under existing (2017) conditions. The choice of expansion alternatives for the Landfill will not significantly change the forecast traffic impacts. The Landfill does not lie within any of the Airport Bird Hazard Zones (ABHZs) at the Brantford Municipal Airport.

ES7.6. Land Use / Agricultural / Visual Environment

Due to current zoning restrictions, there are no agricultural residences (or residences of any kind) within the Site Study Area. There is only one building present, a small barn, located off Biggars Lane in the far western portion of the Site Study Area. The majority of lands within the Site Study Area are currently in a cash crop rotation. No known livestock operations are present. Future land use in this area is not expected to change with the exception of changes resulting from the landfill expansion itself.

The landform in the area slopes gently with an average slope of 4 degrees +/- and is located on a sand plain. The terrain generally slopes down west to east. There are scattered patches of small woodlands and hedge rows within the Local Study Area and structures are limited to residences and agricultural buildings clustered in farmsteads. The mean ground elevation in the area is 231 m. All Alternative Methods for the Biggars Land Landfill expansion alter the terrain in this area by creating what will become the dominant geographic feature with a maximum elevation of 245 m +/-.

ES7.7. Economic Environment

In 2016, the population of County of Brant was 36,707, where there were 13,687 private dwellings (census division). According to Ontario population projections, the population of the County is expected to grow by 15% to 35% during the planning period of this EA. Within the County of Brant, heavy manufacturing, advanced manufacturing and the warehousing / logistics sectors are key industries and employers. Existing businesses within the Local Study Area include the Fescue's Edge Golf Club to the southeast of the existing landfill footprint, adjacent to the Site. According to County records, there are 11 active farms and agricultural operations located within the Local Study Area. The County includes a variety of incomes within its population base. Total income in the County varies widely. In 2015, the average employment income for full-time workers (15 years and older) was $58,341 (Statistics Canada, 2016 Census, Brant Census Division). The median total income of households in 2015 was $68,741, compared to the provincial median of $74,287 (Statistics Canada, 2016 Census).

ES7.8. Cultural Heritage and Archaeological Environment

There are no previously identified cultural heritage resources within the Local or Site Study Areas. Field reconnaissance identified a remnant concrete silo in the Site Study Area, which may be over 40 years old, however, this age of construction cannot be confirmed. Approximately 63 % (57.0 ha) of the Site Study Area demonstrated archaeological potential and was assessed by pedestrian survey and test pit survey at 5 m intervals, and judgemental test pit survey at 10 to 20 m intervals. During the Stage 2 Archaeological Assessment, 159 pre-contact Indigenous findspots, 41 pre-contact Indigenous sites, three multi-component pre-contact Indigenous and historical Euro-Canadian sites, and one historical Euro-Canadian site were identified. Of the findspots and sites encountered, several demonstrate further cultural heritage value or interest and meet the requirements for Stage 3 site-specific assessment. Stage 3 site-specific assessment will be completed if the find spot and/or site will be impacted by the landfill expansion or any other future development.

ES8. Evaluation of Alternative Methods of Landfill Expansion

The four Alternative Methods were qualitatively evaluated across the nine environmental components based on each of the comparative assessment criteria and indicators outlined in the Phase 2 Report and further refined in Phase 3 of the EA. The following sections describe the results of the evaluation.

ES8.1. Geology, Hydrogeology, and Surface Water

Alternative Methods 2 and 4 were preferred for groundwater quality protection. These Methods include a low permeability engineered base (liner) designed to remove leachate from the site for treatment. Leachate collection significantly reduces the volume of

leachate released to the groundwater. Alternative Methods 1 and 3 include an engineered low permeability final cover but no engineered base (liner) or leachate collection. Methods 1 and 3 rely on the natural attenuation (reduction) capacity of the groundwater on the site to dilute leachate from the landfill to acceptable levels at the property boundary.

Qualitative predictive models were created for the existing landfill and Alternative Methods 1 and 3 to assess the capacity of the site to attenuate (reduce) leachate impacts to meet acceptable levels at the property boundary. Infiltration (penetration) of precipitation through the final cover needs to be sufficiently low so that the leachate volume could be attenuated (reduced) on the Site. The models indicated that the very low infiltration rates required could not be achieved using a soil cover alone and would likely require a multi-layered synthetic cover. For this reason, Alternative Methods 1 and 3 were evaluated as less preferred (received lower rankings) with respect to protection of groundwater quality. Alternative Methods 1 and 3 were also less preferred because of the presence of a shallow groundwater divide across the north part of the site. For these natural attenuation Alternative Methods, there is potential for leachate to move northwest and northeast from the Site as well as southward.

Since previous studies and monitoring have indicated southern groundwater flow with probable discharge to the unnamed creek, the analysis of impacts to surface water have been correlated with the impacts to groundwater for the purposes of this EA.

Therefore, Alternative Methods 2 and 4 received the highest ranking and were equally preferred Alternative Methods from a groundwater and surface water quality protection perspective.

ES8.2. Stormwater

All four Alternative Methods would have a similar impact from a stormwater and surface water quantity perspective, but Alternative Method 2 is slightly preferred since it requires the smaller SWM pond and the least amount of ditching.

ES8.3. Natural Environment

From an aquatic standpoint, Alternative Method 2 provides the least potential for an impact to occur as it involves a single footprint as opposed to the wider-spread options while the engineered base containment (liner) minimizes the potential for leachate and impacted groundwater to migrate from the new cell to the aquatic environment.

Alternative Method 1 has the lowest predicted effect on vegetation communities compared to the other three Alternative Methods. Alternative Methods 1 and 2 are considered to have a lower predicted effect on wildlife, Species at Risk (SAR) and SAR habitat compared to Alternative Methods 3 and 4. Alternative Methods 1 and 2 will not

remove SAR habitat for Endangered and Threatened species. Alternative Methods 3 and 4 will permanently remove the forest community (FOD6-5) and associated hedgerows, which is considered SAR habitat for Endangered bats, area-sensitive breeding bird habitat and confirmed habitat for a Special Concern bird species. Alternative Methods 3 and 4 are situated in closer proximity to the naturalized portion of the Site Study Area that is located directly south of these two Alternative Methods. The naturalized portion of the Site Study Area includes the unnamed creek and part of a Locally Significant Wetland complex and contains a number of sensitive wildlife features.

Overall, Alternative Method 1 is preferred from a natural environment perspective.

ES8.4. Atmospheric Environment

In order to compare the environmental effects of the four Alternative Methods based on changes to air quality and odour, dispersion modelling was completed in accordance with the MECP's "Air Dispersion Modelling Guideline for Ontario" PIBS 5165e using the USEPA AERMOD model. Seven residential properties were selected as representative sensitive receptors surrounding landfill property. The assessment of air quality impacts of the four Alternative Methods shows that all the alternatives would keep the Site in compliance with the applicable air quality criteria and therefore, all alternatives should be considered as acceptable from the future air quality perspective.

Acoustic modelling was undertaken to predict the noise impact at all PORs. Modelling was completed for the existing conditions scenario as well as two worst-case scenarios for each of the four Alternative Methods. The assessment of future noise impacts of the four Alternative Methods shows that all the alternatives meet the Ministry daytime criteria at all PORs; therefore, all four Alternative Methods are acceptable options from the perspective of noise impact. None of the Alternative Methods is significantly better or worse than the others; however, single cell design without a liner scenario shows least noise impacts during construction and operation and therefore, overall there is a slight preference for Alternative Method 1.

ES8.5. Transportation Environment

Impacts have been assessed at the primary intersections and roadways that provide a connection for traffic travelling between the arterial roads and the Landfill. It is forecast that the minimal increase in traffic volumes from the Landfill expansion will not significantly impact the traffic operations or collision rates in the Study Area.

The choice of expansion alternatives for the Landfill will not significantly change the forecast traffic impacts from the landfill operations. The maximum volumes of leachate generation would only likely generate one or two vehicles during the peak hour periods. Therefore, the additional traffic volumes generated by leachate haulage would have a minimal effect on traffic in the peak hour periods.

Three existing runways at the Brantford Municipal Airport, located approximately 10 km north of the Biggars Lane Landfill, were analyzed to determine if the Landfill was located within each of the runway's Airport Bird Hazard Zone (ABHZ). The analysis indicated that the Landfill does not lie within any of the ABHZ of Brantford Municipal Airport's three runways.

Therefore, Alternative Methods 1 and 3 are equally preferred and are both marginally preferred over Alternative Methods 2 and 4 since they will result in additional traffic from the leachate haulage.

ES8.6. Land Use / Agricultural / Visual Environments

Alternative Method 2 is preferred from the perspective of land use. Alternative Method 2 results in: no removal of agriculture structures or dwellings, no loss of Class 1 soils, the least amount of Class 2 soil loss, the second largest distance from the nearest point of the Golf Course, sufficient buffers to the existing property boundary off-Site, largely compatible land uses, and equal potential for fragmentation of remaining land and loss of cash crop rotation land compared to the other Alternative Methods.

To compare the environmental effects of the four Alternative Methods from a viability perspective, the impacts at 19 receptors representing five receptor groups within the Local Study Area were assessed. Alternative Methods 1 or 2 will offer the best choice to limit visual impact to the local area. Both Alternative Methods 1 and 2 have the least amount of visible area from all receptor groups. Alternative Methods 1 and 2 allow observation from the south-east to be impacted in a limited way and require the least physical mitigation measures for views from the north-west area of the landfill property.

ES8.7. Economic Environment

No existing businesses will be disturbed or displaced by any of the four Alternative Methods, and the general potential for adverse economic impacts is very low. Alternative Methods 2 and 4 are largely equal regarding their potential for economic benefits with a longer construction period. However, the most preferred is Alternative Method 3 from a local economy perspective due to the larger distance between the proposed east cell and the approximate south buffer distance to the property boundary. Alternative Method 3 also requires constructing increased access roads and SWM controls. This additional construction could provide temporary economic benefits to the Local and Regional Study Areas.

From a financial cost perspective, Alternative Method 1, which involves only one cell and no leachate collection, is the least expensive in all categories, and Alternative Method 4 which involves two cells and leachate collection is the most expensive in nearly all categories.

When comparing the four Alternative Methods based on capital and operations and maintenance costs, Alternative Method 3 is moderately preferred.

ES8.8. Technical and Operational Considerations

Landfill Gas: The ranking for LFG concerns, namely generation, migration and safety related issues, resulted in fairly close alternative rankings. Alternative Method 2 is marginally preferred because of the liner and distance to the property line. The requirement for LFG monitoring and mitigation is equal across the Alternative Methods.

Vector and Vermin: Given that the expansions to the east may involve more removal of deciduous forests, it has been concluded that Alternative Methods 3 and 4 ranked 'Poor' whereas Alternative Methods 1 and 2 ranked 'Average' with respect to potential vector and vermin nuisances.

Geotechnical: Sideslopes are expected to be 3:1 or less (horizontal to vertical distance ratio), which is generally considered stable. In terms of berms, alternatives involving a larger footprint would have a significantly lower berm requirement and final landfill height. It is assumed that some adjustments of the design could reduce berm height and overall height within Alternative Methods 3 and 4 (which have a larger footprint), and therefore these have been given a better ranking. Alternative Methods 3 and 4 are therefore preferred from a Geotechnical perspective.

Infrastructural and Operational Requirements: Considering levels of complexity, final cover requirements, operational flexibility, and integration with existing equipment, overall, Alternative Methods 1 and 3 are preferred. They do not require landfill liner for their footprint area(s), nor do they need a leachate collection and treatment system. Alternative Methods 1 and 3 would be operated much like the existing (current) waste footprint.

Landfill Gas Collection System: As part of the assessment of the level of complexity of the Alternative Methods and as a requirement of the approved ToR, five LFG Collection Options were considered.

LFG Collection Option 1 (Do Nothing) and LFG Collection Option 2 (passive venting) were eliminated from consideration as they do not meet the requirements of O.Reg. 232/98 and are unlikely to be approved by the ministry. LFG Collection Options 3, 4 and 5 were then considered for how they would be applied under the Alternative Methods of landfill expansion. LFG Collection Option 3 (active horizontal collection wells) was considered less effective for expansion of the Biggars Lane Landfill when compared to LFG Collection Option 4 (active vertical collection wells). LFG Collection Option 5, the combination of active horizontal and vertical collection, was also discounted as inappropriate for use under the Alternative Methods of expanding the Biggars Lane Landfill.

Climate Change: Although Alternative Methods 2 and 4 will generate slightly higher greenhouse gas emissions than Alternative Methods 1 and 3, all Alternative Methods were ranked as 'Average' for Project Effects on Climate Change. Alternatives Methods 2 and 4 which involve trucking of leachate generate more greenhouse gas than alternatives without leachate trucking. However, given the nature of the project, the leachate trucking is not considered to be significant. Since Alternative Methods 1 to 4 all provide the same total disposal capacity and the rate of filling (timing) will be identical for each Alternative, the same LFG emissions will result regardless of selected Alternative.

The effects of climate change on the project across all the alternatives are consistent and there are no factors which would make one alternative preferred with respect to the effects of climate change. Climate change may increase risks for slope stability. Soils covering the waste may dry during periods without rain, reducing slope stability. Conversely, intense rains may cause landslides as the cover soils increase mass through infiltration. This risk is applicable to all Alternative Methods and has been considered as part of the geotechnical criterion. All Alternative Methods were ranked as 'Average' for Climate Change Effects on Project.

Therefore, overall, all Alternatives are considered 'Average' within the climate change criterion.

Based on the above, from a technical and operations perspective, all the Alternative Methods received an overall ranking of 'Average'.

ES8.9. Cultural Heritage Resources and Archaeology

No previously identified built heritage resources were identified within or adjacent to the Local Study Area, and therefore all the Alternative Methods received the same ranking from a cultural heritage perspective.

For Alternative Methods 1 and 2, three archaeological sites with potential cultural heritage value will be impacted. These will require Stage 3 Archaeological Assessment over approximately 560 m^2 of the Site Study Area[3]. For Alternative Methods 3 and 4 there are seven archaeological sites that will require Stage 3 Archaeological Assessment in an area of approximately 16,637 m^2. Therefore, from and Archaeology perspective, Alternative Methods 1 and 2 are preferred.

3 The actual size of the area requiring Stage 3 Assessment will be determined at the Environmental Protection Act design stage of the project.

ES8.10. Preferred Method of Landfill Expansion

Based on the comparative evaluation of the four Alternative Methods of landfill expansion across the nine environmental components, the overall Preferred Method of landfill expansion is Alternative Method 2.

ES9. Evaluation of Leachate Treatment and Disposal Options

As noted in Section ES6.2, since the Preferred Method involves leachate collection and would thus require a solution for leachate treatment and disposal, an evaluation of five Leachate Treatment and Disposal Options was completed in accordance with the ToR. The following criteria were used as the basis for comparing the five Leachate Treatment and Disposal Options:

- Surface Water impacts;
- Atmospheric impacts;
- Practicality and economic viability;
- Technical effectiveness; and
- Traffic impacts.

A summary of the evaluation of Leachate Treatment and Disposal Options is provided in the sections below; while a detailed discussion is provided in Section 7.0 of this EA Report.

Surface Water: All of the five options will be required to meet the respective plants' discharge requirements (i.e., ECA) or anticipated requirements in the case of on-Site treatment, Option 4.. The discharge would very minimally impact the surface water quantity for all Options except for Option 4 (on-Site treatment) which will discharge to the Unnamed Creek. Therefore, all options except for Option 4 are ranked the same from a surface water perspective.

Atmosphere: In terms of odour emissions, all options except for Option 4 (on-Site treatment) are anticipated to have minimal emissions if measures are taken to follow appropriate leachate offloading and handling (See Section 7.4.1) at the pick-up and drop-off. Option 4, however, would involve treatment operations that would have a greater number of more complex processes; hence potential odour generation is greater than other options.

In terms of air quality, all options except for Option 4 (on-Site treatment) are anticipated to have emissions due to the leachate transport trucks which is proportional to the distance the leachate is being transported. Therefore, Options 1, 2 and 3 are ranked higher. . Option 4 would not require the use of leachate transport trucks; however, the on-Site treatment operations involve more complex processes. Option 4 is ranked

lowest (worst) because the potential air quality impacts during treatment are greater than the hauled leachate options.

With less leachate truck transport distance, Options 1 and 2 create less noise impact and are therefore ranked higher than Option 3 and 5. Option 4 has more equipment that could create noise, however, this option does not require use of leachate transport vehicles and therefore is ranked 'Best' (highest) for avoiding noise.

Overall, considering odour, air quality and noise, Options 1 and 2 are 'Best'.

Practicality and Economic Viability: Options 2, 3, and 4 would require higher capital costs due to the need for substantial upgrades / new treatment systems to be able to handle the leachate. Option 1 is ranked 'Best' as it does not require any immediate / unplanned upgrades to be able to handle the leachate.

Technical Effectiveness: Option 4 is ranked highest in terms of treatability as it involves a treatment system designed specifically to treat landfill leachate. Options 2 and 3 are ranked the poorest as the St. George WPCP has no capacity to handle the leachate from the landfill. Option 1 is ranked second best as it is capable of handling both the hydraulic and organic loadings associated with leachate from the landfill.

Traffic: Option 4 does not require use of leachate transport vehicles and therefore is ranked highest. Options 1, 2 and 3 are ranked as the next highest as the leachate truck transport distances are smaller than Option 5.

Overall, the preferred leachate treatment and disposal option was identified to be Option 1; trucking the leachate off-Site to Paris WPCP.

ES9.1. Landfill Leachate Haul Routes to Paris WPCP

Additional traffic impact analysis for the leachate haul route to the Paris WPCP was completed. The leachate haulage route from the Biggars Lane Landfill Site to the Paris WPCP will utilize the County's network of Permitted Truck Routes, as recommended in the County's *Transportation Master Plan* (IBI Group, March 2016) and Ellis Avenue, between the landfill and the intersection of County Road 2 (Dundas Street West) / Washington Street.. From this intersection to the Paris WPCP the travel route is along residential local roads. Based on the preliminary EA work completed for the expansion to the Biggars Lane Landfill, it is forecasted that the leachate haulage from the expanded landfill will be 3 to 9 trucks per day. The maximum day haulage of leachate to the Paris WPCP will be similar to the rates currently being experienced at the plant (i.e., including the temporary leachate haulage). Therefore, the long-term impacts / mitigation associated with the leachate haulage to the Paris WPCP will be similar to existing conditions.

Given the location of the Paris WPCP and the minimal amount of trucks being brought to the WPCP, it can be concluded that the existing haul routes can safely accommodate the existing, and future, leachate trucks from the Biggars Lane Landfill. However, to minimize the potential for conflict between trucks and pedestrians it is recommended that further consideration be given to rerouting the leachate truck traffic to a more direct route in the area immediately adjacent to the WPCP, via the implementation of a layby / septic disposal station at the site access. In addition, consideration should be given to restricting parking along the full length of the haul route to one side of the road to allow a wider roadway platform for a shared vehicle and pedestrian use, as well as the installation of sidewalks along the haul route in areas that sidewalks do not currently exist, the next time the right-of-way is reconstructed..

ES10. Climate Change

Based on the overall evaluation of impacts across all environmental components, Alternative Method 2 has been confirmed as the preferred Method from a climate change perspective. The review of Alternative Methods in the supporting studies considered the impacts of the Project on climate change and the impacts of climate change on the Project. Mitigation measures to address impacts from climate change are provided in this EA Report. Methods to reduce the expansion's greenhouse gas emissions and negative impacts on carbon sinks[4] have been considered. The County is planning the landfill expansion in a manner that considers future changes in climate and the impacts a changing climate could have on the Project. The net effects of greenhouse gas generation are also considered in this EA Report. In addition to those measures addressed in this EA Report, consideration of the environmental impacts discussed will be included during the *Environmental Protection Act (EPA), 1990* application process and incorporated into the Site design.

ES11. Preferred Undertaking

The comparative evaluation documented in Section 6.0 of this EA Report identified Alternative Method 2 as the preferred Method for landfill expansion. The preferred Method consists of a separate footprint area of 14.3 ha to the west of the existing landfill footprint with an engineered base (liner) for containment. The height of this landfill cell reaches a peak of about 14 to 15 m above the existing ground surface. The shallow excavation to form the base of the landfill will involve a combination of cutting and filling, with a net soil surplus of about 66,000 m^3 available for daily cover and other Site requirements.

4 A carbon sink is a reservoir (e.g. oceans, plants, soil) that accumulates and stores some carbon-containing chemical compound for an indefinite period.

ES12. Monitoring and Contingency

The potential environmental effects associated with the construction, operations and maintenance phases of the proposed landfill expansion have been identified and are summarized in Section 9.0 of this EA Report. Proposed measures to mitigate these effects and monitoring activities to ensure that the mitigation measures are implemented effectively are also provided in Section 9.0.

An assessment of whether or not there would be any adverse or net effects to the environment after the application of mitigation measures was also completed. No net effects are anticipated after mitigation is applied with the exception of the generation of greenhouse gases; however, contingency plans have been developed and are included in Section 9.0 and shall be reviewed and refined as necessary as part of the *EPA* design phase of the Project to account for possible damage or disruption to normal operations of engineered systems (e.g., landfill liner system, leachate collection system and LFG system) that will be put in place for the Preferred Method. Contingency plans shall also be put in place should unanticipated effects be identified through any of the monitoring activities.