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St. Marys Future Solid Waste Disposal Needs Environmental Assessment Report

Volume I – Environmental Assessment Report

Town of St. Marys

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Town of St. Marys

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Record of Revisions

Revision	Date	Description
0	November 2019	Draft Submission
1	September 2020	Revised Draft Submission to MECP
2	December 2020	Revised Draft Submission to MECP
3	July 2021	Final EA Report Submission to MECP

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Executive Summary

ES1. Introduction

This document is the Environmental Assessment Report (EA Report) for the environmental assessment (EA) of the proposed expansion of the St. Mary's Landfill (also referred to as the Project herein) by the Town of St. Mary's (Town). This is an Individual EA completed under the *Environmental Assessment Act* (*EAA*), *1990*.

The existing St. Marys landfill site (herein referred to as St. Marys Landfill); located at 1221 Water Street South, St. Marys, Ontario, operates under Environmental Compliance Approval (ECA) No. A150203 dated June 24, 2010, issued by the Ministry of the Environment and Climate Change (MOECC)[1]. It has an approved capacity of 380,000 m^3 and receives post-diversion waste from within the Town. The St. Marys Landfill is a 37 ha site and was part of a former clay pit that was used by St. Marys Cement in cement manufacturing. The St. Marys Landfill contains an approved fill area of 8 ha. Site capacity (waste and daily cover) is currently consumed at a rate of approximately 13,500 m^3/year. The site reached its approved capacity in January 2016. To maintain operations during preparation of this EA, the Town applied for and received ECA Notices (amendments) allowing continued use. The current Notice allows operation through September 30, 2020. As required by the ECA, the Town will apply to the Ministry for further operation by July 31, 2020.

ES2. Terms of Reference

To respond to this need, the Town has prepared the Terms of Reference (TOR) for EA which is the first step in Ontario's EA process. The TOR was submitted to the MOECC (now Ontario Ministry of the Environment, Conservation and Parks (MECP)) and approved by the Minister on December 29, 2014. This EA Report has been prepared in accordance with the approved TOR.

ES3. Purpose

The problem which will be addressed through this EA is as follows:

The Town of St. Marys must identify a solution that addresses the Town's post-diversion municipal solid waste disposal needs over a 40-year planning period in a technically and economically feasible manner while minimizing impacts to the environment.

It was calculated that the 40-year planning period would require 708,000 m^3 of waste and operational cover disposal capacity.

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[1] The Ministry of the Environment and Climate Change was renamed the Ministry of the Environment, Conservation and Parks in 2018. In this document, MOECC is referenced as the author on materials published prior to 2018. MOECC is also referenced as the name of the ministry consulted throughout the TOR and much of the EA process. MOECC and MECP are considered synonymous.

ES4. Environmental Assessment Process

In Ontario, waste management projects are governed by O. Reg. 101/07, known as the Waste Management Projects Regulation. According to Part II of the regulation, any new landfill site with a capacity over 100,000 m^3 or any changes to an existing landfill site that result in additional volume over 100,000 m^3 is subject to Part II of the *Ontario Environmental Assessment Act* (EA Act), and, as such, is required to undergo an Individual EA.

In this case, the Town undertook some initial planning work prior to commencement of the EA. Work included a pre-screening of the *Alternatives to the Undertaking*. This work was refined during the TOR process. In accordance with Section 6.1(3) of the EA Act, and since some studies had occurred prior to initiating the EA process and the Town had proceeded through some of the initial stages of the project planning process, the Town has completed a focused EA.

ES5. Alternatives to the Undertaking and Screening Process

Section 6.1(3) of the Environmental Assessment Act (EA Act) allows for an EA with a narrow scope, commonly referred to as a “focused EA”. The TOR outlined why this was deemed appropriate. In summary, the Town of St. Marys undertook some initial planning work prior to commencement of the EA. Work included a pre-screening of the *Alternatives to the Undertaking*.

The EA is scoped to focus on the *Alternatives to the Undertaking* which were remaining after the pre-screening exercise. These Alternatives include:

- Do Nothing (required by EA Act);
- Landfilling at an Expansion of the Existing Landfill Site in St. Marys; and
- Exporting Waste to Another Jurisdiction.

ES6. Evaluation of Alternatives to the Undertaking

ES6.1. Exporting Waste to Another Jurisdiction

In order to collect data to support the evaluation of the *Waste Export Alternatives*, the Study Team developed two surveys, one for municipalities and one for private waste haulers, transfer station and landfill operators. The survey asked whether the municipality would be interested in accepting St. Marys’ waste. A follow-up question asked how the Respondent’s response had been determined.

Of the 14 municipalities who received a survey, 10 responded indicating that they would not be interested in receiving St. Marys’ waste. Four municipalities did not respond to the survey. Based on this information it was determined that export to another municipal landfill is not a feasible option. This municipal option was not considered any further in the study.

Of the six private landfill and transfer station operators contacted, five completed the survey. Of the nine waste haulers contacted, five provided responses. Based on the information provided, costs and ability to receive waste from St. Marys, the Twin Creeks Landfill in Watford and Carleton Farms Landfill in Michigan were identified to be the highest rated opportunities.

The Twin Creeks Landfill has at least 25 years of capacity remaining at the site; they have the willingness to negotiate a 25-year contract and it is relatively close distance from St. Marys. The Carleton Farms Landfill in Michigan has 75 years of capacity remaining at the site (this is the only landfill with sufficient capacity to fully address the 40-year needs of St. Marys) and has a low tipping fee (cost). However, for this option to be feasible, the Town would need to use a private hauler or deliver waste to a private transfer station with the necessary permissions/approval to transport waste across the border into Michigan.

Therefore, delivery to the Twin Creeks Landfill was determined to be the Preferred Alternative for waste export. This *Alternative* was carried as *Alternative 1* in the evaluation of the *Alternatives to the Undertaking*.

ES6.2. Description of the Existing Environment

Built Environment

Existing St. Marys Landfill

Prior to the development of the landfill, the property was licensed by the Ministry of Natural Resources as part of the St. Marys Cement Co. (SMC) quarry. The Site was approved in 1983, and landfilling began in December 1984 in the area known as Phase I. Phase I was completed and finished with final cover in the summer of 1993 (CRA, 2012). Phase II/III was approved in 1992.

The Site is now a 37-ha waste disposal Site with an 8-ha landfill area. Waste for disposal is accepted from the Town of St. Marys only. Phase I had a volume of 104,000 m^3 and Phase II/III has an approved volume of 330,050 m^3, giving the Site a total approved capacity of 434,050 m^3. The ECA has been amended several times to allow continued operation during the preparation of this EA. Fill placed since December 31, 2016 is considered part of the 40-year planning period of this EA.

The northeast portion of the landfill property was purchased by the Town from St. Marys Cement in 2009. The land in this area contains a Cement Kiln Dust (CKD) stockpile from historic St. Marys Cement operations. The CKD stockpile has been in place for approximately 30 years.

The existing landfill access operates under stop control at its intersection with Perth Road 123.

Leachate Collection

The Phase I leachate collection system is a perimeter system consisting of perforated collector pipes connected between manholes. It was installed as a contingency system to control mounding within the waste. The Phase II/III collection system incorporates perimeter collectors as well as lateral collectors passing beneath the waste. Leachate is directed to the Town's wastewater treatment plan (WWTP). The actual amount of leachate directed to the WWTP is small relative to the capacity of the plant. It is estimated that Phase I and Phase II/III produce an average of 24.5 m^3/day of leachate. By comparison, the St. Marys Wastewater Treatment Plant (WWTP) has a Rated Capacity of 5,560 m^3/day. This means the landfill leachate is approximately 0.4% of the WWTP's rated capacity.

There is current no landfill gas collection system in place.

Topography and Drainage

The highest elevation on the Site today is the cement kiln dust (CKD) stockpile at around 334 m amsl at its highest point. The elevations of the fill areas are approximately 327 m for Phase I and 326 m amsl in Phase II/III. The lowest elevations on the Site occur along the watercourse. This channel enters the east side of the Site at an elevation of approximately 310 m amsl and exits at the northwest end below 309 m amsl.

Surface water from the complete landfill areas is directed through a series of perimeter ditches and swales around the landfills and along the interior roadways. The ditches and swales convey the runoff to two stormwater retention basins. These stormwater basins attenuate the peak flows during storm events and allow sedimentation. The stormwater basins outlet to the watercourse via control features. The watercourse leaves the Site by a culvert under Perth Road 123. It eventually discharges into the Thames River, approximately 500 m downstream of the Site.

Social and Cultural Environment

Population, Land Use and Socio-economic Conditions

The Town of St. Marys has a population of a 7,265 according to the 2016 Census. Between 2011 and 2016, the Town population changed from 6,655 to 7,265 (Statistics Canada, 2016).

The landfill property is identified as an Environmental Constraint area, in accordance with the Town's Official Plan. The site is surrounded by the St. Marys Cement plant to the northeast and northwest, agricultural fields to the south and a number of rural residences (there are 16 rural residences within 120 m of the landfill) and farms to the west.

The landfill currently employs one full-time staff position, one part-time staff position and six staff who work occasionally, as required. Economic drivers in the Study Area primarily include the St. Marys Cement operation and agricultural uses to the south and west of the landfill site. The Town's economic stability is strengthened by the presence of this industry as well as a strong agricultural sector.

Archaeological and Cultural Heritage Features

There are no known archaeological sites on, or in the vicinity of, the landfill property. One Built Heritage Resource, a residence, located at 481 Water Street South is present approximately 1 km north of the landfill site. The residence is designated under Part IV of the *Ontario Heritage Act*.

Treaties and Traditional Territory

The St. Marys Landfill is within the lands covered by Treaty 29 (1827). The modern signatories to this treaty, as well as The Haudenosaunee Development Institute (representing the Haudenosaunee Confederacy) and Six Nations of the Grand River Territory, were also contacted as they expressed interest due to the site's location within the area covered by the Nanfan Treaty.

Natural Environment

The Thames River is located approximately 250 m to the northwest of the site. An unnamed watercourse runs through the centre of the site and discharges to the Thames River. There is a large perched culvert along the drain at Water Steet, limiting fish migration from the Thames River into the drain. The Thames River provides habitat for a Species Concern mussel species, several kilometers downstream of the unnamed watercourse outlet. Farther downstream, additional critical habitat for an Endangered mussel species is also present.

The unnamed watercourse wraps around the south and west sides of the CKD stockpile. Water quality samples from the watercourse since 1985 (as part of the landfill monitoring) have not detected an impact from the landfill or the CKD stockpile.

Other natural features on, and around, the site are limited due to the nature of the existing landfill and the surrounding extraction operations.

Source Water Protection

The St. Marys Landfill is located in the Thames-Sydenham & Region Source Protection Area. Mapping supplied by the Upper Thames River Valley Conservation Authority showed that the landfill is not within any Wellhead Protection Areas or Intake Protection Zones for municipal water supplies. There are no Significant Groundwater Recharge Areas mapped on the site. An area in the northeast corner of the landfill site is mapped as Highly Vulnerable Aquifer.

Air Quality

The air quality around the facility is typical of a small landfill. There are residential receptors across the road on the west side of Water Street with more receptors further away to the north and south. The residents around the landfill infrequently complain about odours. Road dust is easily controlled and dust from the working face does not impact the neighbours. All contaminants meet their regulated criteria at the property line.

Twin Creeks Landfill

This site is operated under Environmental Compliance Approval (ECA) No. A032203.

Built Environment

The Twin Creek landfill is located outside of the community of Watford. The landfill began operation in 1972. The landfill property is 301 ha with an approved landfilling area of 101.8 ha with an approved disposal capacity of 26,508,000 m^3.

Land Use and Socio-economic Conditions

Surrounding lands are primarily agricultural with a small number of commercial properties located to the south, along Nauvoo Road. Employment levels at the landfill are unknown.

Archaeological and Cultural Heritage Resources

With the exception of the two cemeteries adjacent to the landfill, the presence of archaeological or cultural heritage resources is unknown. It is assumed that because the landfill has been approved any concerns with archaeological and cultural resources have been addressed.

Treaties and Traditional Territory

There are several Indigenous communities that may have constitutionally protected Indigenous or Treaty Rights associated with the Study Area, or a portion of it. These are the same communities which may have rights associated with the St. Marys Landfill property.

Traffic Conditions

The landfill is accessed through an entrance off County Road 79. The landfill currently results in 19 landfill-related vehicles per hour travelling along various haul routes.

Natural Environment

A watercourse, known as the Vankessel Drain runs from the landfill to the west, where it discharges to the Bear Creek system. Current water quality conditions in the Vankessel Drain are not known. Bear Creek is known to provide critical habitat for a number of endangered mussel species.

Source Water Protection

The landfill is not within any Wellhead Protection Areas (WHPA) or Intake Protection Zones (IPZ) for municipal water supplies. There is a large Significant Groundwater Recharge Area (SGRA) with a vulnerability score of 2 mapped east of the site and covers the southeastern part of the landfill property.

Air Quality

Ground level concentrations for the contaminants emitted at the Twin Creeks landfill do not exceed 50% of the MECP criteria and majority are well below 10% (2017). There were no odour complaints from the surrounding residents according to a 2017 report. However, there were several odour related complaints in 2018 and 2019. An addition of the waste from St. Marys Landfill will have little impact on the emissions considering the size of the Twin Creeks Landfill.

ES7. Phase 1: Evaluation of the Alternatives to the Undertaking

Evaluation Criteria

The evaluation criteria used to evaluate the Alternative to the undertaking, as defined in the TOR (with minor changes), are:

- Natural Environment:
  - Atmosphere (air quality, odour, noise, etc.);
  - Geology and hydrogeology;
  - Surface water (quality and quantity); and
  - Biology (terrestrial, aquatic).
- Cultural Environment:
  - Built Heritage Resources;
  - Cultural Heritage Landscapes; and
  - Archaeological Resources.
- Socio-Economic Environment:
  - Land Use;
  - Transportation Routes;
  - Employment Effects;
  - Economic Conditions; and
  - Aesthetics/Enjoyment of Life.

- Indigenous Connections to the Land:
    - Traditional and Historic Uses; and
    - Land Claims/Treaty Rights/Indigenous Rights.
- Financial Factors:
    - Capital Costs; and
    - Operational and Maintenance Costs.
- Technical Factors:
    - Technical Ability to Carry Out Each Alternative.

Using these criteria, a comparative evaluation was completed. With consideration to potential mitigation measures, the magnitude, frequency, duration, and reversibility of potential net impacts were identified.

Potential Net Effects of the Alternatives to the Undertaking

The evaluation of Alternatives to the Undertaking applied the criteria to the proposed Undertaking and Alternative 1. The potential impacts to each environmental component are identified, followed by measures which could be used to minimize effects. Net effects are then identified and described according to their magnitude, duration, frequency, and reversibility. The evaluation of net effects relative to Doing Nothing is presented in Table ES1.

Table ES1: Evaluation of Alternatives to the Undertaking

Criteria	Comparison to the Do Nothing Alternative	
	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Natural Environment		
Potential Impacts to Atmosphere	Equally Preferred	Preferred
Potential Impacts to Geology and Hydrogeology	Equally Preferred	Equally Preferred
Potential Impacts to Surface Water	Equally Preferred	Equally Preferred
Potential Impacts to Biology	Somewhat Less Preferred	Preferred
Cultural Environment		
Potential Impacts to Archaeological Resources	Equally Preferred	Equally Preferred
Potential Impacts to Built Heritage	Equally Preferred	Equally Preferred

Criteria	**Comparison to the Do Nothing Alternative**	
	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Potential Impacts to Cultural Heritage	Equally Preferred	Equally Preferred
Socio-economic Environment		
Potential Impacts to Transportation Routes	Equally Preferred	Less Preferred
Land Use	Preferred	Less Preferred
Employment Effects	Somewhat Preferred	Less Preferred
Economic Conditions	Equally Preferred	Less Preferred
Aesthetics/Enjoyment of Life	Somewhat Preferred	Preferred
Indigenous Connections to the Land		
Traditional and Historic Uses/Land Claims/ Indigenous and Treaty Rights	Equally Preferred	Somewhat Preferred
Financial Factors		
Capital and Operational Costs	Somewhat Less Preferred	Less Preferred
Technical Factors		
Technical Ability to Carry Out Each Alternative	Equally Preferred	Less Preferred
Overall Preference	**Somewhat Preferred**	**Less Preferred**

ES8. Preferred Undertaking

Based on this scoring and the advantages and disadvantages of each Alternative, it was determined that:

- Doing Nothing does not address the Town’s waste management needs and obligations and is not a feasible solution to the Problem Statement.
- Exporting waste to the Twin Creeks Landfill is preferred to expanding the St. Marys Landfill based on Natural Environment and Indigenous Connections to the Land criteria.
- Expanding the St. Marys Landfill is preferred based on Socio-economic criteria, Financial Factors, and Technical criteria.
- Both options were equally preferred based on Cultural Heritage criteria.

As such, based on cumulative scoring, the alternative to expand the St. Marys Landfill was found to be preferred.

ES9. Phase 2: Review of the Environmental Assessment Requirements

Under Ontario Regulation 101/07, the Waste Management Projects Regulation, landfill expansions in exceedance of 100,000 m^3 are subject to the Individual EA process under the EA Act. As the Town's waste disposal needs exceed this volume, this EA has continued using the scoped process identified in the Terms of Reference including the Evaluation of Alternatives Methods, the impacts and mitigation associated with the preferred Undertaking, consultation measures and commitments to additional actions to be taken during the design, operations, and final decommissioning of the landfill.

ES10. Phase 3: Redefine the Purpose and Rationale for the Undertaking

As it has been determined that expanding the St. Marys Landfill is the preferred solution, the Undertaking can be redefined to:

The expansion of the St. Marys landfill in order to provide the necessary capacity to fulfill the Town's post-diversion solid waste disposal needs for the next 40 years.

ES11. Phase 4: Define the Parameters of the Study

This Phase of the EA frames the parameters for the evaluation of Alternative Methods for Carrying out the Undertaking. The parameters of the study include:

- The *Alternative Methods* to be assessed;
- The Study Area;
- The timeframe to be considered;
- The evaluation criteria;
- The methodology for characterizing the existing environment; and
- The existing environment within which the Undertaking will be implemented.

ES11.1. Alternative Methods

Based on the consideration of a variety of design factors, the Study Team developed and identified five conceptual Alternative Methods summarized in Table ES.2.

Table ES.2: Summary of Alternative Methods

Alternative Methods		Description
	Do Nothing	As a requirement of the EA Act, the 'Do Nothing' Alternative must be considered. Do Nothing represent the result of no action being taken to address the Problem Statement and serves as a baseline against which other Alternatives can be compared.

Alternative Methods		Description
1	Vertical expansion of the existing landfill	This Alternative Method involves an expansion in the vertical direction within the existing footprint of the landfill.
2	Horizontal expansion of the existing landfill	This Alternative Method involves an expansion outside of the existing landfill footprint.
3	A combination of vertical and horizontal expansion	This Alternative Method would involve partial vertical expansion along with some horizontal expansion of the landfill footprint, basically a mixture of Methods 1 and 2.
4	Development of a new landfill footprint	This Alternative Method involves closure of the existing 8 ha footprint and development of a new landfill footprint elsewhere on the 37 ha Site.
5	Vertical expansion plus a new footprint	This Alternative Method is a combination of Alternative Methods 1 and 4.

Although each Alternative is technically feasible, Alternatives 1 and 4 do not provide sufficient volume to address the Town's landfill capacity needs. To meet the Town's waste disposal needs for the next 40 years, 708,000 m^3 of landfill capacity is required. Alternatives 1 and 4 provide only 500,000 m^3 and 397,000 m^3, respectively. Therefore, Alternatives 1 and 4 were discarded as feasible Alternatives as they do not fully address the Problem Statement.

ES12. Description of the Environment

ES12.1. Natural Environment

Air Quality

Following the MECP guidance documents, the emission rates of each contaminant were estimated and modelled using the current version of AERMOD as specified by the MECP. The results of that modeling show that the impact of each contaminant is below its respective criteria at every location along the property line and off-property. The contaminant with the highest off-property impact was particulate matter at 80% of the 24-hour criterion of 120 $\mu g/m^3$.

Noise

The existing impacts at sensitive receptors showed that the worst-case impact is well below the MECP's criteria during the day. The landfill does not operate at night.

Hydrogeology

The highest elevation on the Site today is the cement kiln dust stockpile (CKD) at 334 m amsl. The elevations of the fill areas are approximately 326 to 327 m. The lowest elevations on the Site occur along the watercourse. This channel enters the east side of the Site at an elevation of approximately 310.0 m amsl and exits at the north end under Water Street South at 306.8 m amsl. Perth County Road 123 is a topographic ridge on the west side of the Site and acts as a drainage divide. West of the ridge, runoff flows to the Thames River. East of the road, runoff is eastward toward the landfill stormwater retention basins and the watercourse.

The regional overburden is the result of successive glacial till and inter-till deposits. The overburden is primarily silt till. The regional water table slopes downward from the east toward the west. However, flow along major rivers are toward those rivers. Therefore, in the St. Marys area, flow in the overburden is toward Trout Creek and the North Thames River. On the bedrock surface there is a general downward slope from east to west with local variations. The bedrock surface in the St. Marys area is approximately 300 m amsl. Regional flow in the bedrock is generally east to west. Groundwater flow in the bedrock below the Landfill Site is from the east toward the west and northwest. The North Thames River is above the surface of the bedrock and above the water level in the bedrock. Therefore, there is no groundwater discharge to the river at this point in the river. On the Landfill Site, the water level in the bedrock is 10 to 15 m below the top of the bedrock. Therefore, the bedrock is not fully saturated and is not a confined aquifer.

On the west side of the Landfill Site, groundwater in the shallow soils moves east toward the watercourse. On the east side of the watercourse, groundwater is mounded below the cement kiln dust stockpile, creating radial flow out from the stockpile, toward the watercourse and the exposed edge of the quarry. Based on the report compiled by Golder Associates on the Cement Kiln Dust (CKD) stockpile (from historic SMC operations) and ground water monitoring in June 2019, it was concluded that the groundwater quality is not homogeneous throughout the stockpile. The groundwater quality at the southeast corner of the stockpile is considerably better than the quality in the centre. The groundwater quality data shows an overall improvement with concentrations of many parameters in 2019 compared to 2005.

Groundwater movement through the overburden is minimal at the Site. Therefore, groundwater is not a pathway for significant landfill leachate movement. The groundwater contributes little to the streamflow even when there is discharge to the watercourse. Water quality samples upstream and downstream are similar with little change to water quality through the Site.

Annual monitoring at the Site is conducted in accordance with the ECA. Samples of leachate, groundwater and surface water are collected in the spring and fall and analyzed for general chemistry, metals and volatile organic compounds (VOC). There is little indication of landfill impacts at the Site. This is due to the combination of the low permeable till and the leachate collection systems.

Source Water Protection

The Site is more than 1,000 m from the Wellhead Protection Areas (WHP-A to WHPA-C). Two of the supply wells are GUDI with an additional WHPA-E. The landfill is outside and downstream of the WHPA-E. There are no SGRA mapped on the Landfill Site. A small area in the northeast corner of the Landfill Site is within an HVA.

St. Marys Cement (SMC) has historically dewatered both the plant north of the landfill and the Thomas Street Quarry west of Perth Road 123. They have also used water supply wells on the plant site to provide processing water. Dewatering at the plant site quarry is expected to continue for the life of the landfill since the cement plant is located on the quarry floor. There are no plans for future dewatering locations. The well closest to the landfill is not currently in use.

Surface Water

The Site is within the Upper (North) Thames River Drainage Basin. The North Thames River lies northwest of the Site limits. Locally, the river flows in a southwesterly direction from St. Marys. The primary surface water features of the Landfill Site are the watercourse and the two stormwater management basins. The unnamed watercourse flows through the Site from the southeast corner to the northwest corner.

Clean surface water from the west side of the Site is directed through a series of perimeter ditches and swales around the landfill footprints and along the interior roadways. The ditches and swales convey runoff to two stormwater retention basins.

These stormwater basins attenuate the peak flows during storm events and allow sedimentation. Surface water collected from the cover of the completed Phase I is directed Basin A (north basin). Surface water collected from the completed stages and perimeter of Phase II/III is directed to Basin B (south basin). The stormwater basins outlet to the watercourse via control features.

Semi-annual surface water monitoring is conducted as part of the landfill monitoring program. Water samples are collected in spring and fall from the watercourse and the two stormwater management basins. The main water quality indicators have been chloride, total phosphorus, iron and TSS.

The chloride concentrations at the Basin A outlet range from 30 to 130 mg/L. Iron and total phosphorus concentrations at the outlet are sporadically above the PWQO. TSS levels have had a historical range of less than 10 mg/L. Chloride concentrations at the inlet are typically higher than the outlet and exceeded the Aquatic Protection Value (APV) of 180 mg/L on two occasions (August 2012 and November 2014). Iron and phosphorous have been elevated levels typically exceeding the PWQO at both sampling stations. TSS at the outlet has generally been below 50 mg/L with occasional spikes to 60 to 80 mg/L. The quality at the Basin A outlet is better than the quality from Basin B. The water quality of on-site watercourse is similar between upstream and downstream.

Biology

Both the On-site Study Area and Study Area Vicinity are significantly disturbed and include a high number of human-influenced features and landscapes.

All the vegetation communities identified are considered to be relatively common in Ontario, including both upland and wetland, and natural and cultural vegetation habitats.

- Dry-Fresh Graminoid Meadow (MEGM3): represents the majority of the Site. Cool season grasses, including Smooth Brome (*Bromus inermis*), Quack Grass (*Elymus repens*) and Fescue species (*Festuca sp.*) are the dominant vegetation type found throughout this community.
- Graminoid Mineral Shallow Marsh (MASM1)/Willow Mineral Deciduous Thicket Swamp (SWTM3): This mixed wetland represents the watercourse that extends from the northwest corner of the Site to the central east property limit, at the base of the slopes.
- Cultural Woodland: This community is located on the east side of the Site, growing on the south facing portion of the slope. The dominant trees, Eastern Cottonwood and Manitoba Maple (*Acer negundo*), represent early successional species.
- Cultural Hedgerows: There are three Cultural Hedgerows identified within the On-site Study Area: one at the west limit and the other along the south property limit. The hedgerow at the west limit is predominantly White Spruce that has been planted to screen the landfill from Water Street South and the adjacent residences. Large deciduous species of Eastern Cottonwood and Green Ash are also found in the hedgerow, as well as groupings of Common Buckthorn. The hedgerow at the south property limit is dominated by Manitoba Maple with meadow groundcover in the base in the western portion of the community. The third hedgerow is located at the northwest corner of the site, adjacent to the rural residence. It is comprised of a mix of mid-aged Eastern White Cedar, Black Walnut (*Juglans nigra*), Norway Spruce (*Picea abies*).
- Fresh-Moist Lowland Deciduous Forest (FODM7) (Study Area Vicinity): This forest is located on the east side of the Thames River and is dominated by Willow with associates of White Elm (*Ulmus americana*) and Manitoba Maple.

There are no Significant Wetlands, Woodlands, Valleylands or ANSIs in the On-site Study Area; however, some of these features are present in the Study Area Vicinity. Significant Woodlands and Valleylands are associated with the Thames River and the treed areas along its banks. The St. Marys Cement Company Provincially Significant Earth Science ANSI is located west of the Thames River within the Study Area Vicinity. No other ANSIs were identified within the Study Area Vicinity.

Four bird species listed as either provincially and/or federally significant were observed within the On-site Study Area during the breeding bird surveys: Bald Eagle, Bank Swallow, Barn Swallow, and Eastern Meadowlark. Bald Eagle was a flyover observation only; no key habitat features required by this species are present at the Site. Nesting and foraging habitat for Eastern Meadowlark was confirmed in the Study Area with the suitable nesting habitat at the two capped areas of the landfill (not currently active areas of the landfill operations).

Potential hibernation habitat for Midland Painted Turtle may be present within the existing watercourse. Three species of snakes were observed under cover board materials or materials adjacent to cover boards: Dekay's Brownsnake (*Storeria dekayi*), Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) and Eastern Milksnake. Based on these observations, it is highly likely that reptile hibernaculum is present within the landfill limits.

Eight terrestrial crayfish burrows were incidentally observed during breeding bird surveys/snake cover board surveys. The burrows were observed at the edges of damp Common Reed pockets that have established in the area northwest of the capped cement kiln dust pile.

Two Monarch butterflies (*Danaus plexippus*) were recorded in the cultural meadow of the On-site Study Area during the site visit. The presence of Common Milkweed (*Asclepias syriaca*), which serves as both host (caterpillar) and nectar (food source) plant, indicates that suitable habitat for this species is present within the On-site Study Area. Other wildflower nectar sources also support the species. Monarch is listed as Special Concern under the ESA, 2007.

Several incidental observations of mammals were documented during the field investigations. None of these species are listed as provincially and/or federally significant; all are considered to be common, widespread, and abundant in the province.

Based on the species observed and ecosystems present, several types of Significant Wildlife Habitat (SWH) have been confirmed present or are potentially present and identified as "Candidate Habitat". Candidate and confirmed SWH present in the On-site Study Area and Study Area Vicinity are identified in Table ES.3.

Table ES.3: Candidate and Confirmed SWH present in the On-site Study Area and Vicinity

On-Site Study Area	Study Area Vicinity*
Seasonal Concentration Areas of Animals	
Candidate Reptile Hibernaculum	• Candidate Raptor Wintering Area • Candidate Bat Maternity Colonies • Candidate Turtle Wintering Areas • Candidate Reptile Hibernaculum
Specialized Wildlife Habitat	
None present	• Candidate Bald Eagle and Osprey Nesting, Foraging and Perching Habitat • Candidate Turtle Nesting Areas

On-Site Study Area	Study Area Vicinity*
	• Candidate Amphibian Breeding Habitat (Woodland)
Habitat of Species of Conservation Concern	
Confirmed Terrestrial Crayfish	Candidate Terrestrial Crayfish
Confirmed Special Concern and Rare Wildlife Species: • Monarch (SC) Other: • Eastern Milksnake (formerly listed as SC under SARO; listed as SC under COSEWIC and SARA)	Candidate Special Concern and Rare Wildlife Species: • Bald Eagle • Common Nighthawk • Eastern Wood-pewee • Red-headed Woodpecker • Wood Thrush • Monarch • West Virginia White • Eastern Milksnake • Eastern Ribbonsnake • Northern Map Turtle • Snapping Turtle • Northern Brook Lamprey
Animal Movement Corridors	
None present	Candidate Amphibian Movement Corridors

With the exception of one “Common” Crayfish, no fish were visually observed or captured during the aquatic assessment and fish presence survey. The watercourse on-site does not contain or provide habitat for any fish SAR. However, because the subject watercourse is connected upstream to the Sgariglia Drain, and downstream to the Thames River, it is considered to be indirect fish habitat and contributes to the water quality and quantity of the Thames River. Since the Thames River is known to provide fish habitat and habitat for several aquatic SAR, the proposed works must avoid causing a HADD (as described in the Fisheries Act) to the downstream habitat in the Thames River.

ES12.2. Cultural Environment

Built Heritage Resources and Cultural Heritage Landscapes

12 cultural heritage resources were identified within the Study Area Vicinity. Of these, 11 are Cultural Heritage Landscapes and one is a Built Heritage Resource. No cultural heritage resources were identified within the On-site Study Area. The closest resources to the Landfill Site are the St. Marys Cement Plant. A resource identified (farm property) on Water Street is directly adjacent to the landfill and surrounded by the landfill property on it northern, eastern, and southern borders.

Archaeological Resources

A Stage 1 Archaeological Assessment determined that no previously registered archaeological sites are located within 1 km of the Study Area. A property inspection conducted by a registered archaeologist determined that the entire On-site Study Area has been subject to deep and extensive land disturbance and, as such, is considered to not retain archaeological potential.

ES12.3. Socio-Economic Environment

Population – The Town of St. Marys has a population of a 7,265 according to the 2016 Census. Between 2011 and 2016, the Town population changed from 6,655 to 7,265 (Statistics Canada, 2016).

Land Use – The Town of St. Marys, located on the banks of the Thames River in southwestern Ontario, has a thriving tourism sector and places significant importance on its natural and cultural heritage sites. The landfill property is located along the southwestern edge of the Town, bordering the Township of Perth South in the County of Perth. Adjacent lands therefore span multiple jurisdictions. According to the Town of St. Marys Official Plan, the landfill property is identified as an Environmental Constraint area. Surrounding land uses within the Town include Extractive Industrial uses to the north, northeast and west that encompass the operations of St. Marys Cement. The small residential property immediately to the west of the landfill is zoned as Development. Currently, no properties have been assigned this zone as no future developments are proposed in close proximity to the landfill[3].

Land use related conflicts, including odour, noise and dust concerns, between residents and landfills are not unusual. Town complaint summaries indicate that odour issues are influenced by wind direction (from the east or northeast) following wet site conditions. Annual Monitoring Reports (AMRs) have been prepared since landfill operations began in 1984 and monitoring events are completed twice a year; in the Spring and in the Fall, in compliance with the Site's Environmental Compliance Approval (ECA). No monitoring results in the last five years have indicated that operations at the facility have impacted on recreation, enjoyment of private property or neighboring businesses, including agricultural and quarrying industries. However, correspondence received during the development of the TOR revealed that odours from current landfill operations were deterring customers and negatively impacting sales at a neighbouring farm.

Traffic – The St. Marys Landfill access is a semi-paved tar and chip driveway, located on the east side of Perth Road 123. The landfill site access is stop-sign controlled and forms a T-intersection with Perth Road 123. All traffic into and out of the site uses this

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[3] Since the beginning of this EA study, a number of new residential units have been built mostly concentrated near the entrance to the landfill site, filling in some of the gaps between existing residences.

entrance. Perth Road 123 is a two-lane arterial road under the jurisdiction of the County of Perth. It has a posted speed of 80 km/h in the area of the landfill access. Perth Road 123 becomes Water Street South, a road under the jurisdiction of the Town of St. Marys, at a location about 470 m to the north of the landfill access. Water Street South has a posted speed of 50 km/h. There are no new developments or planned road improvements in the Study Area that may impact traffic on Perth Road 123 or Water Street South near the landfill. There are no existing traffic concerns associated with the entrance or major access routes to the landfill.

Economic Conditions

Economic drivers in the Study Area primarily include the St. Marys Cement operation and agricultural uses to the south and west of the Landfill Site. St. Marys Cement is a key industry for the Town.

In 2016, the employment rate for St. Marys was at 64.8% and the unemployment rate was at 2.5% this is much better than Ontario as a whole. In 2016, 25.6% of St. Marys labour force was employed in management occupations, educational and social services, business and finance, or as health care practitioners. Statistics obtained from the Town's Community Based Strategic Plan (2010), suggests that the Town has a higher percentage of income earners between $30,000 and $99,999 when compared to other regions (Perth, Stratford and the GTA) but lags in the percentage of households earning $100,000 or over.

There are currently eight persons employed at the existing landfill ('as occasionally needed' positions). The Town of St. Marys 2016 budget attributed total staff salary for these employees as approximately $106,000. Continued employment of these individuals provides stability for local employment and the economy.

Social Conditions

In total, there are 16 residences within 120 m of the landfill and 44 residences within the 1 km Study Area Vicinity. The Study Area Vicinity is characterized by industrial uses and a small number of houses and businesses. Several commercial and light industrial businesses are present along James Street South, east of St. Marys Cement. There are no community spaces, public parks or other social services provided in the Study Area Vicinity.

ES12.4. Indigenous Connections to the Land

Indigenous peoples made use of the lands in the Study Area for thousands of years before the European contact. The Thames River was of particular importance as a travel and trade route and source of fish. There are several Indigenous communities that are believed to have constitutionally protected Indigenous or Treaty Rights (or both) associated with the Study Area, or a portion of it.

Phase 5: Assess Alternative Methods for Carrying Out the Undertaking

ES12.5. Evaluation Criteria

The criteria used in this evaluation are similar to those used in the Evaluation of Alternatives to the Undertaking.

ES12.6. Natural Environment

Air Quality and Odour – The maximum Point of Impingement (POI) concentrations were calculated based on the operating conditions where all significant sources are operating simultaneously at their individual maximum rates of production. All the predicted POI concentrations for contaminants were predicted to be below the acceptable levels according to the Air Contaminants Benchmarks (ACB) List, 2018. Odour impacts are at levels generally considered acceptable. The model indicates that the receptors generally do not exceed 6 Odour Units (OU) which is the level at which odour complaints are received. The frequency of this is less than 0.5% at all receptors. The preferred alternative, Alternative Method 3, shows the highest impact but the impact is still at acceptable levels.

Noise – The existing operation, assuming the worst noise emissions possible, shows compliance with the MECP criteria of 55 dBA during the day. Under all five *Alternative Methods*, the noise impact at all receptors is also less than the MECP criterion of 55 dBA. No net effects associated with noise are expected. General mitigation measures will be followed during construction and operation.

Hydrogeology – Each Alternative Method was evaluated according the how it would alter the Site. The alterations included, for example, height of the waste mound, waste footprints, topography and slopes, and stormwater and leachate controls.

The effect of each alteration was then considered on Leachate Generation, Groundwater Quality and Groundwater quantity. It was noted that some impacts could be positive such as increasing the buffer distance between waste and property boundary. A detailed comparison was done for the Hydrogeology Study Volume III, Appendix C.

Mitigation measures were assigned to each negative effect. It is possible to mitigate the effects by monitoring, changing operations, extending current engineering controls (LCS) or adding new engineering controls (full liner). Therefore, while none of the alternatives would have a net effect, each had varying magnitudes of mitigation measures.

Therefore, to differentiate Alternatives, each effect and the associated mitigation measure was ranked according to the perceived magnitude. The magnitude was based on both the potential severity of the effect and the scale of the mitigation measures needed to address it. The Alternative Methods were then ranked according to number of effects (positive and negative) and severity of impact and mitigation.

Surface Water – Each Alternative Method was evaluated according to how it would alter the Site. The alterations included, for example, height of the waste mound, waste footprints, topography and slopes, and stormwater and leachate controls.

The effect of each alteration was then considered on Surface Water Quality and Quantity. It was noted that some impacts could be positive such as increasing the buffer distance between waste and surface water features. A detailed comparison was done for the Hydrogeology Study Volume III, Appendix C.

The Alternative Methods were then ranked according to number of effects (positive and negative) and severity of impact and mitigation.

Biology – In the On-Site Study Area, the only natural features present are:

- Candidate Reptile Hibernacula;
- Habitat for Terrestrial Crayfish, Monarch and Eastern Milksnake, all of which are Considered to be rare species;
- Nesting habitat for Eastern Meadowlark, a Threatened species;
- Foraging habitat for barn swallow and bank swallow, both Threatened species; and
- Fish habitat.

Several other natural features are present in the Study Area Vicinity. Only a small number have the potential to be affected by the Undertaking as they are downstream of the site along the Thames River. These include:

- Turtle Wintering Areas;
- Turtle Nesting Areas;
- Amphibian Breeding Habitat (Woodland);
- Habitat for Terrestrial Crayfish; and
- Fish Habitat.

Under baseline conditions (i.e., the Do Nothing Alternative), there are a small number of natural features present, all of which have been disturbed to varying extents by the existing landfill and surrounding land uses. After mitigation has been applied, the net effects of all of the Alternatives are expected to be limited.

Any habitats lost will be recreated through additional plantings either on the Site or another nearby location. Thus, no net effects are anticipated with the exception of habitat for terrestrial crayfish. This habitat is difficult to recreate and thus some alternatives will result in a net loss of this habitat.

In the long-term it is expected that aquatic habitat will improve with Alternatives in which the watercourse is relocated.

All impacts to downstream fish and wildlife habitat can be appropriately mitigated with sediment and erosion control measures and measure to minimize the impacts of in-water works.

ES12.7. Cultural Environment

Potential Impacts to Built Heritage Resources – There is one Built Heritage Resource present in the Study Area Vicinity, located at 481 Water Street South. No impacts are anticipated. No visual connection and no impacts are anticipated with respect to any of the Alternative Methods. No mitigation is required, and no net effects are anticipated.

Cultural Heritage Landscapes – There are 11 cultural heritage landscapes located within the Study Area Vicinity. Of these, two are directly adjacent to the landfill. The St. Marys Cement Plant Industrial Complex is located to the west. Any impacts to the feature from any of the Alternative Methods are considered minimal, given the industrial nature of the resource.

The farmscape located at 1025 Water Street South is directly adjacent to the landfill. As cultural landscapes are designated based on the perception of scenes and landscape view, visual impacts from adjacent land uses can be detrimental. Other Cultural Heritage Landscapes are also present in the Study Area Vicinity, including farm and streetscapes which may have a view of the landfill. It was therefore assumed that any alternative with a higher elevation could potentially have a greater impact than alternatives at a lower elevation. Alternative 5 will have elevations that are higher than the existing peak height of the landfill. Alternative 3 is only slightly higher (2 m higher than existing peak) and Alternative 2 offer a design that is lower than existing landscape features and will thus have a more minimal effect on the overall landscape.

With appropriate visual screening, including boundary tree plantings, impacts to views can be minimized. During detailed design, a Cultural Heritage Impact Assessment will be required to further assess impacts and identify additional mitigation measures with all cultural heritage resources.

Archaeological Resources – There are no previously registered archaeological sites located within the Study Area Vicinity. The On-Site Study Area offers no archaeological potential, given its past and current disturbances. As such, no archaeological resources are present and no impacts to archaeological resources are anticipated with respect to any of the Alternative Methods. Mitigation to address the discovery of unexpected artifacts will be implemented. With this no net effects are anticipated.

ES12.8. Socio-Economic Environment

Land Use – None of the Alternatives changes the land use designation of the Site. Compatibility with surrounding land uses remains unchanged. A landfill is compatible with adjacent aggregate operations and rural landscapes. Some occasional conflicts with nearby residents can be expected. The Township of Perth zoning by-law does not include appropriate restrictions for adjacent land uses. The need for restrictions applies to all Alternative Methods. With the application of appropriate zoning measures, no net effects associated with land use are expected.

Transportation Routes – None of the Alternatives is expected to increase the amount of waste generated or transported to the landfill, with the exception of small increases as the Town's population grows. All Alternatives will continue to be accessed through the existing entrance off Water Street which is sufficient to meet traffic demands through 2059 and beyond. No effects on traffic are expected and no mitigation is required. No net effects are expected.

Employment Effects – No changes to the staffing at the landfill are expected for any of the Alternatives. A small number of additional short-term temporary positions may be required during construction. No effects on employment are expected. No mitigation is required, and not net effects are anticipated.

Economic Conditions – It is expected that small businesses that are currently serviced by local curbside waste pick up will not have any service changes. Businesses that currently use a private waste collection service will likely continue to do so. As such, none of the Alternatives will have an effect on businesses. No mitigation is required, and no net effects are expected:

- *Aesthetics and Enjoyment of Life* – Under baseline conditions some complaints have been received in recent years due to odour and dust concerns. The number of complaints is not considered to be out of the ordinary with respect to landfill operations and are typically addressed quickly. No changes from baseline conditions are expected for lower elevation Alternatives (i.e., Alternatives 2 and 3). Net effects may be expected for Alternative 5 which can be improved through existing and additional visual blockages that can be erected as part of the new landfill design. Additional berms and tree plantings may not be sufficient to fully block Alternatives with a higher elevation. All noise, odour and air quality related net effects are expected to be low and below provincial emission limits.

ES12.9. Indigenous Connections to the Land

Under baseline conditions lands historically used by Indigenous communities have been subject to aggregate extraction and landfilling for nearly a century, removing any potential for traditional use.

Impacts to Traditional Uses, Land Claims and Treaty and Indigenous Rights are not quantified as these impacts are difficult to measure. However, it is noted that there will be no opportunity to return lands to a condition under which they could be used for traditional uses in the short-term.

ES12.10. Financial Factors

Capital Costs – The cost for capital works was estimated to be $7,360,000 based on the conceptual design of Alternative Method 3 – a combination of vertical and horizontal expansion. The expanded footprint is approximately 3.6 ha, meaning that much of the Site's existing base, with its leachate collection system, can be utilized for the expansion.

Compared to Alternative 3, the remaining Alternatives are assumed to have a higher or lower capital cost:

- Alternative Method 2 is a horizontal expansion. It is expected that this horizontal expansion will require a new base area of approximately 7.0 ha. The larger footprint still requires the relocation of the existing watercourse. It will also require additional ditching and a larger stormwater management pond to control the larger footprint.
- Method 5 eliminates the need for additional EA Planning Period capacity, but it is inefficient from a capital cost perspective for the same reasons mentioned for Methods 1 and 4. Verses the baseline cost estimate, the only savings is that the watercourse realignment is not required. Overall, Method 5 is expected to be costlier than Alternative 3.

Operational and Maintenance Costs

For most operational items during the Site's lifespan or following closure, there is essentially no difference between the Alternative Methods. Staffing and equipment requirements, and monitoring are expected to be the same. The differences are related to items like quantity of leachate requiring disposal and maintenance requirements. A smaller waste footprint generates less leachate than a larger footprint and a larger footprint will require more maintenance than a smaller footprint. The operation and maintenance cost was estimated to be $17,500,000 based on the conceptual design of Alternative Method 3 – a combination of vertical and horizontal expansion.

Compared to the Alternative 3 operations and maintenance costs:

1. Alternative Method 2 is a horizontal expansion. This expansion requires approximately 7.0 ha of new landfill footprint. There will therefore be more length of leachate and stormwater facilities as well as more leachate generated than would be anticipated by the baseline operational cost estimate.

2. Alternative Method 5 is a vertical expansion plus a new footprint that's up to 6.1 ha. Compared to the baseline operational costs, there is more leachate requiring disposal and the maintenance required for the leachate and stormwater systems will be higher as well. As a result, Method 5 is expected to cost more than the baseline for operations.

ES12.11. Technical Factors

Landfill expansion requires extensive permitting and approvals through a variety of agencies. All Alternatives will require completion of this EA followed by MEPC authorization with an Environmental Compliance Approval (ECA) related to landfill operations, stormwater controls and the leachate collection system. All Alternatives will also require completion of further studies with respect to Cultural Heritage Landscapes and acceptance of a Cultural Heritage Impact Assessment from MTCS. Differences lie in the permitting required in relation to natural features.

With respect to ease of engineering, all Alternatives are technically feasible. The infrastructure and engineering requirements differ for each Alternative, with Alternatives 3 and 5 requiring more extensive infrastructure upgrades.

ES12.12. Preferred Method for Landfill Expansion

A full evaluation of the alternative methods was undertaken. Scoring was based on quantitative measures where possible. For many criteria (e.g., technical factors), impacts were based on qualitative assessment and professional experience.

Based on this scoring and the advantages and disadvantages of each alternative it was determined that:

- Alternative 3, expanding the landfill using a combination of vertical and horizontal expansion was Preferred, Somewhat Preferred of Equally Preferred in all major categories (Natural Environment, Cultural Environment, Socio-economic Environment, Indigenous connections, Financial and Technical).

Overall, expanding the St. Marys Landfill both vertically and horizontally, per Alternative Method 3, is preferred. A summary of net effects is provided in Table ES.4.

Table ES.4: Evaluation of Alternative Methods

Criteria	Comparison to the Do Nothing Alternative		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Natural Environment			
Potential Impacts to Air Quality	Equally Preferred	Equally Preferred	Equally Preferred
Potential Effects due to Odour	Equally Preferred	Less Preferred	Somewhat Less Preferred
Potential Effects of Noise	Equally Preferred	Equally Preferred	Equally Preferred

Criteria	**Comparison to the Do Nothing Alternative**		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Potential Impacts to Groundwater	Equally Preferred	Equally Preferred	Less Preferred
Potential Impacts to Surface Water Quality	Somewhat Preferred	Somewhat Preferred	Equally Preferred
Potential Impacts to Surface Water Quantity	Equally Preferred	Equally Preferred	Equally Preferred
Potential Impacts to Biology	Somewhat Less Preferred	Preferred	Less Preferred
Cultural Environment			
Potential Impacts to Built Heritage Resources	Equally Preferred	Equally Preferred	Equally Preferred
Potential Impacts to Cultural Heritage Landscapes	Equally Preferred	Somewhat Less Preferred	Less Preferred
Potential Impacts to Archaeological Resources	Equally Preferred	Equally Preferred	Equally Preferred
Socio-economic Environment			
Potential Impacts to Transportation Routes	Equally Preferred	Equally Preferred	Equally Preferred
Land Use	Somewhat Preferred	Preferred	Somewhat Preferred
Employment Effects	Somewhat Preferred	Somewhat Preferred	Somewhat Preferred
Economic Conditions	Equally Preferred	Equally Preferred	Equally Preferred
Social Conditions	Equally Preferred	Equally Preferred	Equally Preferred
Indigenous Connections to the Land			
Traditional and Historic Uses/Land Claims/Indigenous and Treaty Rights/ Environmental Concerns	Equally Preferred	Equally Preferred	Equally Preferred

Criteria	**Comparison to the Do Nothing Alternative**		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Financial Factors			
Capital and Operational Costs	Less Preferred	Somewhat Less Preferred	Less Preferred
Technical Factors			
Technical Ability to Carry Out Each Alternative	Preferred	Somewhat Preferred	Preferred
Overall Preference	**Somewhat Preferred**	**Preferred**	**Less Preferred**

ES13. Climate Change

Effect of the Preferred Alternative on Climate Change

The landfill's impact on climate change is most directly linked to the fugitive emissions of landfill gas (LFG). This is created by the decomposition of the waste in the landfill. LFG is roughly half carbon dioxide (CO_2) and half methane (CH_4) with a small percentage of other gasses. Ontario Regulation 232/98 under the *Environmental Protection Act* states that landfill sites containing 1.5 million cubic meters (1.5 Mm^3) of landfill capacity or more are required to install an LFG capture and destruction system. Preferred Alternative for the facility expansion (over the 40-year EA Planning Period), averaged over the Site's life, would contribute approximately 0.24% of Ontario's annual solid waste related GHG emissions and approximately 0.001% of the total annual GHG emissions from Ontario. In the national context, expanded landfill will contribute approximately 0.004% of Canada's annual solid waste related GHG emissions, or approximately 0.0003% of the country's total annual GHG emissions.

Effect of Climate Change on the Preferred Alternative

Increased severity of storm events, more intense but less frequent 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 capture volume for ditches and ponds, as well as additional erosion protection as more intense storm events result in higher flow velocities across the landfill cover, in ditches and swales and at discharge points.

The design of the Preferred Alternative will address the MECP design criteria for approval for an ECA under the OWRA, in addition to the landfill-specific requirements in

O. Reg. 232/98. Additional storage areas will be added to the existing stormwater management system to satisfy quantity and quality requirements for the Preferred Alternative.

Climate Change should also be considered in the Site's design. Ensuring the maximum slope is no greater than 25% (4 m run for every 1 m rise, or 4:1), as required by O. Reg. 232/98, will help to mitigate this Climate Change effect.

There may be changes in the precipitation patterns that result in less frequent yet more intense rain. If this occurs as expected, leachate generation could be reduced. Intense rain events result in more runoff than infiltration.

Climate Change results in an increase in the amount of materials being received at landfills in the form of food waste (i.e., from power outages), clean-up debris, construction and demolition debris and reconstruction scrap. Based on an incorporated U.S. Army Corps of Engineers debris model for a single Category 1 hurricane, approximately five months or 1% of additional capacity could be utilized in dealing with the storm debris.

ES14. 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 the Study Area Vicinity.
- 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 Applicable review agencies and organizations (federal, provincial, municipal governments, conservation authority and utilities).
- Circulation of Notices to individuals that signed in at project Public Information Centres (PICs).
- Notices published in local newspapers.
- Notices on the Town's website (https://www.townofstmarys.com/en/living-here/Landfill-Environmental-Assessment.aspx).
- Posting of EA documents on the Town's website.
- Hosting of two PICs.
- Four meetings and several telephone calls between Town and the MECP.

- One meeting with HDI.
- 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.

The consultation activities are described in Section 9.0 of this EA Report with complete documentation provided in Record of Consultation.

ES15. Monitoring and Contingency

Construction, operation and decommissioning of the landfill expansion are expected to result in a number of impacts to the natural, cultural, social and built environments. Potential impact resulting from the *Undertaking*, mitigation measures and net effects are identified in Section 8.0 (Table 8-). Monitoring requirements and contingency measures have also been identified to ensure that:

- Predicted net effects are not exceeded;
- Unexpected negative effects are addressed; and
- Predicted mitigation effects are realized.

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Volume II – Work Plans
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(Note: Work Plans were provided as draft reports only. Comments provided by agencies, Indigenous communities and the public were directly incorporated into the implementation as described in Volume I, Section 10.0, Consultation Summary)

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Glossary of Abbreviations

ASI	ASI Archaeological & Cultural Heritage Services
BRA	Bluewater Recycling Association
CKD	Cement Kiln Dust
CH_4	Methane
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide Equivalent
DFO	Department of Fisheries and Oceans Canada
EA	Environmental Assessment
ECA	Environmental Compliance Approval
ESA	*Endangered Species Act*
e-waste	Electronic Waste
GHG	Greenhouse Gas
IC&I	Industrial, Commercial and Institutional
INAC	Indigenous and Northern Affairs Canada (former organisation)
LFG	Landfill Gas
MHSW	Municipal Hazardous and Special Waste
MNRF	Ministry of Natural Resources and Forestry
MECP	Ministry of the Environment, Conservation and Parks
MOECC	Ministry of the Environment and Climate Change (former name of MECP)
MTCS	Ministry of Tourism, Culture and Sport
PIC	Public Information Centre
SAR	Species at Risk
SMC	St. Marys Cement
SWH	Significant Wildlife Habitat
TOR	Terms of Reference
TOWN	Town of St. Marys
UTRCA	Upper Thames River Conservation Authority
WTE	Waste To Energy

1.0 Introduction

This Environmental Assessment (EA) Report has been prepared in accordance with the Terms of Reference (TOR) approved on December 29, 2014. It documents the EA process undertaken to review options for addressing the future solid waste disposal needs of the Town of St. Marys (herein referred to as the Town), located in southwestern Ontario, as shown on Figure 1-1.

The existing St. Marys landfill site (herein referred to as St. Marys Landfill); located at 1221 Water Street South, St. Marys, Ontario, operates under Environmental Compliance Approval (ECA) No. A150203 dated June 24, 2010, issued by the Ministry of the Environment and Climate Change (MOECC)[4]. It has an approved capacity of 380,000 m^3 and receives post-diversion waste from within the Town. The St. Marys Landfill is a 37-ha site and was part of a former clay pit that was used by St. Marys Cement in cement manufacturing. The St. Marys Landfill contains an approved fill area of 8 ha. The location of the Town and the existing landfill are illustrated on Figure 1-2. Site capacity (waste and daily cover) is currently consumed at a rate of approximately 13,500 m^3/year[5]. The site reached its approved capacity in January 2016. To maintain operations during preparation of this EA, the Town applied for and received ECA Notices (Amended ECA's are now issued in place of Notices) allowing continued use. The current Amended ECA allows operation through September 30, 2021. As required by the ECA, the Town will apply to the Ministry for further operation by July 31, 2021.

For this EA process, measured waste tonnage generation, landfill volumetric survey results and industry standards and trends for waste density were used to determine long-term disposal needs. For the purpose of this exercise long term disposal needs were defined as ensuring post-diversion municipal solid waste disposal capacity for the Town over a 40-year planning period.

The methodology described in this EA Report reflects a process that meets the requirements of the *Environmental Assessment Act* and Ontario Regulation 101/07, the Waste Management Projects Regulation, made under the *EA Act* and will address the post-diversion waste disposal needs and priorities of the Town over a 40-year planning period.

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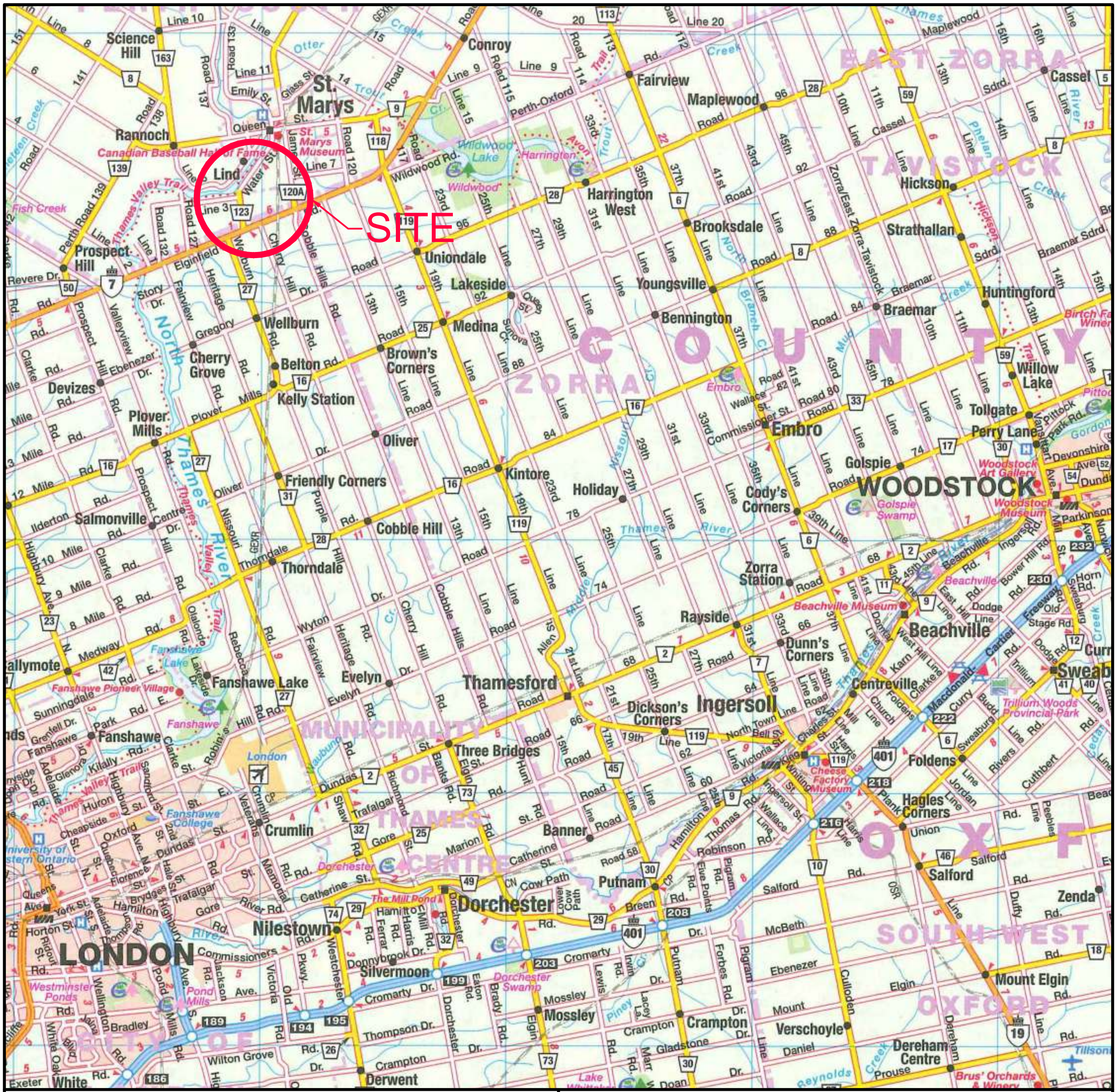
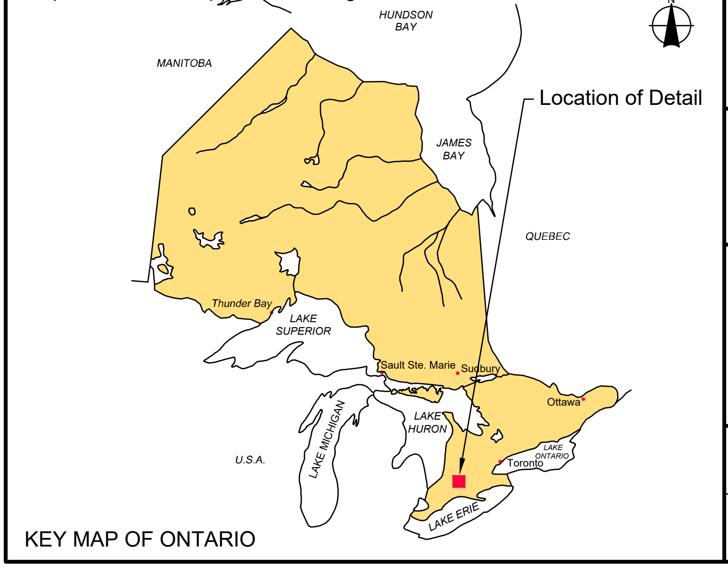
[4] The Ministry of the Environment and Climate Change (MOECC) was renamed the Ministry of the Environment, Conservation and Parks (MECP) in 2018. In this document, MOECC is referenced as the author on materials published prior to 2018. MOECC is also referenced as the name of the ministry consulted throughout the TOR and much of the EA process. MOECC and MECP are considered synonymous.

[5] This is the average rate of fill based on detailed site survey data from 2012 to 2018 (see Table 3-4).



Map Reference: Map Art Publishing, Ontario Road Atlas



KEY MAP OF ONTARIO

BURNSIDE

Client

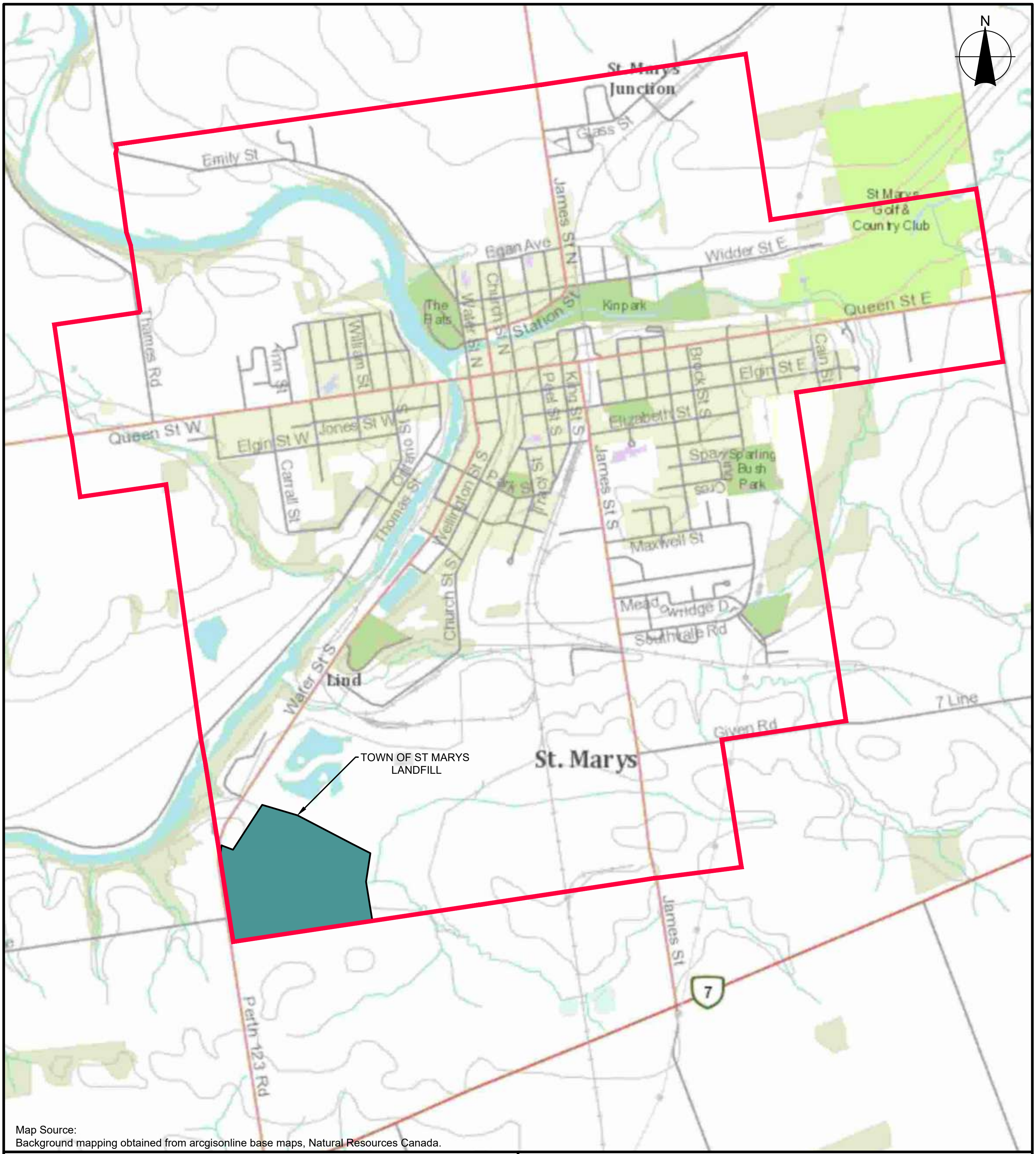
THE CORPORATION OF THE
TOWN OF ST. MARYS

Figure Title

TOWN OF ST. MARYS
FUTURE SOLID WASTE DISPOSAL NEEDS
ENVIRONMENTAL ASSESSMENT REPORT
SITE LOCATION PLAN

Drawn	Checked	Date	Figure No.
CD	TR	JUNE 2021	1-1
Scale		Project No.	
N.T.S.		300032339	

File Name: 032339 Waste Disposal EA Drawing Set.dwg Date Plotted: June 17, 2021 - 4:49 PM



Map Source:
Background mapping obtained from arcgisonline base maps, Natural Resources Canada.

BURNSIDE	Figure Title **TOWN OF ST. MARYS** **FUTURE SOLID WASTE DISPOSAL NEEDS** **ENVIRONMENTAL ASSESSMENT REPORT** TOWN LIMITS AND ST MARYS LANDFILL SITE

Client	Drawn	Checked	Date	Figure No.
THE CORPORATION OF THE TOWN OF ST. MARYS	ZM	JRH	JUNE 2021	**1-2**
	Scale 1:25,000		Project No. 300032339	

File Name: 032339 Waste Disposal EA Drawing Set.dwg Date Plotted: June 11, 2021 - 10:48 AM

This EA has been prepared in accordance with Sections 6(2)(a) and 6.1(3) of the *Environmental Assessment Act* as well as having regard for the following guidance documents:

- "Code of Practice – Preparing and Reviewing Environmental Assessments in Ontario" (MOECC, January 2014).
- "Code of Practice for Consultation in Ontario's Environmental Assessment Process" (MOECC, January 2014).
- "Guide to Environmental Assessment Requirements for Waste Management Projects in Ontario" (MOECC, March 2007).

During preparation of this EA, the Town has consulted with the MECP, other federal and provincial government agencies, the public, Indigenous communities and other interested persons.

This EA Report was reviewed and approved for release by the Town of St. Marys.

1.1 The Proponent

The proponent of the EA is the Corporation of the Town of St. Marys, which currently owns and operates the St. Marys Landfill.

1.1.1 The Study Team

The Study Team is conducting this EA on behalf of the Proponent. The Study Team consists of R.J. Burnside & Associates Limited (Burnside) staff, specialist sub-consultants, and review personnel from the Town.

1.2 Technical Report Volumes and Appendices

Due to the large number of documents prepared for this EA, documents have been organized into volumes and appendices, as follows:

- Volume I: EA Report
- Volume II: Work Plans[6]
- Volume III: Technical Reports
- Volume IV: Consultation Record

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[6] Work Plans were provided as draft reports only. Comments provided by agencies, Indigenous communities and the public were directly incorporated into the implementation as described in Section 10.0, Consultation Summary.

Volume III includes technical reports prepared through the EA process. Each report and its location within Volume III is identified in Table 1-1.

Table 1-1: Reports Prepared Through the EA Process

Report	Location in EA Appendices
Landfill Expansion Emission Summary and Dispersion Modelling Report	Vol III Appendix A
Landfill Expansion Noise Impact Assessment	Vol III Appendix B
Hydrogeology Study	Vol III Appendix C
Natural Heritage Assessment	Vol III Appendix D
Cultural Heritage Resource Assessment*	Vol III Appendix E
Stage 1 Archaeological Assessment*	Vol III Appendix F
Socio-economic Impact Assessment	Vol III Appendix G
Traffic Impact Study	Vol III Appendix H
Leachate Treatment and Disposal Report	Vol III Appendix I
Record of Consultation	Vol IV

*Prepared by Archaeological Services Inc. All other reports prepared by Burnside.

In addition, several existing reports created by others were used to help define existing conditions. These reports are not included in the EA documentation but include the following:

- “CKD Stockpile, St. Marys Plantsite” (aka: “Cement Kiln Dust Report”, or simply “CKD Report”), prepared for St. Marys Cement by Golder & Associates Ltd., March 3, 2005.
- “County of Perth, Town of St. Marys and City of Stratford. 2010. Perth, St. Marys and Stratford Economic Development Strategy and Action Plan: 2010-2014”, Millier Dickinson Blais Inc., April 2010. http://www.townofstmarys.com/en/town-services/resources/Documents/Perth-St-Marys-Stratford-Economic-Plan-Final.pdf (Accessed November 2015).
- County of Perth Planning and Development Department, (2013) Perth County Official Plan. http://www.perthcounty.ca/OfficialPlanSchedulesofDetailed Maps (Accessed November 2015).
- “St. Marys Strategic Plan Revision & Update”, January 2017, prepared by Town of St. Marys. https://www.townofstmarys.com/en/town-services/resources/Documents/FINAL-Strategic-Plan-REV-20170831.pdf (Accessed October 2019).
- “The Corporation of the Town of St. Marys Waste Reduction & Diversion Assessment”, prepared by the Public Works Department, dated August 2018 (accepted by Council on September 11, 2018).

Additional sources of background information are documented in Section 13.0, References.

2.0 Environmental Assessment Framework

2.1 Terms of Reference

The Terms of Reference (TOR) for the EA was approved on December 29, 2014. The TOR outlines how the EA will be conducted.

The EA is being conducted in accordance with Section 6.1(3) of the Environmental Assessment Act (EA Act). This Section allows for an EA with a narrow scope, commonly referred to as a “focused EA”. The TOR outlined why this was deemed appropriate. In summary, the Town of St. Marys undertook some initial planning work prior to commencement of the EA. Work included a pre-screening of the *Alternatives to the Undertaking*.

The EA is scoped to focus on the *Alternatives to the Undertaking* which were remaining after the pre-screening exercise. These Alternatives include:

- Do Nothing (required by EA Act);
- Landfilling at an Expansion of the Existing Landfill Site in St. Marys; and
- Exporting Waste to Another Jurisdiction.

2.2 Environmental Assessment Process

The Terms of Reference outlined a multi-phase process for completing the EA. This process is summarized in Table 2-1. This Table also indicates the location of each step of the process in this report. The remainder of this report follows this outline.

Table 2-1: EA Process

EA Process	Location in Report
PHASE 1: Evaluation of Alternatives to the Undertaking	
Development of a framework for the Evaluation of Alternatives to the Undertaking, including a description of: • The rationale for the proposed Undertaking; • The purpose of the Undertaking; and • The preliminary description of the Undertaking.	Sections 3.1, 3.2, 3.3
Screening of various options to export waste to another jurisdiction.	Section 3.4
A description of Alternatives to the Undertaking.	Section 3.5

EA Process	Location in Report
A description of the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly using publicly available data and a landfill operators' survey.	Section 3.7
– An evaluation of the Alternatives to the Undertaking, including: • Qualitative identification of potential impacts, including their magnitude, frequency, duration and reversibility; and • An evaluation of the advantages and disadvantages to the environment as a result of the Undertaking and the Alternatives to the Undertaking.	Section 3.8
PHASE 2: Re-Assess the Environmental Assessment Requirements	
Review of EA Requirements and need to complete the Evaluation of Alternative Methods.	Section 4.0
PHASE 3: Re-Define the Purpose and Rationale for the Undertaking	
Review and redefine the following: • The description of the Undertaking; and • The purpose and rationale for the Undertaking.	Section 5.0
PHASE 4: Define the Parameters of the Study	
Define the parameters of the study including: • The Study Area; • The timeframe of the Study; • The components of the environment to be studied; • The Alternative Methods to be assessed; and • The evaluation criteria.	Section 6.0
A description of the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly using existing data and information collected through field surveys, modeling and data analysis, in accordance with various Technical Work Plans.	Section 6.6
PHASE 5: Assess Alternative Methods for Carrying Out the Undertaking	
A description of: • The positive and negative environmental effects that could potentially arise from each Alternative Method; • Measures for mitigating potential negative environmental effects; • Any residual impacts that cannot be fully mitigated; and • The selection of the Preferred Alternative based on the potential impacts of each Alternative, including their magnitude, frequency, duration and reversibility.	Section 7.0

EA Process	Location in Report
Detailed Description of the Undertaking	
A detailed description of the Undertaking.	Section 8.0
An assessment of impacts, mitigation, net effects and monitoring requirements.	Section 9.0
Consultation Approach	
A description of the consultation undertaken by the proponent and the results of the consultation.	Section 10.0
Future Commitments	
All future commitments including requirements for future studies, permits and approvals, monitoring and additional consultation.	Section 11.0
A framework for a Compliance Monitoring Plan.	Section 11.5

3.0 Phase 1: Evaluation of Alternatives To the Undertaking

3.1 Project Justification and Rationale

The existing St. Marys landfill reached its approved capacity in January 2016. To maintain operations during preparation of this EA, the Town applied for and received ECA Notices (amendments) allowing continued use. The ECA has been amended to allow operation through September 30, 2021. As required by the ECA, the Town will apply to the Ministry for further operation by July 31, 2021.

The MECP is not expected to extend the site's ECA indefinitely without a long-term plan to manage the Town's waste. The Town is responsible for the management of solid waste generated by the Town, its residents and local industry, businesses and institutions. Wastes generated from other communities or entities are not managed by the Town and there is no intent to accept waste from other communities in the future, as noted in a Town letter, dated December 18, 2019 provided in Volume IV, Appendix A. Therefore, the Town is responsible for developing a long-term management plan and is doing so through the *Environmental Assessment Act* planning process.

A discussion of the Town's projected growth and future waste disposal requirements is provided in the following sections.

To understand the landfilling needs of the Town for the 40-year planning period, investigations were undertaken to understand the Town's projected growth and predicted waste generation volumes. The following section documents the process used to determine the volume of waste requiring disposal over the next 40 years.

3.1.1 Town Demographics

The Town of St. Marys is a compact 12.48 km^2 urban centre with a 2016 Census population of 7,265 people. Table 3-1 provides the Town's population for the 25-year period from 1991 to 2016 according to Statistics Canada Census data.

Table 3-1: Census Data and Growth Rates for St. Marys

Census Year	Population Town of St. Marys	Growth Rate†	
		Period	Annual
1991	5,496	8.30%	1.61%
1996	5,952	5.73%	1.12%
2001	6,293	5.20%	1.02%
2006	6,620	0.68%	0.14%
2011	6,665	9.00%	1.74%
2016	7,265		
1991 to 2016		32.19%	1.12%

† Growth Rate is calculated between Census years, for example, 1991 to 1996 growth is 8.3% overall (for the period) and 1.61% annually.

Overall, the population growth in the Town has been 32.19% over that 25-year period, or an average of 1.12% per year.

Located in southern Perth County and surrounded by the Township of Perth South, St. Marys is approximately 16 km southwest of Stratford and 25 km northeast of London. Founded in 1841, the Town is a traditional support and service centre for surrounding agricultural areas and has a full range of residential, commercial, industrial and institutional areas, facilities, and services.

3.1.2 St. Marys Landfill

Historically the Town has provided waste disposal services for Town residents, businesses, and industries within the Town's boundaries. There are at least two such closed landfill sites dating back to the early to mid-1900's.

The St. Marys Landfill is in the extreme southwest corner of the Town and was opened in 1984 on a 16.2 ha parcel of land leased from the adjacent St. Marys Cement Inc., a major industrial operation and employer in the Town. Prior to its use as a landfill site, St. Marys Cement mined clays for their cement making process. The Town acquired the St. Marys Landfill property in 2009, which included additional lands for continued disposal operations and associated waste management activities and consists of a total site area of 37 ha.

3.1.2.1 Current Waste Diversion

The St. Marys Landfill serves as the sole waste disposal facility for the Town and, in the past decade, has been modified to introduce waste diversion facilities, including:

- An area for the composting of leaf and yard waste;
- A municipal hazardous and special waste (MHSW) facility; and
- A waste transfer station for acceptance of electronic waste (e-waste), cardboard, scrap metal and blue box recycling materials.

The Town of St. Marys is also a member of the Bluewater Recycling Association (BRA), a non-profit organization based in southwestern Ontario with 20 municipal members. BRA is contracted by the Town to provide curbside collection of household waste and recyclable materials. The Town contracts with another contractor for yard waste pickups.

The Town has a Waste Management By-law No. 101-2019, dated November 26, 2019 (and former By-law No. 2012-71) governing the establishment and maintenance of a system for the collection of garbage, yard waste, recyclable materials and the disposal of waste at the St. Marys Landfill. As a member of BRA, the Town of St. Marys operates a comprehensive waste diversion program for Town residents consisting of several key components, including:

- An automated, user-pay, curbside collection system.
- Residential blue box and blue “wheelie” recycling bins.
- Every other week there is collection of paper (e.g., newspapers, magazines, pizza boxes, cereal boxes, flyers, egg cartons, paper towel rolls and telephone books); glass (e.g., clear and coloured glass food and beverage containers with lids and/or labels); plastic (e.g., wide mouth tubs and rigid screw-top containers, grocery and retail bags); and metal (e.g., aluminum and steel beverage and food cans, empty aerosol containers and empty paint cans, all metal lids).
- Curbside yard waste collection was expanded in 2017. Previously, yard waste was collected for five weeks in the spring and fall (10 weeks total). Collection on an alternating week basis from mid-May to mid-November began in 2017.
- The public is also encouraged to drop-off yard waste at the St. Marys Landfill composting area or at the Municipal Operations Centre located at 408 James Street South. Drop-off at these facilities is available year-round.

- MHSW depot at the St. Marys Landfill is open to public four days/week for free drop-off of hazardous wastes (e.g., automobile batteries, waste oils, compressed gas cylinders, herbicides, aerosols and e-waste). The MHSW facility is operated in partnership with the ORANGEDROP program. The MHSW depot is also used by residents from the Township of Perth South, as approved by the MECP.
- Backyard composting, with periodic discounts to Town residents on purchase of back yard composters.
- In 2005, the Town initiated an e-waste collection program for landfill diversion, thereby prohibiting the disposal of e-waste in the St. Marys Landfill.

The Town is currently investigating textile and mattress diversion programs as well.

Table 3-2 provides a list of all the waste (by tonne) diverted from the St. Marys Landfill as per recent Annual Monitoring Reports.

Table 3-2: Summary of Waste Diversion from St. Marys Landfill

Material	Quantity (tonnes)				Receiver
	2015	2016	2017	2018	
Curbside and Convenience Location Collection – Blue Box Recycling	1,070	1,049	1,063	1,050	BRA
Brush Material	196	370.9	69.94	106.77	Town of St. Marys
Leaf & Yard Waste	444	390.1	400.55	496.84	Town of St. Marys
e-waste	38.5†	5.2	21.65	13	Greentech
Wood Waste	85	188.6	114.51	100.1	Town of St. Marys
Scrap Metal	4.3	4.5	1.95	10.93	Robson Scrap Metal
MHSW	6.1	9.2	3.71	4.73	Photech Environmental
Aerosols	0.7		N/A	N/A	
Batteries	N/A		N/A	N/A	Aevitas
Total	**1,844.6**	**2,017.5**	**1,675.31**	**1,782.37**	

† 7.88 tonnes collected at the landfill; 30.66 tonnes collected at the Pyramid Recreation Centre.

The Town is committed to maintaining and expanding its waste diversion program to the extent possible. The benefits of that ongoing commitment include the reduction of the amount of post-diversion waste requiring disposal at the St. Marys Landfill (with the resulting extension in the life of the site) and the reduction of undesirable materials, such as MHSW, going into the landfill for disposal.

The maintenance and expansion of the Town's waste diversion programs are efforts intended to proceed along with, but separate from, this EA process. However, the Town will also review and may implement additional waste diversion efforts as a normal course of future activities, beyond this EA. The ability to separate, process and market additional recyclable materials – or otherwise divert material from landfill disposal is expected to change over the 40-year planning period of this proposed *Undertaking*. Hence, the Town will review and implement diversion activities as technologies and opportunities become available.

3.1.2.2 Interim ECAs

When the Town began the EA process (circa 2011), the Site operated under ECA No. A150203, dated June 24, 2010. According to Condition 13.5 of the 2010 approval, Phase II/III of the Site had a maximum volume of 276,000 m^3, while Phase I – which was completed in 1993 – provided 104,000 m^3. This combines to an approved capacity of 380,000 m^3 for the Site.

As work on the EA progressed, the Town became concerned that the approved capacity would be consumed before all required approvals (EA, EPA, OWRA, etc.) could be obtained. With Burnside's assistance, the Town requested Interim ECA's from the Ministry to allow continued operation of their landfill while completing the required approvals. Table 3-3 summarizes the ECA amendments received to date and their updated landfill volume allowances. These ECA amendments have been completed annually, recognizing the progress made by the Town toward completion of the EA. It is anticipated that additional interim capacity approvals may be required to complete the EA process and obtain all required approvals for the Site's expansion.

Table 3-3: ECA No. A150203 Amendments and Approved Capacity

Notice	Issued	Capacity (m^3)	Comments
	June 24, 2010	380,000	Original ECA (before beginning EA)
1	Dec. 11, 2013	no change	For MHSW Depot (not Interim Capacity)
2	Nov. 16, 2015	395,850	
3	Sep. 6, 2016	411,950	
4	Sep. 5, 2017	no change	
5	Sep. 20, 2018	428,140	
6	Oct. 4, 2019	434,050	
New ECA	Nov. 16, 2020	440,050	Complete ECA: see paragraph below

Historically, as was the case through Notice 6, the Ministry's process for amending an ECA had been to identify only the modification to the ECA. Recently (circa 2020), the Ministry changed their policy; they now issue a complete ECA document, containing all conditions and revoking previous versions (including Notices). As a result, the St. Marys Landfill Site now operates under a new Amended ECA (same number – A150203) dated November 16, 2020.

3.1.2.3 Historic Waste Disposal Rates

As a part of the St. Marys Landfill ECA requirements, annual surveys are conducted to determine the rate of fill of the site for the preceding period. In 2012, the Town installed a scale system at the St. Marys Landfill, which significantly improved the Town's ability to accurately quantify waste entering the site. Since the Town installed a scale system the efficiency of its operations as measured by mass/volumetric tracking has improved. This may also be attributed to continued staff training and experience operating the site. The following table (Table 3-4) provides the available annual data for the site.

Table 3-4: St. Marys Landfill Historic Waste Disposal Rates

Year	Tonnes Received (t)	Rate of Fill (m^3/y)	In-Situ Density (t/m^3)
2010	no data	13,400	
2011	no data	13,690	
2012	4,154	17,315	0.240
2013	6,285	18,439	0.341
2014	5,687	13,662	0.417
2015	4,587	11,076	0.415
2016	5,943	11,457	0.519
2017	4,508	13,161	0.343
2018	5,050	9,246	0.547
2019	5,850	9,359 (note 4)	0.626
2020	5,921	7,137 (note 4)	0.830

Notes:

1. A tonne (t) is 1,000 kilograms (kg) or about 2,205 pounds (lb).
2. Scale was installed in 2012; no data prior to this date.
3. In-Situ Density is the mass of waste divided by the volume of waste and cover material (cover material mass is not included).
4. Annual Monitoring Reports for 2019 and 2020 only provide estimates for the volumetric rate-of-fill. The resulting In-Situ Density exceeds the 2012-2018 average by more than 55%. The Annual Monitoring Reports do not provide insight for waste stream changes or potential operational variations that explain the drastic improvement of in-situ density.

3.1.3 Required Disposal Capacity

The TOR established that 708,000 m^3 of capacity was needed to meet the 40-year planning period for the Town's waste disposal needs. This was based on the rate of fill experienced at the St. Marys Landfill in 2009, 2010, 2011 and 2012.

As outlined in the TOR, a reassessment of the fill rate has been conducted as a part of this EA process to confirm that the requested capacity represents the Town's requirements. The following sections describe the results of the fill rate reassessment.

3.1.3.1 Population Projections

As discussed in the TOR, it is generally accepted that there is a strong correlation between population and waste disposal. As a result, the waste requiring disposal can be assumed to correlate with population growth rates.

The population growth rate for the Town of St. Marys was 32.19% overall or 1.12% per year, based on Census of Population data for 1991 to 2016. Most recently, between 2011 and 2016, St. Marys grew 9.0% (equal to a 1.74% compounding annual growth rate). The Statistics Canada census data and related calculations of growth – both between surveys and annualized – are provided in Table 3-1.

Projections for the growth of the Town of St. Marys population have been discussed in the following studies and reports:

- In 2010, the firm of Miller Dickinson Blais found that the Town of St. Marys had historically grown at a much higher rate than Perth County.
- BMA Management Consulting Inc.'s *Municipal Study 2012*, projected 25-year growth rates for Southwestern Ontario at an average of 13.9% (0.52% per year) with select counties seeing growth rates as high as 32.6% (1.15% per year). The *Municipal Study 2012* indicated that Perth County growth might be on the lower end of the projection. This generally reflected the Town's census data (Table 3-1) between 2006 and 2011 (0.14% per year), corresponding to the period when BMA's report was created. It does not reflect the more recent 2011 to 2016 census period, where the Town's growth was 1.74% per year – significantly ahead of the BMA projection.
- In 2014, B.M. Ross and Associates Limited (B. M. Ross) presented population growth estimates as part of the *Town of St. Marys Municipal Infrastructure Projects Public Information Meeting*. In that study B. M. Ross projected growth rates between 0.50% and 1.15% annually for the Town based on historic population growth.
- In January 2017, the Town of St. Marys issued their *St. Marys Strategic Plan Revision & Update*. In it, the Town has targeted a growth rate of 1.5% per year through 2027 for its infrastructure development.

Related to population projections (and waste generation), St. Marys has a disproportionately large industrial base for a community of its size. This impacts employment and residency within the Town. The various studies noted above will have considered the industrial base, including impacts of plant closures and proposed new developments.

The St. Marys population growth rate used for this EA has been revised from the TOR to reflect current literature. The long-term historic growth rate (Table 3-1) has also been considered. In selecting growth rates, it was felt that it is more important to select conservative rates given the resulting impact on the infrastructure needs. However, we did not want to select rates that were excessively large. Thus, we have selected two growth rates that reflect the available information for the EA planning period. These are:

- 1.50% per year growth through (and including) 2027; per the *St. Marys Strategic Plan Revision & Update*. We note this is significantly below the 1.74% annual growth between previous Census periods.
- 1.15% per year growth beginning in 2028 through the end of the EA Planning Period (end-of 2057); per the B. M. Ross estimate. This is in keeping with the Town's historic growth rate predicted by the Census data (Table 3-5).

By using two population growth rates in projections for the Town's population from recent studies, there is a greater level of precision for future planning. As noted above, the annual growth rate through and including year 2027 is 1.50%. The growth rate then decreases to 1.15% annually from 2028 to the end of the EA Planning Period of 2057. Growing the 2016 census population in this way results in the following population projections:

Table 3-5: Resulting Population Projections

Year	Town Population	Growth Rate (% per year)	Notes
2016	7,265	-	Census value.
2017	7,374	1.5%	• Start of Planning Period. • Growth per *St. Marys Strategic Plan Revision & Update.*
2022	7,944	1.5%	
2027	8,558	1.5%	End of growth per *St. Marys Strategic Plan Revision & Update*.
2032	9,062	1.15%	Growth from 2027 per the B. M. Ross estimate.
2037	9,595	1.15%	
2042	10,160	1.15%	
2047	10,758	1.15%	

Year	Town Population	Growth Rate (% per year)	Notes
2052	11,392	1.15%	
2056	11,926	1.15%	Planning Period ends December 31, 2056.

3.1.3.2 Climate Change Effects on Landfill Disposal Needs

Climate Change is usually associated with any significant change in long-term weather patterns. Weather patterns can change the composition of the atmosphere, which results in processes that alter global temperature and precipitation. These processes can ultimately lead to increased occurrence of extreme weather events such as floods, droughts, ice storms and heat waves. To mitigate climate change and the effect it can have on the environment, government agencies have created strategies and guidelines to reduce Greenhouse Gas (GHG) emissions into the atmosphere, including carbon dioxide and methane, two primary constituents of landfill gas. According to Environment and Climate Change Canada[7], emissions from Canadian landfills account for 20% of national methane emissions.

The Government of Ontario has committed to reducing GHG emissions to 80% below 1990 levels by 2050 and has established two mid-term targets of 15% below 1990 levels by 2020 and 37% below 1990 levels by 2030 (MOECC, 2015).

The MECP has developed a Climate Change Strategy (MOECC, 2015), which outlines the five areas that Ontario will focus on to achieve the GHG reduction targets, including:

- A prosperous low-carbon economy with world-leading innovation, science and technology;
- Government collaboration and leadership;
- A resource-efficient, high-productivity society;
- Reducing GHG emissions across sectors; and
- Adapting and thriving in a changing climate.

Severe weather events influenced by Climate Change can have a direct impact on landfill utilization. These events can result in increased property damages from excessive wind and precipitation, which can subsequently result in an increase in the amount of materials being received at landfills in the form of damaged goods.

For example, the Town of Goderich was struck by a tornado in 2011. In the year following the event, waste acceptance rates at the municipal landfill were approximately

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[7] http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=6f92e701-1, accessed March 28, 2017.

300% of the previous year[8], indicating the single storm event resulted in the creation of the equivalent of an additional two years of waste. A tornado strike in St. Marys, made more likely due to Climate Change, could cause similar damage and require similar disposal needs.

More recently, the 2016 wildfires in Fort McMurray, Alberta, resulted in the loss of 2,400 homes and buildings. Subsequent news reports[9] indicated that these fire damaged homes each generate between 97 and 175 tonnes of waste. A fire in the downtown core of St. Marys or at a manufacturing plant, potentially worsened by dry conditions related to Climate Change, could therefore create significant quantities of waste requiring disposal.

Locally, high water levels have occurred historically along the Thames River. The most recent event was in February 2018. While this event did not result in any major property damage, the Upper Thames River Conservation Authority (UTRCA) issued a flood warning for St. Marys. Since portions of the Town lie within the UTRCA Flood Plain, high water levels resulting from severe weather events could result in increased property damage and a resultant increase in waste for disposal.

Snow and ice storms are also a concern. Several such events have caused widespread damage to trees, power lines and buildings. The most recent event occurred in Winnipeg, Manitoba, on October 14, 2019.

Severe occurrences such as those mentioned above are unlikely to impact the Town directly during the planning period. However, incremental impacts of storm events and Climate Change related impacts are expected to increase in frequency and severity during the planning period.

In order to assess the potential for waste generation from the Town of St. Marys as a result of Climate Change related severe weather events, the Study Team incorporated the U.S. Army Corps of Engineers debris model for a single Category 1 hurricane. This is intended to represent the cumulative effect of more severe storms and resulting damages (disposal needs) that may occur due to Climate Change. Based on the model, approximately five months or 1% of additional capacity could be utilized in dealing with the storm debris. This has been incorporated into our re-evaluation of the disposal capacity required for the Town of St. Marys.

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[8] *Personal communications between James Hollingsworth (Burnside) and Steve Janes (consultant for Huron County Waste Management Planning), June 2014.*

[9] http://www.660news.com/2016/07/10/fort-mcmurrays-genial-landfill-manager-surfs-tsunami-of-wildfire-waste/, accessed July 12, 2016.

3.1.3.3 Increased Waste Diversion

Ongoing efforts by businesses and residents impact the rate of waste production and disposal through diversion efforts. This can change the quantity, and qualities of the wastes being disposed of by the Town over the planning period.

As noted previously, the Town of St. Marys is a member of the Bluewater Recycling Association (BRA). The Resource Productivity & Recovery Authority (RPRA)[10] does not break-out diversion information for the Town and instead reports it for all members of BRA as a single result. While it is recognized that urban areas such as the Town of St. Marys typically enjoy higher diversion rates than rural area, because the services provided by BRA are equivalent across its service area, it has been assumed that the reported diversion rate for the Association is representative of the diversion rate for the Town. It may be, however, that the Town's diversion rate is higher than the overall (averaged) rate reported for BRA.

The most recent data (2018)[11] indicated that the total diversion rate is 33.8% for BRA (and the Town), while the municipal group, Rural Regional, average is 44.1% and the provincial diversion rate is 49.7%. BRA ranked 13 out of the 15 municipal programs within their municipal group, and the group ranked third of nine categories behind Large Urban Regional, and Urban Regional programs (which combined account for 76% and 80% of disposal and diversion by mass, respectively). It is noted that the Town of St. Marys is directly responsible for diversion of brush material, leaf and yard waste, e-waste, wood waste, scrap metal and MHSW. They also recycle concrete and asphalt in the Town's ongoing construction projects. This diversion information is not provided by the Town to BRA and is therefore not considered in the RPRA (and former Waste Diversion Ontario (WDO)) Datacall results.

Based on the differences between the Ontario average diversion rate (49.7%) and the Large Urban systems (52.8%) versus the rate obtained by BRA (lower by 12.1% and 15.2%, respectively), there is a clear opportunity for the Town (and the Province) to obtain higher diversion. However, we note that larger communities are capable of more rapidly adapting to emerging trends, and hence obtain better diversion rates sooner. It is reasonable that as additional technologies are developed and because of continuing education, the diversion rate for St. Marys will increase toward rates experienced elsewhere.

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[10] In November 2016, the RPRA replaced Waste Diversion Ontario.

[11] https://rpra.ca/wp-content/uploads/2017-Residential-Waste-Diversion.xlsx, accessed November 1, 2019.

As explained in *The Evolving Tonne of Recyclables*[12], several waste management companies and municipalities have also detected changes in the waste stream in the last few years. In September 2020 (based on a 2019 report) the Continuous Improvement Fund (CIF) noted[13] the tremendous global growth in the use of flexible packaging[14] as industry attempts to light-weight their products.

Industry has been working to light-weight their packaging for many years now. In particular, packaging has been redesigned to provide the same level of product protection while containing less material – such as through more rigid, thinner walled plastic protective shells, and, to a lesser extent, by optimizing the products themselves. This reduces production and transportation costs for the products. However, these materials typically have the similar volumes as the predecessors. As a result, receiving facilities (for both waste disposal and recyclables) have noticed a decrease in the mass (weight) being handled without a corresponding decrease in handled volumes. Unilever, a multinational consumer goods company, notes[15] "Since 2010 we've reduced the weight of our packaging by 20% through light-weighting and design improvements." This trend may continue as implementation of the *Waste Free Ontario Act* and the *Resource Recovery and Circular Economy Act* proceeds.

Overall – through the 40-year planning period – it is predicted that the mass of waste produced on an annual per capita basis will decrease through continuing diversion efforts. This will occur as programs in rural and small urban areas are established mimicking those of larger urban areas. In addition, we anticipate manufacturers will continue and enhance their efforts to reduce materials used in production and packaging. However, with the current trend towards rigid, lightweight materials, the reduction in per capita disposal requirements on a volume basis will lag mass reductions. This trend may continue as the Province proceeds with implementation of the *Waste Free Ontario Act* and the *Resource Recovery and Circular Economy Act*. In fact, it may continue due to similar pressures external to Ontario.

Burnside has reviewed the MECP's (Nov. 2018) Preserving and Protecting our Environment for Future Generations – A Made-In Ontario Environment Plan and the

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[12] http://www.solidwastemag.com/downloads/165/download/SWR_D15J16_LR.pdf, accessed December 9, 2016.

[13] https://thecif.ca/understanding-flexible-packaging-for-recycling/, accessed November 23, 2020.

[14] From the CIF report, flexible packaging is used for "a wide array of products such as coffee, laundry detergent, baby food, cat litter, single-serve juices, motor oil, toothpaste and even more. Packages can be made with a single layer, a mono-material laminate (i.e. multiple layers from the same polymer) or the more complicated, multi-material laminate (made from multiple layers from different polymers). Flexible packaging can also include papers and metals as key components, closures using zips, spouts or reseal adhesives, and various additives."

[15] https://www.unilever.com/sustainable-living/reducing-environmental-impact/waste-and-packaging/, accessed November 23, 2020.

(Mar. 2019) discussion paper on reducing litter and waste in our communities. The Plan identifies the need for action to be taken to reduce waste being generated and to increase diversion. Reduction of waste can occur at all levels, from the end-users to the producers. As Ontario begins to move towards a Producer Responsibility model to replace the Blue Bin program, it is expected that innovations will be made to reduce single-use plastics and create markets for diverting additional waste streams. The Plan identifies the Province's commitment to work with producers and municipalities to educate residents on the importance of reducing the amount of waste generated, increase waste diversion, and managing food/organic waste (composting). Unfortunately, it is unknown how or when Plan implementation by the Province, waste generators and members of the public will impact the local disposal needs of the Town.

Future diversion rates have not been projected due to the transition of the Blue Box program to Expanded Producer Responsibility (EPR) under the *Resource Recovery and Circular Economy Act*. The regulations for EPR have not been developed and the role of the municipality in the program remains uncertain at this time.

3.1.3.4 Disposal of Industrial, Commercial, and Industrial Waste

The Town has approximately 777 ha of total developed land, of which approximately 410 ha, about 53%, is Industrial, Commercial and Institutional (IC&I). The Town is not responsible for waste collection or disposal from IC&I users. Many of these IC&I users have their waste delivered to the St. Marys Landfill for disposal. To ensure that disposal needs of IC&I users are factored into the overall required capacity, the waste disposal rate calculated for the St. Marys population includes waste disposed by IC&I users, which is subject to annual population growth. As a percentage of the total waste disposed at the St Marys Landfill over the past six years (2015 to 2020, inclusively), an average of 60% originates from the IC&I sector. When comparing the amount of waste disposed by residential and IC&I users verses the land area used for each, there is a clear correlation. It is expected that as the Town experiences growth in population, the IC&I sector will similarly experience growth – this has been accommodated within the required disposal capacity.

3.1.3.5 Waste Reduction and Diversion Assessment (2018)

The *Waste Reduction and Diversion Assessment* (2018) created by St. Marys states that IC&I waste may be largely reduced within the community by following the *Strategy for a Waste Free Ontario: Building a Circular Economy* document. The Town has interest in following guidelines set forth in the *Strategy for a Waste Free Ontario* document, being a long-term initiative toward waste diversion. Also stated in the *Waste Reduction and Diversion Assessment* (2018), there are eight waste diversion and reduction programs operating within the Town, which have successfully diverted approximately 5,500 tonnes of waste from the landfill site over the period of 2015 to 2017 (inclusive). Including 2018 data, shown in Table 3-6, the Town has diverted a total of 7,320 tonnes. These programs include the following:

- Automated Curbside Collection
- Municipal Hazardous and Special Waste Depot
- Leaf and Yard Waste Collection
- Scrap Metal Recycling
- Blue Box Recycling
- Electronic Waste
- Concrete and Asphalt Recycling
- Wood and Brush Grinding

Additional details regarding the programs can be found within the Assessment document, included as Appendix A.

Eight additional waste reduction or diversion programs have been identified for Town future consideration, including the following:

Table 3-6: St. Marys Proposed Potential Diversion Programs

Program	Description
Food and Organics Collection	In line with 'Ontario's Food and Organic Waste Framework Action Plan', which strives to reduce food waste, recover resources from food and organic waste, promote beneficial uses and support resource recovery infrastructure.
Cigarette Waste Recycling Program	St. Marys is evaluating implementing a Cigarette Waste Recycling Program using TerraCycle, which cannisters' accept all portions of the cigarette. The cigarette waste is then shipped for recycling, which are then remodeled to create industrial products.
Asphalt Shingles Recycling Program	Currently being considered by the municipality to increase diversion from the landfill site. The Town has consulted with industry leaders in shingles recycling and other municipalities who currently operate an asphalt shingle recycling program, to understand how it would be incorporated within the Town's waste management system.
Mattress and Box Spring Program	Mattresses and Box Springs are a bulky waste stream currently accepted at the landfill, presenting another avenue to increase waste diversion. Compaction of these wastes can cause issues due to the metal springs becoming entangled within equipment, increasing maintenance requirements. Neighbouring municipalities redirect this stream to third party processors.
Landfill Optimization	The in-situ density of waste is less than what is anticipated with the use of compaction equipment. Further improvement to operations at the landfill will increase density values. St. Marys has been in discussion with local industry regarding diverting waste specific streams from the landfill. Additionally, the Town is investigating additional earth moving equipment at the landfill, which is currently done utilizing compaction equipment.

Program	Description
Backyard Composting Initiatives	Having success in the past, backyard composting is a cost-effective means to increase diversion of food wastes. St. Marys is evaluating The Green Cone, a backyard composting system, which digests all types of food wastes and does not attract animals due to its enclosed design.
Textile Recycling	St. Marys offers multiple location where residents can dispose of their clothing around the Town. The Town is looking at potentially implementing systems for textile material not in a condition to be donated, to increase diversion of this stream.
IC&I Diversion	Based on the Provincial goal of creating a circular economy, the IC&I sector will be required to focus on the following: • Using fewer raw materials to reduce waste; • Design products and packaging to be more durable and recyclable; • Businesses should coordinate with differing sectors to reduce greenhouse gas production; and • Companies should implement programs for the reuse, repair or recycle their products at the end of their life-cycle.

Initiatives have been developed to fit near-term and long-term goals, including additional incentive programs for backyard composters and consideration of implementing a food and organics collection program, respectively. These programs, in addition to the implementation and timeline of the Provincial government's frameworks, goals and programs, may play a role in the long-term reduction of divertible items entering the landfill. The proposed expansion volume is conservative, in order to account for uncertainties regarding the overall timeline of future provincial/Town diversion programs.

As reported within the Assessment document, in 2017 the implemented diversion programs accounted for approximately 44% of wastes being diverted from the landfill. This rate is consistent with the reported diversion rates as calculated in the report from 2010 to 2017, which have an average rate of 47%, not trending in an increased fashion. However, it is difficult to project the future effects on the Town's diversion rate, due to the uncertainty of the timeline and impact of Provincial programs on the Town's waste management practices. The significant impacts of IC&I waste will likely be reduced, due to the government's circular economy approach.

It is reasonable to assume gradual implementation of the Town's and Provincial government initiatives will show improvement over the planning period – reducing the mass of waste requiring disposal. However, the extent that these improvements will reduce the *volume* of waste entering the landfill is unknown. The unquantifiable nature of waste reduction is discussed further below (particularly Section 3.1.3.7, which discounts anticipated disposal requirements by 2.4%).

3.1.3.6 Effect of Provincial Policies

The *Waste-Free Ontario Act* (2016), enacts the *Resource Recovery* and *Circular Economy Act* (2016) (RRCEA). For the Town of St. Marys, the primary impact of the RRCEA will be the transition of responsibilities for the (current) Blue Box recycling program. Producers, as defined in the RRCEA, are to assume responsibility for recycling from the Town. The mechanism for this has not yet been developed, but implementation is currently expected to occur between 2023 and 2025, as stated in the *Strategy for a Waste-Free Ontario: Building a Circular Economy* (2017) and the Minister's August 15, 2019 direction letters to Stewardship Ontario (SO) and the Resource Productivity & Recovery Authority (RPRA).

It is believed that the shift to producer responsibility will increase Ontario's overall recycling rates. Simultaneously, it will promote innovation by producers; they will seek less costly, more eco-friendly packaging materials/methods. Disposal tonnages may also drop in future years due to stricter packaging regulations, limiting manufacturers from incorporating a greater amount of plastic or non-recyclable material within their packaging (see also the discussion on *The Evolving Tonne of Recyclables* in Section 3.1.3.3).

There may also be additional benefits to the Town if product stewardship programs are extended to more materials/products than currently covered by existing diversion programs. However, there are two initial concerns relative to the Town of St. Marys and disposal requirements:

- Will the producers achieve the collection (diversion from disposal) targets that will be set by the province? A producer may decide to pay penalties instead of putting forth the effort to achieve the diversion target.
- Will producers concentrate their collection (diversion from disposal) efforts in large-population centres? Such centres offer efficiency-of-scale benefits to the producers.

Should either (or both) occur, the Town may need to dispose of more material than has historically been landfilled.

As a landfill operator, the Town is also concerned about the relationship between disposal mass (tonnage) and landfill volume (cubic metres). As described in *The Evolving Tonne of Recyclables* in Section 3.1.3.3, lighter material may arrive for disposal. Lighter material might not be packed into an equally smaller volume then the space required in the landfill will not decrease. Annually reported disposal densities (tonnes per cubic metre) at the St. Marys landfill have varied drastically in the last several years. This may be a symptom of producers moving to light-weight packaging material.

Ontario's Food and Organic Waste Policy Statement[16], issued under Section 11 of the *Resource Recovery and Circular Economy Act, 2016*, provides direction to provincial ministries, municipalities, industrial, commercial and institutional establishments, and the waste management sector to increase waste reduction and resource recovery of food and organic waste. In the policy statement's section entitled "Increasing Residential Resource Recovery in Southern Ontario", it indicates that municipalities that do not already provide curbside collection of source separated food and organic waste will only be required to start a collection program if their population exceeds 20,000 (there are other criteria, but this is a simplified explanation; full details can be found in the policy statement). The Town of St. Marys population was 7,265 according to the 2016 Census. Food and organic waste collection is therefore not required by the Province's policy.

The Ontario government is also placing a large emphasis on reducing food wastes from our landfills, proposing to ban the source altogether. Released in November of 2018, the *Made-in-Ontario Environmental Plan* outlines future actions which will work to divert and reduce organic and food waste from landfills. This plan is expanded upon in the associated document, *Reducing Litter and Waste in Our Communities: Discussion Paper* (2019). The discussion paper outlines the creation of a future proposal for a food waste ban from landfills. It states that municipalities are to implement their own promotion and education programs aimed at preventing food waste. The subject of food rescue is also included in the statement, though is more so directed towards shopping establishments, restaurants and manufacturers. Further, it mentions the shift towards a greater amount of compostable packaging, which may further reduce packaging wastes in landfills. The statement says that all commercial locations (involving restaurants) that generate 300 kg or more of organic waste per week shall be responsible for source separation. This is likely not applicable to commercial locations in St. Marys, due to the small size of the community. These changes to the acceptance of food waste will not be applicable to St. Marys, again due to its small population not meeting the participation threshold. The policy statement mentions that local municipalities with a population of greater than 50,000 residents and a population density of greater or equal to 300 persons per square kilometer are required to participate. St. Marys does not meet the population threshold requiring participation.

Following *Ontario's Food and Organic Waste Framework Action Plan* (2018) may have a significant impact on the town's diversion, as the IC&I sector accounts for roughly 45% of organics waste in Ontario. The community also plans to service additional waste streams by establishing a sustainable diversion program for shingles and textiles, as well

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[16] https://www.ontario.ca/page/food-and-organic-waste-policy-statement (accessed October 2019).

as ban mattresses and box springs from the landfill in the future. A pilot program for textile diversion was recently issued[17] but no program is yet in place.

As discussed above, Town of St. Marys is a member of the Bluewater Recycling Association (BRA). BRA collects waste and recyclables for member communities (and some non-member municipalities). BRA does not currently collect food and organic waste. This service may become available in the future, at which time St. Marys may decide to implement food and organic waste collection. Such a program has been envisioned in the Town's August 2018 *Waste Reduction & Diversion Assessment*.

The Town of St. Marys is committed to reviewing their operations and implementing diversion targets set out in provincial policy (see Section 11.4). Through this, we anticipate but cannot quantify future waste reduction and diversion effects. For planning purposes (that is, to be conservative in our assumptions) the impact of future waste reduction and diversion on the required disposal capacity (volume) is assumed to be minor.

3.1.3.7 Calculated Capacity for the 40-Year Planning Period

During preparation of the TOR, the capacity for the 40-year planning period was calculated based on:

a) The landfill volume consumed between January 1, 2009 and December 31, 2012[18]. This was averaged, arriving at a value of 13,500 m^3 per year.

b) Population growth, estimated at 1.0% per year, will correspond with the need for disposal capacity.

c) That the new disposal capacity would be required as of January 1, 2017 (i.e., this is the start of the EA planning period, so 40-year planning period would end on December 31, 2056).

Combined, it was calculated that the 40-year planning period would require 708,000 m^3 of waste and operational cover disposal capacity.

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[17] Per the St. Mary's Request for Proposals document for a textile diversion program; RFP-PW-16-2019, August 2019.

[18] The 2013 annual rate of fill was unknown at the time of TOR preparation.

The reassessment of capacity requirements undertaken during the EA has updated the method of calculation to consider:

a) The per-capita waste disposal volume: 1.888 m^3/person-year. This is calculated from:

   - Total volume used between January 1, 2012 to December 31, 2018[19]: 94,356 m^3 (approximately 13,500 m^3/year), per volumetric surveys – see Table 3-4.
   - Total population that generated the waste volume: 49,964 person-years, calculated from Census data – see Table 3-1.

b) Approximate volumes of waste and operational cover placed in 2017 through 2020 (inclusive)[20]: 38,903 m^3 – see Table 3-4.

c) Projections of Town population for 2021 through 2056 (inclusive): 353,310 person-years, per:

   - Census data in Table 3-1.
   - Population growth rate estimates in Section 3.1.3.1.

d) Summing the above and adding 1% to account for potential climate change disposal needs, per Section 3.1.3.2.

All of this results in a total disposal requirement of 713,013 m^3 for the 40-year planning period (2017 through 2056, inclusive).

Diversion of waste through programs offered by the Town are not included in the waste disposal volumes. The volumes used to calculate the total disposal requirement is residual waste; therefore, increases in waste diversion is considered in the overall disposal requirement for the planning period.

Considering the unquantifiable nature of some of the factors discussed in earlier sub-sections, the planning timeframe and ongoing changes to the waste management industry, the Town has decided to continue the EA process using the 708,000 m^3 proposed in the TOR. This is 1% less than the total disposal requirement calculated above (713,013 m^3). Based on the data presented, it is believed that this represents a reasonable, conservative estimate. It allows the Town to meet its current requirements while still planning for the projected growth in a manner that solid waste infrastructure does not become a limiting factor.

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[19] The accuracy of disposal volumes for 2019 and 2020 is unknown and therefore not incorporated into the per-capita fill rate calculation (see note on Table 3.4).

[20] Despite inaccurate 2019 and 2020 disposal volumes, they are included in our estimate of volume consumed to date. This does not impact disposal requirements for the planning period.

3.1.3.8 Interim Fill and Planning Period Capacity

The Town has chosen, and the TOR approved, a planning period of 40-years, starting January 1, 2017 and ending December 31, 2056. During discussions with the Ministry regarding the interim ECA's, the Town indicated capacity consumed from January 1, 2017 through EA Approval would be removed from the capacity requested by the EA.

Per the previous section, the Town is seeking 708,000 m^3 of total waste and operational cover (disposal) capacity for the *full* 40-year planning period. The Town's records show 38,903 m^3 of capacity has been consumed since January 2017. Therefore, as of January 2021, the capacity requested by this EA is:

708,000 m^3	Planning Period disposal requirements (per Section 3.1.3.7)
minus 38,903 m^3	Volume consumed 2017 through 2020 (per Table 3-4)
669,097 m^3	**Remaining Planning Period Requirements** (through December 31, 2056)

Additional capacity will be consumed while this EA Report is prepared (by the Project Team), and then reviewed and approved (by the Ministry). The volume consumed by interim disposal during 2021 (and beyond) is not currently known and will not be reported herein. Further, the base data and evaluations completed for this EA predate the interim operation approvals (ECA's). As a result, this report and it's supporting documents refer to 708,000 m^3 as the planning period required capacity. We recognise the volume consumed during the EA approval process, and subsequent approvals, will be accounted for when determining the design capacity of the landfill.

3.2 Preliminary Problem Statement

The problem which will be addressed through this EA is as follows:

The Town of St. Marys must identify a solution that addresses the Town's post-diversion municipal solid waste disposal needs over a 40-year planning period in a technically and economically feasible manner while minimizing impacts to the environment.

This Problem Statement is reviewed and refined upon completion of the Evaluation of Alternatives to the Undertaking.

For further clarity, the 40-year planning period is defined as:

January 1, 2017 through ***December 31, 2056***

(see also Section 6.3)

3.3 Preliminary Description of the Undertaking

The following describes the proposed Undertaking:

- The Undertaking will include the proposed changes that are made to address the Town's future municipal waste disposal needs.
- The Undertaking will need to address the Problem Statement defined above. The description is purposely broad at this stage to allow for consideration of the range of Alternatives identified in the Terms of Reference. The description of the Undertaking will be refined as the EA progresses.

3.4 Screening of Waste Export Options

3.4.1 Screening Methodology

As noted in Section 2.0, the initial evaluation of *Alternatives to the Undertaking* evaluates the following:

- Do Nothing;
- Alternative 1: Expanding of the St. Marys Landfill; and
- Alternative 2: Exporting Waste to Another Jurisdiction.

Several options exist regarding how, and to where, waste could be exported. During the TOR phase, a list was developed of alternative receiving locations for exported waste from the Town of St. Marys. At the TOR phase, the Study Team was considering two primary jurisdictional areas for waste export, private and municipally operated landfills. The options identified were:

- Waste Export to Local (Municipal) Landfill Sites;
- Green Lane Landfill (Southwold Township, Ontario)[21];
- Mitchell Domestic Landfill (Municipality of West Perth, Ontario);
- Logan Landfill (Municipality of West Perth, Ontario); and
- Blanchard Landfill (Township of Perth South, Ontario).

Waste Export to Private Landfill Sites:

- Twin Creeks Landfill (Warwick Township, Ontario);
- Carleton Farms Landfill (Sumpter Township, Michigan, USA); and

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[21] Green Lane was listed in the TOR as a private landfill. However, it was purchased by the City of Toronto in 2007 and is, therefore, a municipally owned landfill.

- Proposed Southwestern Landfill[22] (Zorra Township, Ontario).

The TOR noted that other options may be identified during the EA process. During the EA phase, the Study Team identified additional municipal and private landfill options and undertook a screening of these potential options to determine the preferred option for the Town of St. Marys. The additional landfills and screening methodology are presented in the following section.

3.4.1.1 Data Collection

To collect data supporting the evaluation of the *Waste Export Alternatives*, the Study Team developed two surveys, one for municipalities and one for private waste haulers, transfer station and landfill operators.

Municipal Survey

The municipal survey was sent to 14 municipalities that operate landfills within approximately 100 km of St. Marys, including the following:

- County of Wellington;
- Oxford County;
- Regional Municipality of Waterloo;
- Municipality of South Huron;
- Township of Perth South;
- City of Toronto;
- Municipality of West Perth;
- City of Stratford;
- Municipality of North Perth;
- Township of Perth East;
- County of Brant;
- Municipality of Thames Centre;
- Township of Adelaide Metcalfe; and
- Municipality of Southwest Middlesex.

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[22] The Southwestern Landfill proposed by Walker Environmental Group Inc. is undergoing an EA process for approval.

The survey asked whether the municipality would be interested in accepting St. Marys' waste. A follow-up question asked how the answer had been determined (i.e., had there been a discussion about providing waste capacity to St. Marys amongst council, Committee of the Whole, with the County Warden/Mayor/Chief Administrative Officer etc.). A copy of the survey is provided in Appendix B to this report.

Private Hauler, Transfer Station and Landfill Operator Survey

Three private landfill sites were identified in the TOR. Through the EA process it was determined that additional private options exist, including the following:

- Use St. Marys curbside collection vehicles to deliver waste directly to a private landfill.
- Use St. Marys curbside collection vehicles to deliver waste to a transfer station and then use a private hauler to transfer waste to a private landfill.

In addition to private landfills, disposal at the Emerald Energy from Waste site in Mississauga was considered.

A questionnaire was created to obtain comparative data from private trucking, transfer station and disposal facility operators. The questionnaire included a wide range of questions including tipping rates, maximum length of contracts, rate increases in the last five years, remaining capacity of the landfill and whether they are currently licensed/permitted to receive waste from St. Marys, among other questions. A copy of the questionnaire can be found in Appendix B.

3.4.2 Screening Findings

3.4.2.1 Export to a Municipal Landfill

Of the 14 municipalities who received a survey, 10 responded indicating that they would not be interested in receiving St. Marys' waste. Four did not respond to the survey. Copies of responses are provided in Appendix B. Based on this information it was determined that export to another municipal landfill is not a feasible option. This option was not considered any further in the study.

3.4.2.2 Export for Private Disposal

The Private Waste Service Providers Survey was distributed to:

- Six private landfill and/or transfer station operators:
  - Walker Environmental Group (Niagara Landfill, Smithville, Ontario);
  - Waste Management of Canada Corporation (Twin Creeks Landfill, Watford, Ontario);
  - Republic Services Inc. (Carleton Farms Landfill, Michigan, U.S.A.);

  - BFI Canada Inc.[23] (Ridge Landfill, Blenheim, Ontario);
  - Brooks Road Environmental (Brooks Road Landfill, Cayuga, Ontario); and
  - Emerald Energy from Waste Inc. (Thermal waste disposal site in Mississauga).

- Nine waste haulers:
  - Challenger Motor Freight;
  - Wasteco;
  - GFL Environmental Inc.;
  - Bluewater Recycling;
  - Progressive Waste Solutions;
  - TRY Recycling;
  - Green Valley Recycling;
  - Clean Harbours; and
  - ECL Carriers.

It is noted that the TOR indicated that the Southwestern Landfill proposed by Walker Environmental Group Inc. in Zorra Township would be considered. As this proposed landfill was not approved at the time of the survey, it was determined that it should not be included in the screening. However, as noted, a variety of alternative private landfills were assessed.

Of the six private landfill and transfer station operators contacted, five completed the survey. Of the nine waste haulers contacted, five provided responses. The full survey and responses can be found in Appendix B.

A summary of the private landfill and thermal treatment sites costs and ability to receive waste from St. Marys is presented in Table 3-7. The four final disposal and treatment sites which provided responses to the survey questions include:

- Walker Environmental (Niagara Landfill);
- Waste Management of Canada Corporation (Twin Creeks Landfill);
- Republic Services Inc. (Carleton Farms Landfill); and
- Emerald Energy from Waste Inc. (an incinerator in Peel Region).

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[23] Now known as *Waste Connections of Canada*.

Table 3-7: Responses to Private Landfill/Thermal Treatment Fee and Capacity Questions

Questions	Walker Environmental (Niagara Landfill)	Waste Management of Canada Corporation (Twin Creeks Landfill)	Republic Services Inc. (Carleton Farms Landfill)	Emerald Energy from Waste Inc.
Is your site licensed/permitted to receive waste from St. Marys? (Y/N)	Y	Y	Y	Y
Do you have capacity to receive 2000 to 5000 tonnes/year from St. Marys? (Y/N)	Y	Y	Y	Y
What is the estimated remaining capacity at your site (in m^3 and years)?	Volume: 14.5 Mm^3 Life: 13 years	Volume: 20 Mm^3 Life: 25 years‡	Volume: 60 Mm^3 Life: 75 years	N/A
What is the current gate tipping rate?	$45 to 55/tonne	$45 to 50/tonne	$18/tonne	$90/tonne
What is the maximum contract duration you are willing to negotiate?	10	25	10	20
How have tipping rates changed in last 5 years?	± 5% continual decline with par dollar and cheap fuel, stabilizing now with lower Canadian dollar	Rates have decreased to compete with Michigan landfill rates.	Have not increased in last 5 years.	No response provided.
Distance from St. Marys†	157 km	80 km	250 km	144 km
Preferred Private Landfill/Thermal Treatment Site	Not preferred: high tipping fees, short lifespan remaining and short contract duration.	Preferred for proximity and contract duration.	Not preferred: distance and border crossing required.	Not preferred: high tipping fees and distance to the site.

Notes:

† One-way travel distance, from St. Marys to the disposal site.

‡ Rate-of-Fill revised in 2017, resulting in an estimated 15 years of remaining capacity.

No response received for the Ridge Landfill (Blenheim, Ontario) or the Brooks Road Landfill (Cayuga, Ontario).

BFI Canada Inc. provided a survey response that indicate their transfer station would send waste to the Ridge Landfill. They did not answer the landfill related questions featured in Table 3-7. As such, only four of the five respondents have been included.

Based on the information provided, the Twin Creeks Landfill in Watford and Carleton Farms Landfill in Michigan are the highest rated opportunities.

The Twin Creeks Landfill has the following advantages:

- At least 25 years of capacity remaining at the site.
- Willingness to negotiate a 25-year contract.
- Relatively close distance from St. Marys.

The advantages of taking the Town's waste to Carleton Farms Landfill in Michigan include:

- 75 years of capacity remaining at the site (this is the only landfill with sufficient capacity to fully address the 40-year needs of St. Marys).
- A low tipping fee (cost).

Although the option to deliver waste to Michigan offers some advantages, in August 2006[24] Ontario's Environment Minister and US Senators for Michigan, Debbie Stabenow and Carl Levin, agreed to stop cross-border shipments of municipally-managed waste, from Ontario into Michigan by 2011. The agreement does not cover waste under private contract that the Ontario government and its municipalities do not control. The agreement was focussed on the larger Ontario municipalities that were, at the time, shipping their waste to Michigan landfills, namely the City of Toronto and the Regions of Durham, Peel and York. Today some Ontario municipalities are utilizing private waste collection, transfer stations, and/or haulage to send their waste to Michigan landfills. As such, for this option to be feasible, the Town would need to use a private hauler or deliver waste to a private transfer station with the necessary permissions/approval to transport waste across the border into Michigan. Through the survey, Waste Management of Canada Corporation noted the following:

> *St. Marys waste volume is small. Therefore, roll-off and curbside collection vehicles should haul direct to a disposal site. A depot should be set up for local volume service in front-load bins.*

As such, it was determined that using a private hauler would be required to make use of the landfill in Michigan, while it is preferable to use curbside collection vehicles to deliver waste directly to the Twin Creeks Landfill.

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[24] https://www.theglobeandmail.com/news/national/agreement-to-phase-out-shipments-of-ontario-garbage-to-michigan/article1102634/, accessed September 30, 2019.

3.4.2.3 Conclusion

Based on the discussion and comparative analysis provided above, delivery to the Twin Creeks Landfill was determined to be the Preferred Alternative for waste export. This *Alternative* will be carried as *Alternative 2* in the evaluation of the *Alternatives to the Undertaking*.

3.5 Alternatives to the Undertaking

The TOR indicated that the Alternatives to the Undertaking would include a "Do Nothing" option, expansion of the St. Marys Landfill and an option to export waste to another jurisdiction. Based on the screening presented in Section 3.4, the Alternatives to the Undertaking are as follows:

Do Nothing

As a requirement of the *EA Act*, the 'Do Nothing' must be considered. Doing Nothing represents the result of no action being taken to address the Problem Statement and serves as a baseline against which other *Alternatives* can be compared. *Do Nothing* has thus been carried forward for comparison to the Proposed Undertaking and *Alternative* 1 during the EA.

Alternative 1: Expanding the St. Marys Landfill

This Alternative involves the continued operation of the St. Marys Landfill by the Town following the design, approval and construction of expanded waste disposal areas within the existing 37 ha property. The Town plans to continue to contract BRA to undertake the curbside collection program.

For the purposes of this portion of the EA, this Alternative is assumed to have the following characteristics:

- The expansion would be located entirely within the Town-owned property at 1221 Water Street South (the existing landfill property);
- The landfill expansion area would be designed to have a leachate collection system and stormwater management system, in accordance with typical Environmental Compliance Approval (ECA) requirements;
- Setbacks from property lines will be included; and
- Typical nuisance control measures will be in place, including:
  - Applying daily cover to control odour and reduce blowing litter;
  - Providing visual barriers, such as berms or tree plantings to block sightlines;
  - Applying dust control measures, as required;
  - Conducting regular inspections by landfill staff to observe and record any operational issues and implementing corrective actions; and

- Continuing the existing program to record and respond to public complaints and take corrective actions.

Alternative 2: Exporting Waste to the Twin Creeks Landfill

For the purposes of this EA, *Alternative 2* would involve the closure of the St. Marys Landfill for waste disposal. The Bluewater Recycling Association (BRA) would continue to collect municipal waste through their current curbside waste collection program; however, the waste would be transported to another waste disposal site outside the jurisdiction of the Town of St. Marys. For the purposes of this assessment, it was assumed that waste would be taken directly, without using a transfer station, to the Twin Creeks Landfill in Watford, Ontario using existing BRA curbside collection vehicles.

While the Town is not responsible for Industrial, Commercial and Institutional (IC&I) collection or disposal, IC&I users have their waste delivered to the St. Marys Landfill. If it were to close, then all IC&I users would need to have their collection contractors take their wastes to another disposal facility. This could be the Twin Creeks Landfill or another facility.

The Twin Creeks landfill is 301 ha in size with a permitted landfill footprint of 101.8 ha. This site is operated under Environmental Compliance Approval (ECA) No. A032203. The site's name and address were updated by ECA Notice 24, dated May 24, 2019 to:

Twin Creeks Environmental Centre
5768 Nauvoo Road (Watford)
Warwick Township, County of Lambton

As noted through the initial screening survey described in Section 3.4, there is substantial available capacity at the landfill. The Twin Creeks Landfill is approved to accept waste form St. Marys. Therefore, it is assumed that no additional permitting or approvals are required by Waste Management of Canada, the owner and operator of Twin Creeks, should this Alternative be selected.

It is assumed that the St. Marys landfill site would continue to operate as a public waste drop-off and composting site for St. Marys residents.

3.6 Study Area

During preparation of the TOR a specific landfill to be used for exporting waste was not identified. As such, the Study Area for this portion of the EA was not defined.

A reasonable Study Area has been defined by the spatial extent of the proposed Alternatives and the surrounding lands within 120 m of the footprint of each of the Alternatives. This includes the existing St. Marys landfill, the lands around the St. Marys landfill where the expansion could take place, the Twin Creeks Landfill and the travel route between St. Marys and the Twin Creeks Landfill, as shown on Figure 3-1.

Lands immediately adjacent to these features are also included in the Study Area.

3.7 Description of the Existing Environment

The TOR indicated that the evaluation of Alternatives To the Undertaking would be qualitative, based on information from existing data sources or from information to be gathered through the landfill operators' survey. As such, the description of the environment for this phase of the EA is based on publicly available data sources and the survey, described in Section 3.4.1. The TOR indicated that, with respect to Alternative 1, Expansion of the Existing Landfill, data sources will include, but will not be limited to:

- Official Plan documents;
- Background air, surface and groundwater quality reports, studies and previous monitoring results;
- Various operational and technical reports documenting existing landfill operations;
- Complaints history;
- Employment records;
- Statistics Canada data sets; and
- Other sources as identified during the assessment process.

With respect to Alternative 2, Export Waste to Another Jurisdiction, data will primarily be derived from a survey to be administered to the operators of a number of potential waste disposal facilities, expected to be mainly landfills, which may be able to accept the Town's waste.

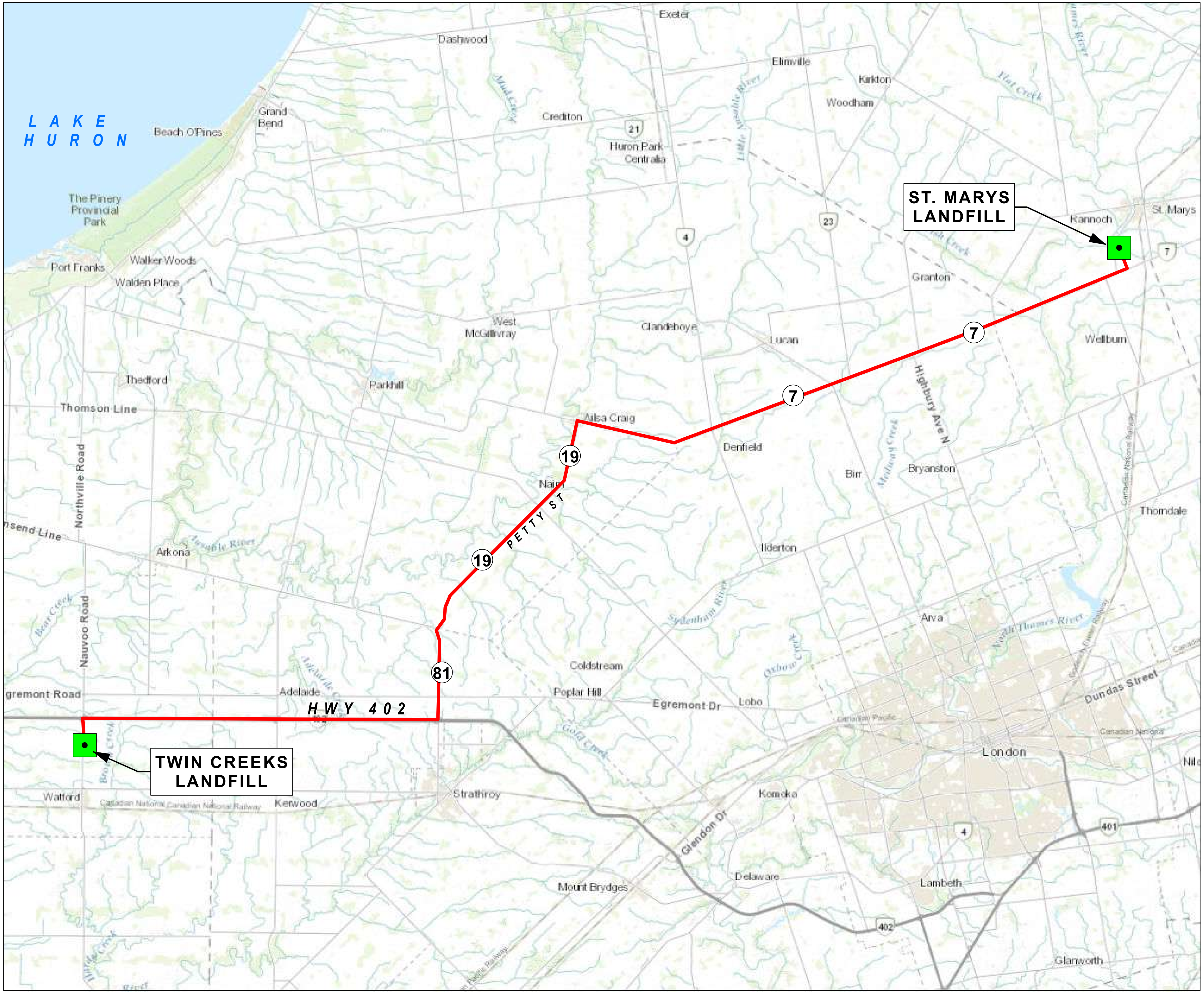
The TOR also indicated that in the subsequent Phase 5 of the EA, additional field investigations would be undertaken to characterize the environment in greater detail. This more detailed description of the environment is provided in Section 6.6.

According to the EA Act, and EA must include, among other items, "a description of… the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly." Section 6.1(1).

In Section 1(1) of the EA Act, the "environment" is defined as:

a) *Air, land or water,*

b) *Plant and animal life, including human life,*



🟩 Landfill Location

🟥 Proposed Route between Landfills

Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario.
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Disclaimer:

R.J. Burnside & Associates Limited and the above mentioned sources and agencies are not responsible for the accuracy of the spatial, temporal, or other aspects of the data represented on this map. It is recommended that users confirm the accuracy of the information represented.

This map is the product of a Geographic Information System (GIS). As such, the data represented on this map may be subject to updates and future reproductions may not be identical.

Datum: North American 1983	
Coord. System: NAD 1983 UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Page Orientation: 0°	Scale Factor: 0.99960

N

Grid North

0 2.5 5 7.5 10 12.5

Kilometers

BURNSIDE

Client

TOWN OF ST. MARYS

Figure Title

ENVIRONMENTAL ASSESSMENT

STUDY AREA

Drawn	Checked	Date	Figure No.
HN	TR	JUNE 2021	3-1
Scale		Project No.	
H 1:225,000		300032339	

File Path: \\elmo\GIS\Project\300\032339 (St. Marys)\Map\032339 Study Area.mxd   Print Date: 2020/10/08 Time: 04:02 PM *d) The social, economic and cultural conditions that influence the life of humans or a community,*

e) Any building, structure, machine or other device or thing made by humans,

f) Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities, or

g) Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

As such, this phase of the EA characterizes the "environment" in accordance with this definition.

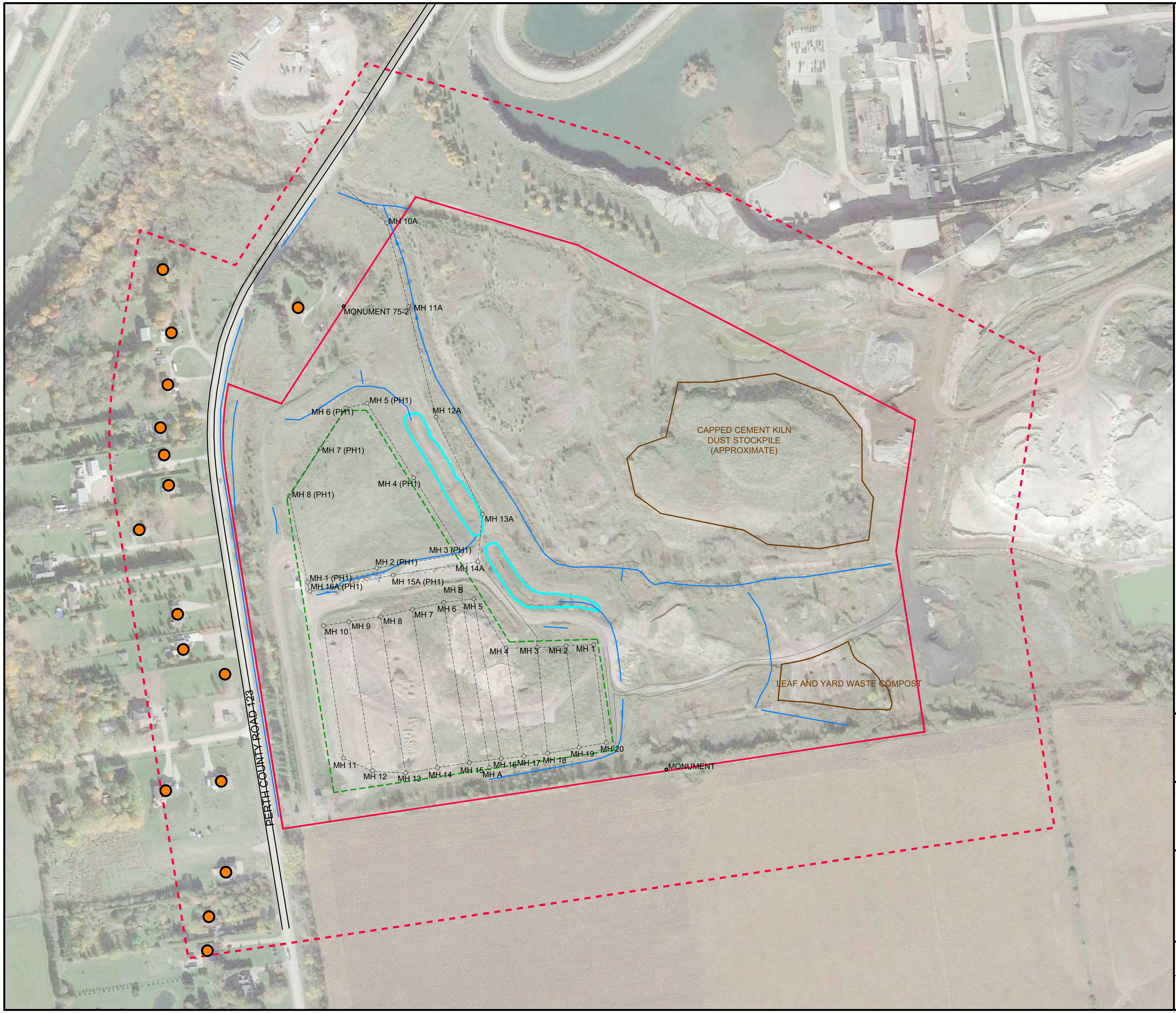
Accordingly, the following sections document the existing environment in the Study Area. The components of the environment, listed above, are organized into the following headings:

- **Built Environment:** including, any building, structure, machine or other device or thing made by humans, any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities.
- **Natural Environment:** including air, land or water, plant and animal life, including human life.
- **Social and Cultural Environment:** including the social, economic and cultural conditions that influence the life of humans or a community.

The following sections describe the existing environment, under these headings, within the Study Area, including the lands associated with the existing St. Marys Landfill property, the Twin Creeks Landfill property and the haul route between St. Marys and Twin Creeks.

3.7.1 Existing St. Marys Landfill

Existing conditions at the St. Marys landfill are shown on Figure 3-2.



LEGEND

▬	PROPERTY BOUNDARY
- - -	PROPERTY BOUNDARY - 120M BUFFER
- - -	LIMIT OF REFUSE DISPOSAL
▬	WATERCOURSE
— — —	LEACHATE COLLECTION SYSTEM
▬	STORM WATER MANAGEMENT BASIN
●	RESIDENCE WITHIN 120M OF LANDFILL PROPERTY

Satellite & Air Photo Source:
Background satellite / air photo circa 2015 obtained from Google Earth Professional.

N

0 40 80 160 240 320
Metres

BURNSIDE

Client / Report

TOWN OF ST. MARYS

ENVIRONMENTAL ASSESSMENT

Figure Title

ST. MARYS LANDFILL EXISTING ENVIRONMENT

Drawn	Checked	Date	Figure No.
HN	TR	June 2021	3-2
Scale		Project No.	
1:3,000		300032339	

File Name: Elmo/gis/Projects/300/032339 St Marys/032339 EXISTING ENVIRONMENT.dwg Date Plotted: June 11, 2021 - 11:02 AM

3.7.1.1 Built Environment

Past Uses and Disturbances

The St. Marys landfill is in the southwestern portion of the Town. The site was originally owned by St. Marys Cement Co. (SMC) now a wholly-owned subsidiary of Votorantim Cimentos based in Sao Paulo, Brazil. Founded in 1912, SMC offices and the cement plant are still located north of the landfill in an area that was formerly a quarry.

Prior to the development of the landfill, the property was licenced by the Ministry of Natural Resources as part of the SMC quarry. Historical aerial photographs show that soil was stripped from the north end of the Site and possibly some rock quarried. The surficial clay was also mined on portions of the Site for use in the cement production. More recently, the north end of the Site was used to stockpile soils and materials associated with cement production.

In 1979, the Town began investigating the feasibility of using a portion of a former clay pit owned by SMC as a municipal landfill site (CRA, 1982). The 16.2 ha property was smaller than the current Site. The property was leased from SMC. At the time, the long-term end use planned for the Site was to become part of a greenbelt buffer zone surrounding the SMC plant (CRA, 2011).

The Site was approved in 1983, landfilling began in December 1984 in the area known as Phase I. The proposed bottom elevation was 315 masl (CRA, 1982 Plan 2). Phase I was completed and finished with final cover in the summer of 1993 (CRA, 2012).

Phase II/III was divided into eight stages, which corresponded with the development of a leachate collection system from east to west. Stage 7 was constructed in the fall of 2010 and began receiving waste in December 2010. A weigh scale was installed in 2012 to assist in operations and filling control. Stage 8 was constructed in late summer 2013 and began receiving waste in September 2013 (Burnside, 2013).

The Town purchased additional property from SMC in 2009. ECA No. A150203 dated June 24, 2010 (amended 2013 and 2015), reflects Site ownership by the Town and incorporated additional land from SMC to bring the Site to its current size. The Site is now a 37-ha waste disposal Site with an 8-ha landfill area.

Cement Kiln Dust (CKD) Stockpile

As described above, the northeast portion of the landfill property was purchased by the Town from St. Marys Cement in 2009. The land in this area contains a Cement Kiln Dust (CKD) stockpile from historic St. Marys Cement operations. The CKD stockpile has been in place for approximately 30 years. The CKD stockpile was studied by Golder in 2005. A copy of the report is provided in Appendix C. The study found that the total volume of CKD is estimated to be approximately 350,000 to 400,000 m^3. Golder compared samples of the material to the 2004 *Soil, Groundwater and Sediment Standards; Table 3: Full Depth Site Conditions in Non-Potable Groundwater, Industrial/Commercial Use*. The results indicated that the material generally did not exceed the Table 3 standards for petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCB) or polycyclic aromatic hydrocarbons (PAH). There was one minor exceedance for cadmium; however, all other metals were below specified limits. Groundwater samples taken from two monitoring wells in the CKD stockpile were tested for inorganics, PCB and PAH. Samples were found to be alkaline with a pH of 10 and high in sulphate, chloride, potassium and sodium. There were no exceedances of Table 3 standards apart from selenium and silver in which the exceedance was due to a detection limit higher than the standard. One groundwater sample was submitted for TCLP analysis with no exceedances.

Existing Landfill Infrastructure

The ECA also approved the Site for the collection and diversion of recyclable waste including Waste Electrical and Electronic Equipment (WEEE), acceptance and transfer of Municipal Hazardous or Special Waste (MHSW), and the composting of leaf and yard waste.

Leachate Collection

The Phase I leachate collection system is a perimeter system consisting of perforated collector pipes connected between manholes. It was installed as a contingency system to control mounding within the waste.

The Phase II/III collection system incorporates perimeter collectors as well as lateral collectors passing beneath the waste. The system was extended as each new Phase was constructed. Both the perimeter system of Phase I and the underdrain system of Phase II/III restrict the movement of leachate beyond the landfilling footprint and control the leachate mound within the waste.

Initially, leachate from Phase I was collected in a holding tank near maintenance hole number 1 in Phase I (MH1, PH1). Leachate from Phase II/III was collected in a holding tank near MH3. In 1997, a sewer was installed to gravity drain the leachate directly from the leachate collection systems to the Town's sanitary sewer system. The Phase I leachate holding tank was decommissioned in 2008. The Phase II/III leachate holding tank was used to connect the Phase II/III leachate collection system to the gravity sewer. It contains a valve to shut off leachate flow for maintenance of the sewer line. There is no dedicated leachate storage tank on-site; however, the site itself can provide leachate storage as does the collection system. Leachate is directed to the Town's wastewater treatment plan (WWTP). The actual amount of leachate directed to the WWTP is small relative to the capacity of the plant. It is estimated that Phase I and Phase II/III produce an average of 24.5 m^3/day of leachate. By comparison, the St. Marys Wastewater

Treatment Plant (WWTP) has a Rated Capacity of 5,560 m^3/day. This means the landfill leachate is approximately 0.4% of the WWTP's rated capacity.

Topography and Drainage

The topography of the site today is a result of not only the landfill, but historical activities connected to St. Marys Cement (SMC) operations. These activities include clay mining over most of the site, overburden stripping and stockpiling east of the watercourse, cement kiln dust stockpiling and rerouting of the watercourse.

The Site has been impacted by industrial activity since the 1960's. It was around that time that the quarry operation to the north began encroaching into what is now the landfill Site. It is likely that there were impacts to the groundwater prior to that time from quarry dewatering. Most of the Site was then disturbed by the SMC borrow pit that mined clay for cement manufacturing. SMC personnel indicate that borrow pit operations at the Site ended in 1977. By this time none of the site was in a natural state.

The highest elevation on the Site today is the cement kiln dust (CKD) stockpile at around 334 m amsl at its highest point. The elevations of the fill areas are approximately 327 m for Phase I and 326 m amsl in Phase II/III. The lowest elevations on the Site occur along the watercourse. This channel enters the east side of the Site at an elevation of approximately 310 m amsl and exits at the northwest end below 309 m amsl. The elevation changes between SP1-10, the surface water station at the east side of the Site and SP3-93, near the north end, is approximately 1.5 m. This is over a distance of about 660 m resulting in a grade of 0.2%.

Perth County Road 123 is a topographic ridge on the west side of the Site and acts as a drainage divide. West of the ridge, runoff flows west toward the Thames River. East of the road, runoff is eastward toward the stormwater retention basins and the watercourse.

Surface water from the complete landfill areas is directed through a series of perimeter ditches and swales around the landfills and along the interior roadways. The ditches and swales convey the runoff to two stormwater retention basins. These stormwater basins attenuate the peak flows during storm events and allow sedimentation. The 2012 Annual Report noted that riser pipes were replaced, and sediment was removed from both stormwater basins during the landfill earthworks in October and November 2007. As part of the Site's ongoing monitoring, swales, culverts and outlets are inspected regularly to ensure surface water flow.

The stormwater basins outlet to the watercourse via control features. The watercourse leaves the Site by a culvert under Perth Road 123. It eventually discharges into the Thames River, approximately 500 m downstream of the Site.

Upstream of the Site, this watercourse divides into two branches (see Figure 3-2). The north branch skirts the south edge of the SMC quarry and drains industrial properties and agricultural fields east of the Site. The south branch occupies a vegetated channel between the agricultural fields and the excavated/filled areas on the SMC property. It drains industrial and agricultural land further south and east before crossing James Street and Elginfield Road (Highway 7). According to the 1982 Hydrogeological Report, it drains an area of approximately 607 ha.

Site reconnaissance in 2015 indicated that site drainage is less defined east of the watercourse. Surface water runoff from the relatively steep slopes of the CKD stockpile flows radially in all directions, including west toward the watercourse and north toward the quarry. There are relatively flat areas between the stockpile and the watercourse with isolated water-filled depressions, some of which contain cattails.

Site Size

Currently, the landfill property is 37 ha in size with 8 ha approved for landfilling. Waste for disposal is accepted from the Town of St. Marys only. The majority of waste collected is from the large IC&I base within the Town as well as from household curbside collection. Private waste companies generally dispose of waste at the St. Marys Landfill with the exception of some specialized waste that is taken to other diversion or disposal locations within the region.

There is current no landfill gas collection system in place.

Traffic Conditions

The landfill access operates under stop control at its intersection with Perth Road 123. The proposed haul routes for the site are primarily Perth Road 123 and Water Street as these are the arterial roads which provide primary access to the landfill site.

- Perth Road 123 is a two-lane arterial road, which has a posted speed of 80 km/hr in the landfill access area. This road is under the jurisdiction of the County of Perth.
- Perth Road 123 becomes Water Street roughly 470 m north of the landfill access point. Also, at this point, the road becomes under the jurisdiction of St. Marys. The road has a posted speed of 50 km/hr.

The above haul routes connect to the tar and chip driveway[25] which serves as the St. Marys Landfill access route, located on the east side of Perth Road 123. The entrance of the access road works to form a T-intersection with Perth Road 123 and is stop-sign controlled.

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[25] The driveway was upgraded to tar and chip in 2019. The air modelling for the Site was based on the previous gravel driveway surface conditions. The tar and chip driveway is an improvement compared to the modelled conditions.

3.7.1.2 Social and Cultural Environment

Population

The Town of St. Marys has a population of a 7,265 according to the 2016 Census. Census data indicates that from 2001 to 2006, the Town grew from 6,293 to 6,617 residents (Statistics Canada, 2006). Between 2011 and 2016, the Town population changed from 6,655 to 7,265 (Statistics Canada, 2016).

Land Use

The site is surrounded by the St. Marys Cement plant to the northeast and northwest, agricultural fields to the south, and a number of rural residences and farms to the west.

The landfill property is identified as an Environmental Constraint area, in accordance with the Town's Official Plan. Surrounding land uses within the Town include Extractive Industrial uses to the north, northeast and west that encompass the operations of St. Marys Cement. One residence is situated on the east side of Water Street South. This residence is surrounded on its north, east and west property limits by the landfill property. This property is identified for Extractive Industrial purposes, according to Schedule A, Land Use Plan of the Official Plan. A small area of floodplain lands lies on either side of the Thames River.

The Township of Perth South lies adjacent to the western and southern boundaries of the landfill. The Township does not have its own Official Plan and, instead, defers to the County of Perth Official Plan. According to Schedule A of the Perth County Official Plan, lands to the immediate south and east are designated as Licensed Quarry Pit/Limestone Resource and Agricultural Lands with a small amount of Natural Resources/Environment adjacent to the Thames River.

In total, there are 16 residences within 120 m of the landfill. These are rural residential properties.

Until recently, St. Marys Cement maintained an aggregate extraction license for a portion of the lands it had sold to the Town. Per the St. Marys Cement Surrender of Land document, under Aggregate License 4494 dated September 21, 2016, the surrendered lands were 19.45 ha and 4.37 ha in size for the existing and potential landfill areas, respectively. This surrender was approved under Section 16(2) of the *Aggregate Resources Act* by the Ministry of Natural Resources and Forestry on November 8, 2016. The entire St. Marys Landfill property is now unencumbered by the aggregate extraction license.

Economic Conditions

The landfill currently employs one full-time staff position, one part-time staff position and six staff who work occasionally, as follows:

- Site Attendant – a full-time position;
- Compactor Operator – a regular part-time position;
- (Five) Equipment Operators – as occasionally needed;
- Environmental Services Supervisor – a full-time position that provides site operations supervision; and
- Supervisor of Operations – as occasionally needed.

The Town of St. Marys 2016 budget attributed total staff salary for these employees as approximately $106,000. For clarity, the Supervisor of Operations spends only a portion of their time dealing with the existing landfill operations. This is also true for others noted “as occasionally needed”. As a result, only a portion of their salaries are attributed to the landfill operations in the budget. The full amount of the site attendant’s salary is included.

St. Marys is home to a significant industrial sector, which represents a substantial employment and economic driver at the local and regional level. St. Marys is strategically located, being approximately 40 km from London (2011 Census population 366,150) and 20 km from Stratford (2011 Census population 30,886). This means there is a large commuter base in the area. As a result, the Town is an important contributor to the economic and social stability of the surrounding municipalities and Southwestern Ontario.

Economic drivers in the Study Area primarily include the St. Marys Cement operation and agricultural uses to the south and west of the landfill site. St. Marys Cement is a key industry for the Town. The company was founded in 1912 and is now part of a global consortium. As stated in The Town of St. Marys Economic Prosperity Community Improvement Plan (2015), St. Marys Cement is an anchor business within the Town and the Region, attracting clients throughout the Great Lakes Region. The Town’s economic stability is strengthened by the presence of this industry as well as a strong agricultural sector. As noted in the Town’s Community Improvement Plan (CIP), the Town believes that these are two key areas that can be built upon to retain and attract firms from other diverse sectors. These industries are therefore crucial sectors and all potential impacts to these must be considered when determining future developments.

Archaeological and Cultural Heritage Features

There are no known archaeological sites on, or in the vicinity of, the landfill property. Schedule D of the Town's Official Plan identifies a number of Heritage Conservation Sites. None are near the landfill, as shown in Figure 3-3. Additional cultural heritage features may be present and will be studied further should expansion of the St. Marys Landfill be selected as the preferred alternative.

Treaties and Traditional Territory

Indigenous peoples made use of the lands in the Study Area for thousands of years before European contact. The Thames River was of particular importance as a travel and trade route and source of fish. The landfill property has not been used directly by Indigenous communities in recent times; however, its location in close proximity to the Thames River gives it historical significance. Any specific evidence of past use has been erased by current quarry and landfill alternations to the landscape. It can be assumed that the landfill site could have been used for hunting, gathering and/or access to the Thames River. There are no records or evidence of specific occupation by a permanent or seasonal village. There are no current uses of the land for traditional purposes or resources.

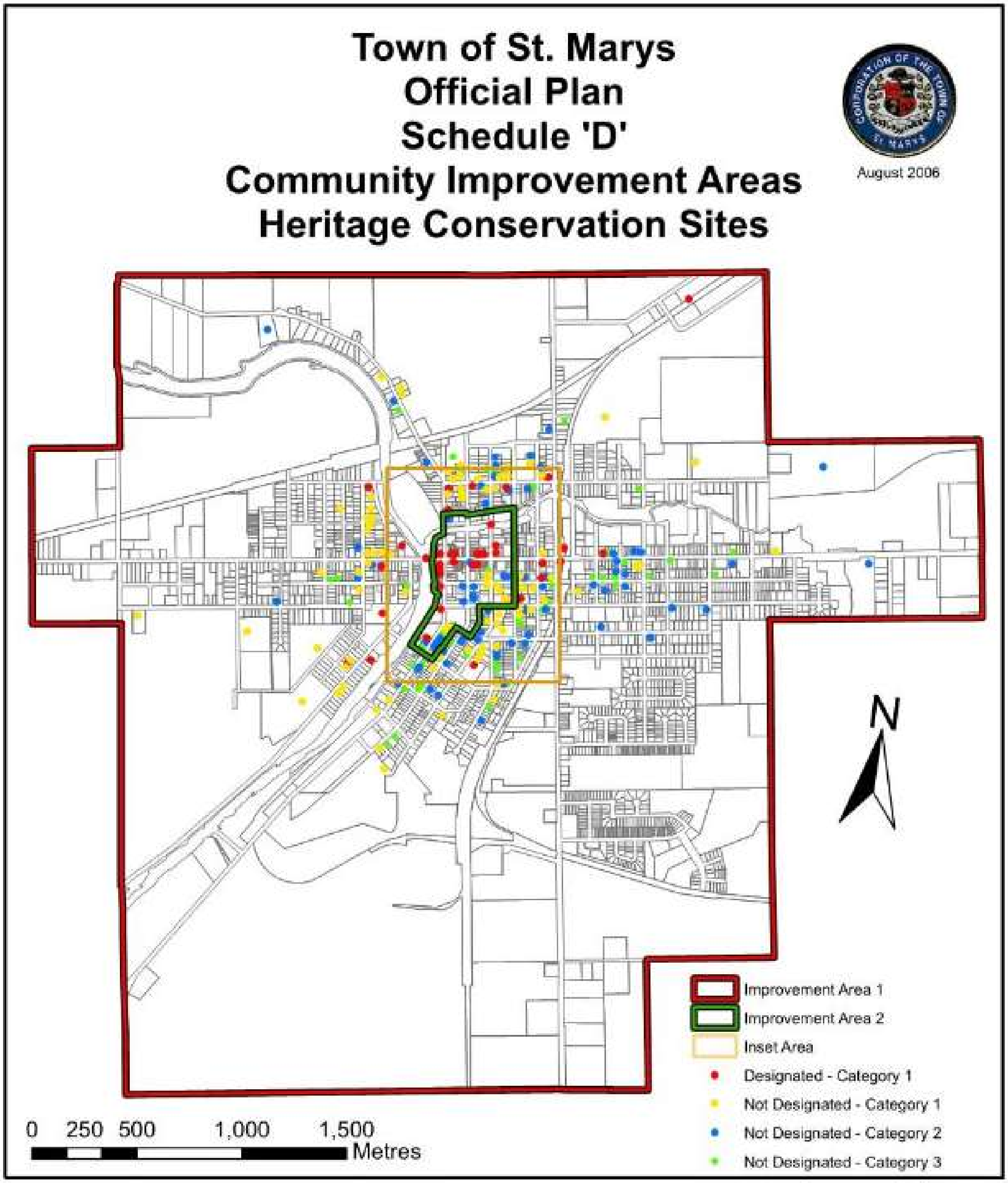
The St. Marys Landfill is within the lands covered by Treaty 29 (1827). The modern signatories to this treaty are:

- Aamjiwnaang First Nation (formerly Chippewas of Sarnia First Nation);
- Caldwell First Nation;
- Chippewas of Kettle & Stoney Point;
- Chippewas of the Thames First Nation; and
- Walpole Island First Nation.

The Haudenosaunee Development Institute (representing the Haudenosaunee Confederacy) and Six Nations of the Grand River Territory were also contacted as they expressed interest due to the site's location within the area covered by the Nanfan Treaty.

The Indigenous communities listed above are believed to have Indigenous Rights, Treaty Rights, or both, affecting the subject property.

Figure 3-3: Schedule D of the Town of St. Marys Official Plan



3.7.1.3 Natural Environment

The Thames River is located approximately 250 m to the northwest of the site. An unnamed watercourse runs through the centre of the site and discharges to the Thames River. There is a large, perched culvert along the unnamed watercourse at Water Street, limiting fish migration from the Thames River into the watercourse. The Thames River provides habitat for a Species Concern mussel species, several kilometers downstream of the unnamed watercourse outlet. Farther downstream, additional critical habitat for an Endangered mussel species is also present. The unnamed watercourse provides indirect fish habitat.

As noted, the northeast portion of the landfill property was purchased by the Town from St. Marys Cement in 2009. The land in this area contains a Cement Kiln Dust (CKD) stockpile from historic St. Marys Cement operations. The CKD stockpile has been in place for approximately 30 years. The cap and side slopes are well vegetated, and no erosion has been noted. The unnamed watercourse wraps around the south and west sides of the stockpile. Water quality samples from the watercourse since 1985 (as part of the landfill monitoring) have not detected an impact from the landfill or the CKD stockpile. The water quality upstream and downstream is typically similar. Monitoring of benthic invertebrates had been part of the landfill's annual monitoring program until 2008. At that time, it was determined that benthic monitoring would no longer be required because upstream and downstream conditions were similarly impaired and there was no clear value in continuing the program. Details are provided on page 2 of the cover letter to the Town's application to amend the site's Certificate of Approval in 2008. A copy of the letter is provided in Volume IV, Appendix B.

Several small-treed areas and wet depressions are scattered throughout the landfill site. Other natural features on, and around, the site are limited due to the nature of the existing landfill and the surrounding extraction operations. Natural woodland areas are present along the Thames River. Some grassland areas are present on inactive and closed landfill cells. Grassland areas may provide habitat for grassland birds or snakes, including some species at risk.

Source Water Protection

The St. Marys Landfill is in the Thames-Sydenham & Region Source Protection Area. Mapping supplied by the Upper Thames River Valley Conservation Authority showed that the landfill is not within any Wellhead Protection Areas or Intake Protection Zones for municipal water supplies. There are no Significant Groundwater Recharge Areas mapped on the site. An area in the northeast corner of the landfill site is mapped as Highly vulnerable Aquifer. This is likely the result of the SMC quarry to the north having removed the protective overburden above the bedrock aquifer during the quarry operation.

The landfill monitoring program includes five residential wells on neighbouring properties. No concerns with drinking water quality have been identified to date by the landfill's monitoring program.

Air Quality

The air quality around the facility is typical of a small landfill. There are 16 residences ("receptors") along the west side of Water Street with additional receptors further away to the north and south. To the east, the nearest residential receptors are on James Street South which is more than 1 km from the landfill.

According to landfill records, the residents around the landfill complain about odours infrequently. Road dust is controlled and dust from the working face does not impact the neighbours. All contaminants meet their regulated criteria at the property line, based on annual monitoring report findings.

3.7.2 Twin Creeks Landfill

The existing conditions at the Twin Creeks landfill are shown on Figure 3-4.

This site is operated under Environmental Compliance Approval (ECA) No. A032203. The site's name and address were updated by ECA Notice 24, dated May 24, 2019 to:

Twin Creeks Environmental Centre
5768 Nauvoo Road (Watford)
Warwick Township, County of Lambton

3.7.2.1 Built Environment

The Twin Creek landfill is located outside of the community of Watford. The landfill began operation in 1972. Waste Management of Canada Corporation (WM) has owned and operated the landfill since 1996. In 2008, after a nearly 12-year technical study and public consultation period, the previously named Warwick Landfill was approved for expansion. Construction of the infrastructure for the Expansion Site began in August of 2008 and continued into the fall of 2009. Waste was first deposited into the Expansion Site in November of 2009.

The landfill property is 301 ha with an approved landfilling area of 101.8 ha. The site accepts residential and ICI-related waste from across Ontario. According to the MECP's Large Landfill Site list[26], The Twin Creeks Landfill was the second largest landfill in Ontario in 2011, with an approved disposal capacity of 26,508,000 m^3.

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[26] https://www.ontario.ca/data/large-landfill-sites, data current to October 21, 2011 (accessed October 30, 2019).

For comparison, the St. Marys Landfill property is 37 ha (12% of Twin Creeks), the existing waste footprint is 8 ha (8% of Twin Creeks) and the existing approved disposal capacity, including all ECA Notices, is 434,050 m^3 (1.6% of Twin Creeks). The expansion envisioned by this EA would result in a total St. Marys landfill capacity of 1,107,875 m^3 or 4% of Twin Creek's capacity.

According to the information provided by Waste Management of Canada Corporation through the private landfill operators survey, described in Section 3.4, the Twin Creeks Landfill includes the following features:

- Full landfill gas collection, including permanent and temporary vertical and horizontal wells. Collection efficiency is estimated at 85%.
- The current landfill gas destruction system is a flare; however, a landfill gas to energy system is in the planning stages.
- Leachate is collected and disposed to willing municipal licensed receivers. There is also seasonal disposal to an onsite poplar plantation.

It is noted that the survey sent to Twin Creeks operators was completed in April 2015. At that time, it was estimated that the landfill had 25 years of capacity remaining. In 2017 the landfill has received an ECA Notice allowing for double its previous fill rate. The Environmental Screening Report[27] completed to support the increased fill rate indicates that the landfill will now reach its approved capacity by 2034 rather than 2047. Thus, at the date of this report, the Twin Creeks Landfill has only 15 years of capacity remaining.

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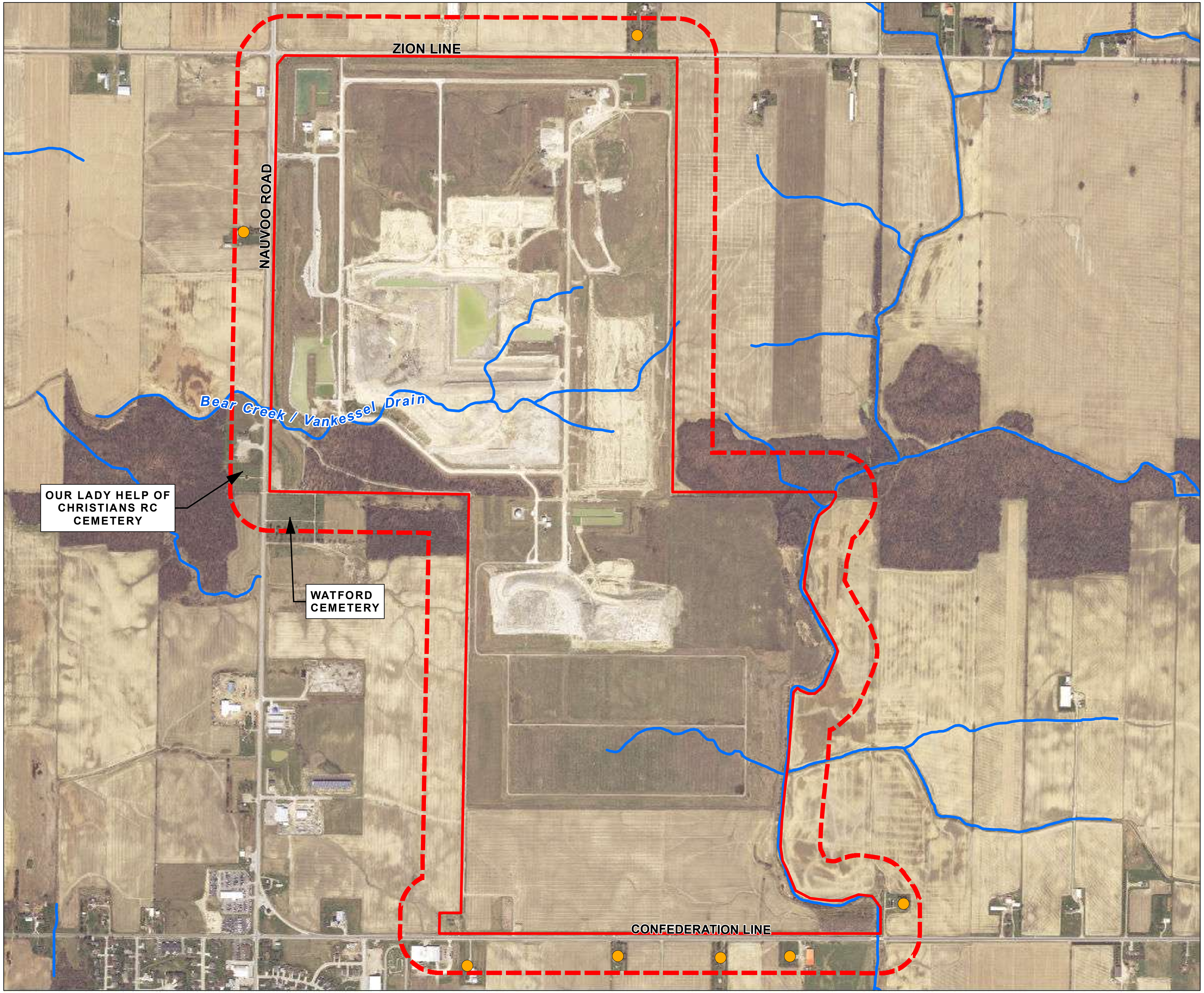
[27] Source: http://twincreekslandfill.wm.com/documents/Environmental%20Screening%20Report%20-%20Twin%20Creeks%20Landfill%20Proposed%20Fill%20Rate%20Increase%20(March%202017)%20(1).pdf



●	Residence within 120m of Landfill Property
▭	Property Boundary - 120m Buffer
🟥	Property Boundary
—	Watercourse

Sources:

1. Ministry of Natural Resources and Forestry, © Queen's Printer for Ontario.
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Disclaimer:

R.J. Burnside & Associates Limited and the above mentioned sources and agencies are not responsible for the accuracy of the spatial, temporal, or other aspects of the data represented on this map. It is recommended that users confirm the accuracy of the information represented.

This map is the product of a Geographic Information System (GIS). As such, the data represented on this map may be subject to updates and future reproductions may not be identical.

Datum: North American 1983 CSRS	
Coord. System: NAD 1983 CSRS UTM Zone 17N	
Projection: Transverse Mercator	
Central Meridian: 81°0'0.00"W	
False Easting: 500,000m	False Northing: 0m
Page Orientation: 0°	Scale Factor: 0.99960

N

Grid North

0 150 300 450 600 750

Metres

BURNSIDE

Client

TOWN OF ST. MARYS

Figure Title

ENVIRONMENTAL ASSESSMENT

TWIN CREEKS LANDFILL
EXISTING ENVIRONMENT

Drawn	Checked	Date	Figure No.
HN	TR	JUNE 2021	3-4
Scale		Project No.	
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File Path: \\elmo\GIS\Project\300\032339 (St. Marys)\Map\032339 Twin Creeks Environment.mxd Print Date: 2020/10/08 Time: 04:03 PM

3.7.2.2 Social and Cultural Environment

Land Use and Socio-economic Conditions

Surrounding lands are primarily agricultural with a small number of commercial properties along Nauvoo Road. Two small cemeteries are located to the immediate southwest of the site. There are approximately seven residences within 120 m of the landfill, as shown on Figure 3-4.

According to the information provided by Waste Management of Canada Corporation through the private landfill operators survey, described in Section 3.4.1, the Twin Creeks Landfill has a number of agreements in place to provide benefits to stakeholders, including:

- A Community Host Agreement with Warwick Township;
- Impact Benefit Agreement with Walpole Island First Nation;
- Impact Benefit Agreement with landfill neighbours;
- Property Value Protection; and
- A local liaison committee.

Employment levels at the landfill are unknown.

Archaeological and Cultural Heritage Resources

With the exception of the two cemeteries adjacent to the landfill, the presence of archaeological or cultural heritage resources is unknown. It is assumed that because the landfill has been approved any concerns with archaeological and cultural resources have been addressed.

Treaties and Traditional Territory

Indigenous peoples made use of the lands in the Study Area for thousands of years before European contact. Bear Creek was likely used a travel and trade route and source of fish. The landfill property has not been used directly by Indigenous communities in recent times; however, its location in close proximity to Bear Creek gives it historical significance.

There are several Indigenous communities that may have constitutionally protected Indigenous or Treaty Rights associated with the Study Area, or a portion of it. These are the same communities which may have rights associated with the St. Marys Landfill property, including (alphabetically):

- Aamjiwnaang First Nation (formerly Chippewas of Sarnia First Nation);
- Caldwell First Nation;

- Chippewas of Kettle & Stoney Point;
- Chippewas of the Thames First Nation;
- Haudenosaunee Development Institute (representing the Haudenosaunee Confederacy);
- Six Nations of the Grand River Territory; and
- Walpole Island First Nation.

The Indigenous communities listed above are believed to have Indigenous Rights, Treaty Rights, or both, affecting the subject property.

Traffic Conditions

The landfill is accessed through an entrance off County Road 79. The landfill currently results in 19 landfill-related vehicles per hour travelling along various haul routes. It is assumed that between 1/3 and half of these would travel from the west along Highway 402 to the landfill[28] along a similar route that would be taken by St. Marys waste collectors, should this alternative be selected.

3.7.2.3 Natural Environment

A watercourse, known as the Vankessel Drain runs from the landfill to the west, where it discharges to the Bear Creek system. Current water quality conditions in the Vankessel Drain are not known. Bear Creek is known to provide critical habitat for a number of Endangered mussel species.

There are several large woodlands to the southeast and southwest of the landfill, with portions on the landfill site itself.

Source Water Protection

The Twin Creeks Landfill is located in the Thames-Sydenham & Region Source Protection Area. Mapping for the 2015 Assessment Report shows that the landfill is not within any Wellhead Protection Areas or Intake Protection Zones for municipal water supplies. There is a large Significant Groundwater Recharge Area (SGRA) with a vulnerability score of 2 mapped east of the site and covers the southeastern part of the landfill property.

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[28] Based on a discussion of increased truck traffic in Section 1.3 of the Environmental Screening Report (2017).

It is assumed that some of the neighbouring residences may have individual wells as a potable water source. Impacts to drinking water quality are not known; however, it is assumed that if any concerns have been identified, they have been addressed as required under the landfills' ECA.

Air Quality

According to the Twin Creeks Landfill Emission Summary and Dispersion Modelling (ESDM) Report, dated March 1, 2017 prepared by RWDI as part of an Environmental Compliance Approval (ECA) amendment application, predicted ground level concentrations for the contaminants emitted at the Twin Creeks landfill do not exceed 50% of the MECP criteria and majority are well below 10%. At the time of the ESDM report, there were no odour complaints from the surrounding residents. However, there were several odour related complaints in 2018 and 2019. Once these issues are resolved at the Twin Creeks landfill, an addition of the waste from St. Marys landfill will have little impact on the emissions considering the size of the Twin Creeks landfill.

3.7.3 Haul Route Between St. Marys and the Twin Creeks Landfill

Existing conditions along the haul route were shown on Figure 3-1.

The most likely route to the Twin Creeks facility would follow Hwy 7 to Ailsa Craig then County Road 19 to Hwy 402 with a final turn on County Road 79 S to the waste facility. The route is approximately 79.5 km. Except for the collection routes through the Town of St. Marys, the route noted includes County Roads maintained by Perth and Lambton Counties and Hwy 402, a Provincial highway.

Land Use and Socio-economic Conditions

The route is entirely through rural landscapes with agricultural and agricultural-related businesses being the primary economic driver. A small number of other uses are present (i.e., a golf course, churches, a group home, small businesses and restaurants, bed and breakfast establishments and a campground). The route also passes through the communities of Ailsa Craig and Nairn in the Municipality of North Middlesex.

Archaeological and Cultural Heritage Resources

The presence of any archaeological or cultural heritage resources along the haul route is unknown.

Traffic Conditions

Approximately 389,400 tonnes of waste will require disposal during the 40-year planning period (see Section 3.1.3.7). It is estimated that approximately 90 trucks per week would be required to deliver waste to the Twin Creeks Landfill. BRA's trucks currently travel from their depot in South Huron, to St. Marys, to the St. Marys Landfill and then back to the depot. This is a distance of 36 km if we ignore the collection route and assume the truck does not complete additional collections in St. Marys or in other BRA communities after tipping at the St. Marys Landfill. Delivering to the Twin Creeks Landfill adds 107 km to each collection vehicle's trip. Based on trucking industry estimates [29], at least 21,000 tonnes of CO_2e would be generated; similar[30] to the greenhouse gases emitted by 4,470 cars operated for a year (or 112 cars operated for each year of the EA Planning Period).

Natural Environment

The route crosses the Thames River and a number of other smaller watercourses. Some woodlots and wetlands are present along the route. No Provincially Significant Wetlands, Areas of Natural and Scientific Interest, Conservation Areas or other designated features are present along the route.

Source Water Protection

The haul route begins and ends in the Thames-Sydenham & Region Source Protection Area, with the centre section (from approximately Elginfield to the 402) crossing the Ausable-Bayfield Source Protection Area. The haul route does not cross any Wellhead Protection Areas or Intake Protection Zones. It passes through some Significant Groundwater Recharge Areas.

Air Quality

There are no significant industries along the haul route. Emissions primarily emanate from traffic and agricultural operations in the area. Air quality is typical of Southern Ontario conditions.

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[29] Estimates are based on http://www.equipmentworld.com/owning-and-operating-costs-8 (accessed April 28, 2017), "Guidelines for Measuring and Managing CO2 Emission from Freight Transport Operations", Cefic and ECTA, March 2011, and http://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/Emission_Factors.pdf (accessed November 4, 2019).

[30] https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references (accessed November 4, 2019).

3.8 Evaluation of the Net Effects of the Alternatives to the Undertaking

The evaluation of *Alternatives to the Undertaking* is summarized in the following sections.

3.8.1 Evaluation Criteria

The TOR defined the criteria to be used in the evaluation. The TOR specifically noted that the *Alternatives to the Undertaking* will be subject to a qualitative screening based on the following criteria:

- Natural Environment, including:
  - Atmosphere (air quality, odour, noise, etc.);
  - Geology and hydrogeology;
  - Surface water (quality and quantity); and
  - Biology (terrestrial, aquatic).
- Cultural Environment[31], including:
  - Archaeological resources;
  - Built Heritage; and
  - Cultural Heritage Landscapes.
- Socio-Economic Environment:
  - Transportation routes;
  - Land use;
  - Employment effects;
  - Economic conditions (local business with a direct link to the landfill or its operations); and
  - Aesthetics/Enjoyment of life.
- Indigenous Connections to the Land:
  - Traditional uses;
  - Historical uses;
  - Land claims/treaty rights/Indigenous rights; and
  - Other areas of interest.
- Financial Factors:
  - Capital costs; and
  - Operational and maintenance costs.
- Technical Factors:
  - Technical ability to carry out each alternative.

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[31] Criteria listed in the TOR were “Buildings, Viewscapes and Archaeological Resources”. Criteria were changed upon advice from MTCS (Now MHSTCI).

Detailed indicators and evaluation metrics were not identified as the assessment was intended to primarily be qualitative, based on information from existing data sources or from information to be gathered through a short survey. As such, a qualitative discussion regarding each of the above noted criteria is provided in the following sections. The evaluation considers impacts under current conditions (i.e., baseline) and the net effects of the "Do Nothing" Alternative. Alternatives 1 and 2 are then compared to the Do Nothing Alternative based on a qualitative description of the number of post-mitigation impacts of high magnitude, long duration, repetitive frequency and which have a limited chance to be reversed. These net effects are then compared using the following descriptors:

- PREFERRED – preferred over the Do Nothing Alternative.
- SOMEWHAT PREFERRED – somewhat preferred over the Do Nothing Alternative.
- EQUALLY PREFERRED – equally preferred to the Do Nothing Alternative.
- SOMEWHAT LESS PREFERRED – somewhat less preferred than the Do Nothing Alternative.
- LESS PREFERRED – less preferred than the Do Nothing Alternative.

The preferred alternative overall is the Alternative that was identified based on the sum of the rankings in each category. No criteria were given greater weight or significance than others.

The evaluation is provided in the following sections.

3.8.2 Natural Environment

3.8.2.1 Potential Impacts to Atmosphere

Potential impacts to the atmosphere, including impacts associated with air quality, dust, odour, and noise are as follows:

Alternative 1: Expand the St. Marys Landfill:

- With the alternative to expand the St. Marys landfill, the quantity and rate of waste to be landfilled will not change in the short-term. As population increases over the next 40 years, some additional increase in waste is expected as a result of population growth. As such, emissions and noise are not expected to increase in the short-term and will increase minimally in the long-term. Thus, greenhouse gas emissions as well as other MNOCs, dust and particulates are expected to be maintained at current levels which cause few complaints and meet regulatory criteria. There have been no noise complaints recorded in the Annual Monitoring reports for 2013 through 2018 (inclusive). A single noise complaint was received in 2019 according to Town records (the AMR is not yet available). Although there may be a minimal increase in noise and dust during the construction period associated with the expansion, noise impacts overall are expected to be minimal.

- Current air quality and odour conditions at the St. Marys Landfill are below acceptable limits set by the Province. As the rate of waste disposal will only minimally increase in the future, this is not expected to change. There are approximately 16 residences in proximity to the St. Marys Landfill. There have been occasional odour and dust complaints in recent years. As time progresses, the working face will move eastward, away from the residents on Water Street, so the number of complaints is expected to decrease.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- The atmosphere in the vicinity of the St. Marys Landfill environment will have fewer emissions, dust, odour, and noise than current conditions. However, ongoing emissions from the adjacent aggregate industries may limit this improvement. Similarly, ongoing use for public waste drop-off and composting at the St. Marys Landfill site may further limit any improvements. There will be a minor short-term increase in work on the site associated with closure of the St. Marys Landfill. This work is not expected to increase dust or noise levels significantly.
- Hauling waste from St. Marys to Twin Creeks will add an additional 160 km roundtrip travel for each collection vehicle (90 vehicles per week). Approximately 1/3 of the trip would be along Hwy 402. Impacts to air emissions along the highway would be negligible. The remaining 2/3 of the trip would be along County and local roads through rural communities and landscapes. The additional traffic along these routes would contribute to a minor increase in emissions from current conditions.
- The waste from St. Marys is a relatively small volume compared to the total amount of waste received by Twin Creeks. This amount will not significantly change operations at Twin Creeks and emission, odour and noise levels in the vicinity are not expected to change by any perceptible amount.
- No landfill gas (LFG) collection system is currently in place at the St. Marys Landfill, and one is not expected to be constructed as part of the expansion. An LFG collection system is in place at Twin Creeks, collecting approximately 85% of the LFG. Thus, this Alternative will result in lower emission of landfill gases relative to Alternative 1.
- The Twin Creeks Landfill has experienced an increased number of complaints associated with odour since the landfill received approval to increase its fill rate in 2017. The addition of waste form St. Marys is not expected to result in an increased number of complaints.

In summary, impacts to the atmosphere are expected to be minimal as a result of both Alternatives 1 and 2.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Both landfills have operational plans in place to manage dust, odours, and noise. It is expected that these plans would be continued should either alternative be selected.
- All haul trucks would be expected to be maintained in good working conditions and to haul full loads to the extent possible to minimize vehicle emissions and vehicle-related noise associated with hauling waste to Twin Creeks.
- Construction activities associated with expanding or closing the St. Marys Landfill would occur during business hours only, respecting the Town's noise by-laws.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), air quality and odour across the Study Area (i.e., at St. Marys Landfill, Twin Creeks Landfill and haul route in between) are within provincially set limits. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- Ongoing emission of landfill gases.
- Minor emission of dust, odour, and noise associated with St. Marys Landfill operations within acceptable provincially-set limits.
- Minor emission of dust and noise during construction of the landfill expansion.

Under Alternative 2: Export Waste to the Twin Creeks Landfill, net effects after mitigation include:

- Ongoing emission of a relatively small amount of landfill gases that escape the LFG collection system.
- Minor emission of dust, odour and noise associated with Twin Creeks Landfill operations within acceptable provincially-set limits.
- Emissions from vehicles used to haul waste from St. Marys to the Twin Creeks Landfill.
- Minor emission of dust and noise during closure of the St. Marys Landfill.

The magnitude, frequency, duration, and reversibility of these net effects are summarized in Table 3-8.

Table 3-8: Net Effects to the Atmosphere

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	Low/Moderate – Air emissions and odour emitted at levels below provincial limits; however, no greenhouse gas collection system is in place. This alternative has lower vehicle related emissions compared to Alternative 2 and fewer receptors potentially affected. Noise levels are below provincial limits. Construction activities will add to current noise levels.	Low – Air emissions and odour emitted at levels below Provincial limits with landfill gas emission reduced through the site's flaring system. Truck emissions along haul routes create a minor increase in air emissions. Noise levels are below provincial limits. Additional truck traffic along haul routes creates a minor increase in noise in addition to a minor increase associated with work to close the St. Marys Landfill.
Duration	Long-term – Contaminants, greenhouse gases, dust, and odour will be emitted for the full duration of the 40-year planning period and beyond. Noise will be created for the full duration of the 40-year planning period and beyond. Construction-related noise will occur in the short-term only as new cells are developed in the landfill	Long-term – Contaminants, greenhouse gases, dust, and odour will be emitted for the full duration of the 40-year planning period and beyond. Noise will also be created for the full duration of the 40-year planning period and beyond.
Frequency	Continuous – Emissions from landfilling will be continuous while emission from truck traffic will be repetitive during business hours. Noise from landfilling activities will be continuous during business hours.	Continuous – Emissions from landfilling will be continuous while emission from truck traffic will be repetitive during business hours. Noise from landfilling and hauling activities will be continuous during business hours.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Reversibility	Non-reversible – Some impacts associated with contaminants and odour can be reversed once landfilling has ceased. Other emissions such as methane will continue for some time beyond the closure of the landfill. Effects associated with noise are reversible immediately upon ceasing landfilling and hauling activities.	Non-reversible – Some impacts associated with contaminants and odour can be reversed once landfilling has ceased. Other emissions such as methane will continue for some time beyond the closure of the landfill. Effects associated with noise are reversible immediately upon ceasing landfilling and hauling activities.
Preference Relative to the Do Nothing Alternative	Equally Preferred	Preferred

3.8.2.2 Potential Impacts to Geology and Hydrogeology

Potential impacts to geology and hydrogeology are as follows:

Alternative 1: Expand the St. Marys Landfill:

- Leachate is created as a result of landfilling activities. Leachate from an expanded landfill would be collected and disposed to the Town's sanitary sewer system and treated at the Town's wastewater treatment plan. The current leachate collection system at the St. Marys Landfill is effective and it is expected that an expansion of the system would continue to appropriately manage leachate. No significant impacts to groundwater quality are expected.
- As discussed in Section 3.7, there is a cement kiln dust (CKD) stockpile in the northwestern corner of the St. Marys Landfill property from historic St. Marys Cement operations. There appears to be sufficient acreage at the St. Marys landfill property to expand the landfill without directly affecting the CKD pile. There is potential that the small watercourse through the site may need to be relocated to accommodate a landfill expansion. If the watercourse needs to be relocated, some work in proximity to the CKD pile may be required. There is some risk that disturbing the pile could release contaminants into ground and surface water. However, channel relocation also offers the opportunity to improve conditions, separating the channel from potential impacts from the CKD stockpile and the landfill, and creating a more robust buffer to filter surface runoff to the watercourse.
- The St. Marys Landfill is not within any Wellhead Protection Areas or Intake Protection Zones, and therefore, there will be no impacts to municipal drinking water sources. There are a number of residents who received potable water from individual wells. Regular groundwater monitoring has not identified concerns with drinking water quality in neighbouring wells. The current leachate collection system at the St. Marys Landfill is effective and it is expected that an expansion of the system would continue to appropriately manage leachate. Monitoring will be ongoing. No significant impacts to groundwater quality or drinking water are expected.
- The potential for spills is similar to current conditions. Spills are possible if the leachate collection system fails.
- The geology of the area is not expected to be affected. The aggregate extraction licence held by St. Marys Cement has been relinquished and there are no aggregate resources present on the landfill property.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- With closure of the St. Marys Landfill, the existing leachate system will continue to be in place and maintained in accordance with all provincial requirements. Over time, it is expected that the leachate strength and production will decline as no further waste is disposed and the fill areas are capped.
- With respect to the Twin Creeks Landfill, leachate is collected and disposed to willing municipal licensed receivers. There is also seasonal disposal to an on-site poplar plantation. It is assumed that the leachate collection system functions properly in accordance with provincial requirements.
- The Twin Creeks Landfill is not within any Wellhead Protection Areas or Intake Protection Zones and the landfill is not a threat to municipal drinking water sources.
- There is some potential for spills during the transport of the St. Marys waste along the haul route. There is also potential for spills at the Twin Creeks landfill, should the leachate collection system fail or potential for spills related to vehicle accidents in moving leachate to area municipalities for treatment.
- No significant geology or aggregate resources are present at the Twin Creeks landfill site and no impacts to geology are expected.

Mitigation

Mitigation can be applied to minimize effects, including the following:

- Both landfills have leachate monitoring, collection, and treatment systems in place as well as spill response plans and emergency procedures.
- With expansion of the St. Marys Landfill, a new leachate collection system will be installed with consideration to the existing infrastructure. An expanded monitoring program to take in account expansion areas will also be developed.
- A plan to manage and monitor the CKD stockpile will be developed should work be required in its vicinity. Any work in its vicinity will include measures to minimize leachate from the stockpile reaching surface or groundwater.
- It is not expected that any additional mitigation will be required at the Twin Creeks Landfill beyond existing measures.
- All haul trucks would be expected to have appropriate equipment to properly manage the waste load. Drivers must be trained in spill response procedures in accordance with regulations.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), impacts to geology and hydrogeology are managed at both landfills, primarily through leachate collection and treatment. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- Minor potential for leachate spills and groundwater contamination on the landfill property.
- Minor potential for unexpected release of contaminants from the CKD pile, if disrupted.

Under Alternative 2: Export Waste to the Twin Creeks Landfill, net effects after mitigation include:

- Minor potential for leachate spills and groundwater contamination on the landfill property.
- Minor potential for spills along the haul route with low potential to contaminate groundwater resources.

The magnitude, frequency, duration, and reversibility of these net effects are summarized in Table **3-9**.

Table 3-9: Net Effects to Geology and Hydrogeology

	Alternative 1: Expand the St. Marys Landfill	Alternative 2: Export Waste to the Twin Creeks Landfill
Magnitude	Low – Effects on groundwater are expected to comply with all provincial requirements. The risk is low with appropriate spill prevention and response measures in place. Risks associated with the CKD pile can be reduced.	Low – Effects on groundwater are expected to comply with all provincial requirements. There is potential for spills along the haul route and at the landfill. The risk is low with appropriate spill prevention and response measures in place.
Duration	Short/Long-term – Spills occur in the short-term. There is potential for longer term effects from leachate spills at the site.	Short/Long-term – Spills occur in the short-term. There is potential for longer term effects from leachate spills at the site.
Frequency	Rarely – Spills are not expected to occur.	Rarely – Spills are not expected to occur. There is a slightly higher risk with the length of travel required to transport waste.
Reversibility	Generally Reversible – Any spills will be cleaned up in accordance with provincial requirements. There is potential for longer term effects that are not immediately reversible from leachate spills at the site.	Generally Reversible – Any spills will be cleaned up in accordance with provincial requirements. There is potential for longer term effects that are not immediately reversible from leachate spills at the site.
Preference Relative to the Do Nothing Alternative	Equally Preferred	Equally Preferred

3.8.2.3 Potential Impacts to Surface Water

Potential impacts to surface water (quality and quantity) are as follows:

Alternative 1: Expand the St. Marys Landfill:

- An unnamed watercourse is present on the St. Marys landfill property site. The watercourse discharges to the Thames River. Surface water runoff from the landfill site could cause contaminants to enter both watercourses.
- With the option to expand the St. Marys landfill, the watercourse may need to be relocated. Construction could negatively affect water quality; however, channel relocation also offers the opportunity to improve conditions, separating the channel from potential impacts from the CKD stockpile and the landfill, and creating a more robust buffer to filter surface runoff to the watercourse.
- The potential for spills is similar to current conditions. Spills to surface water features are possible if the leachate collection system fails.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- The Van Kessel Drain flows through the Twin Creeks landfill property, discharging to Bear Creek. Surface water runoff from the landfill site could cause contaminants to enter both watercourses.
- There is some potential for spills during the transport of the St. Marys waste along the haul route. There is also potential for spills at the Twin Creeks landfill, should the leachate collection system fail.
- With closure of the St. Marys Landfill, there will be no new inputs that could potentially affect surface water quality in the unnamed watercourse. Water quality in the unnamed watercourse is minimally affected by the landfill. Water quality conditions are similar both upstream and downstream of the site. Therefore, water quality is not expected to improve significantly with closure of the landfill.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Both landfills have stormwater management systems in place as well as spill response plans and emergency procedures. At both landfills, the stormwater systems discharge to the watercourse flowing through the sites.

- With expansion of the St. Marys Landfill, a new stormwater management system will be constructed with consideration to the existing infrastructure. An expanded monitoring program to take in account expansion areas will also be developed. A plan to manage and monitor the CKD pile will be developed should work be required in its vicinity. Any work in its vicinity will include measures to separate the CKD pile from surface water systems.
- It is not expected that any additional mitigation will be required at the Twin Creeks Landfill beyond existing measures.
- With export to the Twin Creeks Landfill, all haul trucks would be expected to be equipped with appropriate equipment to properly manage the waste load. Drivers should be trained in spill response procedures.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), impacts to surface water are managed at both landfills, primarily through stormwater management systems and leachate collection and treatment. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- Minor potential for stormwater management and leachate spills to surface water on the landfill property.
- Minor potential for unexpected release of contaminants from the CKD pile, if disrupted.

Alternative 2, Export Waste to the Twin Creeks Landfill net effects after mitigation include:

- Minor potential for stormwater management and leachate spills to surface water on the landfill property.
- Minor potential for spills along the haul route with low potential to contaminate surface water resources.

The magnitude, frequency, duration, and reversibility of these net effects are summarized in Table 3-10.

Table 3-10: Net Effects to Surface Water

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	Low – Effects on surface water are expected to comply with all provincial requirements. The risk is low with appropriate spill prevention and response measures in place. Risks associated with the CKD pile can be reduced.	Low – Effects on surface water are expected to comply with all provincial requirements. There is potential for spills along the haul route and at the landfill. The risk is low with appropriate spill prevention and response measures in place.
Duration	Short/Long-term – Spills occur in the short-term. There is potential for longer term effects from leachate spills at the site.	Short/Long-term – Spills occur in the short-term. There is potential for longer term effects from leachate spills at the site.
Frequency	Rarely – Spills are not expected to occur.	Rarely- Spills are not expected to occur. There is a slightly higher risk with the length of travel required to transport waste.
Reversibility	Generally Reversible – Any spills will be cleaned up in accordance with provincial requirements. There is potential for longer term effects that are not immediately reversible from leachate spills at the site.	Generally Reversible – Any spills will be cleaned up in accordance with provincial requirements. There is potential for longer term effects that are not immediately reversible from leachate spills at the site.
Preference	Equally Preferred	Equally Preferred

3.8.2.4 Potential Impacts to Biology

Potential impacts to biology (terrestrial and aquatic) are as follows:

Alternative 1: Expand the St. Marys Landfill:

- There are very few natural features present on the St. Marys landfill property. A small number of surface depressions provide wetland conditions. The unnamed watercourse provides indirect fish habitat. Some grassland areas are present on inactive and closed landfill cells. Grassland areas may provide habitat for grassland birds or snakes, including some species at risk. Expansion may result in the loss of the small wetlands and some grassland areas.
- The unnamed watercourse runs through the center of the landfill property and may need to be relocated. This watercourse provides indirect fish habitat. Relocation will affect the watercourse temporarily but also offers opportunity for habitat improvements. Downstream impacts to the Thames River are possible.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- The Van Kessel Drain flows through the Twin Creeks landfill property. Water quality and fish habitat conditions are unknown. The addition of St. Marys' waste would not significantly change this habitat and no Species at Risk would be affected by this alternative.
- Several wooded areas are present around the landfill. It is not expected that any will be affected beyond existing conditions as a result of accepting St. Marys' waste.
- Several watercourses and wooded areas are present along the haul route. Any spills or blowing waste could negatively affect these natural areas.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Should at risk bird species be identified in grassland habitat at the St. Marys Landfill, compensation in the form of new grassland habitat will be created elsewhere in accordance with *Endangered Species Act* regulations.
- Any work associated with the unnamed watercourse on the St. Marys property will include measures to improve aquatic habitat. Any trees removed can be replaced with new plantings around the landfill edges or in other locations with the goal of improving the Town's overall natural heritage system.
- No mitigation would be required for the option to export waste to Twin Creeks.

- All haul trucks would be expected to be equipped with appropriate equipment to properly manage the waste load. Drivers should be trained in spill response procedures.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), terrestrial and aquatic features are limited at both the St. Marys and Twin Creeks Landfills. Aquatic habitat in the unnamed watercourse at the St. Marys Landfill is poor and much of the site has been previously disturbed. Habitat features are limited. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- Minor loss of potential species at risk grassland habitat, wetlands, and trees. Loss will only be temporary until compensation plantings mature. Opportunities to improve aquatic habitat are present.

Under Alternative 2: Export Waste to the Twin Creeks Landfill, net effects after mitigation include:

- No net effects to biological systems are expected.

The magnitude, frequency, duration and reversibility of these net effects are summarized in Table 3-11.

Table 3-11: Net Effects to Biology

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	Low – Effects to species at risk grassland habitat, wetlands and trees will be minor given compensation measures. Opportunities to improve aquatic habitat are present.	N/A – No net effect anticipated.
Duration	Short-term – There is a short time in which compensation plantings need time to grow in order to return to similar or better conditions than those lost.	N/A – No net effect anticipated.
Frequency	Once – Habitat is expected to be lost once during construction.	N/A – No net effect anticipated.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Reversibility	Reversible – Habitat loss is reversible with appropriate habitat creation and plantings elsewhere.	N/A – No net effect anticipated.
Preference Relative to the Do Nothing Alternative	Somewhat Less Preferred	Preferred

3.8.3 Cultural Environment

3.8.3.1 Potential Impacts to Archaeological Resources

Potential impacts to archaeological resources are as follows:

Alternative 1: Expand the St. Marys Landfill:

- No archaeological resources are known to be present at, or in the vicinity of, the St. Marys Landfill site. The site was quarried by St. Marys Cement between 1912 and 1977. It has been largely disturbed as a result. Given the existing disturbance at the site and from the industrial operations in the vicinity, no effects are anticipated. Further studies will be completed at the next stage in the EA process, if required, to confirm this assumption.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- No effects to archaeological resources in St. Marys or along the haul route are expected.
- Two cemeteries are present near the Twin Creeks Landfill. No changes are expected to the footprint of the Twin Creeks Landfill thus no impacts are expected.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Although no archaeological resources are likely to be present at, or around, the St. Marys landfill, further study will be undertaken at the next stage in the EA process, as required. If resources are identified, mitigation will be developed in accordance with the *Ontario Heritage Act*.
- No mitigation is expected to be required in association with the option to export waste to Twin Creeks.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), archaeological resources are unknown or unaffected by landfilling activities at both the St. Marys and Twin Creeks sites. No changes from baseline conditions are expected with the Do Nothing option.

No net effects to archaeological resources are anticipated as a result of either Alternative 1 or 2.

Both Alternatives are equally preferred.

3.8.3.2 Potential Impacts to Built Heritage

Potential impacts to Built Heritage are as follows:

Alternative 1: Expand the St. Marys Landfill:

- According to the Town's Official Plan, no Built Heritage features are present at, or in the vicinity of, the St. Marys Landfill. A such, no effects are anticipated.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- No known Built Heritage resources are present in the vicinity of the Twin Creeks Landfill. A such, no effects are anticipated.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Although no Built Heritage resources were identified to be present at, or around, the St. Marys Landfill, further study will be undertaken at the next stage in the EA process, as required. If resources are identified, mitigation will be developed in accordance with the *Ontario Heritage Act*.
- No mitigation is expected to be required in association with the option to export waste to Twin Creeks.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), Built Heritage resources are unknown or unaffected by landfilling activities at both the St. Marys and Twin Creeks sites. No changes from baseline conditions are expected with the Do Nothing option.

No net effects to Built Heritage resources are anticipated as a result of either Alternative 1 or 2.

Both Alternatives are equally preferred.

3.8.3.3 Potential Impacts to Cultural Heritage Landscapes

Potential impacts to Cultural Heritage Landscapes are as follows:

Alternative 1: Expand the St. Marys Landfill:

- According to the Town's Official Plan, no Cultural Heritage Landscapes are present at, or in the vicinity of, the St. Marys Landfill. A such, no effects are anticipated.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- No known Cultural Heritage Landscapes are present in the vicinity of the Twin Creeks Landfill. As such, no effects are anticipated.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Although no Cultural Heritage Landscapes are likely to be present at, or around, the St. Marys Landfill, further study will be undertaken at the next stage in the EA process, as required. If resources are identified, mitigation will be developed in accordance with the *Ontario Heritage Act*.
- No mitigation is expected to be required in association with the option to export waste to Twin Creeks.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), Cultural Heritage Landscapes are unknown or unaffected by landfilling activities at both the St. Marys and Twin Creeks sites. No changes from baseline conditions are expected with the Do Nothing option.

No net effects to Cultural Heritage Landscapes are anticipated as a result of either Alternative 1 or 2.

Both Alternatives are equally preferred.

3.8.4 Socio-Economic Environment

3.8.4.1 Potential Impacts to Transportation Routes

Potential impacts to transportation routes are as follows:

Alternative 1: Expand the St. Marys Landfill:

- With expansion of the St. Marys Landfill, the number of curbside collection trucks and travel routes through St. Marys will not change in the short-term. The population of St. Marys is expected to grow nearly 62% over the 40-year planning period. Waste generation is anticipated to grow at a similar rate. Although there is likely some available capacity within the trucks currently used for the collection of waste, it is assumed this additional waste will require each truck to make more collection trips and/or additional collection trucks will be needed.
- Some minor changes in collection routes through St. Marys may be required over time to accommodate the growth in waste disposal due to population, though overall these changes are considered minor.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- Some minor changes in collection routes through St. Marys may be required over time to accommodate the growth in waste disposal due to population, though overall these changes are considered minor.
- Travel to Twin Creeks will add an additional 160 km roundtrip travel for each collection vehicle. This distance (travel-time) will limit the number of trips that a single truck can make per day. Additional trucks (and crew) may be required as a result.
- Approximately 1/3 of the trip would be along Hwy 402. Impacts to traffic along the highway would be negligible. The remaining 2/3 of the trip would be along County and local roads through rural communities and landscapes. The additional traffic along these routes would represent a minor increase from current conditions.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- In all cases, trucks will be maintained in good working order and will haul full loads to the extent possible to make efficient use of each vehicle trip.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), the curbside collection vehicle collect St. Marys' residential waste and take it directly to the landfill. Waste collection and hauling vehicles associated with the Twin Creeks Landfill arrive from various locations across southern Ontario, including along the route that would be taken by St. Marys waste collectors if that alternative is selected. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- No net effects to transportation routes are expected.

Under Alternative 2: Export Waste to the Twin Creeks Landfill, net effects after mitigation include:

- There will be a minor increase in truck traffic along the haul route between St. Marys and the Twin Creeks Landfill.

The magnitude, frequency, duration and reversibility of these net effects are summarized in Table 3-12.

Table 3-12: Net Effects to Transportation Routes

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	N/A – No net effect anticipated.	Low – There will be an increased number of trucks travelling the route between St. Marys and the Twin Creeks Landfill. Effects on roadways and traffic conditions will be minimal.
Duration	N/A – No net effect anticipated.	Long-term – The increase in truck traffic will be ongoing over the planning period.
Frequency	N/A – No net effect anticipated.	Repeatedly – Truck travel will occur on a daily basis during business hours.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Reversibility	N/A – No net effect anticipated.	Reversible – Once truck traffic is suspended at the end of the planning period, any impacts to roadways and traffic conditions will be removed.
Preference Relative to the Do Nothing Alternative	Equally Preferred	Less Preferred

3.8.4.2 Land Use

Potential impacts to land use are as follows:

Alternative 1: Expand the St. Marys Landfill:

- The St. Marys Landfill is currently properly designated and zoned. Adjacent extractive industrial and agricultural uses are compatible with landfill uses. No changes in zoning or Official Plan designations would be required to expand the landfill. Adjacent lands in the Township of Perth South do not currently have special provisions associated with development adjacent to a landfill. This is not compatible with best practices/provincial direction.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- The Twin Creeks Landfill is also currently properly designated and zoned. Adjacent uses to the Twin Creeks Landfill are also generally compatible; however, there are several more sensitive uses such as the two cemeteries and several businesses along Nauvoo Road in Watford that may be more sensitive to the landfill use. This alternative would not change this land use or how adjacent land uses experience the landfill.
- This alternative would allow for the closure of the existing St. Marys Landfill. Given its location adjacent to extractive industry, and post-closure monitoring required, alternative uses for this site are very limited. Surrounding residential uses may experience improved conditions; however, some activities such as composting and local waste drop-off are likely to continue at the site. The site will likely remain partially vacant or underutilized.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- The Town of St. Marys will work with the Township of Perth on an ongoing issue related to the zoning of lands adjacent to the landfill. Some restrictions on future use of adjacent lands are required regardless of whether the land is expanded or closed.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), lands adjacent to the St. Marys Landfill are not zoned with appropriate restrictions. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- Net benefit expected once the zoning of adjacent lands is updated to reflect restrictions associated with being adjacent to the landfill.

Under Alternative 2: Export Waste to the Twin Creeks Landfill, net effects after mitigation include:

- Lands owned by the Town adjacent to the existing landfill have limited use in the future, given surrounding extraction activities and existing landfill. These lands will have no benefit to the Town and will become unusable vacant lands.

The magnitude, frequency, duration and reversibility of these net effects are summarized in Table 3-13.

Table 3-13: Net Effects to Land Use

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	Minor – Net benefit to updated zoning on adjacent lands.	Moderate – Lands owned by the Town adjacent to the existing landfill have limited use in the future, given surrounding extraction activities and existing landfill.
Duration	Long-term – Zoning restrictions on adjacent lands to be long-term for duration of the landfill and beyond.	Long-term – There will be few alternative uses for these lands in the long-term.
Frequency	Once – Zoning update needed once.	Ongoing – Lands will be vacant on an ongoing basis into the future.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Reversibility	Reversible – Zoning can be updated, as required.	Irreversible – Previous and existing landfilling means the land use cannot be changed to an alternate land use in the near future.
Preference Relative to the Do Nothing Alternative	Preferred	Less Preferred

3.8.4.3 Employment Effects

Potential impacts to current employment levels are as follows:

Alternative 1: Expand the St. Marys Landfill:

- With expansion of the St. Marys Landfill, no change in employment related to the ongoing operation of the landfill is expected. The landfill will continue to employ one full-time position, one part-time position and six staff who work occasionally, as required.
- Some additional jobs may be created during the initial construction phase.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- With the export of waste to Twin Creeks, jobs for current St. Marys Landfill operators will be lost. These jobs tend to be filled by those living locally and who contribute to the Town's local economy. This likely will result in the loss of one full-time position and one part-time position. It is assumed that the occasional staff will be maintained to carry out their additional responsibilities. Some staff may still be required to oversee any ongoing composting and household waste drop-off that may remain at the site.
- Under this Alternative, waste will be picked up and transported directly to the private landfill. Thus, there would be a small number of additional driver/collection jobs or increased hours for waste collection staff given the increased distance to the disposal site. These jobs are unlikely to be filled by St. Marys residents. The current waste collection contractor, Bluewater Recycling Association (BRA), is based in South Huron, Ontario. There are no waste collection contractors currently based in St. Marys.
- The quantity of St. Marys waste is unlikely to require additional staff at the Twin Creeks Landfill.

Mitigation

No mitigation is proposed.

Net Effects

Under baseline conditions, the landfill employs one full-time position, one part-time position and six staff who work occasionally at the site (see Section 3.7.1), as required. However, under the Do Nothing option, the landfill will be closed. Therefore, the site's current employees (two full-time and one part-time) will not be required as these positions will be eliminated. However, as noted in Table 3-14, these employees may find new positions elsewhere.

Under Alternative 1: Expand the St. Marys Landfill, net effects after mitigation include:

- No changes to employment at the landfill are expected.
- Some additional short-term employment may be created as a result of the expansion construction work.

Under Alternative 2: Export Waste to the Twin Creeks Landfill, net effects after mitigation include:

- Loss of one full-time position and potentially other part-time or occasional positions.

The magnitude, frequency, duration, and reversibility of these net effects are summarized in Table 3-14.

Table 3-14: Net Effects on Employment

	Alternative 1: Expand the St. Marys Landfill	Alternative 2: Export Waste to the Twin Creeks Landfill
Magnitude	Low – Net benefit from increase in short-term construction jobs.	Low – A minimal number of jobs may be lost. Staff may be able to be shifted to new positions elsewhere.
Duration	Short-term – Expansion construction jobs to be added only during construction.	Long-term – Landfill operator jobs will be lost in the long-term.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Frequency	Infrequently – Expansion will be constructed in phases (landfill cells) with new cells added as older cells are filled. Therefore, construction jobs will be added on a short-term basis over several expansion periods.	Once – Landfilling jobs will be lost once as the landfill closes.
Reversibility	Reversible – Employment needs may change over the 40-year operational period and can be revised, as necessary.	Irreversible – Once the landfill is closed landfill operating jobs will not be reopened.
Preference Relative to the Do Nothing Alternative	Somewhat Preferred	Less Preferred

3.8.4.4 Economic Conditions

Potential impacts to current economic conditions are as follows:

Alternative 1: Expand the St. Marys Landfill:

- Under baseline conditions, some businesses in St. Marys are serviced under the Town's waste collection system. These businesses pay relatively low rates for waste collection. With expansion of the St. Marys Landfill, local businesses which are currently serviced by BRA with drop-off at the St. Marys Landfill will be able to continue to use this service. Town staff have indicated a strong belief that the landfill is an important factor in maintaining a strong business and industrial sector in the Town.
- Private waste collectors service some of the remainder of the St. Marys business community. Most of these private waste collectors use the St. Marys Landfill as a disposal location. They will be able to continue to dispose of waste at the St. Marys Landfill at similar cost. Excluding inflation, changes in regulatory, labour or market conditions – which are likely to affect all disposal alternatives, there are no changes to costs or methods of disposing of waste for businesses expected.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- With the option to export waste to Twin Creeks, the contract with BRA for curbside collection services will need to be renegotiated. Businesses currently served by BRA and the St. Marys Landfill may or may not continue to be serviced under a new contract, subject to additional costs associated with the longer travel distance. As such, some businesses may need to transfer their collection service to a private waste collector. Costs to these businesses are likely to increase. Town staff believe this could result in some business hardships, closures or relocations.

- Where businesses are currently using a private hauler that disposes of waste at the St. Marys Landfill, costs may also increase as private haulers need to travel farther to an alternative landfill location, increasing their costs. Having local waste disposal capacity has been an economic development advantage for St. Marys.

Mitigation

No mitigation is proposed.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), some businesses in St. Marys are serviced under the Town's waste collection system. These businesses pay relatively low rates for waste collection. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill:

- No impacts are expected.

Under Alternative 2: Export Waste to the Twin Creeks Landfill:

- Some local businesses may experience increased costs related to private waste disposal.

The magnitude, frequency, duration and reversibility of these net effects are summarized in Table 3-15.

Table 3-15: Net Effects on Economic Conditions

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	N/A – No net effect anticipated.	Moderate – Costs to businesses to dispose of waste may increase, thereby decreasing competitiveness and profitability.
Duration	N/A – No net effect anticipated.	Long-term – Cost increases are likely to remain for the duration of the planning period.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Frequency	N/A – No net effect anticipated.	Occasionally – Costs to businesses may increase occasionally each time a contract with a private waste collector is renewed.
Reversibility	N/A- No net effect anticipated.	Irreversible – Once the landfill is closed the Town no longer has control over waste collection prices.
Preference Relative to the Do Nothing Alternative	Equally Preferred	Less Preferred

3.8.4.5 Aesthetics/Enjoyment of Life

Potential impacts to the aesthetics and enjoyment of life for neighboring residents are as follows:

Alternative 1: Expand the St. Marys Landfill:

- In total, there are 16 residences within 120 m of the landfill. These are rural residential properties. According to Annual Monitoring Reports for 2013 through 2018, inclusive, there have been 16 complaints related to odours from the St. Marys Landfill. The Town indicates they received no odour complaints in 2017, 2019 or 2020. The Annual Monitoring Reports indicate that these complaints have been resolved promptly by Town staff. While the Town's goal is to receive zero complaints, the number of complaints recorded are not considered to be out of the ordinary for a landfill.
- With an expansion, no additional odour, traffic or dust concerns are expected as the quantity of waste to be disposed will remain the same, with slight increases over time in conjunction with population growth. As time progresses, the working face will move eastward, away from the residents on Water Street, so the number of complaints is expected to decrease.
- Some nuisance effects may be experienced during construction as an increase in noise and dust may occur in the short-term.
- Additional screening of trees will be added to minimize sightlines and dampen some noise.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- With the option to export waste to Twin Creeks, property owners adjacent to the St. Marys Landfill will experience fewer odour, noise, dust and traffic concerns. However, ongoing noise and dust from the adjacent aggregate industries may limit this improvement. Similarly, ongoing use for public waste drop-off and composting may further limit any improvements.
- The Waste Management of Canada Corporation, who owns the Twin Creeks Landfill has several community benefit agreements, including:
    - A Community Host Agreement with Warwick Township;
    - Impact Benefit Agreement with landfill neighbours;
    - Property Value Protection; and
    - A local liaison committee.
- These benefits help to offset negative effects.
- Residents along the haul route would experience a small increase in traffic. This will be more pronounced on the small roads outside of St. Marys, leading to Hwy 402. However, it is anticipated that the effect is likely to be imperceptible for most of the route.
- The Twin Creeks Landfill has experienced an increased number of complaints associated with odour since 2017, when the landfill received approval to increase its fill rate.

Mitigation

Mitigation can be applied to minimize any effects associated with both Alternatives, including the following:

- Both the St. Marys and Twin Creeks Landfills have operating procedures to document, manage and report dust, odour, traffic, and noise concerns and complaints. These procedures will be reviewed and updated with the expansion of the St. Marys Landfill.
- It is expected that aesthetic effects associated with an expansion to the St. Marys Landfill can also be improved through additional visual blockages that can be erected as part of the new landfill design.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), some complaints have been received at both the St. Marys and Twin Creeks Landfills in recent years due to odour and dust concerns. The number of complaints is not considered to be out of the ordinary with respect to landfill operations and are typically addressed quickly. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill:

- A small number of odour, noise, and dust issues may infrequently affect neighbouring residents within acceptable provincially-set limits. It is expected that these can be addressed quickly through operational measures. Effects will decrease over time as the landfill face moves eastward.
- Additional tree plantings will further minimize sightlines and act to dampen noise.

Under Alternative 2: Export Waste to the Twin Creeks Landfill:

- A small number of odour, noise, and dust issues may infrequently affect neighbouring residents within acceptable provincially-set limits. It is expected that these can be addressed quickly through operational measures.
- Residents adjacent to the St. Marys Landfill may experience fewer nuisance effects associated with noise, dust, and odour from the landfill. Disruptions to enjoyment of life may still persist from other adjacent land uses, such as the aggregate extraction operations.
- Residents along the haul route may experience minor disruptions to enjoyment of life as a result of a minor increase in truck traffic.

The magnitude, frequency, duration and reversibility of these net effects are summarized in Table 3-16.

Table 3-16: Net Effects on Local Aesthetics and Enjoyment of Life

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	Low – A small number of odour, noise, dust, and aesthetic issues may arise in line with that typically expected of landfills. It is expected that these will be reduced from current conditions as a result of increased screening and movement of the landfill face to the east.	Moderate Benefit – Residents adjacent to the St. Marys Landfill may experience improved conditions with fewer odour concerns. Dust and noise may continue to be problematic due to other adjacent land uses.
Duration	Ongoing – Enjoyment of Life impacts can be expected over the life of the landfill.	Long-term – Improved conditions for adjacent residents will be ongoing as long as the landfill remains closed.

	Alternative 1: Expand the St. Marys Landfill	Alternative 2: Export Waste to the Twin Creeks Landfill
Frequency	Once – Infrequent complaints are expected and often depend on weather and wind conditions.	Ongoing – Improved conditions for adjacent residents will be ongoing as long as the landfill remains closed.
Reversibility	Reversible – All enjoyment of life concerns are reversible with the application of operating procedures to minimize noise, dust and odours.	Irreversible – Once the landfill is closed it will not be reopened.
Preference Relative to the Do Nothing Alternative	Somewhat Preferred	Preferred

3.8.5 Indigenous Connections to the Land

3.8.5.1 Traditional and Historic Uses/Land Claims/Treaty and Indigenous Rights

Potential impacts to traditional and historical uses associated with Treaty and Indigenous Rights or Land Claims are as follows:

Alternative 1: Expand the St. Marys Landfill:

- The St. Marys Landfill is located in close proximity to the Thames River, which was an important travel corridor, source of sustenance and culturally significant feature for the Indigenous people who historically lived in the area.
- Traditional uses may occur in the vicinity but have not occurred on the landfill property since before St. Marys Cement was active on the site. There would be no opportunity for traditional uses to be re-established in the foreseeable future if the landfill is expanded.
- The St. Marys Landfill is located within lands subject to Treaties. It is believed that six First Nations and the Haudenosaunee Confederacy have Indigenous and Treaty Rights associated with lands in, and around, the landfill, as described in Section 3.7.1.2. Expansion of the landfill represents a development within a Treaty area.
- There are no known land claims associated with the site.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- With Alternative 2, waste would be exported to the Twin Creeks Landfill, which is located in proximity to Bear Creek which would have been used as a travel corridor and source of sustenance for the Indigenous people who historically lived in the area.

- With the waste export option, there would be no opportunity for traditional uses to be re-established at the St. Marys site due to the closure and long-term monitoring required. Portions of the site are likely to continue to be used for composting, and local waste drop-off.
- The Twin Creeks Landfill is also on lands subject to a Treaty signed by the Crown and the original inhabitants of the area. It is believed that six First Nations and the Haudenosaunee Confederacy have Indigenous and Treaty Rights associated with lands in, and around, the landfill.
- There are no known land claims associated with the site.

Mitigation

Mitigation can be applied to minimize any effects as follows:

Alternative 1: Expand the St. Marys Landfill:

- The Town will continue to consult with Indigenous communities to identify measures to mitigate potential effects.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- It is noted that Waste Management of Canada Corporation has signed an Impact Benefit Agreement with the Walpole Island First Nation. It is not known whether any additional First Nations are covered under this agreement.
- These benefits help to offset negative effects. It is assumed that any waste received from St. Marys at the Twin Creeks Landfill will be covered under existing agreements held by Waste Management of Canada Corporation.

Net Effects

Under baseline conditions (i.e., the Do Nothing Alternative), lands at the St. Marys landfill site historically used by Indigenous communities have been subject to aggregate extraction and landfilling for nearly a century, removing any potential for traditional use and any use associated with Treaty or Indigenous Rights. Similarly, the Twin Creeks landfill has been in operation since 1972. No changes from baseline conditions are expected with the Do Nothing option.

Under Alternative 1: Expand the St. Marys Landfill:

- The site will not re-open for use by Indigenous People for the foreseeable future.

Under Alternative 2: Export Waste to the Twin Creeks Landfill:

- The site will not re-open for use by Indigenous People for the foreseeable future.
- The net effects of landfilling at the Twin Creeks Landfill are lessened by the Impact Benefit Agreements in place. However, it is believed that this only applied to Walpole Island First Nation. Agreements with other Indigenous Communities are unknown.

The magnitude, frequency, duration and reversibility of these net effects are summarized in Table 3-17.

Table 3-17: Net Effects on Traditional and Historical Uses by Indigenous Communities

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Magnitude	Unknown – The magnitude of the loss of traditional uses cannot be quantified by the authors of this report. It is understood that loss of traditional uses as a result of development such as the original landfill construction may continue to be felt by Indigenous communities.	Unknown – The magnitude of the loss of traditional uses cannot be quantified by the authors of this report. It is understood that loss of traditional uses as a result of development such as the original landfill construction may continue to be felt by Indigenous communities. The magnitude of the loss may be slightly reduced as a result of the Impact Benefit Agreements in place.
Duration	Long-term – Loss of traditional and historical uses can be expected over the life of the landfill and beyond. No changes to use of the site by Indigenous communities from the current baseline would occur from the project.	Long-term – Loss of traditional and historical uses at Twin Creeks and the St. Marys landfill site can be expected over the life of the landfills and beyond. No changes to use of the site by Indigenous communities from the current baseline would occur from the project.
Frequency	Once – The ability to use the lands for traditional uses was lost during the original development of the site long ago.	Once – The ability to use the lands for traditional uses was lost during the original development of both sites long ago.

	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Reversibility	Irreversible – No changes to traditional and historical uses of the site by Indigenous communities from the current baseline would occur from the project. Traditional and historical uses are not expected to be re-established at the site.	Irreversible – No changes to traditional and historical uses of the site by Indigenous communities from the current baseline would occur from the project. Traditional and historical uses are not expected to be re-established at the Twin Creeks or St. Marys Landfill sites.
Preference Relative to the Do Nothing Alternative	Equally Preferred	Somewhat Preferred

3.8.6 Financial Factors

3.8.6.1 Capital and Operational Costs

A discussion and analysis of potential capital and operational costs associated with each Alternative is as follows:

Alternative 1: Expand the St. Marys Landfill:

- It is assumed that the Town's existing curbside collection process would continue unchanged. Residents and businesses currently collected by Bluewater Recycling Association (BRA) would continue to have their waste collected by BRA.
- It is expected that current collection and disposal rates by BRA would likely remain the same, with moderate increases over the next 40 years in line with the cost of living, price of fuel and other factors affecting transportation. Waste transportation cost estimates were provided by several survey respondents (see Section 3.4.2.2). Based on responses, it is assumed that a standard collection vehicle used by BRA would typically cost $2.53 to $2.97 per km (dependent on congestion)[32], with an 8-tonne capacity. For comparative purposes, this provides a cost/tonne/km of $0.37[33].
- Delivery to an expanded St. Marys Landfill: It is 3.2 km from the centre of St. Marys to the landfill site. Using the collection truck, a round trip costs $2.36/tonne.

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[32] http://www.bv.transports.gouv.qc.ca/mono/0965385.pdf, accessed May 5, 2015, plus data collected from survey respondents.

[33] Value used for comparison of alternatives.

- There are capital costs associated with constructing new landfill cells and associated infrastructure, including expanded leachate collection, stormwater and interior roads, etc. These costs have been estimated to be $7,360,000, which is equivalent to approximately $24.00/tonne over the planning period.

This assessment of costs for the expansion of the St. Marys Landfill is based on costs developed for Alternative Method 3. The total estimated present value cost for this alternative is $24,860,000. The following key items were incorporated into the cost estimate, and cost summaries are provided in Table 3-18:

- Studies, Approvals, and Construction:
  - Studies required to develop and operate the site and obtaining required approvals from relevant agencies; and
  - Construction of the facility, including:
    - Earthworks to prepare the site;
    - Cell base preparation;
    - Forcemain upgrades;
    - Upgrades to Public Drop-Off area;
    - Leachate collection system; and
    - Phased development of the four cells (estimated 10-year life of each cell).
- Closure Cost:
  - Begins 2 years after completion of the first cell;
  - Phased closure of cells; and
  - Application of vegetative cover.
- Annual Operations Costs:
  - Incurred annually during site operation;
  - General labour and staffing of site;
  - Fuel costs for on-site equipment; and
  - Annual environmental and operational monitoring.
- Post-Closure Care (operational) Costs:
  - Estimated timeline of 50 years post-closure;
  - Operation and inspection of leachate collection system; and
  - Annual environmental monitoring.

Table 3-18: Cost Summary for Alternative 1

	Present Value Cost
Studies, Approvals, and Construction	$6,590,000
Closure	$760,000
Annual Operations	$17,190,000
Post-Closure Care	$320,000
Total	**$24,860,000**

Note: Estimated based on 2015 costs.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- It is assumed that the Town's existing curbside collection process would continue with some minor modifications. Residents and some businesses currently collected by Bluewater Recycling Association (BRA) would continue to have their waste collected by BRA.
- Regarding collection and delivery costs, larger tractor-trailers are likely to be used to transport waste from St. Marys to Twin Creeks. Haulage using a tractor-trailer is much less expensive on a tonne/km basis because haulage vehicles carry significantly more waste than curbside collection trucks (delivery vehicles) despite being slightly more expensive to purchase and consuming slightly more fuel per km. it is assumed that a standard collection vehicle used by BRA would typically cost \$3.12 to \$3.84[34], with a 32-tonne capacity. For comparative purposes, this provides a cost/tonne/km of \$0.12[35].
- It is expected that the BRA collection vehicles will leave their depot in South Huron, travel to St. Marys to complete curbside collection, drive to Twin Creeks to tip their load and finally return to their depot. Excluding the collection route in St. Marys, and using the Town centre as the measuring point, gives a trip distance of 143 km. By comparison, BRA's trucks currently travel from their depot to St. Marys, complete their collection route, travel to the St. Marys Landfill and then back to the depot. Excluding the collection route, this is a distance of 36 km if we assume the truck does not complete additional collections in St. Marys or in other BRA communities. Therefore, delivery to Twin Creeks adds 107 km to the collection vehicle's trip, which is expected to cost \$39.59 per tonne (rounded to \$40.00/tonne). This \$40.00/tonne is the anticipated additional cost for the Town's curbside collection contract with BRA.
- For disposal costs (also known as 'tipping fees'), in their export survey response, Waste Management of Canada Corporation indicated that disposal at the Twin Creeks Landfill would cost between \$40.00 and \$50.00 per tonne. While it is possible that the Town of St. Marys could negotiate a better tipping fee than \$50.00/tonne, this cost was assumed to be a reasonable estimate for longer term planning.
- The Town will also have additional administrative costs for tendering and negotiating contracts, monitoring these contracts and making contract payments. Typically, disposal contracts with private waste service providers are in the range of 3 to 5 years. Longer periods can be negotiated, with the term-length providing the customer (i.e., Town of St. Marys) some security at the risk of paying a slightly higher disposal cost.

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[34] http://www.bv.transports.gouv.qc.ca/mono/0965385.pdf, accessed May 5, 2015, plus data collected from survey respondents.

[35] Value used for comparison of alternatives.

- According to the (2015) export survey response provided by Waste Management of Canada Corporation (see Section 3.4.2.2), they were willing to commit to a 25-year contract for disposal, corresponding with the estimated remaining lifespan of the Twin Creeks Landfill. In 2017, the Twin Creeks Landfill received Ministry approval to increase annual their rate-of-fill. The site is now expected to be full in about 15-years. It is therefore expected that a contract for disposal at the Twin Creeks Landfill will be a maximum of 15 years. This means that at least one other disposal contract, at an alternative disposal site, would be required during the 40-year planning period of this EA. While other disposal sites may result in different tipping fees and transportation costs, we have chosen to ignore this possibility for our evaluation. Overall, though considering typical contract lengths and the remaining capacity of the Twin Creeks Landfill, export costs may not be stable or predictable for the EA planning period.
- To create an even cost comparison with expanding the St. Marys Landfill, we need to incorporate an estimate of the closure and post-closure care costs for the Town's current site. Such costs are included above as part of the St. Marys Landfill expansion per tonne cost.
- In March 2018, Burnside prepared an estimate of landfill liabilities for the St. Marys Landfill in accordance with the Public-Sector Accounting Board rule PS 3270. This assessment concluded that closure and post-closure care for the existing landfill would cost between $1,800,000 and $2,900,000. This is equivalent to $4.66 to $7.56/tonne. For exporting to the Twin Creeks Landfill, we have selected $5.00/tonne as an appropriate estimated cost for closure and care of the existing (not-expanded) St. Marys Landfill.

Resulting Cost Comparison

The cost to expand the St. Marys Landfill or export to the Twin Creeks Landfill is the combination of component costs discussed above. These are summarized in the table below.

Table 3-19: Cost Comparison of Alternatives

Element	Expand St. Marys Landfill	Export to Twin Creeks Landfill
Collection Operations	Equal to existing cost	Equal to existing cost
Transportation	Equal to existing cost	Existing cost, plus $40.00/tonne
Disposal	$51.00/tonne	$50.00/tonne tipping fee
Capital Costs	$7,360,000 (=$24.00/tonne)	$1,800,000 to $2,900,000 to close existing landfill (assume $5.00/tonne)
Total	**$75.00/tonne**	**$95.00/tonne**

The Town's current disposal fee at the landfill site is $82.50/tonne[36]. From Table 3-19, above:

- Expanding the St. Marys Landfill may result in a slightly lower cost for disposal than currently enjoyed by residents and businesses that deliver waste directly to the site. Curbside collection and transportation costs are expected to be about the same. Additional costs are expected to construct new landfill cells and expand infrastructure associated with leachate collection, stormwater management, and other design features.
- Disposal at the Twin Creeks Landfill is expected to be substantially more expensive than expansion of the St. Marys Landfill – almost 30% more expensive. While curbside collection costs are not expected to change, all other aspects of the disposal cost will, including the closure and care for the existing (un-expanded) St. Marys Landfill.

Mitigation Measures and Net Effects

There are no impacts associated with costs, apart from the payment itself. While it is assumed that the Town will seek to minimize these costs, there are no specific mitigation measures that can be applied. Thus, mitigation and net effects are not discussed for this criterion.

3.8.7 Technical Factors

3.8.7.1 Technical Ability to Carry Out Each Alternative

Considerations associated with technical factors are as follows:

Alternative 1: Expand the St. Marys Landfill:

- Expanding the St. Marys Landfill will require extensive permitting, including approval of this EA document, detailed design, and an Environmental Compliance Approval (ECA). However, the expanded landfill will meet the Town's needs over the full planning period.

Alternative 2: Export Waste to the Twin Creeks Landfill:

- For Alternative 2, disposal at the Twin Creeks Landfill, the regulatory process would be straightforward. An Environmental Assessment or other permits or approvals are not required as Twin Creeks is already permitted to accept St. Marys' waste. Some work would be required in relation to the closure of the St. Marys Landfill and options to maintain a public drop-off facility and composting at the site. A contract with Twin Creeks would be required. Based on the information provided by Waste

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[36] https://www.townofstmarys.com/en/living-here/Landfill.aspx (accessed October 28, 2019).

Management of Canada Co. (WM), as noted in Section 3.4.2.2, a contract covering the full 40-year planning period will not be possible. The contract with BRA will also need to be renewed and updated to incorporate the increased travel to the disposal site. As such, this alternative does not fully address the needs of the Town over the planning period. Through their survey response, WM noted that a 25-year contract may be possible. However, given the recent increase to the landfill's fill rate, only 15 years of capacity may be left. Thus, an alternative landfill with longer travel route may be required before even half of the planning period is over. This will result in significant uncertainty and risk for the Town as they will need to review their waste management option again soon. Costs could rise significantly from those predicted in this EA.

Mitigation Measures and Net Effects

Impacts associated with this criterion are discussed above. However, no mitigation measures can be applied. Thus, mitigation and net effects are not discussed for this criterion.

3.9 Summary of Net Effects

The evaluation of net effects relative to Doing Nothing is presented in Table 3-20. All rankings are relative to the Do Nothing Alternative.

Table 3-20: Summary of Net Effects

Criteria	Comparison to the Do Nothing Alternative	
	Alternative 1: Expand the St. Marys Landfill	Alternative 2: Export Waste to the Twin Creeks Landfill
Natural Environment		
Potential Impacts to Atmosphere	Equally Preferred	Preferred
Potential Impacts to Geology and Hydrogeology	Equally Preferred	Equally Preferred
Potential Impacts to Surface Water	Equally Preferred	Equally Preferred
Potential Impacts to Biology	Somewhat Less Preferred	Preferred
Cultural Environment		
Potential Impacts to Archaeological Resources	Equally Preferred	Equally Preferred
Potential Impacts to Built Heritage	Equally Preferred	Equally Preferred

Criteria	**Comparison to the Do Nothing Alternative**	
	Alternative 1: Expand the St. Marys Landfill	**Alternative 2: Export Waste to the Twin Creeks Landfill**
Potential Impacts to Cultural Heritage	Equally Preferred	Equally Preferred
Socio-economic Environment		
Potential Impacts to Transportation Routes	Equally Preferred	Less Preferred
Land Use	Preferred	Less Preferred
Employment Effects	Somewhat Preferred	Less Preferred
Economic Conditions	Equally Preferred	Less Preferred
Aesthetics/Enjoyment of Life	Somewhat Preferred	Preferred
Indigenous Connections to the Land		
Traditional and Historic Uses/Land Claims/ Indigenous and Treaty Rights	Equally Preferred	Somewhat Preferred
Financial Factors		
Capital and Operational Costs	Somewhat Less Preferred	Less Preferred
Technical Factors		
Technical Ability to Carry Out Each Alternative	Equally Preferred	Less Preferred
Overall Preference	**Somewhat Preferred**	**Less Preferred**

3.10 Advantages and Disadvantages of the Alternatives to the Undertaking

Based on the discussion of net effects in Section 3.8, the advantages and disadvantages of the proposed Undertaking and Alternative to the Undertaking are summarized in Table 3-21.

Table 3-21: Summary of Advantages and Disadvantages

Do Nothing	Alternative 1: Expand the St. Marys Landfill	Alternative 2: Export Waste to the Twin Creeks Landfill
Advantages		
• Does not have any effect on the natural, cultural, or social environment beyond baseline conditions. • Does not affect Indigenous connections to the land beyond baseline conditions. • Does not have a capital or operational cost.	• Minimal transportation impacts. • Tipping fees are set and controlled by the Town. • Promotes local employment and economy. • Town maintains social and economic benefits of having disposal capacity for current and future residents and IC&I sectors. • Makes efficient use of land that would otherwise have few alternative uses. • Offers an opportunity to improve natural heritage and surface water conditions at the site. • Provides a 40-year solution.	• Reduces greenhouse gas emissions through landfill gas collection and flaring. • Improves noise, dust, and odour concerns for residents adjacent to the St. Marys Landfill. • The Twin Creeks Landfill is subject to community benefit agreements to help offset impacts.

Do Nothing	Alternative 1: Expand the St. Marys Landfill	Alternative 2: Export Waste to the Twin Creeks Landfill
Disadvantages		
• Does not provide a solution to the Problem Statement.	• Results in a higher emissions potential as a result of the lack of LFG collection when compared to Twin Creeks. • Uses a very small amount of WWTP capacity that could otherwise be used for future development. • Causes temporary impacts to natural features, including potential habitat for species at risk and aquatic habitat that will require restoration and compensation. • May effect Cultural Heritage Resources. • Requires more permits and approvals and engineering design.	• Does not provide a solution for the full 40-year planning period. • Costs may fluctuate over the planning period and Town does not control cost increases. • May result in the loss of a small number of jobs in St. Marys. • May negatively affect businesses in St. Marys that rely on lower cost waste transportation and disposal at the St. Marys Landfill. • Results in increased trucking emissions and traffic impacts on truck route.

Input from Stakeholders, Agencies, Indigenous Communities and the Public

A Public Information Centre was held at the end of Phase 1 of the EA process. In addition, information was posted to the Town's website and notification was provided to the public, agencies, and Indigenous communities.

No input was received from agencies or Indigenous communities with respect to the evaluation of Alternatives to the Undertaking. Several comments were received from the public and interested stakeholders and are summarized in Table 3-22.

Table 3-22: Comments Received from the Public Regarding the Alternatives to the Undertaking

Comment	Comment Type	Study Team Response	Where Addressed in EA
Concerned with drinking water well quality	Verbal	Groundwater quality is monitored on a regular and ongoing basis as part of the current landfill operations. To date, there are no concerns related to the landfill's impact on off-site groundwater quality. Landfill monitoring reports are available online at the Town's website. Further to the existing site monitoring, the draft Hydrogeological Work Plan will consider the likely impacts of Alternative Methods for the expansion of the landfill, helping to determine a preferred Method. Recommendations will be made for the preferred Method to minimize groundwater (and surface water) impacts.	Sections 6.6.1 and 8.0
Concerned with dust from site entrance.	Verbal	Through discussion with the resident, it was found that a significant dust concern occurred a few years ago during the reconstruction of Hwy 7. Excess soils from that project were brought to the landfill for use as cover, to build berms, etc. The truck traffic on the access road caused excessive dust until calcium chloride was spread. Regular site operations have not been as problematic, though some	Sections 6.6.1 and 8.0

Comment	Comment Type	Study Team Response	Where Addressed in EA
		dust from the site access road is occasionally generated. Relative to current operations, dust concerns are taken seriously by the Town. The resident was encouraged to contact the Town if dust becomes an issue again. The draft Air, Noise and Vibration Work Plan was discussed. This work plan includes an assessment of dust generation by each Alternative Method for landfill expansion. Recommendations will be made for the preferred Method to minimize and mitigate dust generation for the expanded facility.	
Concerned that thermal treatment has been discarded as an alternative at this stage in the study. Offered suggestion that kiln at St. Marys Cement could be used for a waste-to energy solution.	Verbal	Thermal treatment was discarded because it is not financially feasible for the Town based on the quantities of waste generated. St. Marys Cement is not at a stage where it could begin accepting waste within the timeframe required by the Town. Also, there are questions as to what portions of the waste disposal stream would be acceptable in the kiln. It is unclear whether such a facility could be financially or technically viable. The Town is always open to discussions with St. Marys Cement.	Section 4.0.

It was determined that concerns raised by stakeholders (i.e., drinking water quality and dust) can be addressed through standard landfill design, operational procedures and regular monitoring. These issues were considered in the evaluation as described in Sections 3.8.2.1 and 3.8.2.2. Thermal treatment options in participation with St. Marys Cement were considered but are not feasible at this time.

Preferred Undertaking

Based on the evaluation presented in Section 3.8, the advantages and disadvantages of each alternative and input from the public, it was determined that:

- Doing Nothing does not address the Town's waste management needs and obligations and is not a feasible solution to the Problem Statement.
- Exporting waste to the Twin Creeks Landfill is preferred to expanding the St. Marys Landfill based on Natural Environment and Indigenous Connections to the Land criteria.
- Expanding the St. Marys Landfill is preferred based on Socio-economic criteria, Financial Factors, and Technical criteria.
- Both options were equally preferred based on Cultural Heritage criteria.

Overall, expanding the St. Marys Landfill is preferred.

4.0 Phase 2: Review of the Environmental Assessment Requirements

Through the evaluation of Alternatives To the Undertaking, completed in Section 3.0, it was determined that expanding the existing St. Marys Landfill is preferred over exporting waste to another jurisdiction.

If exporting waste had been selected, this EA would have concluded, as an Undertaking involving exporting waste is not subject to this EA process.

Under Ontario Regulation 101/07, the Waste Management Projects Regulation, landfill expansions in exceedance of 100,000 m^3, are subject to the Individual EA process under the EA Act. As the Town's waste disposal needs exceed this volume, this EA has continued using the scoped process identified in the Terms of Reference.

As such, the remainder of this document describes the Evaluation of Alternatives Methods, the impacts and mitigation associated with the preferred Undertaking, consultation measures and commitments to additional actions to be taken during the design, operations, and final decommissioning of the landfill.

5.0 Phase 3: Redefine the Purpose and Rationale for the Undertaking

In the early stages of this Study the description of the Undertaking was broad to allow for the variety of solutions under investigation. In Section 3.3, the Undertaking was defined as, "the proposed changes that are made to address the Town's future municipal waste disposal needs."

As it has been determined that expanding the St. Marys Landfill is the preferred solution, the Problem Statement and the rationale for the Undertaking can be redefined to:

> *The expansion of the St. Marys Landfill in order to provide the necessary capacity to fulfill the Town's post-diversion solid waste disposal needs for the next 40 years.*

The rationale for the Undertaking was also reviewed. It was determined that the rationale and justification for the Undertaking, provided in Section 3.1, remains valid. Please note that the above Problem Statement supersedes the Preliminary Problem Statement noted under Section 3.2.

The existing St. Marys Landfill reached its approved capacity in January 2016. To maintain operations during preparation of this EA, the Town applied for and received ECA Notices (amendments) allowing continued use. The current Notice allows operation through September 30, 2020. As required by the ECA, the Town will apply to the Ministry for further operation by July 31, 2020.

MECP is not expected to extend the site's ECA indefinitely without a long-term plan to manage the Town's waste. The Town is responsible for the management of solid waste generated by the Town, its residents and local industry, businesses, and institutions. Wastes generated from other communities or entities are not managed by the Town and there is no intent to accept waste from other communities in the future, as noted in a Town letter, dated December 18, 2019 provided in Volume IV, Appendix A. Therefore, the Town is responsible for developing a long-term management plan and is doing so through the *Environmental Assessment Act* planning process. Through an evaluation of Alternatives To the Undertaking, it was determined that expanding the existing St. Marys Landfill is the preferred means to address the Town's waste disposal needs.

Based on the calculations provided in Section 3.1.3, the expanded landfill must have a capacity of 708,000 m^3 (as noted in Section 3.1.3.8, this includes 38,903 m^3 of capacity that has already been approved and filled through various interim ECA amendments) and a future waste density of 550 kg/m^3, results in 389,400 tonnes of waste capacity.

6.0 Phase 4: Define the Parameters of the Study

The TOR indicated that this Phase of the EA would frame the parameters for the evaluation of Alternative Methods for Carrying out the Undertaking. The parameters of the study include:

- The *Alternative Methods* to be assessed;
- The Study Area;
- The timeframe to be considered;
- The evaluation criteria;
- The methodology for characterizing the existing environment; and
- The existing environment within which the Undertaking will be implemented.

Each of these are discussed in the following sections.

6.1 Alternative Methods to be Assessed

Alternative Methods are the various approaches that could be used to address the revised Problem Statement. In this case, the *Alternative Methods* are the various landfill design options that could be developed.

The Study Team developed and identified five conceptual *Alternative Methods*. The "Do Nothing" Alternative has also been brought forward as a baseline against which the other Alternatives can be compared. These *Alternative Methods* are summarized in Table 6-1 and are shown in Figure 6-1 through Figure 6-5.

For all Alternatives, the following assumptions were made:

- The current Phase I and Phase II/III waste footprints use the site's native clays as a liner system. For the conceptual Alternative Method designs the Study Team assumed the native clays of the site would, together with a leachate collection system, provide appropriate protection for groundwater resources.
- Ontario Regulation 232/98 under the *Environmental Protection Act* states that landfill sites containing 1.5 million cubic meters (1.5 Mm^3) of landfill capacity or more are required to install a landfill gas capture and flare system. The proposed total capacity of the St. Marys Landfill if the expansion is constructed will remain below this threshold. Further the Regulation recognizes low landfill gas generation rates as a potential reason to avoid installation of a landfill gas management system even if the site capacity exceeds the 1.5 m^3 threshold. The age of waste already contained within the site, the anticipated rate of fill, and thus the ultimate rate of landfill gas generation, is relatively low. Therefore, on both counts (total capacity and rate of fill),

the site does not require a gas management system. In the long run, this may result in the Town installing an LFG system in the future. Such a system may be voluntarily installed based on beneficial economics, community recognition of benefit(s) or to mitigate a currently unanticipated LFG issue. Regulatory changes could also result in installation of an LFG system. However, in developing and evaluating the *Alternative Methods* we have assumed that an LFG system will not be installed.

- A leachate collection system will likely be required at the site. Based on the existing Phase II/III site design and that of similar facilities, an underlying leachate collection pipe network would be installed for the expanded St. Marys Landfill. The installation of the collection system requires that the base of the cells be designed and graded in a manner that permits proper function. Namely, the base should be graded to maintain leachate flow to areas allowing for leachate removal.

Although each Alternative is technically feasible, Alternatives 1 and 4 do not provide sufficient volume to address the Town's landfill capacity needs, as identified in Section 3.1.3. To meet the Town's waste disposal needs for the next 40 years, 708,000 m^3 of landfill capacity is required. As noted in Section 3.1.3.8, some of this volume has already been used. However, the assessment used 2016 landfill topographic data to create the Alternative Method design concepts. This 2016 data does not account for more recent fill quantities. As such, each of the concepts shown in Figure 6-1 through Figure 6-5 incorporate 38,903 m^3 of waste volume that has been placed above the existing landfill.

Alternatives 1 and 4 provide only 500,000 m^3 and 397,000 m^3, respectively. Based on our initial assessment, the liner system of the existing landfill will be replicated for each horizontal expansion. The existing liner will be used for all vertical expansion footprints. All Alternatives, including Alternatives 1 and 4, were considered in detail in the various technical reports provided in Volume III of this EA. However, for the purposes of this primary EA documentation, Alternatives 1 and 4 are discarded as feasible Alternatives as they do not fully address the Problem Statement. The remainder of the Evaluation of Alternative Methods does not include further consideration of Alternatives 1 and 4.

Table 6-1: Summary of Alternative Methods for Expanding the St. Marys Landfill

Alternative Methods		Description	Expansion Capacity (m3)	Buffer Area	Leachate Collection	Infrastructure Changes	Carry Forward?
	Do Nothing	As a requirement of the EA Act, the 'Do Nothing' Alternative must be considered. Do Nothing represent the result of no action being taken to address the Problem Statement and serves as a baseline against which other Alternatives can be compared.	Zero – Only provides currently permitted capacity.	Current property setbacks.	Existing leachate liner and collection system.	None	Yes, The Do Nothing Alternative is a requirement of the EA process.
1	Vertical expansion of the existing landfill (see Figure 6-1)	This Alternative Method involves an expansion in the vertical direction within the existing footprint of the landfill.	500,000 m^3 Approx. 30 years (not sufficient for the Town's needs)	Existing property setbacks and buffers will be maintained.	Extends existing liner and leachate collection system to allow filling between Phase I and Phase II/III. Increasing the height of filling in the area of the existing leachate collection system maintenance holes puts additional stress on the liner and collection system and the base of those maintenance holes.	New roads and public drop-off area are required. Existing manholes need to be extended to allow continued access to the access to the existing leachate collection system for maintenance. The collection system needs to be extended between Phase I and Phase II/III. May require some sizing upgrades. Generally, additional waste thickness, synonymous with height, can also cause technical difficulties with leachate seeps, hydraulic conductivity, landfill gas migration and overall geotechnical stability of the landfill.	No, this Alternative does not meet the required landfill capacity and does not fully address the Problem Statement.
2	Horizontal expansion of the existing landfill (see Figure 6-2)	This Alternative Method involves an expansion outside of the existing landfill footprint.	733,000 m^3 >40 years Capacity	No change to buffers from Phase I or Phase II/III. New (expansion) waste footprint provides 100 m of buffer.	A liner and leachate collection system like that used for Phase II/III will be placed in the expansion footprint.	The watercourse through the site must be relocated. Roads leading to the new waste footprint must be built. The site's surface water management system must be revised. New footprint requires liner, leachate collection systems, stormwater controls.	Yes, this Alternative provides a functionally feasible solution to the Problem Statement.

Alternative Methods		**Description**	**Expansion Capacity (m3)**	**Buffer Area**	**Leachate Collection**	**Infrastructure Changes**	**Carry Forward?**
3	Combination of vertical and horizontal expansion (see Figure 6-3)	This Alternative Method would involve partial vertical expansion along with some horizontal expansion of the landfill footprint, basically a mixture of Methods 1 and 2.	756,000 m^3 >40 years Capacity	Existing property setbacks and buffers will be maintained for fill above Phase I and Phase II/III, with new (expansion) waste footprint providing a 100 m buffer.	Extend existing liner and leachate collection system between Phase I and Phase II/III, and east under new (expansion) waste footprint.	New footprint requires liner, leachate collection systems, stormwater controls, although the size of this infrastructure is less than needed for Alternative 2. The watercourse through the site must be relocated. New roads and public drop-off area required. Existing manholes need to be extended to allow continued access to the access to the existing leachate collection system for maintenance. The collection system needs to be extended between Phase I and Phase II/III. May require some sizing upgrades. Stormwater management basins must be relocated. Generally, additional waste thickness, synonymous with height, can also cause technical difficulties with leachate seeps, hydraulic conductivity, landfill gas migration and overall geotechnical stability of the landfill.	Yes, this Alternative provides a functionally feasible solution to the Problem Statement.
4	Development of a new landfill footprint (see Figure 6-4)	This Alternative Method involves closure of the existing 8 ha footprint and development of a new landfill footprint elsewhere on the landfill property.	397,000 m^3 Approx. 25 years (not sufficient for the Town's needs)	No change to buffers from Phase I or Phase II/III. New (expansion) waste footprint provides 100 m of buffer.	A liner and leachate collection system like that used for Phase II/III will be placed in the expansion footprint. Liner system may be complicated by Cement Kiln Dust pile (see Section 3.7.1.1).	New footprint requires liner and leachate collection systems, including modifications to the leachate handling infrastructure. New surface water management and roads required for expansion area. The separate fill area eliminates the need for upgrades of Phase I and Phase II/III areas. Some retrofitting may be required to ensure exiting infrastructure continues to operate for the proposed lifespan.	No, this Alternative does not meet the required landfill capacity and does not fully address the Problem Statement.

Alternative Methods		Description	Expansion Capacity (m3)	Buffer Area	Leachate Collection	Infrastructure Changes	Carry Forward?
5	Vertical expansion plus a new footprint (see Figure 6-5)	This Alternative Method is a combination of Alternative Methods 1 and 4.	974,000 m^3 >40 years Capacity	No change to buffers from Phase I or Phase II/III. New (expansion) waste footprint provides 100 m of buffer.	A liner and leachate collection system like that used for Phase II/III will be placed in the expansion footprint. Liner system may be complicated by Cement Kiln Dust pile (see Section 3.7.1.1) Increased fill height above Phase I and Phase II/III may impact liner and leachate collection system.	New footprint requires liner and leachate collection systems, including modifications to the leachate handling infrastructure. New roads and public drop-off area required. Manholes need to be extended to allow continued access to the access to the existing leachate collection system for maintenance. The collection system needs to be extended between Phase I and Phase II/III. May require some sizing upgrades. Generally, additional waste thickness, synonymous with height, can also cause technical difficulties with leachate seeps, hydraulic conductivity, landfill gas migration and overall geotechnical stability of the landfill.	Yes, this Alternative provides a functionally feasible solution to the Problem Statement.

OBTAINED CAPACITY - 577,000 m³

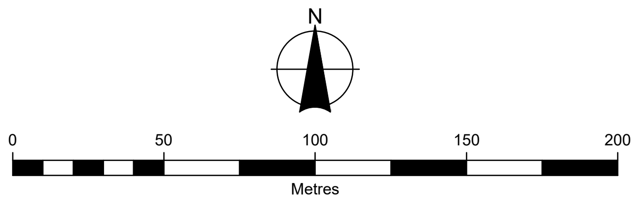

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Figure Title

SOLID WASTE CAPACITY DEVELOPMENT

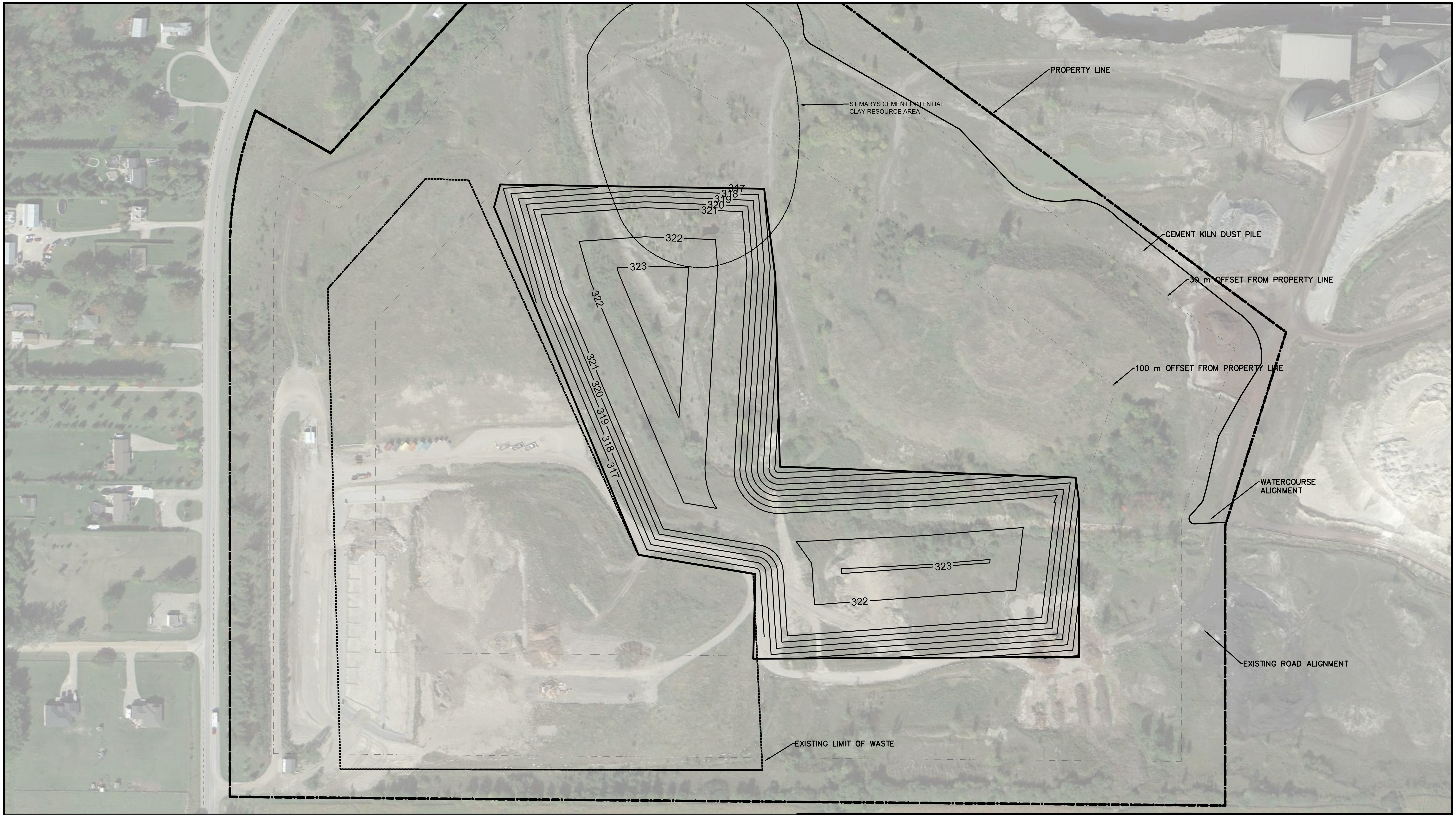
ALTERNATIVE METHOD 1 - VERTICAL EXPANSION

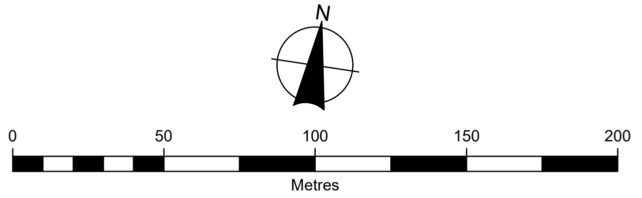
Client

TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJ	JRH	JUNE 2021	**6-1**
Scale		Project No.	
1:2500		300032339	

File: \\pops\Shared Work Areas\032339 - St. Marys Waste\CIVIL\02 ProductionDwg\EA Concepts\Alternative Method 1.dwg Date Plotted: June 21, 2021 - 11:39 AM





OBTAINED CAPACITY -	733,000 m³
ABOVE GRADE -	403,000 m³
BELOW GRADE-	330,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF WASTE TO m ELEVLATION 321 m. FOLLOWED BY A 20:1 GRADE TO THE PEAK AT 323m. COMBINED WITH A 5 m VERTICAL EXCAVATION (CKD PILE EXCLUDED).

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30 m
GUIDELINE SETBACK = 100 m

BURNSIDE

Client
TOWN OF ST. MARYS

Figure Title
SOLID WASTE CAPACITY DEVELOPMENT

METHOD 2 - HORIZONTAL EXPANSION OF THE EXISTING LANDFILL

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Date JUNE 2021
Scale 1:2500
Project No. 300032339
Figure No. **6-2**

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N

0 50 100 150 200
Metres

OBTAINED CAPACITY -	756,000 m³
ABOVE GRADE -	506,000 m³
BELOW GRADE-	250,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WASTE TO ELEVATION OF 323m, FOLLOWED BY A 20:1 SLOPE ON THE PEAK. COMBINED WITH A 5m VERTICAL EXCAVATION (CKD PILE EXCLUDED).

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30 m
GUIDELINE SETBACK = 100 m

BURNSIDE

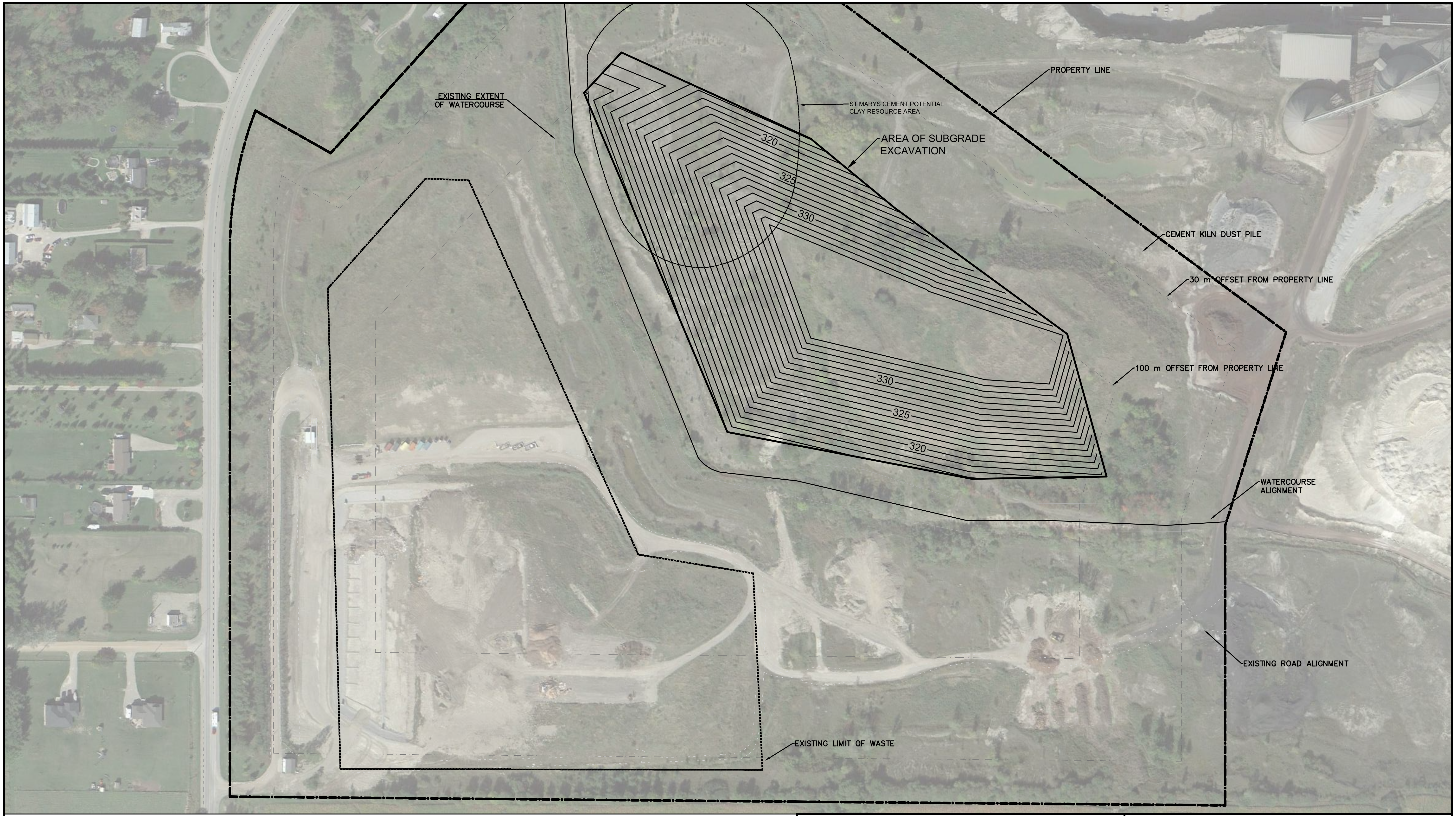
Client
TOWN OF ST. MARYS

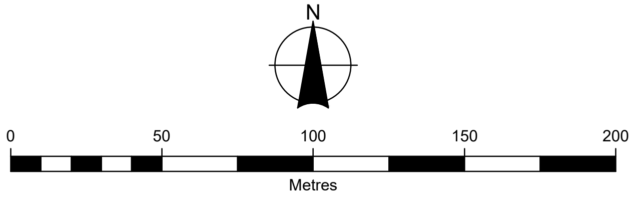
Figure Title
SOLID WASTE CAPACITY DEVELOPMENT

METHOD 3 - COMBINATION OF VERTICAL AND HORIZONTAL EXPANSION

Drawn: CJ
Checked: JRH
Date: JUNE 2021
Figure No. 6-3
Scale: 1:2500
Project No. 300032339

File: \\pops\Shared Work Areas\032339 - St. Marys Waste\CIVIL\02 ProductionDwg\EA Concepts\Alternative Method 3.dwg Date Plotted: June 21, 2021 - 11:12 AM





OBTAINED CAPACITY -	397,000 m³
ABOVE GRADE -	252,000 m³
BELOW GRADE-	145,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WATERCOURSE BANK TO THE ELEVATION OF THE EXISTING TOPOGRAPHY. COMBINED WITH A 5 m VERTICAL EXCAVATION (CKD PILE EXCLUDED).

BURNSIDE

Client

TOWN OF ST. MARYS

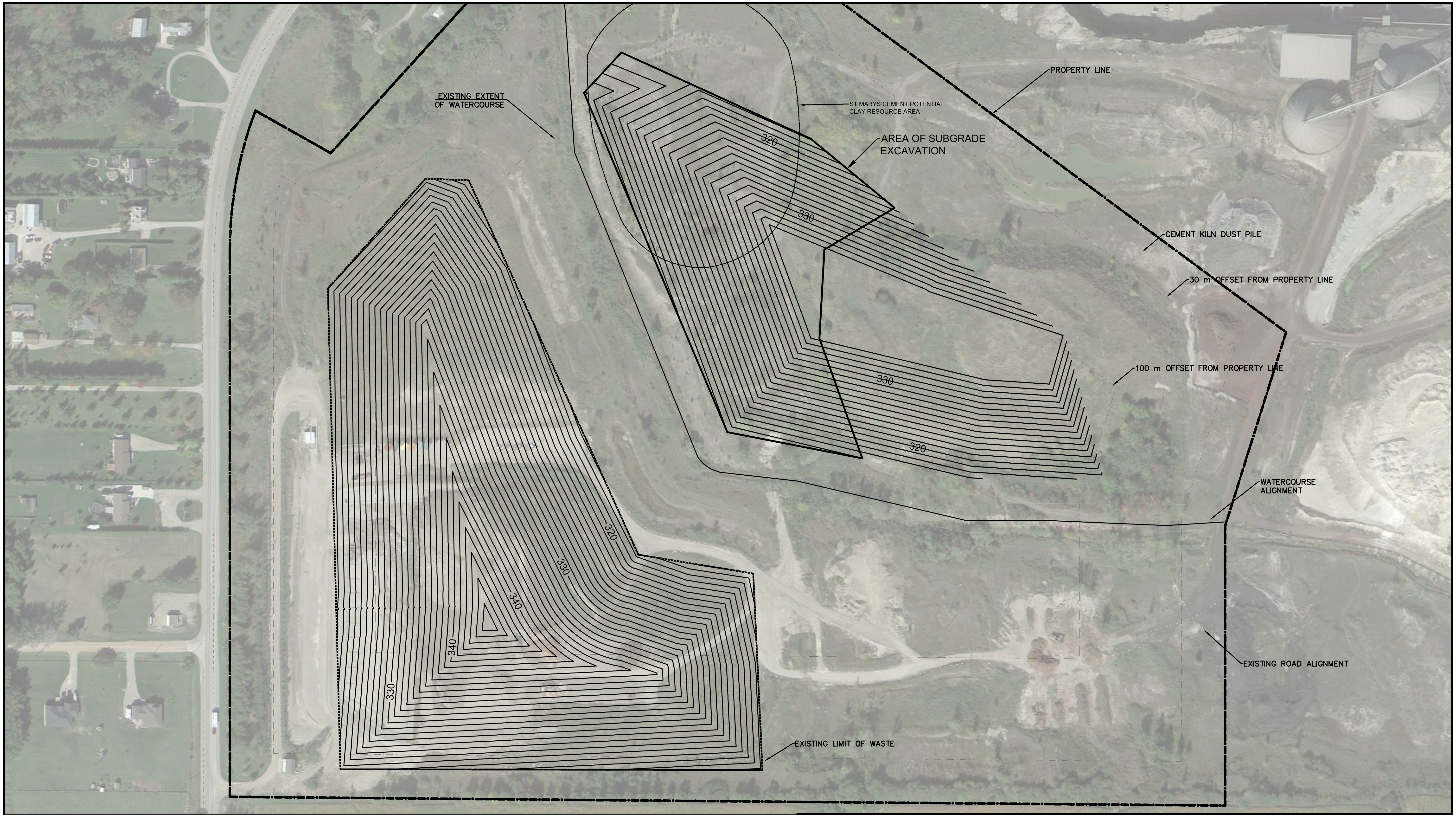
Figure Title

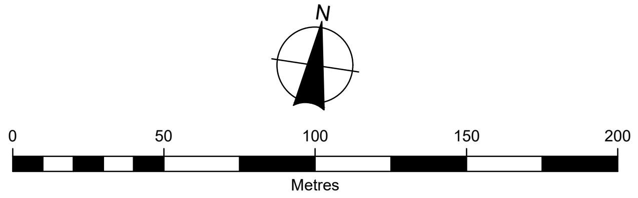
SOLID WASTE CAPACITY DEVELOPMENT

ALTERNATIVE METHOD 4 -
NEW LANDFILL FOOTPRINT

Drawn	Checked	Date	Figure No.
CJ	JRH	JUNE 2021	6-4
Scale		Project No.	
1:2500		300032339	

File: \\pops\Shared Work Areas\032339 - St. Marys Waste\CIVIL\02 ProductionDwg\EA Concepts\Alternative Method 4.dwg Date Plotted: June 21, 2021 - 11:25 AM





OBTAINED CAPACITY -	974,000 m³
ABOVE GRADE -	827,000 m³
BELOW GRADE-	145,000 m³

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WATERCOURSE BANK TO THE ELEVATION OF THE EXISTING TOPOGRAPHY. COMBINED WITH A 5 m VERTICAL EXCAVATION (CKD PILE EXCLUDED). ADDITIONALLY WASTES WILL BE PLACED OVERTOP OF THE EXISTING PHASES.

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30 m
GUIDELINE SETBACK = 100 m

BURNSIDE

Client

TOWN OF ST. MARYS

Figure Title

SOLID WASTE CAPACITY DEVELOPMENT

METHOD 5 - COMBINATION OF VERTICAL EXPANSION AND SEPARATE DEVELOPMENT OF A NEW LANDFILL FOOTPRINT

Drawn	Checked	Date	Figure No.
CJ	JRH	JUNE 2021	6-5
Scale		Project No.	
1:2500		300032339.0000	

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Alternatives 2, 3, and 5 will be considered for further review. Each Alternative can be designed in a manner that would provide greater capacity than that being sought. Although each design could potentially provide the capacity listed in Table 6-1 and shown on Figure 6-1 through Figure 6-5, the expansion would only be designed during the detailed design process to meet the 708,000 m^3 requirement, taking into account the volume already filled. For the purposes of this EA, it is assumed that each Alternative would be designed in keeping with the footprints shown on the figures. However, as the full capacity identified on each figure is not required, each Alternative would be capped at a slightly lower height than shown. Further details regarding the design of Alternatives 2, 3, and 5 are presented in Table 6-2.

Table 6-2: Available vs. Required Capacity of Suitable Alternatives

	Alternative 2	**Alternative 3**	**Alternative 5** [1.]	
			Vertical	**New**
Figure	6-2	6-3	6-5	
Area of Landfill Footprint				
Existing Footprint	80,000 m^2	80,000 m^2	80,000 m^2	
New Footprint (expansion)	70,000 m^2	36,000 m^2	61,000 m^2	
Total Footprint	150,000 m^2	116,000 m^2	141,000 m^2	
Volume				
Potential Capacity	733,000 m^3	756,000 m^3	974,000 m^3	
Required Capacity	708,000 m^3	708,000 m^3	708,000 m^3	
Excess Capacity	25,000 m^3	48,000 m^3	266,000 m^3	
Implications for Final Height				
Height Shown on Figure	323 masl	326 masl	345 masl	334 masl
Height with Final Cover (assuming 1 metre thickness)	324	327	346 masl	335 masl
Excess Height (for refuse capacity)	- 0.17 m	- 0.41 m	- 1.89 m	
Anticipated Height	323.8 masl	326.6 masl	344.1 masl [2.]	333.1 masl

Notes:

† Excess Height (m) = Excess Capacity (m^3) ÷ Total Footprint (m^2)

1. Divided into Vertical Expansion (Vertical) and Separate (New) Development, where applicable.
2. Vertical Expansion of existing footprint is unlikely to extend to the pyramidal peak shown on Figure 6-5. Some space will be required to allow equipment movements. Therefore, the anticipated heights are likely to be somewhat lower.

For the purposes of this portion of the EA, each of the Alternatives (Alternatives 2, 3, and 5) are assumed to include the standard mitigation and nuisance control measures in O. Reg. 232/98, such as:

- An expanded leachate control system to capture leachate for treatment at the Town's wastewater management facility.
- Stormwater and erosion controls measures incorporated into the design, potentially including berms, retention ponds, grassed waterways, and vegetated buffer strips.
- Proper grading and stormwater controls to direct, slow and retain water.
- Applying daily cover to control odour and reduce blowing litter.
- Providing visual barriers, such as berms or tree plantings to block sightlines.
- Applying dust control measures, as required.
- Conducting regular inspections by landfill staff to observe and record any operational issues and implementing corrective actions.
- Continuing the existing program to record and respond to public complaints and take corrective actions.

The landfill components listed in Table 6-1 and these typical nuisance control measures are considered in the evaluation of Alternative Methods.

6.2 Study Area

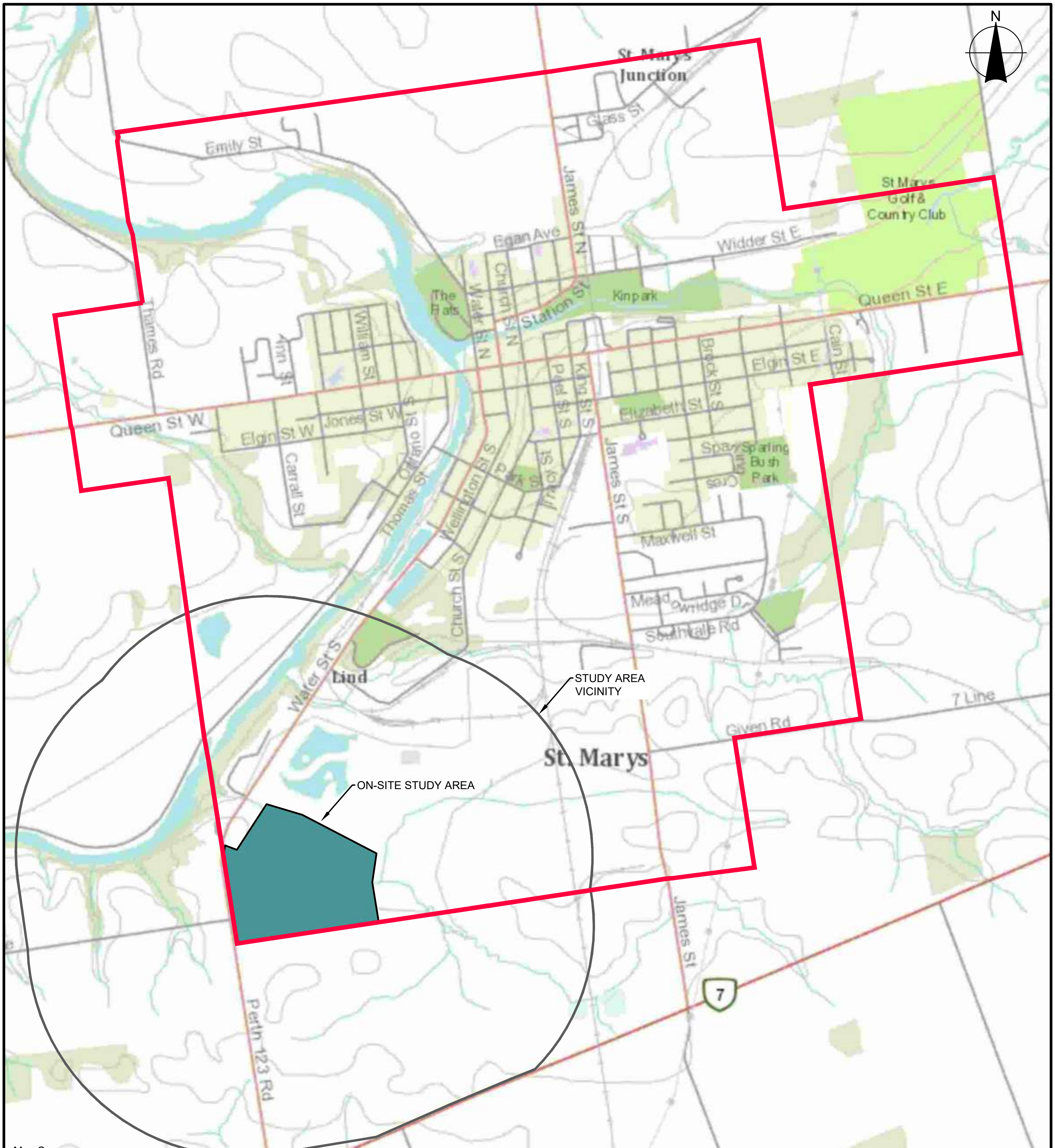
In accordance with the *Code of Practice – Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (MOECC, January 2014), the Study Area is "the area within which activities associated with the undertaking will occur and where potential environmental effects will be studied."

All Alternatives house the landfill expansion entirely within the existing landfill property. Some direct effects can be expected beyond the landfill property. As such, two specific Study Areas have been identified, which will be used as the basis for defining and characterizing the natural, social, cultural, and built environments that may be potentially affected by the expansion.

The Study Areas are as follows:

- *On-Site Study Area* – includes all lands associated with the St. Marys Landfill, the 37-ha property identified as 1221 Water Street South, St. Marys.
- *Study Area Vicinity* – all lands within a 1,000 m radius of the On-Site Study Area.

The Study Areas are presented on Figure 6-6.



Map Source:
Background mapping obtained from arcgisonline base maps, Natural Resources Canada.

Figure Title

TOWN OF ST. MARYS
FUTURE SOLID WASTE DISPOSAL NEEDS
ENVIRONMENTAL ASSESSMENT REPORT
STUDY AREAS

Client

THE CORPORATION OF THE TOWN OF ST. MARYS

Drawn	Checked	Date	Figure No.
CJ	JRH	JUNE 2021	6-6
Scale		Project No.	
1:25,000		300032339	

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6.3 Timeframe of the Study

The EA will consider the potential effects on various environmental components over the following time periods:

- Construction and operation of the expanded landfill – 2017 through 2056, inclusive:
  - Construction was originally projected to begin January 1, 2017. It is now expected to occur January 1, 2022 for approximately a six-month period.
- Operations would occur over a 40-year period, ending December 31, 2056.
- Closure of the landfill would begin in 2057.

The site would begin a post-closure care period in 2057. For planning purposes, a 50-year post-closure care period, through 2106, was assumed.

Note that for the purposes of planning period capacity calculations, the waste placed from January 1, 2017 is considered part of the capacity. Per Section 3.1.3.8, this capacity is incorporated into the planning period despite the waste being already added to the site.

6.4 Evaluation Criteria

The following paragraphs taken from the TOR describe how the alternative Methods will be assessed:

> *Positive and negative environmental effects that could potentially arise from the undertaking and from Alternative Methods will be identified and described for each of the Alternatives. This will include all possible impacts to the natural, social, cultural and man-made components of the environment. Effects will be characterized based on their magnitude, duration, frequency and reversibility.*
>
> *Any change can result in some type of effect. Although the Preferred Alternative will be selected on the basis that it will result in minimal effects, some impact is still likely to be felt. Measures for mitigating potential negative environmental effects from the undertaking and from Alternative Methods will be identified and described. Any residual impacts that cannot be fully mitigated will then be identified.*
>
> *The evaluation of Alternative Methods will consider the potential effects of each alternative on the various components of the environment taking into consideration the mitigation efforts that can be made to reduce or eliminate these impacts and the residual impacts which cannot be mitigated. The Preferred Alternative will then be selected based on*

> *public, Aboriginal and agency comments as well as professional judgement as to which Alternative is most likely to result in the least number of post-mitigation impacts of high magnitude, long duration, repetitive frequency and which have a limited chance to be reversed. At the conclusion of the assessment a Preferred Method for Carrying Out the Undertaking will be identified.*

Draft evaluation criteria were provided in the Terms of Reference and are presented in Table 6-2.

The TOR included “Geology – Aggregate Extraction Considerations” and “Aggregate Extraction” under the Land Use heading as evaluation criteria with “Remaining reserves in the vicinity of the landfill property” and “Status of the license and any attached conditions” as key indicators. It was established in Section 3.7.1.2 that St. Marys Cement surrendered their licence under Aggregate License 4494 dated September 21, 2016, for the existing and potential expanded landfill areas. This surrender was approved under Section 16(2) of the *Aggregate Resources Act* by the Ministry of Natural Resources and Forestry on November 8, 2016. The entire St. Marys Landfill property is now unencumbered by the aggregate extraction license. As such, these criteria have been removed from the evaluation.

Table 6-3: Evaluation Criteria and Indicators

Environmental Component	Environmental Sub-component	Indicator	Data Sources[37]
Atmosphere	Air Quality	• Emissions modelling outputs. • Number of people potentially impacted.	• Air quality modeling. • Aerial photography and Official Plan figures.
	Odours	• Amount generated by existing operations. • Number of potential impacts. • Predicted boundary operations.	• Modeling of potential odour emissions. • Aerial photography and Official Plan figures.
	Noise	• Amount generated by existing operations. • Times noise is anticipated during operations. • Number of impacts. • Boundary conditions.	• Modeling of potential noise emissions. • Aerial photography and Official Plan figures. • Landfill operational hours.
Hydrogeology	Groundwater Impacts	• Contaminating lifespan. • Hydraulic head, local, and regional hydrogeology. • Nearby groundwater receivers. • Number and severity of potential impacts. • Potential Drinking Water Source Impacts.	• Results from landfill's annual monitoring program. • Additional boreholes to be drilled to gain additional information about groundwater conditions. • Source Water Protection Plan mapping. • Modeling of potential impacts.

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[37] Data sources differ slightly from the TOR recommendations. Data sources are based on Work Plans prepared during the EA process. Work Plans are provided in Volume II of the EA documentation.

Environmental Component	**Environmental Sub-component**	**Indicator**	**Data Sources**[37]
Surface Water	Quality	• Number of watercourses in Study Area. • Size of watercourses in area. • Predicted impacts to off-site quality.	• Aerial photography. • Results from landfill's annual monitoring program. • Modeling of potential impacts.
	Quantity	• Duration/frequency/severity of potential on and off-site impacts.	• Results from landfill's annual monitoring program. • Modeling of potential impacts.
Biology	Terrestrial	• Impact and duration of site changes on habitat. • Number and populations of species at risk present. • Potential for interactions.	• Field inventories using MNRF/MECP approved methodologies. • Existing records from the Natural Heritage Information Centre, Breeding Bird Atlas, and other natural heritage databases.
	Aquatic	• Quantity and variety of SAR present. • Changes as a result of site development.	• Field inventories using MNRF approved methodologies. • Existing records from the Natural Heritage Information Centre, Breeding Bird Atlas and other natural heritage databases.

Environmental Component	Environmental Sub-component	Indicator	Data Sources[37]
Cultural Heritage Resources[38]	Built Heritage Resources	• Number of significant Built Heritage Resources in the local area. • Potential impacts to Built Heritage Resources.	• Historical atlases, maps, and records. • Municipal, provincial, and federal databases for heritage structures. • Drive-by inventory.
	Cultural Heritage Landscapes	• Presence of significant Cultural Heritage Landscapes.	• Historical atlases, maps, and records. • Municipal, provincial, and federal databases for heritage structures. • Drive-by inventory.
	Archaeological Resources	• Presence of or likelihood of archaeological resources.	• Historical atlases, maps, and records. • Mapping and documentation of existing site conditions.
Transportation	Local	• Amount/type of traffic generated.	• Local and County Official Plans. • Existing local and regional traffic studies, road asset management plans and design guidelines. • Modeling of future traffic conditions.
	Regional	• Amount/type of traffic generated.	

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[38] Criteria listed in the TOR were "Buildings, Viewscapes and Archaeological Resources". Criteria were changed upon advice from MTCS (Now MHSTCI).

Environmental Component	Environmental Sub-component	Indicator	Data Sources[37]
Land Use	General	• Amount of land required. • Current land use. • Presence of sensitive lands within Study Areas. • Compatibility with Ministry Guideline D-4: Land Use On or Near Landfills and Dumps and Guideline D-1: Land Use Compatibility[39]	• Local and County Official Plans. • Aerial photography.
	Agriculture	• Number and type of farms in Study Area.	• Local and County Official Plans. • Aerial photography. • Agricultural Information Atlas (OMAFRA).
Socio-economic	Employment	• Number, type, duration of changes to local workforce.	• Local and County Official Plans. • Aerial photography. • Town records. • Findings of other technical reports, e.g., air quality, traffic, etc.
	Financial	• Short, medium, long-term financial costs to the Town.	
	Economic	• Changes to revenues, costs, taxes anticipated to local businesses	
	Social	• Number of residences impacted, type/area of impacted land uses, etc.	
Indigenous	Environmental[40]	• Impacts to any environmental items brought forward as concerns by Indigenous communities.	• Consultation with Indigenous communities.

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[39] This indicator was added at the request of MECP during review of the draft EA.

[40] This criterion was listed under the socio-economic heading in the TOR. It has been moved here as it relates to environmental concerns expressed by Indigenous communities and is more appropriate under the Indigenous heading.

Environmental Component	Environmental Sub-component	Indicator	Data Sources[37]
	Cultural	• Presence of known sites within the area. Records of previous site disturbances. • Distance to established communities • Expressed concerns	• Correspondence with MECP. • Search of Indigenous Treaty Rights Information System (ATRIS). • Consultation with Indigenous communities.
	Land Use	• Existing land use focusing on first nation's significance, size of area, presence of any sensitive uses.	• Correspondence with MECP. • Search of (ATRIS). • Consultation with Indigenous communities.

6.5 Methodology for Characterizing the Existing Environment

The TOR indicated that the environment would be characterized in further detail at this stage in the EA. That characterization was to be completed using a combination of:

- Background data sources;
- Field studies and on-site investigations;
- Surveys; and
- Other means to be identified in detailed Work Plans for each primary discipline.

Data sources were described in Table 6-3. In addition to these data sources, the following Work Plans were created in the early stages of the EA process:

- Air Quality, Noise and Vibration Work Plan;
- Hydrogeological Work Plan;
- Ecological Work Plan;
- Archaeological and Cultural Heritage Work Plan; and
- Socio-economic Work Plan.

Work Plans provide a detailed methodology for characterizing each component of the environment and how the evaluation will be carried out. Work Plans are provided in Volume II, Appendices A though E of this report. Work Plans were circulated to relevant agencies for review and comment. Work Plans were also circulated to Indigenous communities and presented to the public at the first Public Information Centre. The actual field studies and the assessment methodology took into account any comments received on the Work Plans. Comments are presented as part of the consultation summary in Volume IV. Methodologies used to describe the existing environment are included in the following sections.

6.6 Description of the Existing Environment

6.6.1 Natural Environment

6.6.1.1 Air Quality and Odour

Methodology

The methodology for characterizing existing air quality and odour is documented in the Air Quality, Noise and Vibration Work Plan provided in Volume II.

Some changes to the Work Plan were made based on comments received from agencies. These changes included acknowledging that expansion after 40 years was possible, increasing the modelled are screening all 50 contaminants found in LFG against their respective criteria to determine the contaminants with the highest POI impact per unit of emission, and describing current air quality.

In summary, dispersion modelling was completed in accordance with the MECP's "Air Dispersion Modelling Guideline for Ontario" PIBS 5165e (ADMGO). The following dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. AERMOD_MPI_Lakes_16216r).
- AERMAP surface pre-processor (v. AERMAP_EPA_16216).
- BPIP building downwash pre-processor (v. 0474).

The modelling MECP provided site specific meteorological data based on AERMOD v16216 was used for this assessment.

Terrain elevation contour data was downloaded from Ontario Digital Elevation Model Data set and processed using the AERMOD terrain processor AERMAP. AERMAP determines base terrain elevation using the DEM data for all sources, receptors, and buildings, and provides the user with a suitable input file for use with AERMOD.

Existing Air Quality and Odour

Existing air quality and odour conditions were determined in the Landfill Expansion Emission Summary and Dispersion Modelling Report provided in Volume III, Appendix A.

The assessment examined the impact of 13 different contaminants variously on five different averaging periods, depending on the criteria for each contaminant. All of the contaminants except odour and particulate matter are less than 50% of their respective criteria under the worst-case scenario.

Following the MECP guidance documents, the emission rates of each contaminant were estimated and modelled using the current version of AERMOD as specified by the MECP. The results of that modeling show that the impact of each contaminant is below its respective criteria at every location along the property line and off-property. The contaminant with the highest off-property impact was particulate matter at 80% of the 24-hour criterion of 120 $\mu g/m^3$.

With regard to odour, under baseline conditions, the existing impacts at sensitive receptors showed that the worst-case impact occurs at the property line. The highest impact is 99 OU. At sensitive receptors, the impact of 6 OU appears to match the level of odour at which complaints tend to be received. Under current conditions, approximately eight receptors may experience 6 OU 0.5% of the time.

6.6.1.2 Noise Levels

Methodology

The methodology for characterizing existing noise levels is documented in the Air Quality, Noise and Vibration Work Plan provided in Volume II.

No changes to the Noise Work Plan were requested by agencies.

In summary, noise modelling was completed in accordance with the MECP's "Noise Pollution Control" (NPC) series of documents. Road traffic assessments were done using the MECP's ORNAMENT methodology as implemented in their program STAMSON v5.04.

The impact of on-site equipment at receptors off-property were assessed using Predictor v12's ISO 9613-2 implementation.

Existing Noise

Existing off-property sound levels were determined in the Landfill Noise Impact Assessment Report provided in Volume III, Appendix B.

Six representative sensitive receptors were selected at which to assess impacts. The highest impact was found to be 48 dBA against a criterion of 55 dBA. The other impacts were between 27 dBA and 47 dBA.

The existing impacts at sensitive receptors showed that the worst-case impact is well below the MECP's criteria during the day. The landfill does not operate at night.

6.6.1.3 Groundwater

Methodology

Data from various sources was collected and incorporated into an updated Site conceptual model. Background data included the Annual Monitoring Reports for the Landfill that contained geology, hydrogeology, and water quality data for the site dating from 1984. Other background data sources included:

- Published geology and hydrogeology maps and reports;
- Landfill hydrogeological investigations and design documents (1982 and 1992);
- Landfill monitoring reports (2010 to 2015);

- Historic aerial photography and satellite imagery;
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA);
- Ontario Ministry of Natural Resources and Forestry (MNRF);
- Ontario Ministry of the Environment and Climate Change (MOECC);
- Thames-Sydenham and Region Source Protection;
- Upper Thames River Conservation Authority;
- Environment Canada;
- Town of St. Marys; and
- St. Marys Cement Co. (SMC).

Collection of additional field data began in the fall of 2015 and included:

- Test pits excavated east of the existing Phase I and Phase II/III landfill areas, east of the watercourse and around the cement kiln dust stockpile;
- Drive point piezometers installed along the watercourse;
- Existing wells from previous studies that were not part of the annual monitoring were located and water levels and/or water quality samples were obtained;
- Water levels measured monthly in all Site wells for a minimum of six months;
- Surface water flows measured monthly at the upstream surface water station (near DP1) and the downstream surface water station (SP3) through the spring into summer of 2016;
- Geomorphic study of the existing watercourse completed by Matrix Solutions Inc. during the summer of 2015 as part of the Ecological Work Plan; and
- Elevation survey of all test pits, drive points and non-monitoring wells to establish locations, ground elevations and measuring point elevations.

Some changes to the Work Plan were made based on comments received from agencies. These changes included:

- The installation of a new monitoring well (OW36) downgradient of Phase II/III; and
- Collecting and analysing groundwater samples from three existing monitoring wells in the CKD stockpile.

An additional change to the Work Plan was the installation of new groundwater monitoring wells. The Work Plan included a program of drilling and well installation. This was necessary because there were no borehole logs or well details available for the existing monitoring wells and no geology data from the previous landfill investigations. Therefore, geology data for the site was limited and the drilling program was needed to fill this data gap.

However, after the Work Plan was submitted the Town located all of the borehole and monitoring well data for the monitoring program, the previous landfill studies, and the SMC investigations. Wells were also located in the cement kiln dust stockpile and added to the Work Plan monitoring. This was a significant amount of geologic and hydrogeologic data that allowed for a reasonably thorough conceptual site model.

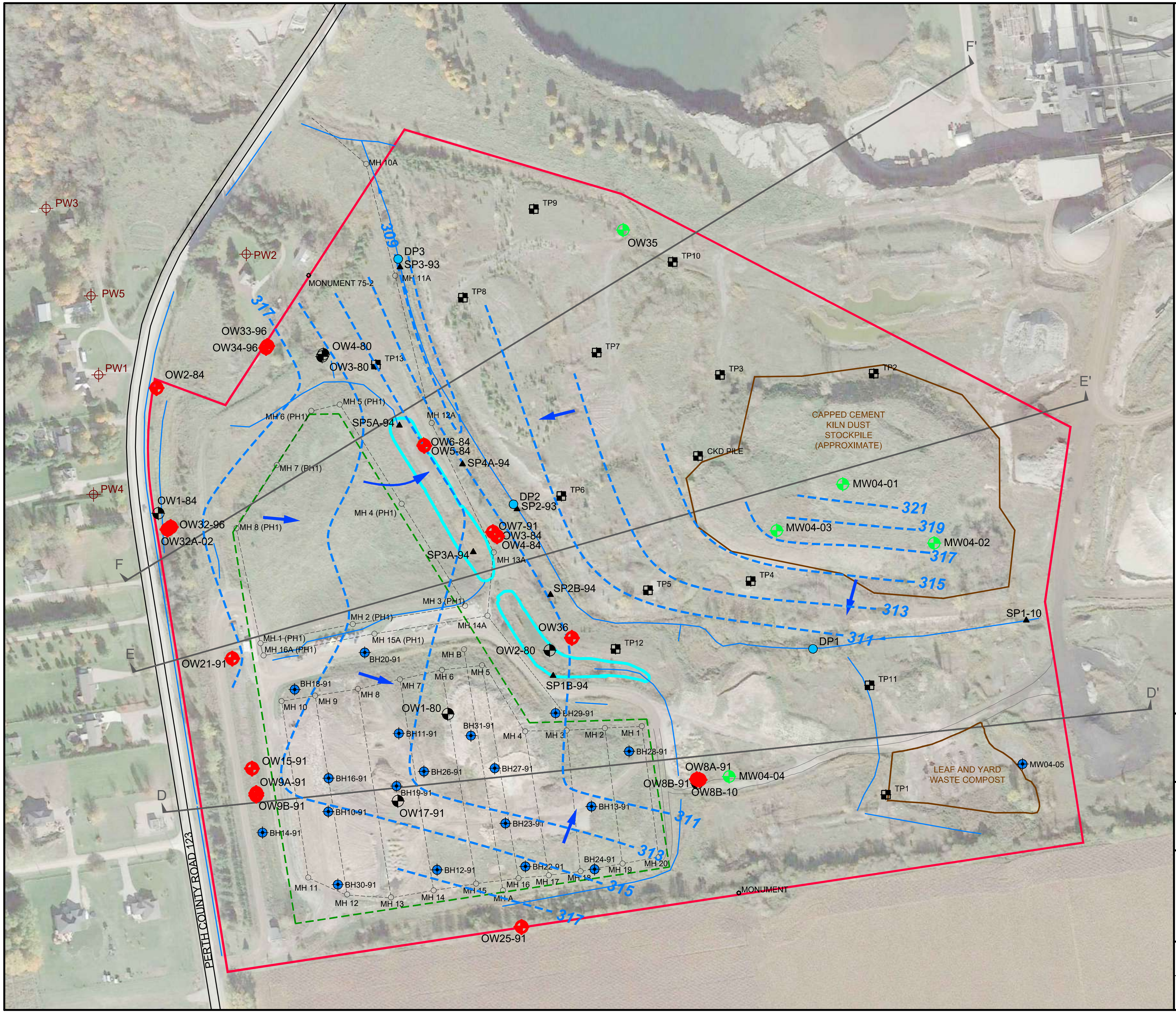
A decision was made to defer adding new monitoring wells until later in the approval process, once the future Site configuration was known. It was acknowledged that future Site development would require decommissioning existing wells and installing new wells. One new well (OW36) was added in 2016.

Existing Geology

The Hydrogeology Study Report in Volume III, Appendix C provides a detailed description and analysis of the existing conditions in the Study Area Vicinity and the On-Site Study Area.

The surface of the Site has been impacted by industrial activity since around 1960. It was around that time that the quarry operation to the north progressed onto what is now the landfill Site. It is likely that there were impacts to the groundwater prior to that time with earlier dewatering of the quarry. By 1978, none of the Site was in a natural state. The topography of the Site today is a result of the overburden stripping/filling east of the watercourse, kiln dust stockpiling, a previous realignment of the watercourse, clay mining over most of the Site west of the watercourse, and construction of the landfill.

The highest elevation on the Site today is the cement kiln dust stockpile (CKD) at 334 m amsl. Figure 6-7 shows the Site features. The elevations of the fill areas are approximately 326 to 327 m. The lowest elevations on the Site occur along the watercourse. This channel enters the east side of the Site at an elevation of approximately 310.0 m amsl and exits at the north end under Water Street South at 306.8 m amsl. Perth County Road 123 is a topographic ridge on the west side of the Site and acts as a drainage divide. West of the ridge, runoff flows to the Thames River. East of the road, runoff is eastward toward the landfill stormwater retention basins and the watercourse.



LEGEND

🟥	PROPERTY BOUNDARY
– – –	LIMIT OF REFUSE DISPOSAL
—	WATERCOURSE
— — — —	LEACHATE COLLECTION SYSTEM
▬	STORM WATER MANAGEMENT BASIN
●	LANDFILL OBSERVATION WELL
◐	LANDFILL OBSERVATION WELL (ABANDONED AND SEALED)
●	EA MONITORING WELL
⊕	BOREHOLE
⌖	PRIVATE DOMESTIC WELL (APPROXIMATE LOCATION)
▲	SURFACE WATER MONITORING LOCATION
◩	TEST PIT
○	DRIVE POINT PIEZOMETER
A A'	CROSS-SECTION LOCATION KEY
– – –	INTERPRETED GROUNDWATER CONTOUR (masl)
←	INTERPRETED GROUNDWATER FLOW DIRECTION

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BURNSIDE

Client / Report
TOWN OF ST. MARYS
ENVIRONMENTAL ASSESSMENT

Figure Title
SITE PLAN

Drawn	Checked	Date	Figure No.
SK	JR	June 2021	6-7
Scale		Project No.	
1:3,000		300032339.4500	

File Name: Elmo/gis/Projects/300/032339 St Marys/032339 2019 EA Study Site Plan.dwg Date Plotted: June 14, 2021 - 2:56 PM

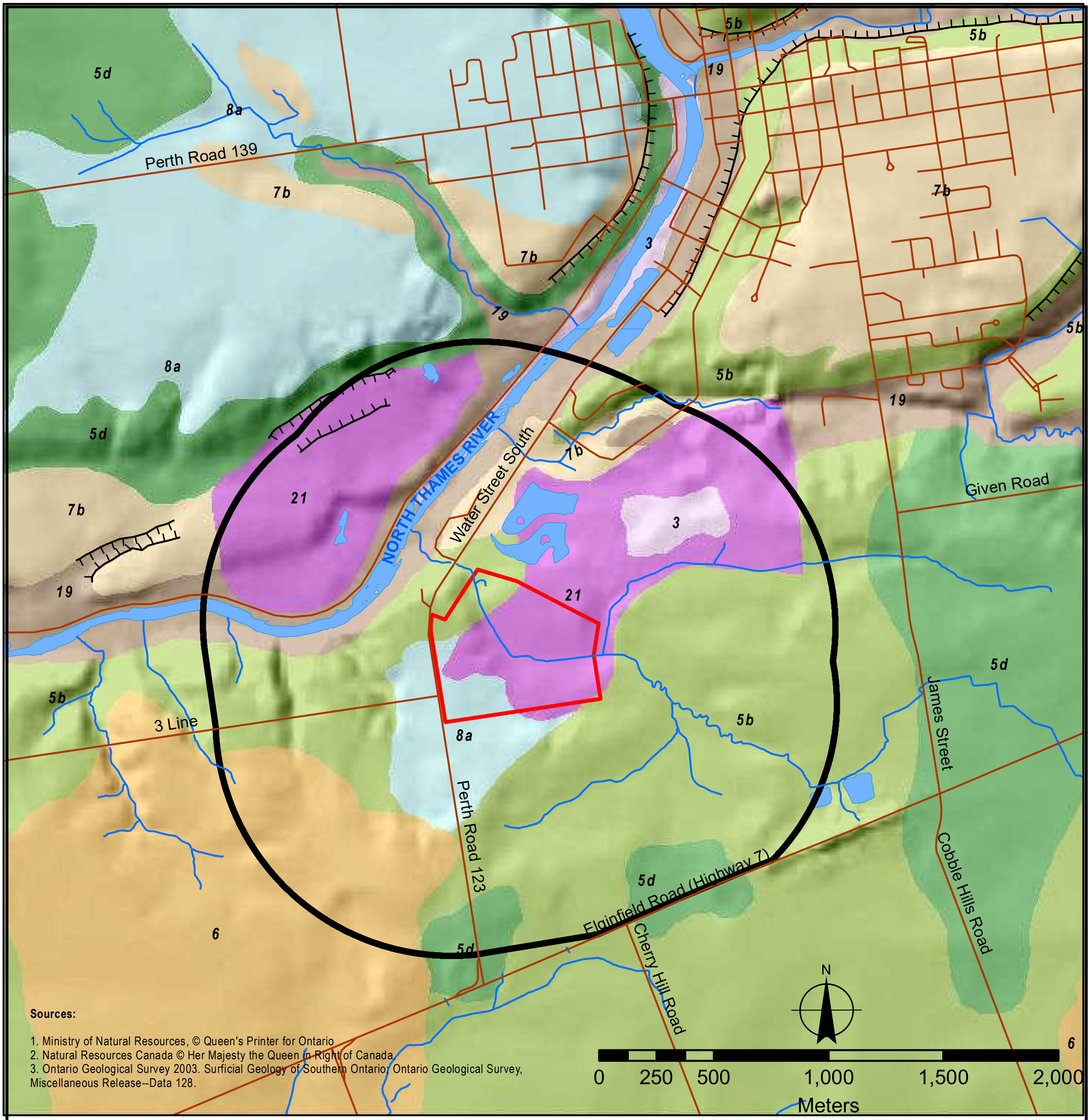
Overburden

The regional overburden is the result of successive glacial till and inter-till deposits. Surficial geology mapping is shown in Figure 6-8. The large continental ice sheets alternated between advances (when glacial tills were laid down) and retreats (when meltwater deposited layers of sorted gravel, sand, silt, and clay). The inter-till meltwater deposits can be small and isolated or significant and regional.

The various deposits that may make up the overburden within the vicinity of the Site are summarized below. The order is from oldest (overlying the bedrock) to youngest (at ground surface):

- Clay or silt till, local, mapped in the old St. Mary Cement quarry.
- Catfish Creek Till, a regionally extensive stony sandy silt till that is characteristically very hard (and often referred to as hardpan in drilling logs). Considered to be the oldest regional till.
- Clayey Silt Till, local, probably younger than the Catfish Creek till (outcrops south of the Site and may or may not be present at the Site).
- Inter-till deposits associated with meltwater, possibly related to the Wildwood Silts.
- Tavistock Till, regional, a gritty clayey to sandy silt till that occurs extensively at the surface south and east of the North Thames River.
- Glacio-lacustrine and glacial outwash deposits associated with last meltwater event. There is a small area near the Site mapped as lacustrine (sand, silt, and clay) that extends onto the western part of the Site and may have been the source of the mined clay.

Drift thickness mapping for the Site Area Vicinity indicates 10 to 15 m of overburden over the bedrock north of the Site increasing to 30 m south of the Site. The geology in the Study Area Vicinity (constructed from MECP well records and Site monitoring wells) shows that the overburden is primarily glacial till overlying the bedrock. Isolated seams of silt, sand, and gravel do occur within the till and may mark the division between till sheets.



Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada
3. Ontario Geological Survey 2003. Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128.

LEGEND

━ ROADWAY
━ WATERCOURSE
🟦 WATERBODY
🟥 ON-SITE STUDY AREA
⬛ STUDY AREA VICINITY
┬┬┬ Terrace

▨ 3: Paleozoic bedrock
▨ 5b: Stone-poor, carbonate-derived silty to sandy till
🟩 5d: Glaciolacustrine-derived silty to clayey till
🟧 6: Ice-contact stratified deposits

▨ 7b: Glaciofluvial deposits: Gravelly deposits
▨ 8a: Fine-textured glaciolacustrine deposits: Massive-well laminated
🟫 19: Modern alluvial deposits
🟪 21: Man-made deposits

BURNSIDE

Map Title

SURFICIAL GEOLOGY

Client / Report

THE TOWN OF ST. MARYS

ENVIRONMENTAL ASSESSMENT

Drawn
SK

Checked
CM

Date
JUNE 2021

Figure No.
6-8

Scale
1:25,000

Project No.
300032339

File Path: gis (DrTeeth) \elmo\GIS\Project\300\032339 (St. Marys)\2020 Updated Study Area Figures\032339 2016 EA HG STUDY SG.mxd Print Date: 2020/10/08 Time: 04:44 PM

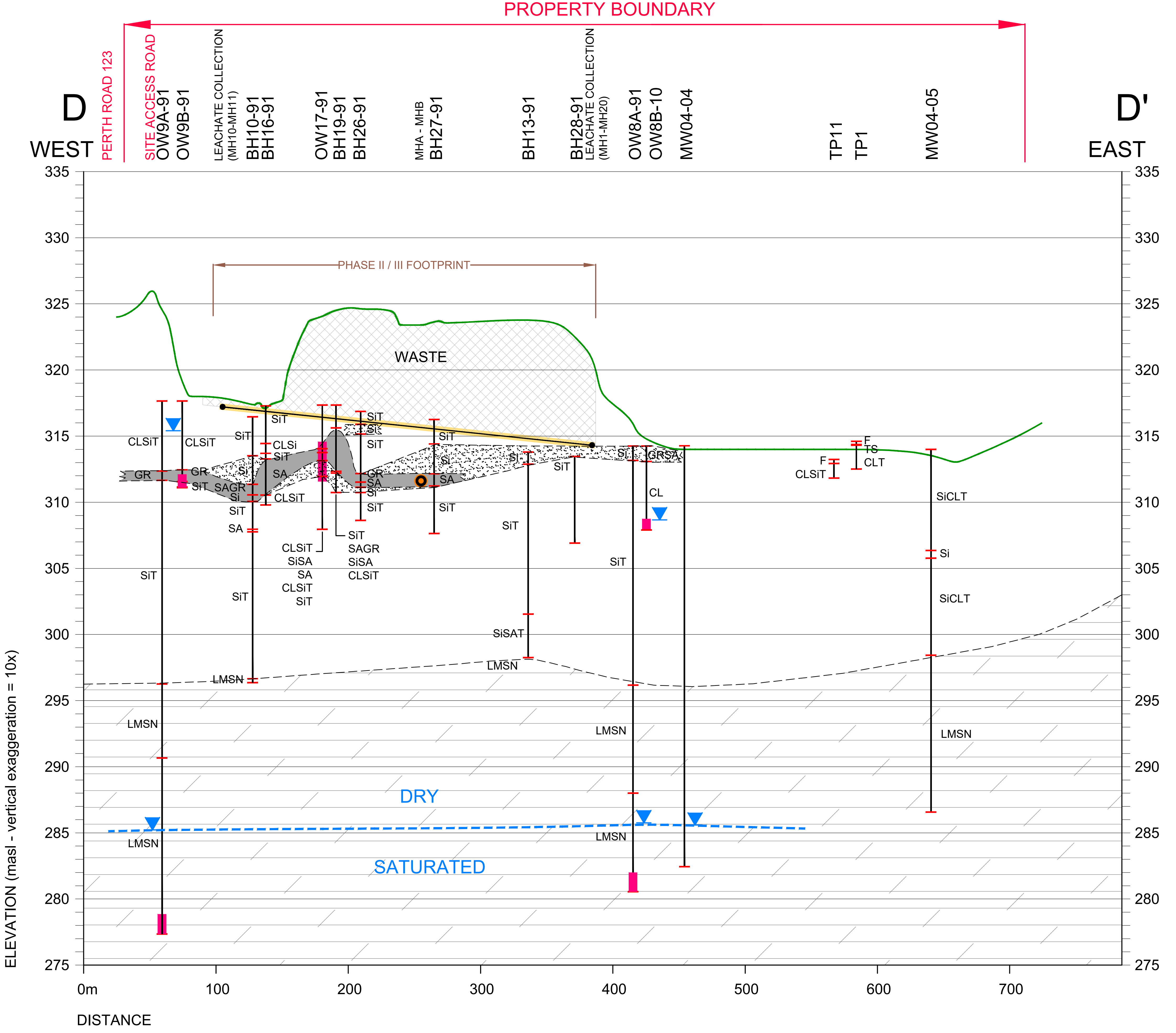
Three cross-sections were constructed through the On-Site Study Area using all available subsurface data (see Figure 6-9 to Figure 6-11). The sections show an overburden thickness below the landfill of 20 m in the south and west parts of the Site to 10 m along the northern edge of the Site. The overburden is primarily silt till, and the cross-sections confirm the main stratigraphic sequence on the Site from top to bottom to be:

- Lacustrine (clay and/or silt) and more recent fill;
- Upper till (possibly Tavistock);
- Localized inter-till meltwater deposits;
- Lower till (possibly Catfish Creek); and
- Bedrock.

Lacustrine: Little of this soil remains on the Site. Approximately 3 to 5 m of material may have been removed across the Site while 7 to 10 m of material was removed along the south edge of the Site. Most of the soil logs on Site record till at surface. A test pit in the northwest corner of the Site encountered 0.75 m of sand and gravel over 0.65 m of varved silty fine sand. Boreholes and test pits along both sides of the watercourse recorded surface sand, gravel, and silt at surface but these are thought to be related to the inter-till meltwater deposits.

Fill: soil was noted at ground surface east of the watercourse that may have been overburden stripped during quarrying or the previous realignment of the watercourse.

Upper and Lower Till: Till was reported at all of the drilling locations on the Site. It is 15 to 19 m thick below Phase I and 18 to 20 m thick below Phase II/III. East of the watercourse, a rising bedrock surface reduces the depth to about 14 m. At the north property boundary, coinciding with the quarry edge, the till depth may be reduced to 9 to 10 m. The till is predominantly silt (36 to 55%) with a clay content of 21 to 32% and sand content of 10 to 29%. Deeper samples had a clay content of only 8% and a sand content of 40%. This may be more representative of the deeper Catfish Creek Till. While higher in sand content, it is generally considered to be of greater density.



LEGEND

MW9 — WELL NUMBER

GEOLOGICAL STRATIGRAPHY

▼ MEASURED WATER LEVEL (DEC.14, 2015)

▮ WELL SCREEN

cl	clayey	TS	Topsoil
si	silty	T	Till
sa	sandy	F	Fill
gr	gravelly	HPAN	Hardpan
CL	Clay	BLD	Boulder
Si	Silt	RCK	Rock
SA	Sand	CKD	Cemented Kiln Dust
GR	Gravel	LMSN	Limestone
STN	Stones		

INTERPRETED GEOLOGICAL CONTACT

INTERPRETED WATER TABLE

LEACHATE COLLECTION SYSTEM

DRAIN PIPE BETWEEN MHA AND MHB

MELTWATER SAND AND GRAVEL

MELTWATER SILT

TILL

LIMESTONE

Client / Report

TOWN OF ST. MARYS

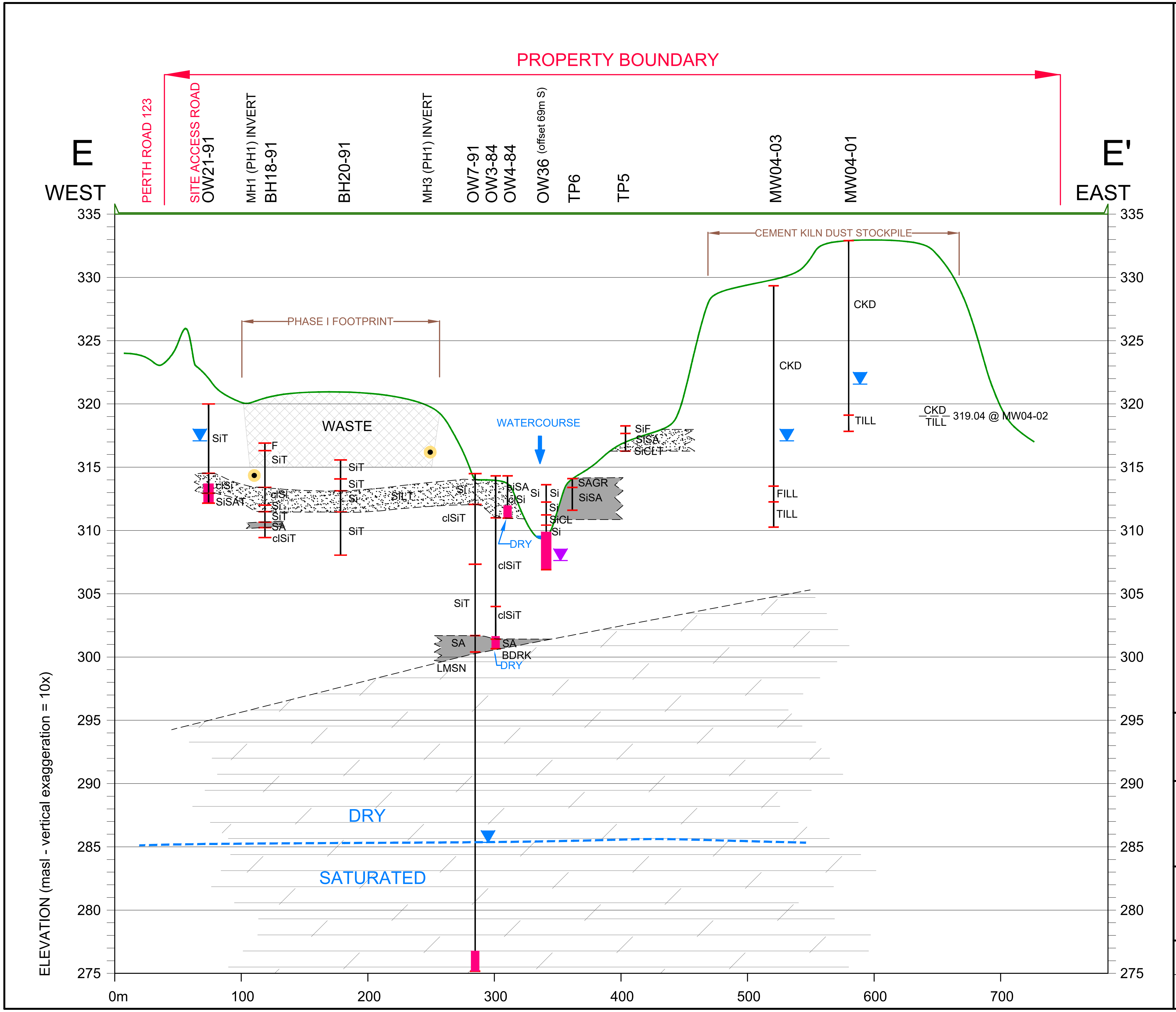
ENVIRONMENTAL ASSESSMENT

Figure Title

SITE CROSS SECTION D-D'

Drawn SK
Checked JR
Date June 2021
Figure No. **6-9**
Scale H - 1:3,000 V - 1:300
Project No. 300032339.4500

File Name: 032339 2019 EA HG Study Appendix 1 Cross-Sections.dwg Date Plotted: June 14, 2021 - 3:02 PM



LEGEND

MW9	WELL NUMBER
	GEOLOGICAL STRATIGRAPHY
▼	MEASURED WATER LEVEL (DEC.14, 2015)
▼	MEASURED WATER LEVEL (2017)
▮	WELL SCREEN

cl	clayey	TS	Topsoil
si	silty	T	Till
sa	sandy	F	Fill
gr	gravelly	HPAN	Hardpan
CL	Clay	BLD	Boulder
Si	Silt	RCK	Rock
SA	Sand	CKD	Cemented Kiln Dust
GR	Gravel	LMSN	Limestone
STN	Stones		

- - - - -	INTERPRETED GEOLOGICAL CONTACT
- - - - -	INTERPRETED WATER TABLE
●	LEACHATE COLLECTION SYSTEM
▨	MELTWATER SAND AND GRAVEL
▨	MELTWATER SILT
- - - - -	TILL
- - - - -	LIMESTONE

BURNSIDE

Client / Report

TOWN OF ST. MARYS

ENVIRONMENTAL ASSESSMENT

Figure Title

SITE CROSS SECTION E-E'

Drawn	Checked	Date	Figure No.
SK	JR	June 2021	6-10
Scale		Project No.	
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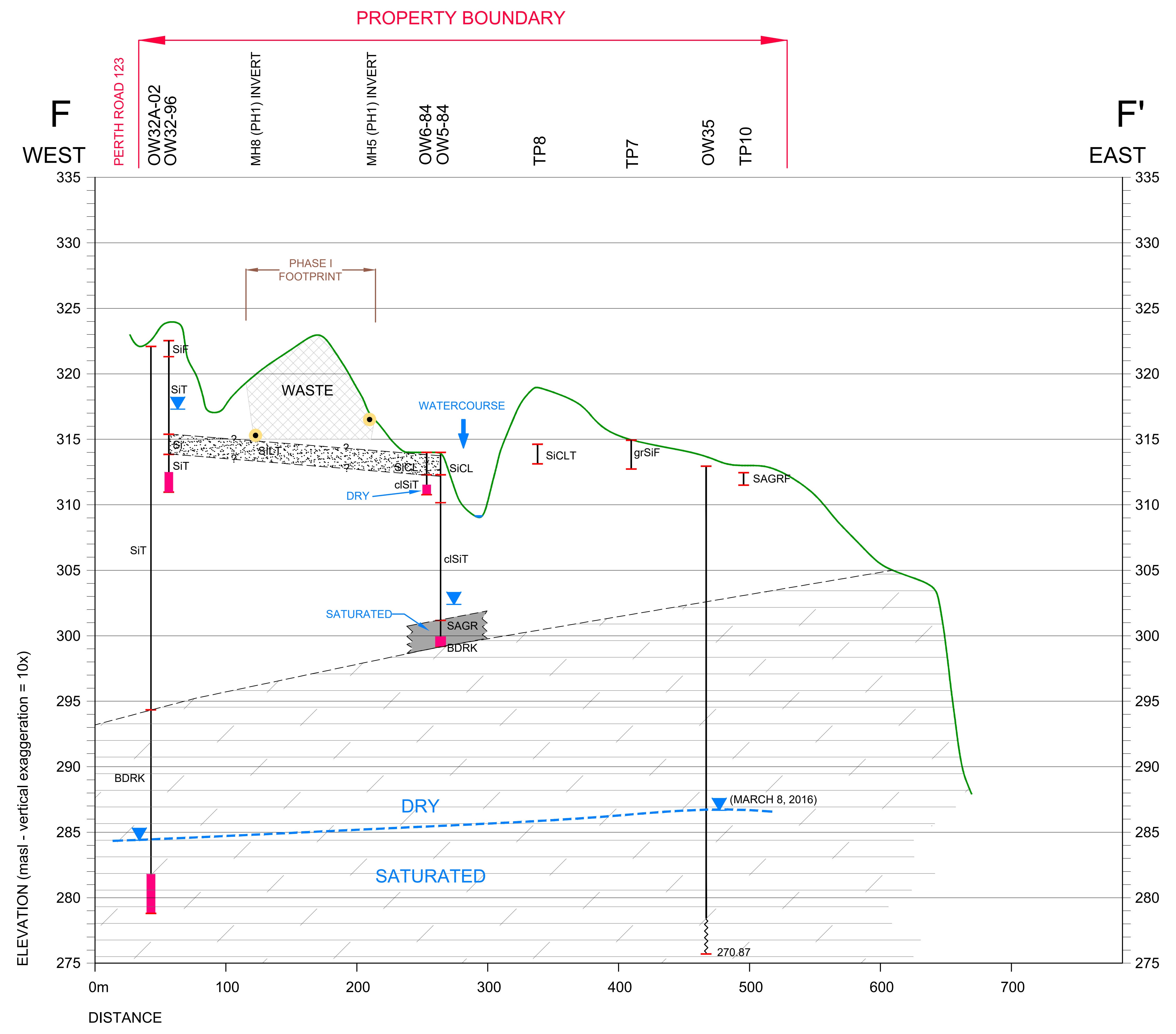
File Name: 032339 2019 EA HG Study Appendix 1 Cross-Sections.dwg Date Plotted: June 17, 2021 - 3:30 PM



LEGEND

MW9 WELL NUMBER

GEOLOGICAL STRATIGRAPHY

▼ MEASURED WATER LEVEL (DEC.14, 2015)

▮ WELL SCREEN

cl	clayey	TS	Topsoil
si	silty	T	Till
sa	sandy	F	Fill
gr	gravelly	HPAN	Hardpan
CL	Clay	BLD	Boulder
Si	Silt	RCK	Rock
SA	Sand	CKD	Cemented Kiln Dust
GR	Gravel	LMSN	Limestone
STN	Stones		

- - - - INTERPRETED GEOLOGICAL CONTACT

- - - - INTERPRETED WATER TABLE

● LEACHATE COLLECTION SYSTEM

▬ MELTWATER SAND AND GRAVEL

▨ MELTWATER SILT

- - - - TILL

- - - - LIMESTONE

BURNSIDE

Client / Report

TOWN OF ST. MARYS

ENVIRONMENTAL ASSESSMENT

Figure Title

SITE CROSS SECTION F-F'

Drawn SK	Checked JR	Date June 2021	Figure No. **6-11**
Scale H - 1:3,000 V - 1:300		Project No. 300032339.0000	

File Name: 032339 2019 EA HG Study Appendix 1 Cross-Sections.dwg Date Plotted: June 17, 2021 - 3:52 PM

Inter-Till Meltwater Deposit: Found between the upper and lower till, this local unit consists of clay, silt, sand and/or gravel. This unit is missing in some areas of the site but occurs below Phase II/III. A seam of sand and gravel runs was observed in boreholes in the centre Phase II/III. The deposit becomes silt and clay north, east, and south of this seam. It is 2.9 to 3.4 m thick at its thickest and pinches out to nothing. The elevation is generally 310 to 315 m amsl. The unit appears to be missing east of Phase II/III. The 2012 Annual Monitoring Report stated that "*A portion of this sub-unit was removed in 1993, 1997, and 2003 as part of base preparation activities in the active Phase II/III landfilling area. This sub-unit was not encountered during the base preparation of Stage 6 in 2007 or Stage 7 in 2010, of Phase II/III*". The unit was not encountered during construction of Stage 8 in 2013.

Till – Bedrock Interface: Sand was reported between the oldest till and the bedrock at one borehole and two monitoring wells that extended to bedrock. It was not reported in six other boreholes. It is expected to be a very local deposit.

Bedrock

The cross-sections show a general downward slope on the bedrock surface from east to west with local variations. The bedrock surface in the St. Marys area is approximately 300 m amsl. The north half of the Study Area Vicinity and the On-Site Study Area, as well as the North Thames River and the SMC quarries are underlain grey to tan brown, medium to thickly-bedded, fossiliferous limestone and minor dolostone of the Dundee Formation. Bituminous partings are common and oil staining occurs in more porous fossiliferous beds and along fractures. This formation is underlain by a light-brown to grey-brown, thin to medium-bedded, fine crystalline, poorly fossiliferous, limestone and dolostone of the Lucas Formation (Detroit River Group).

Existing Hydrogeology

Groundwater Movement – Bedrock

Regional flow in the bedrock is generally east to west. Groundwater flow in the bedrock below the Landfill Site is from the east toward the west and northwest. This is the direction of the regional groundwater flow, as well as the location of the North Thames River and the SMC Thomas Street Quarry. The North Thames River is above the surface of the bedrock and above the water level in the bedrock. Therefore, there is no groundwater discharge to the river at this point in the river.

In the area around St. Marys and the western side of Perth County, the water level in the bedrock is below the top of the bedrock. This is also evident in cross-sections as the static water levels are below the top of the bedrock surface. On the Landfill Site, the water level in the bedrock is 10 to 15 m below the top of the bedrock. Therefore, the bedrock is not fully saturated and is not a confined aquifer. There is a substantial thickness of dry limestone below the overburden and any groundwater in the overburden is perched.

The SMC plant is located northeast of the Site within the former limestone quarry. This former quarry and the active Thomas Street Quarry (located west of the Thames River and northwest of the Site), are currently dewatered by pumping systems which discharge to the Thames River. Dewatering of the quarry below the water level in the bedrock will affect the water levels in the bedrock at the landfill. However, the regional water levels are already within the bedrock in this area and throughout western Perth County. There are no pre-quarry water levels at the landfill site as the quarry pre-dates landfill. Therefore, the quarry impact on landfill water levels cannot be known. The dewatering at the Thomas Street quarry to levels below 280 m will be depressing the bedrock water levels in that area, but natural flow is from the landfill toward the quarry. The dewatering may be steepening the gradient, thereby increasing the flow rate, but not affecting flow direction.

Groundwater Movement – Overburden

The regional water table slopes downward from the east toward the west. However, flow along major rivers are toward those rivers. Therefore, in the St. Marys area, flow in the overburden is toward Trout Creek and the North Thames River.

There is a shallow groundwater divide along Perth Road 123 with water flowing west and east from the road. The water levels are higher along the road and fall across the landfill to the watercourse. Therefore, on the west side of the Landfill Site, groundwater in the shallow soils moves east toward the watercourse. On the east side of the watercourse, groundwater is mounded below the cement kiln dust stockpile, creating radial flow out from the stockpile, toward the watercourse and the exposed edge of the quarry. Both watercourse and quarry would be discharge points for the shallow flow. Groundwater contours and flow directions are shown on Figure 6-7.

Mounding in the landfill cell could create some westward movement between the landfill and the property boundary. However, the leachate control systems are maintaining leachate levels in the manholes below the water level along the Perth Road 123. This prevents further westward flow and could create stagnant water within the inter-till deposit below Phase II/III.

Flow mapping indicates discharge to the watercourse. However, the watercourse may be both a gaining stream and a losing stream during different seasons and along different sections of the channel. Flow volumes have been measured at Site upstream and downstream stations. The comparison between the stations showed a gaining stream in the spring and fall and a losing stream in the summer. The watercourse also gains and loses across the site. At an upstream station water levels in the watercourse were slightly higher than in the ground below the channel, indicating that water is moving from the watercourse to the groundwater. The reverse was measured at the downstream station.

These observations, combined with the low permeability of the till, means the groundwater contributes little to the streamflow even when there is discharge to the watercourse. Water quality samples upstream and downstream are similar with little change to water quality through the site. However, to produce the flow patterns noted on the groundwater flow maps there must be a low flow into or below the watercourse.

The hydraulic conductivity in the overburden was tested at several wells. Most of the shallow lacustrine soils have been removed; therefore, flow is either through the shallow till or the inter-till deposits. The geometric mean K in the clayey silt till was $1x10^{-10}$ m/s. The geometric mean K in the sand and gravel seams was $3x10^{-6}$ m/s.

The hydraulic gradient west of the watercourse has ranged from 0.01 to 0.04. The hydraulic gradient east of the watercourse has ranged from 0.04 to 0.09, with the steepest gradient occurring on the south side of the CKD stockpile. A horizontal gradient of 0.03 was used to estimate groundwater velocity using Darcy relationship of V=Ki/n where V is average linear velocity, K is hydraulic conductivity, is hydraulic gradient and n is porosity. The estimated velocity for the till would be 0.001 m/year. The velocity for the sand would be 3 m/year.

As noted in the discussion of groundwater in the bedrock, the water table in the bedrock is below the bedrock surface. The top of the bedrock is dry. Therefore, water found above the bedrock is perched in localized and possibly isolated permeable seams. For example, water is found in the surficial lacustrine deposit (OW4-84), the upper till (OW8B-10), the inter-till deposits (OW9B-91, OW21-91, OW32-96), and the interface between the till and the bedrock (OW5-84).

However, these units can also be dry. For example, OW6-84 in the surficial lacustrine deposit and OW3-84 at the interface between the till and bedrock are both dry and have been since installation. These wells are important to understanding the conceptual model of the Site. The presence of isolated, meltwater deposits between and below the less permeable tills, combined with under-draining of the overburden by unsaturated bedrock results in the sporadic saturated zones in the overburden. Groundwater movement through the overburden is minimal at the Site. Therefore, groundwater is not a pathway for significant landfill leachate movement.

Source Water Protection

In 2006, the provincial government made a commitment to the citizens of Ontario by passing the Clean Water Act, which aims to protect municipal drinking water in the Province with a multi-barrier approach, starting with Source Water Protection. Source Water Protection Plans identify four vulnerable areas:

- Wellhead Protection Areas (WHPA) – Wellhead protection areas are areas on the land around a municipal well, the size of which is determined by how quickly water travels underground to the well, measured in years. The WHPA ranges from WHPA-A to WHPA-D, which represents a travel time between 0 and 25 years.
- Intake Protection Zones (IPZ) – Intake protection zones are the area on the water and land surrounding a municipal surface water intake. The size of each zone is determined by how quickly water flows to the intake in hours.
- Highly Vulnerable Aquifers (HVA) – An aquifer is an area underground that is highly saturated with water – enough water that it can be drawn for human use. A highly vulnerable aquifer is one that is particularly susceptible to contamination, because of either its location near the ground's surface, or because of the type of materials found in the ground around it (for instance, clay versus sand versus fractured rock).
- Significant Groundwater Recharge Areas (SGRA) – These are areas on the landscape that are characterized by porous soils, such as sand or gravel, that allow the water to seep easily into the ground and flow to an aquifer. A recharge area is considered significant when it helps maintain the water level in an aquifer that supplies a community with drinking water.

There were no regional overburden aquifers in the Site Vicinity. There are shallow alluvial deposits associated with the river, as well as localized sand seems that may be used by shallow wells. The limestone and dolomite bedrock of the Dundee and Lucas Formations form the regional water supply aquifer. The Town of St. Marys obtains its water supply from three bedrock wells located northeast of the Site. The Site is more than 1,000 m from the Wellhead Protection Areas (WHP-A to WHPA-C). Two of the supply wells are GUDI with an additional WHPA-E. The landfill is outside and downstream of the WHPA-E.

Residential properties along Perth Road 123 are outside the Town water supply system. These homes are supplied by private wells. The landfill monitoring program includes five of these properties. Initially, four dug wells and one drilled well were monitored. Over the years, all but one of the dug wells have been replaced with drilled wells.

Mapping of Significant Groundwater Recharge Areas (SGRA) generally correspond to the areas mapped with surficial sand or gravel. Within the Study Area Vicinity, this includes surficial lacustrine sand above the till and the gravel along the Thames River.

The sand deposits south of the Site are likely separated from the bedrock by the underlying till, and therefore, the recharge is local and shallow. There are no SGRA mapped on the Landfill Site.

Mapping of Highly Vulnerable Aquifers (HVA) within the Study Area Vicinity generally corresponds to the quarry sites both north of the landfill (SMC plant) and the Thomas Street Quarry west of the landfill. This is because the surficial soil has been removed and the bedrock aquifer has been exposed. A small area in the northeast corner of the Landfill Site is within an HVA.

St. Marys Cement Activity

The proximity of the St. Marys Cement (SMC) quarries to the Landfill Site and the potential for mutual interference in the future makes the quarry activity important to the landfill assessment. SMC has historically dewatered both the plant north of the landfill and the Thomas Street Quarry west of Perth Road 123. They have also used water supply wells on the plant site to provide processing water.

Dewatering at the plant site quarry is expected to continue for the life of the landfill since the cement plant is located on the quarry floor. Communication with the SMC Environmental Coordinator in 2015 confirmed that there are no plans for future dewatering locations. They only have a mining plan for the Thomas Street Quarry. Based on current resources and production assets, the estimated lifespan of the two quarries is approximately 60 years. They noted that on the Plant Site, the well closest to the landfill is not currently in use.

Cement Kiln Dust (CKD) Stockpile

The northeast portion of the landfill property contains a Cement Kiln Dust (CKD) stockpile from historic SMC operations. Historic aerial photographs show that the stockpile has been in place for approximately 30 years. In 2005, a report on the CKD stockpile was compiled by Golder Associates for SMC. This report was made available to the Town of St. Marys when the Town acquired that part of the site. However, the report contents remained confidential and were only made available for the EA in 2019. The work included drilling three boreholes through the CKD, collecting and testing samples of the material, installing three monitoring wells and collecting a round of water samples for testing.

The report estimated the total volume to be approximately 350,000 to 400,000 m^3. Samples of the material were tested and compared to the 2004 *Soil, Groundwater and Sediment Standards; Table 3: Full Depth Site Conditions in Non-Potable Groundwater, Industrial/Commercial Use*. The results indicated that the material generally did not exceed the Table 3 standards for petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCB) or polycyclic aromatic hydrocarbons (PAH). There was one minor exceedance for cadmium, all other metals were below Table 3 standards.

In 2005, groundwater samples from two of the monitoring wells in stockpile were tested for inorganics, PCB and PAH. Samples were found to be alkaline with a pH of 10 and high in sulphate, chloride, potassium, and sodium. There were no exceedances of Table 3 standards. Selenium and silver were flagged as exceedances due to laboratory detection limits that were higher than the standards. One groundwater sample was submitted for TCLP analysis with no exceedances.

In June 2019, groundwater samples were collected from all three monitoring wells in the stockpile. Water levels had been measured in these wells as part of the EA study. The results were compared to the *Table 2: Full Depth Site Conditions in Potable Groundwater*. Table 6-4, below, shows the parameters that exceed Table 2 standards.

Table 6-4: Groundwater – Table 2 Potable Water Exceedances

	MW04-01 Centre		**MW04-03 SW Corner**		**MW04-02 SE Corner**
	2005	2019	2005	2019	2019
Chloride	X	X	X	X	-
Sodium	X	X	X	-	-
Arsenic	X	-	-	-	-
Molybdenum	X	X	-	X	-
Selenium	-	X	-	-	-
Uranium	X	-	-	-	-
Vanadium	X	X	-	-	-
PCB	-	-	-	-	-
PAH	-	-	-	-	-

Two conclusions from the water quality testing were:

- The water quality is not homogeneous throughout the stockpile. The water quality at the southeast corner of the stockpile is considerably better than the quality in the centre.
- The water quality data shows an overall improvement with concentrations of many parameters lower in 2019 than 2005.

Landfill Monitoring

Annual monitoring at the Site is conducted in accordance with the ECA. Monitoring of groundwater and surface water on the Site began in 1984. Current monitoring locations are shown on Figure 6-7. Samples of leachate, groundwater and surface water are collected in the spring and fall and analyzed for general chemistry, metals, and volatile organic compounds (VOC).

There is little indication of landfill impacts at the site. Downgradient wells in the shallow overburden (OW4-84 and OW36) show only minor impacts. This is due to the combination of the low permeable till and the leachate collection systems (LCS). The LCS has been controlling leachate migration from the landfill footprints since 1993. Leachate levels in the LCS manholes are checked twice yearly. The levels are consistently low indicating that the leachate is being effectively drained and there is no leachate mounding.

OW4-84 (located downgradient of Phase I) has been monitored twice a year since 1984. There was water in the well at every monitoring event from 1984 to February 1993. The Phase I LCS was installed in the early 1990s when the Phase was closed. After 1993, the water levels in OW4-84 declined and the well became intermittently dry. The Phase I LCS is capturing leachate from the area upgradient of OW4-84, lowering the water level below the footprint and downgradient of the footprint. The water level elevation west of Phase I is higher than the LCS. The chloride concentrations at OW4-84 from 1984 to 1993 climbed from a background level to a high of 354 mg/L. After 1993, when the LCS was added to Phase I, the concentration declined and by 2002 was again at background.

OW36 (located downgradient of Phase II/III) and overflow from MHB have been added to the monitoring program in recent years. MHB is a manhole at the north end of a drainpipe that passes through the meltwater deposits below the LCS in Phase II/III. Chloride is slightly elevated at these monitoring points with concentrations around 20 mg/L at OW36 and 100 mg/L from MHB. The cause of the slightly elevated concentrations is under investigation. The concentrations are still quite low compared with the leachate chloride concentration of 1,000 to 3,000 mg/L.

6.6.1.4 Surface Water

Methodology

The Hydrogeology Study Report in Volume III, Appendix C provides a detailed description and analysis of the existing conditions in the Study Area Vicinity and the On-Site Study Area.

Data from various sources was collected including data from the Annual Monitoring Reports for the Landfill that have collected surface water data since 1984. Additional field data was collected that included:

- Water levels in drive point piezometers installed along the watercourse.
- Monthly surface water flows at the upstream surface water station and the downstream surface water station through the spring into summer of 2016.
- Geomorphic study of the existing watercourse completed by Matrix Solutions Inc. during the summer of 2015 as part of the Ecological Work Plan.

Existing Surface Water Features

The Site is within the Upper (North) Thames River Drainage Basin. The North Thames River lies northwest of the Site limits. Locally, the river flows in a southwesterly direction from St. Marys.

The primary surface water features of the Landfill Site are the watercourse and the two stormwater management basins. The unnamed watercourse flows through the Site from the southeast corner to the northwest corner. This man-made watercourse provides drainage for the SMC lands up-gradient of the landfill, as well as industrial and agricultural land further upstream. It has a relatively small drainage area of approximately 600 ha. This small watershed is bounded to the north and east by Trout Creek, to the south by Gregory Creek, and to the west by small creeks that flow the North Thames River.

Clean surface water from the west side of the Site is directed through a series of perimeter ditches and swales around the landfill footprints and along the interior roadways. The ditches and swales convey runoff to two stormwater retention basins. The outline of these basins and the sampling stations are shown on Figure 6-7.

These stormwater basins attenuate the peak flows during storm events and allow sedimentation. Surface water collected from the cover of the completed Phase I is directed Basin A (north basin). Surface water collected from the completed stages and perimeter of Phase II/III is directed to Basin B (south basin). The stormwater basins outlet to the watercourse via control features.

Drainage on the east side of the Site is less defined. Surface water runoff from the slopes of the cement kiln dust stockpile flows radially in all directions, including west toward the watercourse and north toward the quarry. There are relatively flat areas between the stockpile and the watercourse with isolated seasonally water-filled depressions.

The watercourse leaves the Site by a culvert under Perth Road 123 and eventually discharges into the Thames River approximately 500 m downstream of the Site.

Surface Water Monitoring

Semi-annual surface water monitoring is conducted as part of the landfill monitoring program. Water samples are collected in spring and fall from the watercourse and the two stormwater management basins. In the watercourse this includes upstream and downstream monitoring stations as well as a mid-site station between the stormwater basins. Samples are also collected from the inlets and outlets of basins. The main water quality indicators have been chloride, total phosphorus, iron and TSS.

Water levels are measured at all surface water stations during each monitoring event and stream flows are measured at the watercourse downstream station.

Basin A

Samples for Basin A are collected at two inlet points (north and south) and one outlet. Historically, chloride concentrations tended to be the highest at the north inlet which receives water from the north end of Phase I. The concentrations for 2004 to 2012 were in the 60 to 160 mg/L range. This sampling point has been dry since 2013. The concentrations at the south inlet were typically below 100 mg/L and it has also been sporadically dry.

The chloride concentrations at the Basin A outlet range from 30 to 130 mg/L. Iron and total phosphorus concentrations at the outlet are sporadically above the PWQO. TSS levels have had a historical range of less than 10 mg/L.

Basin B

Samples for Basin B are collected a one inlet point and one outlet. These sampling stations are sporadically dry. Chloride concentrations at the inlet are typically higher than the outlet and exceeded the Aquatic Protection Value (APV) of 180 mg/L on two occasions (August 2012 and November 2014). Iron and phosphorous have been elevated levels typically exceeding the PWQO at both sampling stations. TSS at the outlet has generally been below 50 mg//L with occasional spikes to 60 to 80 mg/L. The quality at the Basin A outlet is better than the quality from Basin B.

On-Site Watercourse

Flows have been measured at the downstream surface water station since 1994. Flow rates vary from highs ranging from 200 to 600 L/s to lows of less than 5 L/s. The channel has also been dry. This reflects the small drainage area upstream of the site.

As part of the EA work, flows were measured monthly in 2016 at the upstream and downstream locations from March to July and again in October. The comparison of flows between the stations showed the stream gaining water between upstream and downstream in the spring and fall. In the summer, the stream lost water between upstream and downstream.

There are three water quality sampling stations along the watercourse. Typically, the water quality is similar between upstream and downstream. This indicates no landfill impact on the watercourse. Chlorides at the upstream station have varied from 13 to 887 mg/L, phosphorus from less than detection limit to 0.69 mg/L and iron from 0.05 to 127 mg/L. Iron and phosphorous typically exceed PWQO at all three locations.

Benthic surveys were conducted in the watercourse in 1993, 1994, 1995, 1996, 1998, 2000, 2002, 2004 and 2006. The surveys compared qualitative and quantitative samples taken from upstream and downstream. The results of these surveys indicated no landfill impact on the benthic communities in the watercourse.

6.6.1.5 Biology

Methodology

Existing conditions were determined through a comprehensive search of existing records and a series of field investigations.

The records review covered lands within the On-site Study Area and Study Area Vicinity. Records, mapping, and databases included in the search were:

- Natural Heritage Information Center;
- Land Information Ontario, publicly available mapping;
- MNRF Interactive Map of Species at Risk by County/Region;
- Ontario Breeding Bird Atlas (OBBA 2001-2005);
- Conservation Authority/Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping;
- Ontario Reptile and Amphibian Atlas (ORAA);
- OMAFRA Soil Surveys of Ontario;
- OMAFRA Agricultural Capability/Soils Classification;
- Upper Thames River Conservation Authority (UTRCA) Regulation Limit mapping;
- Town of St. Marys Official Plan;
- Perth County Official Plan;

- Aquatic Species at Risk in the Thames River Watershed (Cudmore et. al., 2004);
- Aquatic Ecosystem Recovery in the Thames River Watershed (Taylor 2004);
- The Thames River, Ontario Canadian Heritage Rivers System Ten Year Monitoring Report 2000-2012; and
- Plover Mills Watershed Report Card 2012.

The purpose of the site investigations was to verify the information collected through the background records review, further characterize known features, and identify any additional features not previously recorded. The site investigations and methodologies used are summarized in Table 6-5. Further information regarding the survey methodologies used are summarized and described in the Natural Heritage Assessment Report (Volume III, Appendix D).

Table 6-5: Methodology of Natural Heritage Field Investigations

Field Study	Purpose	Methodology	Date(s)
Ecological Land Classification	To characterize vegetation communities.	**On-Site Study Area:** Ecological Land Classification for Southern Ontario (Lee et. al., 1998), including updated communities found in the 2008 draft version of the ecosystem catalogue for Southern Ontario. Vegetation classified to the Vegetation Type level.	May 8, 2015 August 21, 2015 Surveys occurred 9:30 a.m. to 4:00 p.m.
		Study Area Vicinity: Ecological Land Classification for Southern Ontario (Lee et. al., 1998) classified to the Community Series or Ecosite level through air photo interpretation and windshield survey only.	
Breeding Bird Surveys	To identify bird species which may be nesting at the site.	**On-Site Study Area:** Ontario Breeding Bird Atlas Guide for Participants (BSC, March 2001).	June 4, 2015 June 22, 2015 July 3, 2015 Surveys occurred 6:30 a.m. to 10:30 a.m.
		Study Area Vicinity: No surveys conducted. Bird communities identified from background records.	

Field Study	Purpose	Methodology	Date(s)
Bobolink and Eastern Meadowlark Surveys	To confirm he presence or absence of Bobolink and Eastern Meadowlark which are Threatened Species protected under the ESA, 2007.	**On-Site Study Area:** Draft Survey Methodology under the ESA 2007 for Bobolink (2011).	June 4, 2015 June 22, 2015 July 3, 2015 Surveys occurred 6:30 a.m. to 10:30 a.m.
		Study Area Vicinity: No surveys conducted. Bird communities identified from background records.	
Amphibian Call Surveys	To confirm the presence or absence of amphibians in on-site surface water features.	**On-Site Study Area:** Marsh Monitoring Program Participant’s Handbook for Surveying Amphibians (BSC, 2009).	April 30, 2014 May 20, 2014 June 24, 2014 Surveys occurred 9:30 p.m. to 10:30 p.m.
		Study Area Vicinity: No surveys conducted. Amphibian communities identified from background records.	
Turtle Basking Surveys	To confirm the use of on-site surface water features by turtles.	**On-Site Study Area:** Visual search for basking turtles during bird surveys and snake coverboard searches.	In conjunction with ELC and breeding bird surveys.
		Study Area Vicinity: No surveys conducted. Reptile communities identified from background records.	

Field Study	Purpose	Methodology	Date(s)
Snake coverboard Surveys	To confirm the potential presence of two species listed as Special Concern under the ESA 2007[41]: Eastern Milksnake (*Lampropeltis triangulum*) and Eastern Ribbonsnake (*Thamnophis sauritus*).	**On-Site Study Area:** Eastern Milksnake surveys were conducted by a combination of active hand searches (i.e., looking under and turning over potential cover objects by hand) cover board surveys, whereby artificial covers (1 m x 1 m plywood) were installed within the On-site Study Area to attract Eastern Milksnake seeking shelter. These cover boards were uniquely identified and labeled. Eastern Ribbonsnake surveys were conducted by walking transects and visually inspecting shoreline and wetland edges within the landfill limits for snakes moving around or basking. The Eastern Ribbonsnake is generally not found under cover materials.	May 8, 2015 June 4, 2015 June 12, 2015 June 22, 2015 July 3, 2015 August 21, 2015. Surveys were conducted on sunny days when air temperature was between 8°C and 25°C.
		Study Area Vicinity: No surveys conducted. Reptile communities identified from background records.	

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[41] As of June 15, 2016, Eastern Milksnake is no longer a species at risk under the Ontario Endangered Species Act. Although the Milksnake is still listed as a species of special concern under the federal Species at Risk Act, the Committee on the Status of Species at Risk in Ontario (COSSARO) has downlisted this species to “Not at Risk”. According to the MNRF,” the status change was based largely on the fact that Milksnakes are relatively widespread in Ontario, there is no evidence of decline throughout most of its Canadian (Ontario) range, and threats to this species are limited outside of southern Ontario.” This status change has been updated throughout the remainder of this Report.

Field Study	Purpose	Methodology	Date(s)
Bat Maternity Roosting Habitat Surveys	To identify potential roosting habitats for: Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*Myotis septentrionalis*) both listed as Endangered.	**On-Site Study Area:** A search was conducted during ELC surveys for any large, mature trees with cavities which could provide habitat for bats.	May 8, 2015 August 21, 2015 Surveys occurred 9:30 a.m. to 4:00 p.m.
		Study Area Vicinity: No surveys conducted. Bat habitat identified from background records and air photo interpretation.	
Fish Habitat Characterization	To characterize aquatic habitat features and functions.	**On-Site Study Area:** Fish habitat was characterized using MTO/DFO/MNRF Fisheries Protocol – Environmental Guide for Fish and Fish Habitat (June 2009). The entire length of the subject watercourse was observed for morphology, function, as well as fish habitat and potential enhancement opportunities and limitations.	April 30, 2014 June 22, 2015
		Study Area Vicinity: No surveys conducted. Fish habitat identified from background records and air photo interpretation.	
Fish Community Sampling	To identify fish species present.	**On-Site Study Area:** A fish presence investigation was conducted using baited minnow traps as well as targeted dip-net sampling. In total, seven minnow traps were set and distributed throughout the watercourse where conditions allowed (water depth) and where fish were most likely to be present (relatively	June 22, 2015 June 23, 2015

Field Study	Purpose	Methodology	Date(s)
		deep pools). Traps were retrieved approximately 12 hours later, and their inventory was recorded. Targeted dip-net surveys were also conducted at locations throughout the complete length of watercourse within the site property.	
		Study Area Vicinity: No surveys conducted. Fish communities identified from background records.	
Incidental flora and fauna observations	To document incidental sightings of flora and fauna which may not have been the target of specific field studies.	Visual observations of animals, tracks or scat and compilation of a plant inventory during all site visits.	Completed during all field investigations.

Existing Biology

Both the On-Site Study Area and Study Area Vicinity are significantly disturbed and include a high number of human-influenced features and landscapes. The Natural Heritage Assessment, found in Volume III, Appendix D, identified features of provincial and local significance, including the following:

- Significant wetlands/significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat (SWH);
- Significant Areas of Natural and Scientific Interest (ANSIs);
- Fish and Fish Habitat;
- Habitat of Endangered and Threatened species; and
- Other features identified in the Town's Official Plan.

The presence of these types of features is described in the following sections.

Vegetation

Vegetation communities are summarized in Table 6-6 and shown on Figure 6-12. None of these vegetation communities are rare or protected.

Table 6-6: Vegetation Communities in the On-Site Study Area and Study Area Vicinity

Vegetation Community Name	Community Description
On-Site Study Area	
Dry-Fresh Graminoid Meadow (MEGM3)	This community represents the majority of the Site. Cool season grasses, including Smooth Brome (*Bromus inermis*), Quack Grass (*Elymus repens*) and Fescue species (*Festuca sp.*) are the dominant vegetation type found throughout this community. Tree and shrub cover in the canopy, subcanopy and understory is sparse (<10% total coverage) within scattered small groupings and individual trees in less active areas of the landfill: groupings (inclusions) of Eastern Cottonwood (*Populus deltoides ssp. deltoides*), Black Walnut (*Juglans nigra*) and Eastern White Cedar (*Thuja occidentalis*) were documented and single open-grown Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood and Black Locust (*Robinia pseudoacacia*) are also found. Common Buckthorn (*Rhamnus cathartica*) is found establishing throughout the meadow. Garden species, mainly annuals, likely originating from the compost area at the southeast corner of the Site, were recorded spreading southward into the meadow.
Graminoid Mineral Shallow Marsh (MASM1)/Willow Mineral Deciduous Thicket Swamp (SWTM3)	This mixed wetland represents the watercourse that extends from the northwest corner of the Site to the central east property limit, at the base of the slopes. Dominant vegetation found within the wetland varies between graminoid marsh dominated by Reed Canary Grass (*Phalaris arundinacea*), Common Reed or Narrowleaf Cattail, or deciduous swamp dominated by shrub Willow species: *Salix eriocephala*, *S. petiolaris*, *S. exigua* and *S. lucida*, as well as Cracked Willow (*Salix x rubens*).

Vegetation Community Name	Community Description
Cultural Woodland	This community is located on the east side of the Site, growing on the south facing portion of the slope. The dominant trees, Eastern Cottonwood and Manitoba Maple (*Acer negundo*), represent early successional species that indicate that this community is in the early stages of its establishment. Meadow species, such as Canada Goldenrod and cool season grasses are found throughout the majority of the community.
Cultural Hedgerows	There are three Cultural Hedgerows identified within the On-Site Study Area: one at the west limit and the other along the south property limit. The former is predominantly White Spruce that has been planted to screen the landfill from Water Street South and the adjacent residences. Large deciduous species of Eastern Cottonwood and Green Ash are also found in the hedgerow, as well as groupings of Common Buckthorn. The hedgerow at the south property limit is dominated by Manitoba Maple with meadow groundcover (i.e., Smooth Brome, Canada Goldenrod) in the base in the western portion of the community. The hedgerow is much denser, with no groundlayer vegetation and is dominated by Apple (*Malus pumila*) with abundant Common Buckthorn. The third hedgerow is located at the northwest corner of the site, adjacent to the rural residence. It is comprised of a mix of mid-aged Eastern White Cedar, Black Walnut (*Juglans nigra*), Norway Spruce (*Picea abies*). It is contiguous with the hedgerows that surround the periphery of the residence.
Study Area Vicinity	
Fresh-Moist Lowland Deciduous Forest (FODM7)	This forest is located on the east side of the Thames River and is dominated by Willow with associates of White Elm (*Ulmus americana*) and Manitoba Maple. A cultural mixed wooded area is found north of On-Site Study Area, immediately east of Water Street South. Hedgerows associated with the roadside and separating agricultural properties generally consist of a single tree species including Black Walnut, Eastern Cottonwood, and Green Ash.

Vegetation Community Name	Community Description
	A spruce-dominated plantation, ornamental trees associated with rural residences and vegetated drainage features are also found within 1,000 m of the On-Site Study Area.

Significant Wetlands, Woodlands, Valleylands and ANSIs

There are no Significant Wetlands, Woodlands, Valleylands or ANSIs in the On-Site Study Area. With the exception of Significant Wetlands, all of these features are present in the Study Area Vicinity. Significant Woodlands and Valleylands are associated with the Thames River and the treed areas along its banks. The boundaries of the valley, including floodplain and adjacent vegetation are limited to the western side of Water Street South and do not extend onto the On-Site Study Area.

One ANSI was identified through the background information review: the St. Marys Cement Company Provincially Significant Earth Science ANSI. This ANSI is located west of the Thames River within the Study Area Vicinity. No other ANSIs were identified within the Study Area Vicinity.

Within the On-Site Study Area, there are no wetlands which could potentially meet the criteria for significance. There are two narrow stormwater management basins along the central portion of the Site. These are man-made and serve a stormwater control function. Due to their nature, stormwater management basins typically contain relatively poor water quality that could inhibit their use by wildlife. The habitat provided from these basins/ponds is marginal and does not include any habitat structures (i.e., logs, rocks). Both basins/ponds are also subject to ongoing disturbance from landfill activities and regular clean-out requirements. Some wetland vegetation is found within the riparian corridor along the existing watercourse. Species include Reed Canary Grass, Common Reed, Narrowleaf Cattail, and a variety of shrub willow species. There is little wetland function provided by this narrow strip of vegetation.

There are two ponds to the north of the On-Site Study Area within the St. Marys Cement operations. These are remnant pits from aggregate extraction activities and habitat features are minimal. No other wetlands were observed within the Study Area Vicinity.

LEGEND

– – –	APPROXIMATE ON-SITE STUDY AREA

ECOLOGICAL LAND CLASSIFICATION

CUH	CULTURAL HEDGEROW
CUW	CULTURAL WOODLAND
MEGM3	DRY-FRESH GRAMINOID MEADOW
OAO	OPEN WATER
CVC_4	EXTRACTION
RES	RESIDENTIAL (URBAN OR RURAL)

COMMUNITY COMPLEX

MASM1	GRAMINOID MINERAL SHALLOW MARSH
SWTM3	WILLOW MINERAL DECIDUOUS THICKET SWAMP

—	WATERCOURSE
⬡	STORMWATER MANAGEMENT BASIN
⬡	WET DEPRESSION

Air Photo Source:
Background 2013 satellite / air photoobtained from Google Earth Professional. © Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

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BURNSIDE

Client

THE CORPORATION OF THE TOWN OF ST. MARYS

Figure Title

VEGETATION COMMUNITIES

Drawn	Checked	Date	Figure No.
CD	TR	JUNE 2021	**6-12**
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Avifauna

At total of 35 summer resident bird species exhibiting some level of breeding evidence were observed within the On-Site Study Area during the breeding bird surveys conducted in 2015.

Four bird species listed as either provincially and/or federally significant were observed within the On-Site Study Area during the breeding bird surveys: Bald Eagle, Bank Swallow, Barn Swallow, and Eastern Meadowlark. Bald Eagle was a flyover observation only; no key habitat features required by this species are present at the site.

Barn Swallow was observed foraging over the graminoid meadows present within the landfill. No nesting habitat for this species is present within the On-Site Study Area.

A pair of Bank Swallows was observed at the beginning of the breeding bird season attempting to nest in a soil stockpile in the composting area of the landfill. Nesting habitat was confirmed at the active windrow composting area in the southeast portion of the landfill. One pair was observed on June 4, 2015 entering and exiting excavated burrows located on the vertical slopes of a topsoil pile. On subsequent visits during breeding bird surveys on June 22 and July 3, 2015, the topsoil pile was found to have slumped causing the entrances to the excavated burrows to partially collapse. An unidentified animal burrow was also noted immediately adjacent to the excavated sites. No Bank Swallows were observed utilizing the topsoil pile on these subsequent visits. The pair was likely forced to abandon the site when the site became unsuitable. Burnside consulted with MNRF after the first observation of breeding evidence on June 4, 2015 to determine what, if any, mitigation measures were required to be in place during active landfill operations in order to avoid disturbance or destruction to Bank Swallow habitat. A 50 m setback from the nesting site was implemented where disturbance was not permitted. Due to absence of breeding evidence at the topsoil pile on subsequent surveys, it was confirmed with MNRF that if no further evidence of breeding was observed at the site after the final and third breeding bird survey, it was safe to assume that the habitat was no longer suitable or occupied by this species and the Town could resume activities at the topsoil pile and surrounding area (pers. comm. with Graham Buck, June 24, 2015).

Nesting and foraging habitat for Eastern Meadowlark was confirmed in the Study Area. The extent of suitable nesting habitat for this species includes the two capped areas of the landfill that have been characterized as ELC community MEGM3 “Dry-Fresh Graminoid Meadow”. These two capped areas of the landfill are not currently active areas of the landfill operations.

Amphibians and Reptiles

One Midland Painted Turtle was observed in the existing watercourse on May 27, 2015. A second individual was observed on July 3, 2015 in the stormwater management basin located in the central portion of the landfill. Potential hibernation habitat for Midland Painted Turtle may be present within the existing watercourse. Observations made from the shoreline indicated that the plunge pool at the upstream culvert on the east side of the On-Site Study Area was noted to be approximately 2.5 to 3 m wide and could potentially have the depth and substrate required for turtle hibernation (i.e., to bury beneath the frost line). No evidence of turtle nesting was observed within the On-Site Study Area. Turtle habitat for species that are highly aquatic and that inhabit mainly larger waterbodies such as the Thames River is present within the Study Area Vicinity and the Thames River generally (e.g., Spiny Softshell and Northern Map Turtle). Given the large-perched culvert located at the downstream end of the landfill watercourse at Water Street South (i.e., draining into the Thames River), this culvert is considered a significant barrier for these two highly aquatic turtle species to access the watercourse present within the On-Site Study Area.

Three species of snakes were observed under cover board materials or materials adjacent to cover boards: Dekay’s Brownsnake (*Storeria dekayi*), Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) and Eastern Milksnake. Based on these observations, it is highly likely that reptile hibernaculum is present within the landfill limits. Anthropogenic features that may be suitable include mammal burrows and crevices that may be present within the landfill. A portion of the landfill was a former clay pit. Large excavations that have disturbed underlying material may have created suitable crevices that snakes can reach below the frost line during the winter months. Exact locations have not been identified.

Terrestrial Crayfish

Some terrestrial crayfish are considered to be rare in the province. As such, crayfish burrows can be identified as a type of Significant Wildlife Habitat. Because the presence of burrows or chimneys is often the only indicator of species presence, observance or collection of individuals is very difficult. Eight terrestrial crayfish burrows were incidentally observed on July 3, 2015 during breeding bird surveys/snake cover board surveys. The burrows were observed at the edges of damp Common Reed pockets that have established in the area northwest of the capped cement kiln dust pile.

Insect Habitat

Two Monarch butterflies (*Danaus plexippus*) were recorded in the cultural meadow of the On-Site Study Area during the August site visit. The presence of Common Milkweed (*Asclepias syriaca*), which serves as both host (caterpillar) and nectar (food source) plant, indicates that suitable habitat for this species is present within the On-Site Study Area. Other wildflower nectar sources also support the species. Monarch is listed as Special Concern under the ESA, 2007.

Mammal Habitat

Several incidental observations of mammals were documented during the field investigations. These include: Muskrat (*Ondatra zibethicus*), White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*), Ermine (*Mustela ermine*), Striped Skunk (*Mephitis mephitis*) and Star-nosed Mole (*Condylura cristata*). White-tailed Deer appear to utilize the On-Site Study Area based on extensive tracks and signs (i.e., scat, browsing) observed during field investigations. Muskrat lodges were observed in one of the small ponds within the landfill. None of these species are listed as provincially and/or federally significant; all are considered to be common, widespread and abundant in the province.

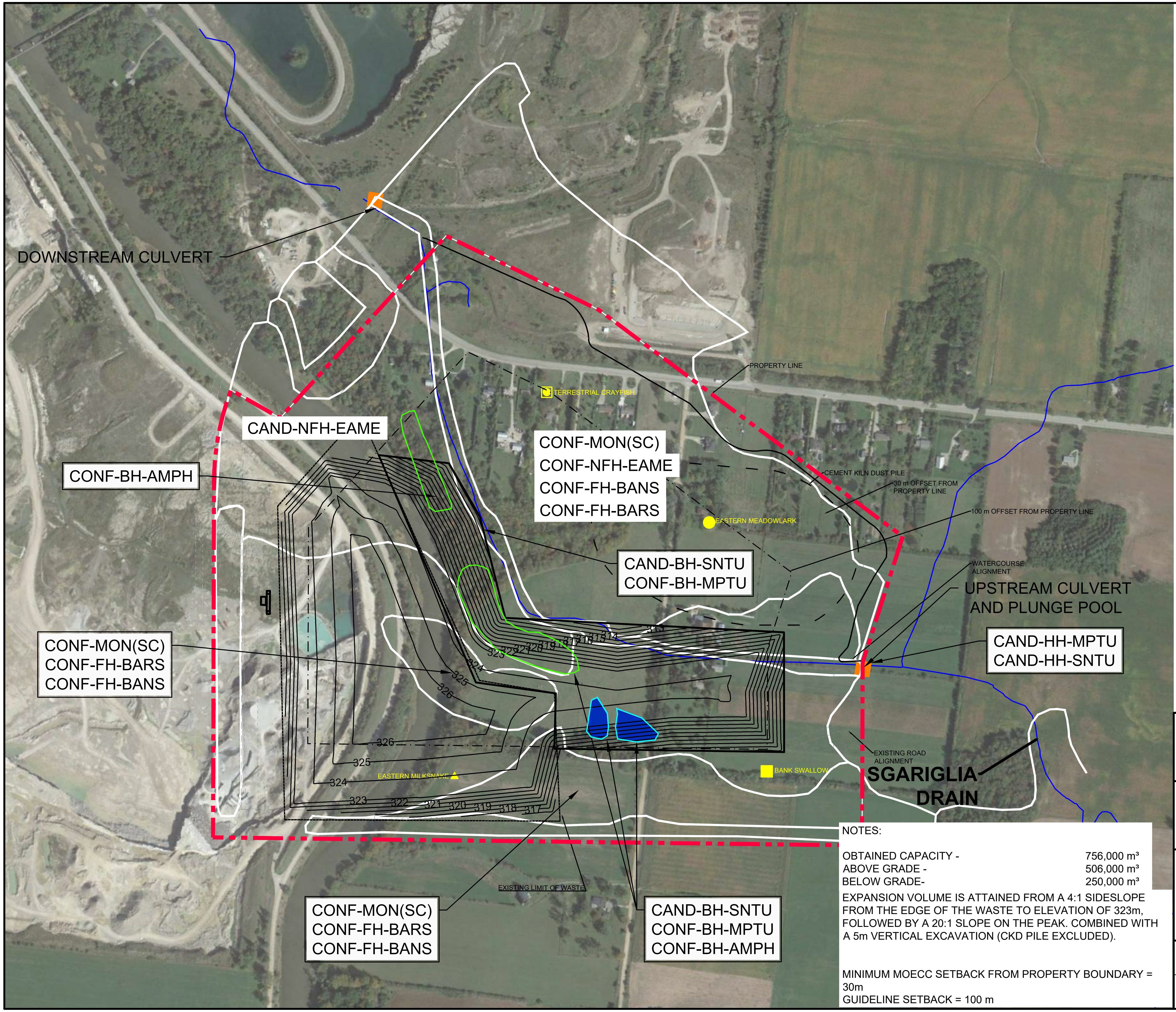
Significant Wildlife Habitat

Based on the species observed and ecosystems present, several types of Significant Wildlife Habitat (SWH) have been confirmed present or are potentially present and identified as “Candidate Habitat”. Candidate and confirmed SWH present in the On-Site Study Area and Study Area Vicinity are identified in Table 6-7 and shown on Figure 6-13.

Table 6-7: Candidate and Confirmed SWH within the On-Site Study Area and Study Area Vicinity

On-Site Study Area	Study Area Vicinity*
Seasonal Concentration Areas of Animals	
Candidate Reptile Hibernaculum	• Candidate Raptor Wintering Area. • Candidate Bat Maternity Colonies. • Candidate Turtle Wintering Areas. • Candidate Reptile Hibernaculum.
Specialized Wildlife Habitat	
None present	• Candidate Bald Eagle and Osprey Nesting, Foraging and Perching Habitat. • Candidate Turtle Nesting Areas. • Candidate Amphibian Breeding Habitat (Woodland).

On-Site Study Area	Study Area Vicinity*
Habitat of Species of Conservation Concern	
Confirmed Terrestrial Crayfish	Candidate Terrestrial Crayfish.
Confirmed Special Concern and Rare Wildlife Species: • Monarch (SC). Other: • Eastern Milksnake (formerly listed as SC under SARO; listed as SC under COSEWIC and SARA).	Candidate Special Concern and Rare Wildlife Species: • Bald Eagle. • Common Nighthawk. • Eastern Wood-pewee. • Red-headed Woodpecker. • Wood Thrush. • Monarch. • West Virginia White. • Eastern Milksnake. • Eastern Ribbonsnake. • Northern Map Turtle. • Snapping Turtle. • Northern Brook Lamprey.
Animal Movement Corridors	
None present	Candidate Amphibian Movement Corridors



NOTES:

OBTAINED CAPACITY -	756,000 m^3
ABOVE GRADE -	506,000 m^3
BELOW GRADE-	250,000 m^3

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WASTE TO ELEVATION OF 323m, FOLLOWED BY A 20:1 SLOPE ON THE PEAK. COMBINED WITH A 5m VERTICAL EXCAVATION (CKD PILE EXCLUDED).

MINIMUM MOECC SETBACK FROM PROPERTY BOUNDARY = 30m
GUIDELINE SETBACK = 100 m

LEGEND

SPECIES AT RISK CONFIRMED IN 2015

●	EASTERN MEADOWLARK (THR)
■	BANK SWALLOW (THR)

HABITAT FOR ENDANGERED AND THREATENED SPECIES

CAND-NFH-EAME	CANDIDATE NESTING/FORAGING HABITAT FOR EASTERN MEADOWLARK
CONF-NFH-EAME	CONFIRMED NESTING/FORAGING HABITAT FOR EASTERN MEADOWLARK
CONF-FH-BARS	CONFIRMED FORAGING HABITAT FOR BARN SWALLOW
CONF-FH-BANS	CONFIRMED FORAGING HABITAT FOR BANK SWALLOW

SIGNIFICANT WILDLIFE HABITAT

▣	TERRESTRIAL CRAYFISH CONFIRMED IN 2015
▲	EASTERN MILKSNAKE CONFIRMED IN 2015
CAND-HH-MPTU	CANDIDATE HIBERNATION HABITAT FOR MIDLAND PAINTED TURTLE
CAND-HH-SNTU	CANDIDATE HIBERNATION HABITAT FOR SNAPPING TURTLE
CONF-MON(SC)	CONFIRMED HABITAT FOR MONARCH (SPECIAL CONVERN)
CAND-RH	CANDIDATE REPTILE HIBERNACULUM (ENTIRE SITE IS CONSIDERED "CANDIDATE")

OTHER WILDLIFE HABITAT FEATURES

CAND-BH-SNTU	CANDIDATE BASKING HABITAT FOR SNAPPING TURTLE
CONF-BH-MPTU	CONFIRMED BASKING HABITAT FOR MIDLAND PAINTED TURTLE
CONF-BH-AMPH	CONFIRMED AMPHIBIAN BREEDING HABITAT

ELC CLASSIFICATION

🟧	CULTURAL
🟩	MEADOW
🟪	WETLAND
🟥	CONSTRUCTED
🟦	OTHER
—	WATERCOURSE
⬠	STORMWATER MANAGEMENT BASIN
⬠	WET DEPRESSION

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BURNSIDE

Client
THE CORPORATION OF THE TOWN OF ST. MARYS

Figure Title
ST. MARYS FUTURE SOLID WASTE DISPOSAL NEEDS ENVIRONMENTAL ASSESSMENT
SIGNIFICANT WILDLIFE HABITAT

Drawn	Checked	Date	Figure No.
AE/CD	HM	June 2021	**6-13**
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Fish Habitat

With the exception of one “Common” Crayfish, no fish were visually observed or captured during the aquatic assessment and fish presence survey. This result, combined with the results of the background information (fish restricted to downstream and a pond upstream), and the lack of direct connectivity with the Thames River, indicates that this section of watercourse is not considered to be direct fish habitat. As such, the watercourse on-site does not contain or provide habitat for any fish SAR. However, because the subject watercourse is connected upstream to the Sgariglia Drain, and downstream to the Thames River, it is considered to be indirect fish habitat and contributes to the water quality and quantity of the Thames River. The Thames River provides habitat for a variety of fish species and several aquatic SAR. Due to amendments to the Fisheries Act (August 2019), any harmful alteration, disruption or destruction (HADD) to waters frequented by fish must be avoided or adequately mitigated as part of the proposed site works.

Summary of Protected Features

The following natural features are present in the On-Site Study Area:

- Candidate Reptile Hibernacula;
- Candidate Turtle Overwintering Areas;
- Habitat for Terrestrial Crayfish, Monarch and Eastern Milksnake, all of which are Considered to be rare species;
- Nesting habitat for Eastern Meadowlark, a Threatened species;
- Foraging habitat for Barn Swallow and Bank Swallow, both Threatened species;
- Basking habitat for turtles in stormwater basins; and
- Fish habitat.

Several other natural features are present in the Study Area Vicinity. Only a small number have the potential to be affected by the Undertaking as they are downstream of the site along the Thames River. These include:

- Turtle Wintering Areas;
- Turtle Nesting Areas;
- Amphibian Breeding Habitat (Woodland);
- Habitat for Terrestrial Crayfish; and
- Fish Habitat.

6.6.2 Cultural Environment

6.6.2.1 Built Heritage Resources and Cultural Heritage Landscapes

Methodology

A Cultural Heritage Resource Assessment (CHRA) was conducted as part of the EA[42]. The CHRA assessed the presence of Built Heritage Resources and Cultural Heritage Landscapes using guidance from the Ministry of Tourism Culture and Sport in the following documents:

- Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments (1992).
- Guidelines on the Man-Made Heritage Components of Environmental Assessments (1981).

The CHRA can be found in Volume III, Appendix E.

Existing Built Heritage and Cultural Heritage Landscapes

The background research, data collection, and field review conducted for the Study Area determined that 12 cultural heritage resources are located within the Study Area Vicinity, as summarized in Table 6-8. Of these, 11 are Cultural Heritage Landscapes and one is a Built Heritage Resource.

No cultural heritage resources were identified within the On-Site Study Area. Figure 6-14 shows the location of the cultural heritage resources.

Table 6-8: Cultural Heritage Resources in the Study Area Vicinity

Resource	Type	Location	Recognition
CHL 1	Waterscape and associated features	Thames River	Identified as a Canadian Heritage River
CHL 2	Roadscape	3 Line	Identified during background research/field review
CHL 3	Farmscape	1579 Perth Road 123	Identified during background research/field review

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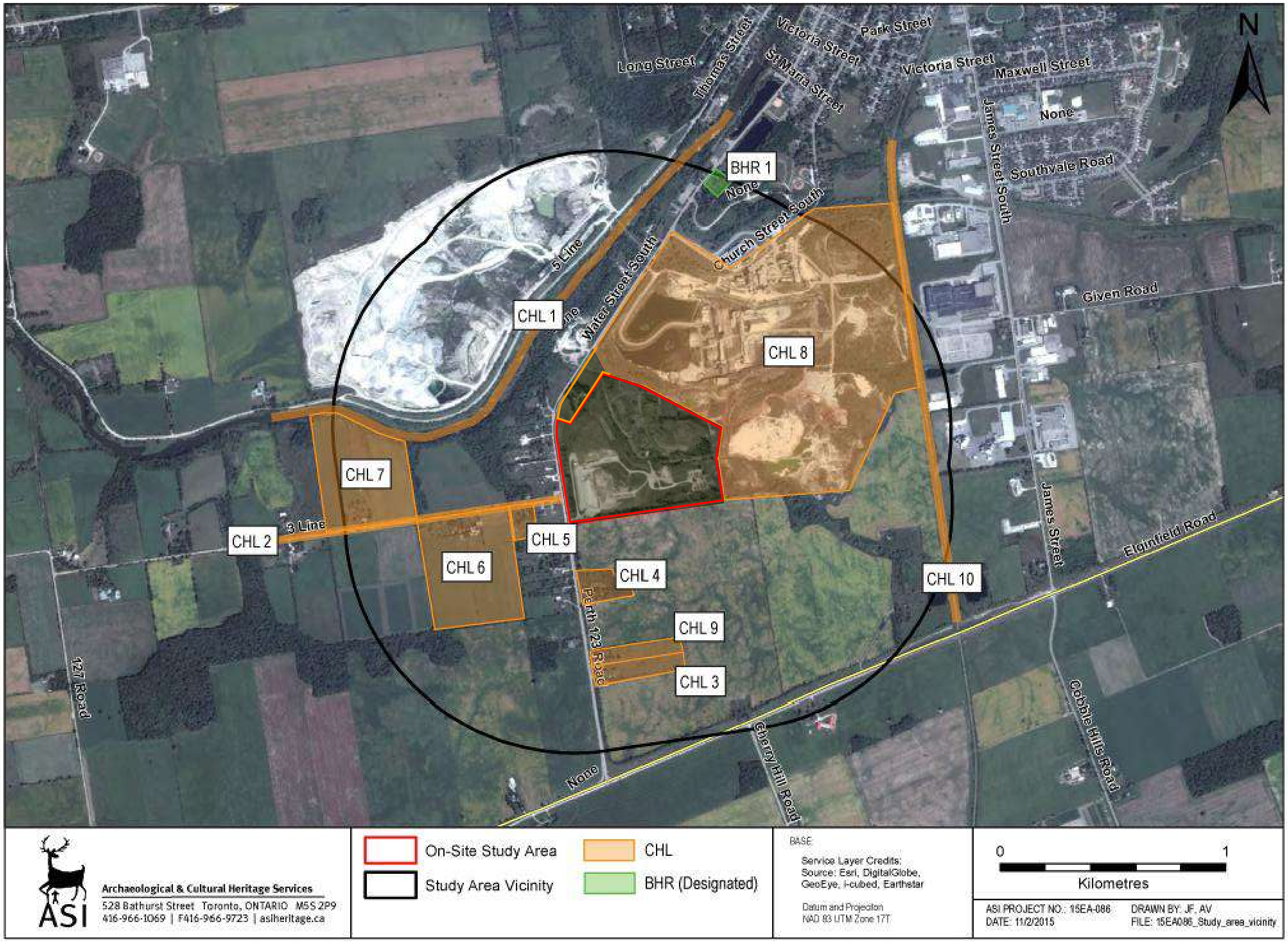
[42] This Study was conducted as part of the evaluation of Alternative Methods and its findings were not available at the time of the evaluation of Alternatives To the Undertaking. The evaluation of Alternatives to the Undertaking was reviewed in light of this new information. It is not believed that this would change the overall results of the evaluation.

Resource	Type	Location	Recognition
CHL 4	Farmscape	1631 Perth Road 123	Identified during background research/field review
CHL 5	Farmscape	4469 3 Line	Identified during background research/field review
CHL 6	Farmscape	4495 3 Line	Identified during background research/field review
CHL 7	Farmscape	4544 3 Line	Identified during background research/field review
CHL 8	Industrial Complex	St. Marys Cement Plant	Identified during background research/field review
CHL 9	Farmscape	1595 Perth Road 123	Identified during background research/field review
CHL 10	Railscape	Canadian National Rail Line	Identified during background research/field review
CHL 11	Farmscape	1025 Water Street South	Identified during background research/field review
BHR 1	Residence	481 Water Street South	Designated under Part IV of the Ontario Heritage Act (By-law 63-2008)

The closest resources to the landfill site are the St. Marys Cement Plant which covers the entirety of the St. Marys Cement active operations directly to the north and east of the landfill. The resource identified as CHL 11 in Table 6-8 is a farm property on Water Street which is directly adjacent to the landfill and surrounded by the landfill property on it northern, eastern, and southern borders.

6-14 CULTURAL HERITAGE RESOURCES



6.6.2.2 Archaeological Resources

Methodology

A Stage 1 Archaeological Assessment (Background Research and Property Inspection) was conducted in accordance with the *Ontario Heritage Act* and the Standards and Guidelines for Consultant Archaeologists (Ministry of Tourism and Culture, 2011).

Existing Archaeological Resources

Background research conducted as part of the Stage 1 Archaeological Assessment determined that no previously registered archaeological sites are located within one kilometre of the Study Area. A property inspection conducted by a registered archaeologist determined that the entire On-Site Study Area has been subject to deep and extensive land disturbance and, as such, is considered to not retain archaeological potential.

The Study Area Vicinity was not studied in detail as no impacts to archaeological resources are expected beyond the landfill property.

The Stage 1 Archaeological Assessment can be found in Volume III, Appendix F.

6.6.3 Transportation

Methodology

A Traffic Impact Study (TIS) was prepared as part of the EA process. The following background reports were reviewed to identify existing traffic conditions:

- Official Plan of the Town of St. Marys (Town of St. Marys, October 2007).
- Population Discussion Paper prepared to support the Official Plan Update.
- Town of St. Marys 2011 Development Charge Background Study (Watson & Associates, September 29, 2017).
- St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services – draft (Town of St. Marys, May 3, 2017).
- Town of St. Marys Road Assessment Study Asset Management Plan (R.J. Burnside & Associates Limited, October 2014).
- County of Perth Official Plan (County of Perth, consolidated April 2015).

The TIS can be found in Volume III, Appendix H.

Existing Traffic Conditions

The St. Marys Landfill access is a tar and chip driveway, located on the east side of Perth Road 123. The landfill site access is stop-sign controlled and forms a T-intersection with Perth Road 123. All traffic into and out of the site uses this entrance. The TIS conducted for the EA provides detailed analysis on the traffic patterns in the areas outside of the landfill facility. The TIS assessed traffic patterns, accounting for the transportation links to the landfill and adjacent arterial roads.

Current traffic patterns show that the landfill access operates under stop control at its intersection with Perth Road 123. Perth Road 123 is a two-lane arterial road under the jurisdiction of the County of Perth. It has a posted speed of 80 km/h in the area of the landfill access. Perth Road 123 becomes Water Street South, a road under the jurisdiction of the Town of St. Marys, at a location about 470 m to the north of the landfill access. Water Street South has a posted speed of 50 km/h. There are no new developments or planned road improvements in the Study Area that may impact traffic on Perth Road 123 or Water Street South near the landfill. There are no existing traffic concerns associated with the entrance or major access routes to the landfill.

6.6.4 Land Use

Methodology

Land Use was studied in conjunction with the Socio-economic conditions and is described in the Socio-economic Impact Assessment found in Volume III, Appendix G. Existing land uses were identified through a review of the following documents and data sources:

- Official Plan of The Town of St. Marys October 1987 (Consolidated October 1, 2007).
- County of Perth Official Plan (Consolidated February 2016).
- Town of St. Marys Zoning By-law, consolidated December 2018.
- Township of Perth South Consolidated Zoning By-law 4-1999.
- Agricultural Information Atlas (OMAFRA, accessed April 2016)

In addition, a windshield survey was conducted in May 2015 to document farm types.

Existing Land Use

The Town of St. Marys, located on the banks of the Thames River in Southwestern Ontario, has a thriving tourism sector and places significant importance on its natural and cultural heritage sites. St. Marys recognizes the importance of maintaining its historical and cultural heritage sites. The landfill property is located along the southwestern edge of the Town, bordering the Township of Perth South in the County of Perth. Adjacent lands, therefore, span multiple jurisdictions.

Official Plans

According to the Towns of St. Marys Official Plan, the landfill property is identified as an Environmental Constraint area. Surrounding land uses within the Town include Extractive Industrial uses to the north, northeast and west that encompass the operations of St. Marys Cement.

The Township of Perth South lies adjacent to the western and southern boundaries of the landfill. The Township does not have its own Official Plan and, instead, defers to the County of Perth Official Plan. According to Schedule A of the Perth County Official Plan, lands to the immediate south and east fall outside of the Town's limits but are designated as Licensed Quarry Pit/Limestone Resource and Agricultural Lands with a small amount of Natural Resources/Environment adjacent to the Thames River. A small number of residences are located on the east side of Perth Road 123 and Water Street South, immediately adjacent to the landfill.

Zoning By-laws

The Town of St. Marys Zoning By-law identifies the southwestern portion of the landfill property as Extractive Industrial. This Extractive Industrial zoning corresponds with the aggregate extraction license previously in effect for this portion of the property. Lands surrounding the landfill to the north and east are all identified as Extractive Industrial. The small residential property immediately to the west of the landfill is zoned as Development. This indicates that its existing residential use is permitted. New development within this zone would require additional study to ensure compatibility with the landfill. Currently, no properties have been assigned this zone as no future developments are proposed in close proximity to the landfill.

The Township of Perth South Zoning By-law does not include any special provisions for development on lands adjacent to the landfill. Township lands adjacent to the St. Marys Landfill are currently zoned Mineral Aggregate Resource to the south and Agricultural to the west. There is also a small Institutional designation to the west associated with the Union Gas pipeline pumping station located on the northwest corner of Water Street and 3rd Line. A Natural Resources/Environmental Zone Two designation is present for a small area along the Thames River.

Agricultural Land Uses

Agriculture is important is the local economy. Perth County has a large agricultural industry with over 2,200 farms operating within the County (Perth County Agriculture and

Food, 2012). In 2006, primary agricultural industries accounted for 18% of the County's labour force and since 2001, the total land on farms increased 0.7% to 506,291 acres, with an average farm size of 225 acres. Perth County has a high concentration of labour in agriculture and food compared to the rest of southwestern Ontario (County of Perth, 2010).

The Agriculture, Value Added Agriculture and Agri-Food Sector provide 5,535 jobs and employ 5,340 residents in the region. The region is a net importer of 195 agriculture-related jobs (Town of St. Marys, 2015). According to 2006 Census data, many of the jobs are on farms (3,775) and in food manufacturing (1,610). It was estimated that the specialty food sector has been growing by 9% annually (prior to 2010) and is expected to rise by a further 12% annually through 2015 (County of Perth, 2010). Indeed, the County of Perth, Town of St. Marys and City of Stratford combined (also referred to as "the region") have a significant agricultural heritage since much of the land base and climatic conditions are suited for agricultural and farming activities (County of Perth, 2010).

Several assessments conducted during the development of the County of Perth, Town of St. Marys and City of Stratford Economic Development Strategy and Action Plan (2010) determined that overall, the region's growth has been driven by a strong agricultural and manufacturing economy and that the region's agriculture industry is a dominant employment industry. It was concluded that, despite the declining employment growth in this industry, any further economic development efforts need to include agriculture and farming.

Agricultural production is present in rural areas throughout the Township of Perth South, including lands adjacent to the landfill. The agricultural industry relies on high quality agricultural soils and a clean water source for irrigation, where required. The existing landfill has not affected surrounding agricultural soils or water sources and agricultural production has successfully coexisted adjacent to the landfill to date.

It is noted, however, that during the preparation of the TOR, correspondence was received indicating that a neighbouring farm was affected by odour from the landfill. The letter stated that strong odour had deterred customers from purchasing their produce, hence negatively impacting farmgate sales.

Agricultural lands are present in the Study Area Vicinity to the south and west of the landfill. Agricultural lands appear to be primarily in cash crop production. According to the Agricultural Information Atlas (Ontario Ministry of Agriculture, Food and Rural Affairs, accessed April 2016), some adjacent farmland is tile drained. The actual number of farms within the Study Area Vicinity is difficult to ascertain as landownership data is not readily available and multiple fields may be in single ownership. Farming is concentrated to the southwest and south of the landfill, with approximately six farms within the Study Area Vicinity, encompassing approximately 320 ha of agricultural land.

Compatibility with Adjacent Land Uses

16 residences are located within 120 m of the landfill and an additional 28 residences are located within the 1 km Study Area Vicinity. Land use related conflicts, including odour, noise and dust concerns, between residents are landfills are not unusual. Annual Monitoring Reports (AMRs) have been prepared since landfill operations began in 1984[43]. Monitoring events are completed twice a year; in the Spring and in the Fall, in compliance with the site's Environmental Compliance Approval (ECA). A review of AMRs reveals that there were no complaints received in the reporting periods 2010, 2011 and 2012. From 2013 through 2015 a total of nine complaints have been received from residents related to odour from the landfill. Town complaint summaries indicate that odour issues are influenced by wind direction (from the east or northeast) following wet site conditions. The Complaint Summary table shows two odour complaints in 2016 and four odour complaints in 2018 with no odour complaints in 2017, 2019 or 2020. The 2019 to 2020 cessation of odour complaints can likely be attributed to the Town's revised operating practise of using a thicker cover and more localized cover stockpiles, as recommended in the 2018-09-19 and 2018-09-23 investigations.

Table 6-9: Complaint Summary (2016 to 2020)

Date	Type
Calendar 2013, 2014 and 2015	Odour – Nine complaints
2016-04-14	Odour
2016-04-27	Odour
2018-03-10	Odour
2018-07-09	Odour
2018-09-19	Odour
2018-09-23	Odour
2019-04-10	Noise – Backup beeper
2020	None

Once the landfill is closed, the odour emissions will drop dramatically as all the waste will be covered and capped. Most of the odour emissions come from the working face which will no longer exist.

In recent years, visual impacts to the area have been significantly reduced through the placement of earthen berms and tree screens near the site boundaries where visual impacts could occur.

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[43] Burnside completed AMRs for 2013 through 2017, inclusive.

6.6.5 Socio-Economic Environment

6.6.5.1 Employment

Methodology

Employment characteristics were obtained from the following documents and data sources:

- County of Perth, Town of St. Marys and City of Stratford Economic Development Strategy and Action Plan: 2010-2014.
- Final Economic Prosperity CIP, March 9, 2015 – The Town of St Marys Community Improvement Plan (Draft 2015).
- Final Report, Town of St. Marys, Community Based Strategic Plan, February 2010.
- 2016 Census of Canada (Statistics Canada).

Existing employment levels at the landfill were obtained from the City.

Additional information can be found in the Socio-economic Impact Assessment provided in Volume III, Appendix G.

Existing Employment

Income and Employment Characteristics

Surveys conducted by Statistics Canada for the National Household Survey in 2011 reveal that for St. Marys, 3,525 people were employed and 195 were unemployed for a total labour force of 3,720. In 2011, the employment rate for St. Marys was at 64.3% and the unemployment rate was at 5.2%. This is slightly better than Ontario as a whole.

The top occupations are in Service support and other service occupations, Labourers in processing, agriculture, manufacturing, arts, entertainment and recreation, wholesale trade, construction and utilities, and Professional occupations in education services (County of Perth, 2010). In 2016, 25.6% of St. Marys labour force was employed in management occupations, educational and social services, business, and finance, or as health care practitioners.

In 2010, the combined total income for the Town was $206.6 million (Statistics Canada, 2011). The median employment income was $45,263 for the working population (age 15 and over) compared to $50,116 for Ontario as a whole. Statistics obtained from the Town's Community Based Strategic Plan (2010), suggests that the Town has a higher percentage of income earners between $30,000 and $99,999 when compared to other regions (Perth, Stratford and the GTA) but lags in the percentage of households earning $100,000 or over.

Direct Landfill Related Employment

There are eight persons employed at the existing landfill:

- Site Attendant – a full time position;
- Compactor Operator – a part-time position;
- (Four) Equipment Operators – as occasionally needed;
- Supervisor of Environmental Services – as occasionally needed; and
- Supervisor of Operations – as occasionally needed.

The Town of St. Marys 2016 budget attributed total staff salary for these employees as approximately $106,000. For clarity, the Supervisor of Operations spends only a portion of their time dealing with the existing landfill operations. This is also true for others noted “as occasionally needed”. As a result, only a portion of their salaries are attributed to the landfill operations in the budget. The full amount of the site attendant’s salary is included.

6.6.5.2 Economic Conditions

Methodology

The economy was characterized through a comprehensive review of existing background information. The following documents were reviewed:

- County of Perth, Town of St. Marys and City of Stratford Economic Development Strategy and Action Plan: 2010-2014.
- Final Economic Prosperity CIP, March 9, 2015 – The Town of St Marys Community Improvement Plan (Draft 2015).
- Final Report, Town of St. Marys, Community Based Strategic Plan, February 2010.

Additional information can be found in the Socio-economic Impact Assessment provided in Volume III, Appendix G.

Existing Economic Conditions

The Town of St. Marys Community Based Strategic Plan (2010) highlights the importance of developing and maintaining a community that is sustainable and vibrant. The Strategic Plan focuses on providing business opportunities and encouraging economic growth. The Town also notes the importance of managing its human, financial and environmental resources and the significance of these relative to economic stability.

There are four key sectors that support the economy of St. Marys. These are:

- Manufacturing/Industrial;
- Health Care and Social Assistance;
- Agriculture and related activities; and
- Wholesale Trade.

The stability and growth of these sectors must be taken into consideration when proposing any development. The proposed expansion of the Town's landfill is an example of development that must be carefully considered.

St. Marys is home to a significant industrial sector, which represents a substantial employment and economic driver at the local and regional level. St. Marys is strategically located, being approximately 40 km from London (2011 Census population 366,150) and 20 km from Stratford (2011 Census population 30,886). This means there is a large commuter base in the area. As a result, the Town is an important contributor to the economic and social stability of the surrounding municipalities and Southwestern Ontario.

Economic drivers in the Study Area primarily include the St. Marys Cement operation and agricultural uses to the south and west of the landfill site. St. Marys Cement is a key industry for the Town. The company was founded in 1912 and is now part of a global consortium. As stated in The Town of St. Marys Economic Prosperity Community Improvement Plan (2015), St. Marys Cement is an anchor business within the Town and the Region, attracting clients throughout the Great Lakes Region. The Town's economic stability is strengthened by the presence of this industry as well as a strong agricultural sector. As noted in the Town's Community Improvement Plan (CIP), the Town believes that these are two key areas that can be built upon to retain and attract firms from other diverse sectors.

6.6.5.3 Social Conditions

In total, there are 16 residences within 120 m of the landfill and 44 residences within the 1 km Study Area Vicinity. Several commercial and light industrial businesses are present along James Street South, east of St. Marys Cement. The Canadian Baseball Hall of Fame and Museum, Hall of Fame baseball diamonds and other recreational facilities are located north of St. Marys Cement, outside of the Study Area Vicinity.

The Study Area Vicinity is characterized by industrial uses and a small number of houses and businesses. The landfill provides a social service to the community by providing a safe and sanitary means of disposing of the Town's solid waste. There are no community spaces, public parks or other social services provided in the Study Area Vicinity.

6.6.6 Indigenous Connections to the Land

Indigenous and Treaty Rights are protected under Section 35 of the *Constitution Act, 1982*. Indigenous Rights are associated with practices, customs or traditions that are integral to the distinctive culture of the Indigenous community claiming the right. Treaty Rights are those specified in historic treaties signed between Indigenous people and the Crown.

Indigenous connections to the land were described in Section 3.7.1.2.

7.0 Phase 5: Assess Alternative Methods for Carrying Out the Undertaking

The evaluation process was carried out in several steps, according to the natural, cultural, socio-economic, Indigenous connections, financial and technical criteria, as follows:

- First, the evaluation considered impacts under current conditions (i.e., baseline or the “Do Nothing” Alternative).
- The impacts from Alternatives 2, 3 and 5 were identified based on the various indicators listed in Table 6-3. It was assumed that the standard landfill mitigation, design and operational measures listed in Section 6.1 will be implemented.
- Any additional, site-specific mitigation measures were also identified.
- Finally, net effects were identified. The magnitude, duration, frequency, and reversibility of any net effects was also identified.

These net effects are then compared using the following descriptors:

- PREFERRED – preferred over the Do Nothing Alternative.
- SOMEWHAT PREFERRED – somewhat preferred over the Do Nothing Alternative.
- EQUALLY PREFERRED – equally preferred to the Do Nothing Alternative.
- SOMEWHAT LESS PREFERRED – somewhat less preferred than the Do Nothing Alternative.
- LESS PREFERRED – less preferred than the Do Nothing Alternative.

The preferred alternative overall is the Alternative that was identified based on the sum of the rankings in each category. No criteria were given greater weight or significance than others.

The evaluation of Alternative Methods is presented in the following sections.

7.1 Natural Environment

7.1.1 Air Quality

Under baseline conditions, the existing impacts at sensitive receptors showed that the worst-case impact is well below the MECP's criteria during the day. The landfill does not operate at night. No changes from baseline conditions are expected with the Do Nothing option.

All Alternatives are expected to emit products of combustion, and particulate matter (PM). There is potential for increased dust emission due to construction vehicle traffic during construction of new landfill cell areas as well as decommissioning activities. This increase is expected to be minor and last for a short period of time during construction and decommissioning. Dust will be suppressed with water, as required to reduce effects.

An Air Quality Report was prepared and can be found in Volume III, Appendix A. This report discusses air quality during operations. The maximum Point of Impingement (POI) concentrations were calculated based on the operating conditions where all significant sources are operating simultaneously at their individual maximum rates of production. An estimated POI concentration for each significant contaminant emitted from the Site was identified based on the calculated emission rates and the output from the Air Dispersion Model. The POI concentrations were compared against the "Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants", 2018. All the predicted POI concentrations for contaminants were predicted to be below the levels in that document. There were no significant differences in the quantity or type of emissions from the various Alternative Methods and no significant changes from baseline conditions.

As such, any effects are within acceptable ranges and are not considered to be significant.

A summary of the potential effects to air quality is provided in Table 7-1.

Table 7-1: Potential Effects to Air Quality

		Comparison to the Do Nothing Alternative [44]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Emissions modelling outputs**	Emission of contaminants into the air is expected to be within provincial limits.	Emission of contaminants into the air is expected to be within provincial limits.	Emission of contaminants into the air is expected to be within provincial limits.
	Number of people (receptors) potentially impacted	Based on modeling results, no residential units (receptors) within the Study Area Vicinity are expected to experience air quality concerns above the provincial limits during the operational phase of the landfill. Minor effects of dust during construction and decommissioning can be mitigated with water and other dust suppression techniques, as required. No receptors are expected to be significantly affected.	Based on modeling results, no residential units (receptors) within the Study Area Vicinity are expected to experience air quality concerns above the provincial limits during the operational phase of the landfill. Minor effects of dust during construction and decommissioning can be mitigated with water and other dust suppression techniques, as required. No receptors are expected to be significantly affected.	Based on modeling results, no residential units (receptors) within the Study Area Vicinity are expected to experience air quality concerns above the provincial limits during the operational phase of the landfill. Minor effects of dust during construction and decommissioning can be mitigated with water and other dust suppression techniques, as required. No receptors are expected to be significantly affected.
Mitigation		No additional mitigation beyond that identified in Section 6.1 is required.		
Net Effects		No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

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[44] Baseline conditions are described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

7.1.2 Odours

Under baseline conditions, the existing impacts at sensitive receptors showed that the worst-case impact occurs at the property line. The highest impact is 99 OU. At sensitive receptors, the impact of 6 OU appears to match the level of odour at which complaints tend to be received. Under current conditions, approximately eight receptors may experience 6 OU 0.5% of the time. Using that baseline for comparison, modeling was conducted to determine the number of receptors which may be expected to experience this level of odour as a result of each Alternative.

All Alternatives are expected to emit odour during operations. During construction and closure, odours are expected to be minimal and less than current operating conditions.

During operations, for each of the Alternative Methods, under the worst-case scenario, the impacts are similar to baseline conditions, with only minor differences, as follows:

- Under Alternative 2, eight residences may experience 6 OU 0.5% of the time.
- Under Alternative 3, ten residences may experience this level of odour. Modeling for Alternative 3 also shows one to two locations that exceed 6 OU more than 0.5% of the time.
- Under Alternative Method 5, nine residences may experience this level of odour.

All odour impacts are based on the worst-case scenario which occurred in 2019 where the working face was as close as possible to Water Street. All future impacts will be less than modelled as the working face moves east over the next 40 years.

The record of complaints for the facility shows two odour complaints in 2016 and four odour complaints in 2018 with no odour complaints in 2017, 2019 and 2020. The 2019 to 2020 cessation of odour complaints can likely be attributed to the Town’s revised operating practise of using a thicker cover and more localized cover stockpiles, as recommended in the 2018-09-19 and 2018-09-23 investigations.

A summary of the potential effects to air quality from odour is provided in Table 7-2.

Table 7-2: Potential Effects due to Odour

		Comparison to the Do Nothing Alternative		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Number of Potential Impacts (Emissions modelling outputs)**	Maximum off-property concentration of 87 OU.	Maximum off-property concentration of 87 OU.	Maximum off-property concentration of 100 OU.
	Predicted Boundary Operations and Effects (Number of receptors potentially impacted)	8 units within the Study Area Vicinity may experience infrequent odour concerns.	10 units within the Study Area Vicinity may experience infrequent odour concerns.	9 units within the Study Area Vicinity may experience infrequent odour concerns.
Mitigation		• No additional mitigation beyond that identified in Section 6.1 is required. • As per a request by MECP, odour will be re-modeled during detailed design.		

	Comparison to the Do Nothing Alternative		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Net Effects magnitude (M), frequency (F), duration (D), and reversibility (R)	**M**: Minor – Effect is expected to be low and in-line with existing conditions. **F**: Infrequent – Odour effects are expected only infrequently. **D**: Long-Term – Odour effects will be experienced over the life of the landfill. **R**: Reversible – Odour effects are reversible once the landfill has closed.	**M**: Minor – Effect is expected to be low and only slightly more than existing conditions. **F**: Infrequent – Odour effects are expected only infrequently. **D**: Long-Term – Odour effects will be experienced over the life of the landfill. **R**: Reversible – Odour effects are reversible once the landfill has closed.	**M**: Minor – Effect is expected to be low and only slightly more than existing conditions. **F**: Infrequent – Odour effects are expected only infrequently. **D**: Long-Term – Odour effects will be experienced over the life of the landfill. **R**: Reversible – Odour effects are reversible once the landfill has closed.
Evaluation	**Equally Preferred**	**Less Preferred**	**Somewhat Less Preferred**

7.1.3 Noise

Under baseline conditions, the existing impacts at sensitive receptors showed that the worst-case impact occurs at the property line. The existing operation, assuming the worst noise emissions possible, shows compliance with the MECP criteria of 55 dBA during the day.

A Noise Impact Assessment was completed and is provided in Volume III, Appendix B. The assessment modelled noise emissions. All Alternatives are expected to emit some noise.

Site construction activities would likely include one or more of each of the following equipment: excavator, wheel tractor scraper, bulldozer, construction truck, and a compactor, along with vehicles arriving for on-site delivery of materials. It is expected that all construction activities will conform to the criteria set out in NPC-115 of 83 dB.

The MECP does not regulate construction noise[45]. The typical value used in construction noise control plans is 80 dBA.

For the Preferred Alternative, Alternative 3, considering the highest impact at any receptor (50 dBA) at the second storey of POR3, sound power of two excavators at highest impact (total increase in impact of 11 dBA), and adjusting the distance of the closest point on Cell 3 to any receptor (OPOR1) to 78.5 m (impact increase by 6 dBA), results in an increase impact of 67 dBA which is 13 dBA below the typical construction noise control level (see Appendix B for details). This impact is so low that the number of excavators could be increased by 10 times and still show an impact 3 dBA below the typical construction noise control level.

It is important to note that the residents may experience noise levels during the day that are greater than the maximum predicted on-site noise level (50 dB) or the maximum noise from the traffic (50 to 60 dB). However, as the construction will be confined to relatively short periods (likely two to three months at a time) compared to years of landfill operations, the disruption due to construction is considered minor.

During the operational phase of the landfill, under all *Alternative Methods*, the noise impact at all receptors is less than the MECP criterion of 55 dBA. Some receptors show an increase in noise while others show a decrease but, in general, the increases are largest at locations that show an impact substantially below the criterion while the most impacted locations see a decrease. Therefore, none of the *Alternative Methods* is significantly better or worse than the others from a noise impact point of view.

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[45] NPC-300, Definitions Section, “Stationary source”, (5).

The existing noise levels experienced at each point of reception (POR) are compared to the predicted noise levels in each Alternative Method. These levels were used to characterize the difference in sound level impact at the PORs.

At OPOR_03_A for all three Alternative Methods the change in sound levels is Very Significant; however, the resultant sound level for each method is below the exclusionary limit of 55 dB and is expected to be below the traffic noise experienced at that location as well.

During operations, each Alternative Method meets the Ministry daytime criteria of 55 dB at all sensitive points of reception; therefore, all Alternative Methods are acceptable potential expansion options for the St. Marys Landfill. Based on the ESDM and Noise reports, there are no significant differences between the Alternative Methods.

During final closure, there may be some additional noise, like that experienced during construction. That is expected to be for a minimal period compared to the operating life. Once operations cease, noise will be minor and related to monitoring only. No differences between Alternatives are expected at this stage and noise levels would be below current operating levels.

A summary of the potential effects to air quality from noise is provided in Table 7-3.

Table 7-3: Potential Effects of Noise

		Comparison to the Do Nothing Alternative		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Time Noise is Anticipated During Operations**	Daytime operations only between the hours of 8:00 a.m. and 4:30 p.m.	Daytime operations only between the hours of 8:00 a.m. and 4:30 p.m.	Daytime operations only between the hours of 8:00 a.m. and 4:30 p.m.
	Number of Impacts (Modelling outputs)	Below 55 dB at each receptor during the operational phase of the landfill.	Below 55 dB at each receptor during the operational phase of the landfill.	Below 55 dB at each receptor during the operational phase of the landfill.
	Predicted Boundary Operations (Number of receptors potentially impacted[46])	0 residences will experience sound levels above the provincial criteria.	0 residences will experience sound levels above the provincial criteria.	0 residences will experience sound levels above the provincial criteria.
Mitigation		No additional mitigation beyond that identified in Section 6.1 is required.		
Net Effects		No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation		**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

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[46] A receptor is a modelled point on a residential property near the house. Because of spacing, some houses get more than 1 receptor.

7.1.4 Hydrogeology

A detailed assessment of the alternative methods, including an impact and mitigation evaluation, was completed in Section 6.0 of the Hydrogeology Study. Each alternative was evaluated according to how it would alter the Site (e.g., increasing the height of the waste mound, increasing the waste footprint area, changing topography and slopes, altering current stormwater and leachate controls, etc.). The impact of each alteration was then considered relative to:

- Leachate generation;
- Groundwater quantity;
- Groundwater quality;
- Surface water quantity; and
- Surface water quality.

The advantages and disadvantages of the alternatives were determined based on their potential for impact on the hydrology of the Site during the construction phase(s), active filling phase, and closure and post-closure phase. Table 7-4 (also Table H-1 in Appendix H of the Hydrogeology Study) evaluates the expected Site alterations for each Alternative Method and the related potential impacts. The Site alterations use the existing conditions and current landfill design and operations as the baseline. Therefore, if a Site alteration is judged to have No Net Impact to groundwater or surface water that does not mean no impact at all, but rather no new impact beyond current Site conditions.

The potential impacts outlined in Table 7-4 could be positive or negative. Each negative impact was given a sequential number (N1, N2, N3, etc.) and listed in its respective Groundwater (Table 7-5) or Surface Water (Table 7-7) Mitigation Measures and Ranking Table; these were Tables H-2 and H-3 in Appendix H of the Hydrogeology Study. Each negative impact and associated mitigation measures were ranked according to the perceived magnitude. The magnitude was based on both the severity of the impact and the scale of the mitigation measures needed to address it. The rankings were:

- Minor potential impact;
- Low potential impact;
- Medium potential impact; and
- Major potential impact.

The following groundwater and surface water sections summarize the impacts and outline some of the possible mitigation measures. The purpose of outlining the mitigation measures is not to provide all the possible outcomes, but to evaluate the magnitude of the impact by the scale of the mitigation measures that may be needed. Alternative methods that have many minor impacts would be more acceptable than methods that have one or two major impacts.

Table 7-4
Potential Impacts

Description of Site Alteration	Leachate Generation		Groundwater				Surface Water			
			Quantity		Quality		Quantity		Quality	
Method 2 Horizontal Expansion of Existing Landfill (733,000 m3)										
Height slighlty less than current Phase I and Phase II/III	o		o		o		o		o	
Increased waste footprint	N6	Increased infiltration into waste	o	Potential decreased infiltration (increased runoff) - minor	N7	Potential for migration of leachate downward into sand/silt seam	o	Decreased runoff during filling Increased runoff from finished slopes	N8	Potential for contaminated runoff from fill area
New waste footprint in centre of property - farther from boundary	o		o		P	Creates large buffer between fill and property boundary	o		P	Creates large buffer between fill and property boundary
Create long narrow depressions between footprint expansion and existing Phases	N9	could cause surface ponding and increased infiltration	o		N2	Potential for increased leachate elevation - increased head could drive leachate into sand/silt seam	P	Decreased stormwater runoff	N5	Potential for leachate breakout on final side slope
5 metre excavation	o		N10	Could intersect saturated soil or sand/silt seam	N10	Could intersect saturated soil or sand/silt seam	o		o	
Bottom of waste may be closer to bedrock surface	o		o		N11	Shorter travel distance between bottom of waste and bedrock	o		o	
Displaces stormwater basins - requires relocation	o		o		N12	Potential for migration of stormwater downward into sand/silt seam	o		o	
Displaces watercourse - requires relocation	o		N13	Potential to change flow direction in shallow groundwater	N14	Potential for migration of leachate laterally into sand/silt seam (exposed on bank of watercourse)	N15	Will require alterations of surface water movement to reach new watercourse	P N16	Increase waste to watercourse distance Decrease CKD to watercourse distance

Legend

o	No net impact or neutral when compared to the existing site
P	Positive Impact
N2	Negative impact - numbered in order in which they appear on table Follow number to mitigation tables in Volume III, Appendix C

Table 7-4
Potential Impacts

Description of Site Alteration	Leachate Generation		Groundwater				Surface Water			
			Quantity		Quality		Quantity		Quality	
Method 3 Combionation of Vertical and Horizontal Expansion of Existing Landfill (Method 1 and Method 2) (756,000 m3)										
Filled between Phase I and Phase II/III - increased waste footprint	N6	Increased infiltration into waste	o	Potential decreased infiltration (increased runoff) - minor	N7	Potential for migration of leachate downward into sand/silt seam	o	Decreased runoff during filling Increased runoff from finished slopes	N8	Potential for contaminated runoff from fill area
Increased waste footprint but less area than Method 2	N6	Increased infiltration into waste	o	Potential decreased infiltration (increased runoff) - minor	N7	Potential for migration of leachate downward into sand/silt seam	o	Decreased runoff during filling Increased runoff from finished slopes	N8	Potential for contaminated runoff from fill area
New waste footprint in centre of property - farther from boundary	o		o		P	Creates large buffer between fill and property boundary	o		P	Creates large buffer between fill and property boundary
Eliminates long narrow depressions between footprint expansion and existing Phases created by Method 2	o		o		o		o		o	
5 metre excavation	o		N10	Could intersect saturated soil or sand/silt seam	N10	Could intersect saturated soil or sand/silt seam	o		o	
Displaces stormwater basins - requires relocation	o		o		N12	Potential for migration of stormwater downward into sand/silt seam	o		o	
Displaces watercourse - requires relocation	o		N13	Potential to change flow direction in shallow groundwater	N14	Potential for migration of leachate laterally into sand/silt seam (exposed on bank of watercourse)	N15	Will require alterations of surface water movement to reach new watercourse	P	Increase waste to watercourse distance
									N16	Decrease CKD to watercourse distance

Table 7-4
Potential Impacts

Description of Site Alteration	Leachate Generation		Groundwater				Surface Water			
			Quantity		Quality		Quantity		Quality	
Method 5 Vertical Expansion of Existing plus Development of a New Landfill Footprint (Method 1 and Method 4) (974,000 m3)										
Added height to Phase I and Phase II/III during operation	N1	Increased leachate strength	o		N2	Potential for increased leachate elevation - increased head could drive leachate into sand/silt seam and into till	o		N3	Potential for contaminated runoff from footprint during filling
Added height to Phase I and Phase II/III when closed	P	Decreased generation - increased runoff on longer side slopes	o		N2	Potential for increased leachate elevation - increased head could drive leachate into sand/silt seam and into till	N4	Increased runoff from footprint - longer side slopes No change outside footprint	N5	Potential for leachate breakout on final side slope
Added height to currently flat area	o		N13	Potential to change flow direction in shallow groundwater	N2	Potential for increased leachate elevation - increased head could drive leachate into sand/silt seam	o		N8	Potential for contaminated runoff from fill area
Added slopes to currently flat area	o		o	Potential decreased infiltration (increased runoff) - minor	o		N17	Increased runoff from western side slopes into watercourse	o	
Increased waste footprint	N6	Increased infiltration into waste	o	Potential decreased infiltration (increased runoff) - minor	N7	Potential for migration of leachate downward into sand/silt seam	o	Decreased runoff during filling Increased runoff from finished slopes	N8	Potential for contaminated runoff from fill area
Filled between Phase I and Phase II/III - increases waste footprint	N6	Increased infiltration into waste	o	Potential decreased infiltration (increased runoff) - minor	N7	Potential for migration of leachate downward into sand/silt seam	o	Decreased runoff during filling Increased runoff from finished slopes	N8	Potential for contaminated runoff from fill area
New waste footprint closer to eastern property boundary	o		o		N11	Shorter travel distance between bottom of waste and bedrock	o		o	
5 metre excavation east of watercourse	o		N10	Could intersect saturated soil or sand/silt seam	N10	Could intersect saturated soil or sand/silt seam	o		o	
Bottom of waste may be closer to bedrock surface	o		o		N11	Shorter travel distance between bottom of waste and bedrock	o		o	
Footprint does not encroach on stormwater basins	o		o		P	No alterations to stormwater basin with regard to sand/silt seam	P	No alterations to stormwater basin location	o	
Footprint does not encroach on watercourse but is close to top of bank	o		o		P	No alterations to water course with regard to sand/silt seam	N17	Increased runoff from western side slopes into watercourse	N8	Potential for contaminated runoff from fill area
Overlaps part of cement kiln dust stockpile	N18	CKD leachate unknown Combination unknown	N19	Potential to change current mounding in CKD stockpile and change shallow flow direction	o		o		o	

Legend

o	No net impact or neutral when compared to the existing site
P	Positive Impact
N2	Negative impact - numbered in order in which they appear on table Follow number to mitigation tables in Volume III, Appendix C

7.1.4.1 Groundwater Impacts

Under baseline conditions, the existing impacts to groundwater are minimal. There is little indication of landfill impacts at the site. Downgradient wells in the shallow overburden show only minor impacts. This is due to the combination of the low permeable till and the leachate collection systems (LCS). The LCS has been controlling leachate migration from the landfill footprints since 1993. Leachate levels in the LCS manholes are checked twice yearly. The levels are consistently low indicating that the leachate is being effectively drained and there is no leachate mounding.

OW36 (located downgradient of Phase II/III) and overflow from MHB have been added to the monitoring program in recent years. MHB is a manhole at the north end of a drainpipe that passes through the meltwater deposits below the LCS in Phase II/III. Chloride is slightly elevated at these monitoring points with concentrations around 20 mg/L at OW36 and 100 mg/L from MHB. Monitoring is continuing at these locations and is being assessed as part of the landfill monitoring program.

Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

To assess compliance with the Ministry's Reasonable Use Guideline (RUG) for an expanded site, calculations were completed. The primary direction of leachate migration and groundwater movement is expected to be downward, through the till, to the bedrock aquifer. The existing landfill footprint has an established leachate collection system. This same leachate collection system design is expected for the expansion footprint. As with the existing system, it should capture most of the leachate generated at the site. However, to illustrate the worst-case scenario, the maximum leachate volume that could be transmitted through the till to the bedrock has been calculated based on site permeability and vertical gradients.

Chloride was the contaminant considered since it is a conservative parameter. It migrates at the rate of groundwater flow, is not altered by biological degradation or oxidation/reduction and is not adsorbed by the soil. The background and leachate chloride concentrations for the site were determined from historical monitoring data.

Based on historical monitoring data, the bedrock chloride RUG is approximately 130 mg/L. The bedrock chloride concentration calculated for Alternative Method 3 is 31 mg/L; significantly below the RUG. Our calculations assume leachate dilution does not occur within the overburden, only within the bedrock aquifer. Furthermore, this is the concentration below the landfill footprint. Some additional dilution will occur between the landfill footprint and the site boundary. Therefore, the actual chloride concentration in the bedrock aquifer is expected to be less, meaning the proposed landfill expansion is expected to meet the RUG. The detailed calculations were included in Appendix J of the Hydrogeology Study.

Potential groundwater impacts and mitigation measures associated with landfill expansion are described below.

Leachate Generation

- Increased leachate generation – This includes an increase in the volume of leachate produced by increasing the footprint area and exposing a larger surface area of waste. It also includes changes to topography within the footprint that could induce more infiltration of precipitation.
- Increased mounding of leachate in the waste – Increasing the height of the waste mound could increase the height of the leachate mounding within the waste. The current leachate collection system was put in place to control the mounding in the existing phases. It was recognized in the design of the phases that infiltration of leachate into the till would be low due to the low permeability of the till. To reduce the potential for leachate breakouts on the side slopes, the current systems were constructed. Controlling the leachate head was also a consideration to controlling the downward movement of leachate into the sand seam underlying Phase II/III.
- Change in leachate chemistry or strength – Placing new waste over existing waste or over the existing CKD stockpile could change the chemistry of the leachate.

These impacts can be reduced with the following mitigation:

- Increased leachate generation – Design and Operations to reduce work area (keeping working area small), good use of interim, final cover and grading to promote runoff, vegetation to promote evapotranspiration, and stormwater collection and controls. An extension of the current leachate collection system to cover additional footprint areas. Reducing infiltration into the waste will lower the annual production of leachate but could increase leachate strength or increase the contaminating life expectancy.
- Increased mounding of leachate in the waste – The design of the leachate collection system would need to be modified or enhanced to maintain the current leachate levels within the waste.
- Change in leachate chemistry or strength – Monitoring chemistry in the leachate collection system and/or the CKD and evaluating it against the municipal sewer use by-law.

Groundwater Quality

- Leachate or stormwater runoff moving downward to sand/silt seam – An inter-till sand seam has been identified below Phase II/III. The seam is not present or is present as silt over the remainder of the Site. Adding more waste above Phase II/III could result in higher leachate heads moving water downward into this seam. There is also potential for additional footprint areas or new Site features such as excavated stormwater basins or a re-aligned watercourse to open pathways for water to reach the seam (if present).
- Leachate moving laterally into sand/silt seam from excavation of new footprint or filling of existing watercourse channel – Excavating 5 m of soil from new footprint areas would result in the bottom of the new landfill being at approximately the depth of the current watercourse channel (the channel is approximately 5 m deep from top of bank). Therefore, silt and sand noted in OW4 84, OW6-84, TP5 and TP6 (see Figure 6-9 through Figure 6-11, Site Cross-Sections) would be exposed in sidewalls of excavation. If the seam is not saturated, leachate could migrate into the sidewalls. If the seam is saturated, shallow groundwater would seep into the excavation or into the waste once in place.
- Reduced separation between bottom of waste and bedrock – The elevation of the top of the bedrock appears to rise toward the north and east sides of the Site. Placing waste in those areas, in conjunction with excavation below current ground level, places the waste closer to the top of the bedrock (the regional aquifer). This reduces till thickness separating the waste from the bedrock.

These impacts can be reduced with the following mitigation:

- Leachate or stormwater runoff moving downward to sand/silt seam – The presence of the seam would be determined in proposed construction locations. If present and shallow, it may need to be excavated and replace with more impermeable soil. The leachate head in waste may need to be controlled by an extension of the current LCS or by modifying and enhancing the LCS.
- Leachate moving laterally into sand/silt seam from excavation of new footprint or filling of existing watercourse channel – The presence of the seam would be determined in proposed construction locations. If present and shallow, it may need to be excavated and replace with more impermeable soil. The depth of excavation may need to be reduced to maintain the bottom of landfill above the seams, increasing the above ground contours. Another alternative would be a liner designed to separate groundwater in the seam from the waste. Where the seam is not present, construction inspection of floor and side walls for permeable seams would be required.

- Reduced separation between bottom of waste and bedrock – The depth to bedrock and characteristics of soil between surface and bedrock would need to be confirmed if footprint beyond current boreholes. Current groundwater flow in the bedrock is toward the west (toward private wells and the Thomas Street Quarry) and toward the north (the SMC plant and quarry wall). Major enhancement of the LCS (such as adding a liner) may need to be considered to provide additional separation between waste and bedrock.

Groundwater Quantity

- Infiltration – The most significant impact to groundwater quantity would be reducing infiltration or increasing discharge. Extensions of the Leachate Control System (LCS) would increase the removal of water from the Site through the STP. Steeper side slopes or additional slope area would increase rainfall runoff to stormwater features for release into the surface water system, rather than infiltration into groundwater.
- Flow Direction – The shallow groundwater flow pattern below the existing footprint is from west to east toward the watercourse with some discharge of groundwater into the watercourse. East of the watercourse, there is a groundwater mound below the CKD stockpile. The shallow groundwater moves radially from the CKD stockpile with some movement westward toward the watercourse. Moving the watercourse or altering the topography of the Site without controlling groundwater mounding could alter the shallow flow path. Re-aligning the watercourse and using the current channel as part of a future footprint would remove a shallow groundwater discharge point. With no outlet, water levels in that area would rise until the flow direction changed.

These impacts can be reduced with the following mitigation:

- Infiltration – The change to infiltration on the Site has not been considered to be significant. The amount of groundwater recharge at the Site is already low. The current groundwater conditions include a low permeable till that is partially dry with perched water near the surface or in the inter-till sand/silt seams. The top of the bedrock is dry as there is little downward movement of groundwater from till to bedrock. No mitigation is required.
- Flow Direction – A conceptual model of current flow and potential flow taking into account the mounding in the waste, in the CKD mound, the location of the new watercourse may be needed to design new footprint areas. An extended leachate collection system would control mounding in the waste, but additional works may be required to maintain shallow groundwater flow from the CKD mound toward the current watercourse location. The groundwater flow would have to be either cut off before reaching the waste or picked up in the LCS. The water level monitoring

program will need to be revised to track changes to the shallow groundwater movement as expansion development occurs.

Cement Kiln Dust Stockpile

- Changes in groundwater flow direction could also increase the potential for groundwater contaminated by the CKD to migrate west of the stockpile and influence water quality near the expanded landfill footprint.

These impacts can be reduced with the following mitigation:

- Movement of contaminants from the CKD stockpile toward existing or extended landfill footprints can be mitigated by intercepting shallow groundwater before it reaches the waste. However, this water may be impacted by the CKD and would have to be tested and potentially treated if discharged to surface water. Alternatively, as the volume is expected to be low, shallow groundwater moving west from the CKD stockpile could be picked up in the LCS. This would continue to intercept shallow groundwater moving west from the CKD and maintain the current groundwater movement pattern on the Site. Available options would be determined as part of the EPA design for the Site.

Table 7-5 provides a detailed assessment of the groundwater mitigation measures and ranking. A high-level summary of the potential effects to groundwater, based on the detailed assessment, is provided in Table 7-6.

Table 7-5
Groundwater Mitigation Measures and Ranking

Impact No	Alternative Methods 2	3	5	Impact	Site Alteration Leading to Impact	Impacted Feature	Possible Mitigation
N1			◕	Increased leachate strength	Added height to Phase I and Phase II/III	Leachate	· Monitor leachate quality and quantity in leachate collection system · Review capacity of sewage treatment plant
N2			○	Potential for increased leachate elevation - increased head could drive leachate into sand/silt seam	Added height to Phase I and Phase II/III	GW	· Monitor flow rate from leachate collection system · Leachate head control by enchanced or modified leachate collection system
	◑				Create long narrow depressions between footprint expansion and existing Phases	Leachate	· Design stormwater control between existing and expansion footprints for operation and closed stages to prevent ponding and infiltration into waste
			◔		Added height to currently flat area	GW	· Map presence and remove sand/silt seams · Install a leachate collection system of similar design to current system
N6		◑	◑	Increased infiltration into waste (increased leachate generation)	Filled between Phase I and Phase II/III - increased waste footprint	Leachate	· Design and operations to reduce work area & interim cover to promote clean runoff · Evaluate leachate generation potential against sewage treatment plant capacity
	◑	◑	◑		Increased footprint area	Leachate	· Design and operations to reduce work area & interim cover to promote clean runoff · Evaluate leachate generation potential against sewage treatment plant capacity
N7		◔	◔	Potential for migration of leachate downward into sand/silt seam	Filled between Phase I and Phase II/III - increased waste footprint	GW	· Map presence and remove sand/silt seams · Extend leachate collection system between Phase I and Phase II/III
	◔	◔	◔		Increased footprint area	GW	· Map presence and remove sand/silt seams · Install a leachate collection system of similar design to current system
N9	◑			Could cause surface ponding and increased infiltration	Create long narrow depressions between footprint expansion and existing Phases	Leachate	· Design stormwater control between existing and expansion footprints for to prevent ponding and infiltration into waste
N10	○	○	○	Could intersect saturated soil or sand/silt seam	5 metre excavation	GW	· Map presence and remove sand/silt seam · Map depth to water table and maintain landfill base above water table · Liner designed to separate groundwater in the seam from the waste · Induce groundwater from sand/silt seam toward leachate collection system
N11	○		○	Reduced separation distance between bottom of waste and bedrock	Bottom of waste may be closer to bedrock surface	GW	· Confirm depth to bedrock and soil characteristic between waste and bedrock · Enhance leachate collection system (e.g. liner)
			○		New waste footprint closer to eastern property boundary	GW	· Confirm depth to bedrock and soil characteristic between waste and bedrock · Confirm groundwater flow direction in bedrock at northeast corner · Enhance leachate collection system (e.g. liner)
N12	◑	◑		Potential for migration of stormwater downward into sand/silt seam	Displaces stormwater basins - requires relocation	GW	· Determine presence and depth of sand/silt seam in new basin location · Remove seam or maintain separation distance from basin bottom to seam
N13	○	○		Potential to change flow direction in shallow groundwater	Displaces watercourse - requires relocation	GW	· Create conceptual model of new flow direction · Design leachate collection system to induce flow from CKD stockpile toward former watercouse location
			◔		Added height to currently flat area	GW	· Create conceptual model of new flow direction · Install a leachate collection system of similar design to current system

Table 7-5
Groundwater Mitigation Measures and Ranking

	Alternative Methods						
	2	3	5				
Impact No				Impact	Site Alteration Leading to Impact	Impacted Feature	Possible Mitigation
N14	○	○		Potential for migration of leachate laterally into sand/silt seam (exposed on bank of watercourse)	Displaces watercourse - requires relocation	GW	· Map presence and remove sand/silt seams · Design leachate collection system to induce flow toward former watercouse location
N18			◕	CKD leachate unknown Combination unknown	Overlaps part of cement kiln dust stockpile	Leachate	· Monitoring samples from wells in CKD
N19			◕	Potential to change current mounding in CKD stockpile and change shallow flow direction	Overlaps part of cement kiln dust stockpile	GW	· Monitor water levels in wells in CKD

Negative Impacts for Each Method

	2	3	5	Legend
◕	-	-	3	Minor Impact - monitoring with potential mitigation (e.g. monitoring of groundwater around CKD stockpile)
◑	4	3	2	Low Impact - feature alteration with monitoring (e.g. stormwater controls)
◔	1	2	4	Medium Impact - enhanced engineering with monitoring (e.g. extension of current leachate control system)
○	4	3	4	Major Impact - major mitigation engineering required (e.g. liner, redesigned leachate control system)

Positive Impacts	1	1	3

Least			
⇩		▨	
⇩	▨		
Most			▨

Table 7-6: Potential Effects to Groundwater

		Comparison to the Do Nothing Alternative		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Contaminating Lifespan**	• Any potential contamination would have a lifespan of the 40-year landfill site and beyond.	Any potential contamination would have a lifespan of the 40-year landfill site and beyond.	Any potential contamination would have a lifespan of the 40-year landfill site and beyond.
	Groundwater receivers	• There were no regional overburden aquifers in the Site Vicinity. There are shallow alluvial deposits associated with the river, as well as localized sand seams that may be used by shallow wells. The limestone and dolomite bedrock of the Dundee and Lucas Formations form the regional water supply aquifer.	• There were no regional overburden aquifers in the Site Vicinity. There are shallow alluvial deposits associated with the river, as well as localized sand seams that may be used by shallow wells. The limestone and dolomite bedrock of the Dundee and Lucas Formations form the regional water supply aquifer.	• There were no regional overburden aquifers in the Site Vicinity. There are shallow alluvial deposits associated with the river, as well as localized sand seams that may be used by shallow wells. The limestone and dolomite bedrock of the Dundee and Lucas Formations form the regional water supply aquifer.
	Number and severity of potential impacts	• Any potential contamination is expected to be managed by the leachate control system. • No effects are anticipated.	• Any potential contamination is expected to be managed by the leachate control system. • No effects are anticipated.	• Any potential contamination is expected to be managed by the leachate control system. • No effects are anticipated.

		Comparison to the Do Nothing Alternative		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
	Potential drinking water source impacts	• The Site is more than 1,000 m from the Wellhead Protection Areas and outside and downstream of two wells that are GUDI. • 5 private wells are monitored regularly. • No effects are anticipated.	• The Site is more than 1,000 m from the Wellhead Protection Areas and outside and downstream of two wells that are GUDI. • 5 private wells are monitored regularly. • No effects are anticipated.	• The Site is more than 1,000 m from the Wellhead Protection Areas and outside and downstream of two wells that are GUDI. • 5 private wells are monitored regularly. • No effects are anticipated.
Mitigation to be applied to all Alternatives		In addition to the mitigation identified in Section 6.1, the following additional mitigation will be required: • Map presence and, if warranted, remove sand/silt seams below the waste footprint, or improve the landfill liner. • Map depth to water table and maintain landfill base above water table. • Induce groundwater from sand/silt seam toward leachate collection system. • Create conceptual model of groundwater flow direction given expanded landfill footprint.		
Alternative-specific Mitigation		• Geotechnical stability of the CKD pile will be determined by a Geotechnical Engineer. Measures will be put in place in accordance with the Engineer's recommendations to prevent slope failure into the relocated watercourse.	• Geotechnical stability of the CKD pile will be determined by a Geotechnical Engineer. Measures will be put in place in accordance with the Engineer's recommendations to prevent slope failure into the relocated watercourse.	• Geotechnical stability of the CKD pile will be determined by a Geotechnical Engineer. • Interaction of leachate from waste and the CKD pile must be assessed for settlement and chemical stability.

	Comparison to the Do Nothing Alternative		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
	• Consider designing the leachate collection system to induce flow from CKD stockpile toward former (pre-relocation) watercourse.	• Consider designing the leachate collection system to induce flow from CKD stockpile toward former (pre-relocation) watercourse.	• Additional assessment is required to construct a liner and leachate collection system above CKD pile.
Net Effects[47,48]	No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation[49]	**Equally Preferred**	**Equally Preferred**	**Less Preferred**

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[47] Assumes the mitigation measures required for proper landfill operations are of sound design and construction.
[48] *No net effect* does not mean no impact at all, but rather no new impact beyond baseline conditions described in Section 6.6.
[49] Based on the number and magnitude of negative impacts; alternative methods that have many minor impacts would be more acceptable than methods that have more major impacts.

7.1.5 Surface Water

7.1.5.1 Surface Water Quality

Under baseline conditions, the existing impacts to surface water quality are minimal. Surface water quality sampling measures have shown that water quality is somewhat impaired, but conditions are similar both upstream and downstream of the landfill, indicating that the landfill is not a significant contributor to water quality. Sampling stations upstream and downstream have recorded concentrations above the PWQO, particularly for iron and phosphorus. Under the Do Nothing Alternative, surface water quality is not expected to change.

Potential surface water quality impacts and mitigation measures associated with landfill expansion are described below.

Surface Water Quality

- Potential for contaminated runoff – The risk of precipitation and clean runoff coming into contact with waste may be increased by adding waste above the current Phase I and Phase II/III footprints, adding new footprint areas, and moving the footprint closer to the stormwater basins and watercourse.
- Leachate break out on side slopes – Mounding of leachate within the waste could lead to leachate seeps along slide slopes. There is a potential for seeps to mix with clean runoff and move into the stormwater system.
- For Alternatives 2 and 3, realignment of watercourse closer to CKD stockpile – Realigning the watercourse from the centre of the Site to the eastern and northern boundary could put the watercourse closer to the CKD stockpile. Water levels within the stockpile indicate mounding and radial flow outwards from the pile. Cutting a new channel near the toe of the stockpile could induce shallow flow from the stockpile into the channel.
- For Alternative 5, the active landfill area will be located closer to the watercourse with greater potential for surface runoff from the landfill flowing into the watercourse.

These impacts can be reduced with the following mitigation:

- Potential for contaminated runoff – The Design and Operations for the preferred alternative will need to incorporate proper stormwater design and best management practices. These could include:
  - Control of the size of active working areas.
  - Timely grading and covering of completed or dormant areas.
  - Diverting clean water away from the waste (including drop-off, recycling, MHSW, and compost areas).

  - Retaining water that contacts waste within the footprint and LCS.
  - Slowing release of runoff to the watercourse and controlling erosion and sedimentation.
  - Berms or vegetated buffer strips to separate footprint areas and watercourse/stormwater retention areas.
  - Final cover and erosion control vegetation to maintain cover.
  - Contain waste to waste handling areas (including drop-off, recycling, MHSW, compost areas, and wood wastes).
  - Encouraging growth of native vegetation in stormwater retention areas.

- Leachate break out on side slopes – Leachate mounding may be controlled by reducing infiltration into the top of the waste, facilitating seepage of leachate out the bottom of the waste (LCS) or adding a leachate drainage layer on the above-grade side slope to direct leachate seeps to the LCS. Operations, final cover and proper grading are important in reducing infiltration. Depressions that hold water on the landfill surface must be eliminated. Due to the low permeability soils at this Site, removing leachate from the mound requires the installation and maintenance of a leachate control system.

- For Alternatives 2 and 3, realignment of watercourse closer to CKD stockpile – The stockpile has been in place for approximately 30 years. The cap and side slopes are well vegetated, and no erosion has been noted in recent field work in the area. The current watercourse wraps around the south and west sides of the stockpile. Water quality samples from the watercourse since 1985 (as part of the landfill monitoring) have not detected an impact from the landfill or the CKD stockpile. The water quality upstream and downstream is typically similar. The potential for future impact remains low as the stockpile is to be left largely undisturbed with the vegetation in place. The relocation of the watercourse may necessitate acquisition of additional land from St. Marys Cement or relocating some of the CKD material along the north side of the stockpile. CKD relocation efforts, including re-establishing cover materials, would need to be completed prior to relocation of the watercourse. Runoff from the surface of the stockpile does not appear to be a significant issue. Of more importance is ensuring that the realigned watercourse is separated from the actual CKD material and that groundwater discharge from the stockpile to the watercourse is minimized. Mitigation will be designed, as required, to ensure adequate separation.

- For Alternative 5, additional stormwater management measures will be required to limit surface runoff and leachate from entering the watercourse as the landfill will be closer to the watercourse than under existing conditions. The landfill to be placed on top of the CKD also creates the potential for CKD material to slump or collapse creating a greater opportunity for contaminated runoff to enter the watercourse.

Table 7-7 provides a detailed assessment of the surface water mitigation measures and ranking. A high-level summary of the potential effects to surface water quality, based on the detailed assessment, is provided in Table 7-8.

Table 7-7
Surface Water Mitigation Measures and Ranking

Impact No	Alternative Methods			Impact	Site Alteration Leading to Impact	Impacted Feature	Possible Mitigation
	2	3	5				
N3			◑	Potential for contaminated runoff from footprint during filling	Added height to Phase I and Phase II/III	SW	· Storm water diversion and sedimentation control away from fill area · Leachate containment within footprint to LCS
N4			◑	Increased runoff from footprint - longer side slopes	Added height to Phase I and Phase II/III	SW	· Design storm water and erosion control for side slopes and toe
N5			○	Potential for leachate breakout on final side slopes	Added height to Phase I and Phase II/III	SW	· Leachate head control by enhanced or modified leachate collection system
	◑				Create long narrow depressions between footprint expansion and existing Phases	SW	· Design stormwater control between existing and expansion footprints for closed stage to prevent ponding and infiltration into waste
N8		◑	◑	Potential for contaminated runoff from fill area	Filled between Phase I and Phase II/III - increased waste footprint	SW	· Design and operations to reduce work area & interim cover to promote clean runoff
	◑	◑	◑		Increased footprint area	SW	· Design and operations to reduce work area & interim cover to promote clean runoff
			◑		Added height to currently flat area	SW	· Create soil berm along watercourse to contain water within waste area
			◑		Footprint does not encroach on watercourse but is close to top of bank	SW	· Create soil berm along watercourse to contain water within waste area
N15	◑	◑		Will require alterations of surface water movement to reach new watercourse	Displaces watercourse - requires relocation	SW	· Grading, storm water and erosion control to redirect, slow or hold runoff
N16	◕	◕		Decrease CKD to watercourse distance	Displaces watercourse - requires relocation	SW	· Monitoring samples from wells in CKD and new watercourse
N17			◑	Increased runoff from western side slopes into watercourse	Added slopes to currently flat area	SW	· Create vegetated water control buffer strip between landfill toe and watercourse
			◑		Footprint does not encroach on watercourse but is close to top of bank	SW	· Create vegetated water control buffer strip between landfill toe and watercourse

Negative Impacts for Each Method

	2	3	5	Legend
◕	1	1	-	Minor Impact - monitoring with potential mitigation (e.g. monitoring of groundwater around CKD stockpile)
◑	3	3	8	Low Impact - feature alteration with monitoring (e.g. stormwater controls)
◔	-	-	-	Medium Impact - enhanced engineering with monitoring (e.g. extension of current leachate control system)
○	-	-	1	Major Impact - major mitigation engineering required (e.g. liner, redesigned leachate control system)

Positive Impacts	3	2	1

Table 7-8: Potential Effects to Surface Water Quality

		Comparison to the Do Nothing Alternative		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Number of watercourses in study area**	• The unnamed watercourse runs through the Study Area. • The Thames River is within the Study Area Vicinity.	• The unnamed watercourse runs through the Study Area. • The Thames River is within the Study Area Vicinity.	• The unnamed watercourse runs through the Study Area. • The Thames River is within the Study Area Vicinity.
	Size of watercourses in area	• The unnamed watercourse is a small second-order stream that has been altered substantially by the previous and ongoing land uses in the area. • The Thames River is a large watercourse of approximately 273 km with a drainage basin of approximately 5,825 km^2. The reach within the Study Area is part of the main branch of the Thames River.	• The unnamed watercourse is a small second-order stream that has been altered substantially by the previous and ongoing land uses in the area. • The Thames River is a large watercourse of approximately 273 km with a drainage basin of approximately 5,825 km^2. The reach within the Study Area is part of the main branch of the Thames River.	• The unnamed watercourse is a small second-order stream that has been altered substantially by the previous and ongoing land uses in the area. • The Thames River is a large watercourse of approximately 273 km with a drainage basin of approximately 5,825 km^2. The reach within the Study Area is part of the main branch of the Thames River.
	Predicted impacts to off-site quality	• Existing water quality conditions in the unnamed watercourse are currently poor as a result of a variety of surrounding land uses.	• Existing water quality conditions in the unnamed watercourse are currently poor as a result of a variety of surrounding land uses.	• Existing water quality conditions in the unnamed watercourse are currently poor as a result of a variety of surrounding land uses.

	Comparison to the Do Nothing Alternative		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
	• Any potential contamination is expected to be managed by the leachate control system, surface water management system, and Site design and operations. • No effects are anticipated.	• Any potential contamination is expected to be managed by the leachate control system, surface water management system, and Site design and operations. • No effects are anticipated.	• Any potential contamination is expected to be managed by the leachate control system, surface water management system, and Site design and operations. • No effects are anticipated.
Mitigation to be applied to all Alternatives	• In addition to the mitigation identified in Section 6.1, a surface water management system in accordance with O. Reg. 232/98 and Ontario Water Resources Act will be developed or extended to address waste footprint.		
Alternative-specific Mitigation	• Measures to relocate the watercourse offer an opportunity to improve conditions and further separates the majority of the watercourse from the landfill area.	• Measures to relocate the watercourse offer an opportunity to improve conditions and further separates the majority of the watercourse from the landfill area.	• N/A
Net Effects[50, 51]	No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation[52]	**Equally Preferred**	**Equally Preferred**	**Somewhat Less Preferred**

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[50] Assumes the mitigation measures required for proper landfill operations are of sound design and construction.
[51] *No net effect* does not mean no impact at all, but rather no new impact beyond baseline conditions described in Section 6.6.
[52] Based on the number and magnitude of negative impacts; alternative methods that have many minor impacts would be more acceptable than methods that have more major impacts.

7.1.5.2 Surface Water Quantity

Under baseline conditions, the existing impacts to surface water quantity are minimal. Under the Do Nothing Alternative, surface water quantity is not expected to change.

Potential surface water quantity impacts and mitigation measures associated with landfill expansion are described below.

Surface Water Quantity

- Increased Runoff – Adding height to the current fill areas (increasing slope length), adding more waste footprint area (creating more sloped areas), creating slopes on areas that are currently flat, and creating slopes closer to the top of watercourse bank will increase runoff. Runoff could be more rapid with slightly less infiltration; however, infiltration is low in existing conditions due to low permeable surface soil. There could be less retention of water in flat areas or surface depressions and less potential for evaporation or evapotranspiration.
- Altered surface water movement across the Site – Altering the location of the watercourse and stormwater basins or altering Site topography by adding new footprint areas will redirect surface water movement across the Site. Currently, surface water is channeled to the stormwater basins and from there into the watercourse in the centre of the Site. Similarly, runoff from the west side of the CKD stockpile moves toward the centre of the Site. Realigning the watercourse to a position along the eastern and northern property boundary will require moving water from the west and south part of the Site across the Site.

These impacts can be reduced with the following mitigation:

- Increased Runoff – Stormwater and erosion controls measures would have to be incorporated into the design. This could include berms, retention ponds, grassed waterways, and vegetated buffer strips.
- Altered surface water movement across the Site – Landfill design will need to incorporate proper grading and stormwater controls to direct, slow and retain water.

Table 7-7 provides a detailed assessment of the surface water mitigation measures and ranking. A high-level summary of the potential effects to surface water quantity, based on the detailed assessment, is provided in Table 7-9.

Table 7-9: Potential Effects to Surface Water Quantity

		Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion	Alternative 5: Vertical Expansion plus a New Footprint
Impact Indicators	**Duration/ frequency/ severity of potential on and off-site impacts**	Adding more waste footprint area (creating more sloped areas), creating slopes on areas that are currently flat, and creating slopes closer to the top of watercourse bank will increase runoff and reduce infiltration. Altering the location of the watercourse and stormwater basins or altering Site topography by adding new footprint areas will redirect surface water movement across the Site.	Adding more waste footprint area (creating more sloped areas), creating slopes on areas that are currently flat, steeper side slopes, and creating slopes closer to the top of watercourse bank will increase runoff and reduce infiltration. Altering the location of the watercourse and stormwater basins or altering Site topography by adding new footprint areas will redirect surface water movement across the Site.	Adding more waste footprint area (creating more sloped areas), creating slopes on areas that are currently flat, steeper side slopes, and creating slopes closer to the top of watercourse bank will increase runoff and reduce infiltration. Altering Site topography by adding new footprint areas will redirect surface water movement across the Site.
Mitigation		No additional mitigation beyond that identified in Section 6.1 is required.		
Net Effects[53,54]		No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation[55]		Equally Preferred	Equally Preferred	Equally Preferred

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[53] Assumes the mitigation measures required for proper landfill operations are of sound design and construction.
[54] *No net effect* does not mean no impact at all, but rather no new impact beyond baseline conditions described in Section 6.6.
[55] Based on the number and magnitude of negative impacts; alternative methods that have many minor impacts would be more acceptable than methods that have more major impacts.

7.1.6 Biology

Under baseline conditions, the existing impacts to biology are minimal. Under the 'Do Nothing' Alternative, biology is not expected be affected.

Potential impacts associated with landfill expansion are described in the following:

In the On-Site Study Area, the only natural features present are:

- Candidate Reptile Hibernacula;
- Habitat for Terrestrial Crayfish, Monarch and Eastern Milksnake, all of which are considered to be rare species;
- Nesting habitat for Eastern Meadowlark, a Threatened species;
- Foraging habitat for barn swallow and bank swallow, both Threatened species; and
- Fish habitat.

Several other natural features are present in the Study Area Vicinity. Only a small number have the potential to be affected by the Undertaking as they are downstream of the site along the Thames River. These include:

- Turtle Wintering Areas;
- Turtle Nesting Areas;
- Amphibian Breeding Habitat (Woodland);
- Habitat for Terrestrial Crayfish; and
- Fish Habitat.

These features will be impacted by land clearing associated with the expansion area as well as potential relocation of the watercourse to accommodate the expansion. Erosion during construction also has the potential to impact the watercourse and associated habitats as ground is disturbed.

With regard to fish habitat, it is noted that the unnamed watercourse does not provide direct fish habitat; however, it contributes to downstream fish habitat. The watercourse outlets to the Thames River. As such, alternatives which have potential to disturb the watercourse may affect indirect fish habitat as well as direct fish habitat and other aquatic habitats downstream (i.e., turtle habitats, etc.).

The most significant impacts to aquatic habitat will occur where the watercourse may need to be realigned to allow for the expansion. This realignment is only required for Alternative Methods 2 and 3. Although realigning the watercourse has the potential for the greatest negative impact, it also offers potential to improve habitat conditions as the new channel can be designed to incorporate habitat features, including appropriate width/depth, substrate, and riparian vegetation.

Alternative 5 have no requirements for in-water work and the watercourse will remain in its current position. However, the active landfill area will be located closer to the watercourse than it is currently.

Although existing stormwater basins and wet depressions provide some minimal habitat function for a small number of turtles and amphibians, there loss is not considered significant. The remaining watercourse or relocated watercourse will continue to provide a habitat function for these species.

Any habitats lost will be recreated through additional plantings either on the site or another nearby location. Thus, no net effects are anticipated. The only exception is habitat for terrestrial crayfish. This habitat is difficult to recreate and thus some alternatives will result in a net loss of this habitat.

It is also noted that while habitat re-creation will eliminate net effects in the long-term, there will be a lag period before newly created habitats mature. Overall, this is expected to be a very minor effect, given the disturbed nature of the habitats that currently exist.

In the long-term it is expected that aquatic habitat will improve with Alternatives in which the watercourse is relocated.

All impacts to downstream fish and wildlife habitat can be appropriately mitigated with sediment and erosion control measures and measures to minimize the impacts of in-water works.

Impacts associated with each Alternative as identified in Table 7-10.

Table 7-10: Summary of Potential Impacts to Biology

		Comparison to the Do Nothing Alternative [56]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Impact and duration of site changes on habitat**	Habitat to be Removed[57]: • Midland Painted Turtle Basking Habitat/Movement Corridor. • Amphibian breeding habitat in stormwater basins and wet depressions. • Refuge Habitat for Eastern Milksnake. • Terrestrial Crayfish. Opportunity to design for aquatic habitat in the relocated watercourse.	Habitat to be Removed[58]: • Midland Painted Turtle Basking Habitat/Movement Corridor. • Amphibian breeding habitat in stormwater basins and wet depressions. • Refuge Habitat for Eastern Milksnake. Opportunity to design for aquatic habitat in the relocated watercourse.	Habitat to be Removed[59]: • Refuge Habitat for Eastern Milksnake. • Terrestrial Crayfish. Aquatic habitat in the existing watercourse may be affected by the close proximity of the active landfill, including fill placement above the CKD pile which may disturb the pile.

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[56] Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

[57] Additional habitats may be present but were not confirmed, including turtle overwintering habitat, reptile hibernaculum.

[58] Additional habitats may be present but were not confirmed, including turtle overwintering habitat, reptile hibernaculum.

[59] Additional habitats may be present but were not confirmed, including reptile hibernaculum.

		Comparison to the Do Nothing Alternative [56]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
	Number and populations of species at risk present	Habitats for the following SAR are present and will be affected: • Monarch. • Foraging habitat for Barn Swallow and Bank Swallow.	Habitats for the following SAR are present and will be affected: • Monarch. • Nesting foraging habitat for Eastern Meadowlark.	Habitats for the following SAR are present and will be affected: • Monarch. • Nesting foraging habitat for Eastern Meadowlark. • Foraging habitat for Barn Swallow and Bank Swallow.
	Potential for interactions	• There is potential for wildlife to interact with construction activities and longer-term landfill operations.		
Mitigation to be applied to all Alternatives		• Where habitat for Monarch is removed, compensation habitat will be created on site through plantings of milkweed and other wildflowers on closed portions of the landfill or in property setback and on berms. • As the location of reptile hibernacula has not been confirmed, a biologist will be on-site during construction as required. Should hibernacula be found, all work in the area will cease until the MECP[60] is consulted and appropriate mitigation measures developed. • Revegetation of areas with native groundcover vegetation species as portions of the landfill are closed. Installation of woody plants adjacent to the realigned watercourse to enhance watercourse shading, fish, and wildlife habitat, as well as improve tree cover within the watershed. • Revegetate disturbed areas as soon as possible to minimize potential for reseeding of non-native and/or invasive species.		

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[60] MECP is now responsible for the *Endangered Species Act*. Any reference to the Ministry of Natural Resources and Forestry (MNRF) is historic (from when MNRF were responsible).

	Comparison to the Do Nothing Alternative [56]		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
	• Avoid the creation of temporary vertical or near-vertical spoil piles within the landfill that are prone to frequent disturbance from landfill operations in order to reduce the chance of attracting nesting Bank Swallow. • Should snake hibernacula features be identified during construction works, consultation with the MNRF and/or MECP may be warranted to confirm appropriate mitigation measures are in place to protect this feature. • No in-water work will occur during June and July. Prior to conducting near or in-water works, all necessary approvals under the Fisheries Act will be obtained.		
Alternative-specific Mitigation	• Maintaining watercourse baseflow throughout construction, timing restrictions to avoid turtle hibernation will be enforced, undertaking a fish and wildlife salvage, redesign watercourse to include fish and wildlife habitat features. • Incorporation of design details to improve the aquatic habitat features of the realigned watercourse. • With regard to terrestrial crayfish, consultation with MNRF to determine whether	• Compensation Eastern Meadowlark habitat will be created elsewhere in accordance with Endangered Species Act regulations. • Maintaining watercourse baseflow throughout construction, timing restrictions to avoid turtle hibernation will be enforced, undertaking a fish and wildlife salvage, redesign watercourse to include fish and wildlife habitat features.	• Compensation Eastern Meadowlark habitat will be created elsewhere in accordance with Endangered Species Act regulations. • With regard to terrestrial crayfish, consultation with MNRF to determine whether this population is considered “significant”. • If “significant”, MNRF will provide guidance on appropriate mitigation measures suitable to the proposed expansion activities.

	Comparison to the Do Nothing Alternative [56]		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
	this population is considered "significant". • If "significant", MNRF will provide guidance on appropriate mitigation measures suitable to the proposed expansion activities.	• Incorporation of design details to improve the aquatic habitat features of the realigned watercourse.	
Net Effects magnitude (M), frequency (F), duration (D), and reversibility (R)	Limited net effects anticipated: **M**: Low. Loss of terrestrial crayfish habitat. Opportunity to improve aquatic habitat. **F**: One-time loss of crayfish habitat. **D**: Crayfish habitat loss is a long-term effect. Improvements to watercourse will also be long-term. **R**: Removal of terrestrial crayfish habitat is irreversible.	Limited net effects anticipated: **M**: Overall benefit. Opportunity to improve aquatic habitat. **F**: Nil **D**: Nil **R**: Nil	Limited net effects anticipated: **M**: Low. Loss of terrestrial crayfish habitat. Opportunity to improve aquatic habitat. **F**: One-time loss of crayfish habitat. **D**: Crayfish habitat loss is a long-term effect. Improvements to watercourse will also be long-term. **R**: Removal of terrestrial crayfish habitat is irreversible.
Evaluation	**Somewhat Less Preferred**	**Preferred**	**Less Preferred**

7.2 Cultural Environment

7.2.1 Built Heritage Resources

Potential Impacts to Built Heritage Resources

There is one Built Heritage Resource present in the Study Area Vicinity. This is a residence located at 481 Water Street South. This resource is located well to the north of the landfill property. St. Marys Cement Co. is located between this residence and the landfill. As such, there does not appear to be a visual connection and no impacts are anticipated with respect to any of the Alternative Methods.

No mitigation is required, and not net effects are anticipated.

7.2.2 Cultural Heritage Landscapes

Potential Impacts to Cultural Heritage Landscapes

MTCS describes cultural heritage landscapes as being, “the use and physical appearance of the land as we see it now as a result of man’s activities over time in modifying pristine landscapes for his own purpose.” (MTCS, 1992) There are 11 Cultural Heritage Landscapes located within the Study Area Vicinity. Of these, two are directly adjacent to the landfill. The St. Marys Cement Plant Industrial Complex is located to the west. Any impacts to the feature from any of the Alternative Methods are considered minimal, given the industrial nature of the resource.

The farmscape located at 1025 Water Street South is directly adjacent to the landfill. As cultural landscapes are designated based on the perception of scenes and landscape view, visual impacts from adjacent land uses can be detrimental. Other Cultural Heritage Landscapes are also present in the Study Area Vicinity, including farm and streetscapes which may have a view of the landfill.

Given that views associated with farm and streetscapes are important, it was assumed that any alternative with a higher elevation could potentially have a greater impact than alternatives at a lower elevation.

Based on the existing property line, the average elevation of the road in front of the site is 321 m above mean sea level (masl). The St. Marys Landfill has three existing elevated areas:

1. Phase I on the west of the site, with an elevation of 327 masl.
2. Phase II/III to the south, with an approved elevation of 326 masl.

3. An existing pile of cement kiln dust ("CKD") to the east with an elevation of 334 masl – the highest current point on the site.

Visual impacts to the area have been significantly reduced through the placement of earthen berms and tree screens near the site boundaries where visual impacts could occur. The Town has an ongoing program for the existing landfill operation that is intended to further improve berms and tree screening on the west side of the Site from Perth Road 123/Water Street South and residents located along this road.

As described in Table 6-2, the Alternative Methods will have peak elevations (assuming 1 m final cover thickness) of:

- Alternative Method 2 = 324 masl
- Alternative Method 3 = 327 masl
- Alternative Method 5:
  - Vertical Expansion = 346 masl
  - New Landfill Footprint = 335 masl

From this:

- Alternative 2 offers a design that is lower than the existing landscape features and will thus have the least effect on the overall landscape.
- Alternative 3 will have a final elevation equal to the peak of Phase I (which already has final cover in place). It will be lower than the peak of the CKD pile. This is expected to have little effect on the overall landscape.
- Alternative 5 has the highest final (peak) elevation, adding about 1 m of elevation for the New Landfill Footprint when compared to the existing CKD pile and a little over 10 m for the Vertical Expansion. However, as it does not significantly alter the peak of the site overall, this is not expected to have a significant effect on the landscape.

In all cases, the change to the landscape is not considered significant.

Cultural Heritage Landscape Mitigation

With appropriate visual screening, including boundary tree plantings, impacts to views can be minimized.

During detailed design a Cultural Heritage Impact Assessment will be required to further assess impacts and identify additional mitigation measures with all cultural heritage resources.

Cultural Heritage Landscape Net Effects

Although further study is required, for the purposes of this assessment it is assumed that visual screening may not be sufficient to mitigate the landscape changes which will occur as a result of the Alternatives with higher elevations. Net effects are described in Table 7-11 according to their magnitude, frequency, duration, and reversibility.

Table 7-11: Potential Effects to Cultural Heritage Landscapes

		Comparison to the Do Nothing Alternative [61]		
		Alternative 2: Horizontal expansion of the existing landfill	**Alternative 3: A combination of vertical and horizontal expansion**	**Alternative 5: Vertical expansion plus a new footprint**
Impact Indicators	**Presence of, or likelihood to disturb Cultural Heritage Landscapes.**	Visual changes to the landscape may affect the heritage value of the landscape. Alternatives with a higher elevation could potentially have a greater impact than alternatives at a lower elevation. Maximum Elevation: 324 masl, 3 m lower than the existing peak elevation of Phase I and 2 m lower than Phase II/III.	Maximum Elevation: 327 masl, a similar elevation as the existing Phase I landfill peak.	Maximum Elevation: 335 masl, 8 m above existing landfill peak and 1 m higher than (similar to) the existing CKD pile.

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[61] Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

	Comparison to the Do Nothing Alternative [61]		
	Alternative 2: Horizontal expansion of the existing landfill	**Alternative 3: A combination of vertical and horizontal expansion**	**Alternative 5: Vertical expansion plus a new footprint**
Mitigation	• With appropriate visual screening, including boundary tree plantings, impacts to views can be minimized. • During detailed design, a Cultural Heritage Impact Assessment will be required to further assess impacts and identify additional mitigation measures with all cultural heritage resources.		
Net Effects magnitude (M), frequency (F), duration (D), and reversibility (R)	**M**: No net effect to Cultural Heritage. Visual mitigation sufficient to block landscape changes. **F**: Nil **D**: Nil **R**: Nil	**M**: Minor change to landscape view. **F**: Landscape change will occur slowly over time as landfill is filled and elevation rises. **D**: Change will be experienced over life of landfill and beyond. **R**: Landscape change is generally irreversible.	**M**: Moderate change to landscape view. **F**: Landscape change will occur slowly over time as landfill is filled and elevation rises. **D**: Change will be experienced over life of landfill and beyond. **R**: Landscape change is generally irreversible
Evaluation	**Equally Preferred**	**Somewhat Less Preferred**	**Less Preferred**

7.2.3 Archaeological Resources

Potential Impacts to Archaeological Resources

There are no previously registered archaeological sites are located within the Study Area Vicinity. The On-Site Study Area offers no archaeological potential, given its past and current disturbances.

As such, no archaeological resources are present and no impacts to archaeological resources are anticipated with respect to any of the Alternative Methods.

Mitigation to address the discovery of unexpected artifacts will be implemented. With this no net effects are anticipated.

7.3 Socio-Economic Environment

7.3.1 Local and Regional Transportation

Potential Transportation Effects

The purpose of the Transportation criteria was to determine if any of the Alternatives would result in changes to the amount or type of local or regional traffic.

None of the Alternatives is expected to increase the amount of waste generated or transported to the landfill, with the exception of small increases as the Town's population grows. All Alternatives will continue to be accessed through the existing entrance off Water Street. The Traffic Impact Study (Volume III, Appendix H), determined that the intersection at Water Street (Perth Road 123) and the landfill access is sufficient to meet traffic demands through 2059 and beyond. The landfill is only intended to service the Town of St. Marys. There is no short-term or long-term intent to accept waste from outside of the Town. No waste will be hauled from beyond the Town's borders. Therefore, no effects are expected beyond Water Street. No capacity improvements are needed to Water Street or the entrance intersection. No effects on traffic are expected and no mitigation is required. No net effects are expected.

7.3.2 Land Use

Ministry Guideline D-4: Land Use On or Near Landfills and Dumps, specifies restrictions and controls on land use that the Ministry wishes to see implemented in the vicinity of landfills and dumps, in order to protect the health, safety, convenience and welfare of residents near such facilities. It complements existing ministry abatement programs for landfills and dumps. It is a direct application of Guideline D-1: "Land Use Compatibility."

None of the Alternatives changes the land use designation of the site. Compatibility with surrounding land uses remains unchanged. A landfill is compatible with adjacent aggregate operations and rural landscapes. Some occasional conflicts with nearby residents can be expected. These are further discussed under the Air Quality, Noise and Odour discussions in Sections 7.1.1 through 7.1.3.

All Alternative Methods are compatible with surround uses and will not affect the current use of land surrounding the site. However, as noted in the Evaluation of Alternatives To the Undertaking, the Township of Perth South zoning by-law does not include appropriate restrictions for adjacent land uses. The need for restrictions applies to all Alternative Methods.

It is preferable to make the most efficient use of the landfill property, given the long-term implications of a landfill and restrictions on future use. Alternative 3 has the smallest footprint outside of the existing landfilled boundary, as much of the expansion will be located above the existing cells. The expanded footprint of each Alternative beyond the existing landfilled area is as follows:

- Alternative 2: 7 ha
- Alternative 3: 3.8 ha
- Alternative 5: 6.1 ha

The proposed expansion lands have limited use in the future, given surrounding extraction activities and existing landfill. These lands will have no benefit to the Town and will become unusable vacant lands. A such, it is preferable to use the remaining lands for landfilling purposes in the most efficient manner.

With the application of appropriate zoning measures, no net effects associated with land use are expected. All Alternatives are preferred over existing conditions because the zoning bylaw for the Township of Perth South will be updated and improved. Alternative 3 is preferred overall as it provides a more efficient use of the land. The land will be appropriately decommissioned at the end of the landfill period. Land use restrictions will remain in place over the post-operational period and will limit the use of the site. All three Alternatives will have similar post-operational land use restrictions.

A summary of Land Use considerations is provided in Table 7-12.

Table 7-12: Summary of Land Use Considerations

		Comparison to the Do Nothing Alternative [62]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Amount of land required**	• 7 ha of land beyond the existing landfill area will be required.	• 3.8 ha of land beyond the existing landfill area will be required. • This alternative requires a small “new” footprint as much of the expansion will be above the existing landfill, making this Alternative a more efficient use of the land.	• 6.1 ha of land beyond the existing landfill area will be required.
	Current land use	• Expansion area is currently appropriately zoned for landfill uses. Expansion area is currently vacant.	• Expansion area is currently appropriately zoned for landfill uses. Expansion area is currently vacant.	• Expansion area is currently appropriately zoned for landfill uses. Expansion area is currently vacant.
	Presence of sensitive lands within study areas	• Adjacent lands are primarily aggregate extraction. • Some rural residences are present.	• Adjacent lands are primarily aggregate extraction. • Some rural residences are present.	• Adjacent lands are primarily aggregate extraction. • Some rural residences are present.

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[62] Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

		Comparison to the Do Nothing Alternative [62]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
		• A cultural heritage farmscape is located at 1025 Water Street South is directly adjacent to the landfill.	• A cultural heritage farmscape is located at 1025 Water Street South is directly adjacent to the landfill.	• A cultural heritage farmscape is located at 1025 Water Street South is directly adjacent to the landfill.
	Compatibility with Ministry Guideline D-4: Land Use On or Near Landfills and Dumps and Guideline D-1: Land Use Compatibility	• A landfill is compatible with adjacent aggregate operations and rural landscapes.	• A landfill is compatible with adjacent aggregate operations and rural landscapes.	• A landfill is compatible with adjacent aggregate operations and rural landscapes.
	Number and type of farms in study area[63]	• Approximately 6 farms.	• Approximately 6 farms.	• Approximately 6 farms.
Mitigation		• With appropriate visual screening, including boundary tree plantings, impacts to adjacent residences can be minimized. • The Town of St. Marys will work with the Township of Perth on an ongoing issue related to the zoning of lands adjacent to the landfill. • As per a request by MECP, odour will be re-modeled during detailed design.		
Net Effects[64]		No net effects anticipated		
Evaluation		**Somewhat Preferred**	**Preferred**	**Somewhat Preferred**

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[63] As noted in Section 6.6.4, farm ownership is difficult to determine, and multiple farms may be in single ownership. The number of farms is an approximation based on air photo interpretation and a windshield survey of the area.

[64] Net effects include measures of magnitude (M), frequency (F), duration (D) and reversibility (R)

7.3.3 Employment Effects

Potential Employment Effects

No changes to the staffing at the landfill are expected for any of the Alternatives. The landfill will continue to employ one full-time position, one part-time position and six staff who work occasionally, as required. A small number of additional short-term temporary positions may be required during construction and decommissioning.

No mitigation is required. There will be a minor net benefit from all Alternatives related to the temporary construction and decommissioning employment opportunities.

A summary of employment effects is provided in Table 7-13.

Table 7-13: Potential Changes in Employment

		Comparison to the Do Nothing Alternative [65]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Number, type, duration of changes to local workforce**	• Landfill staff expected to remain the same. • Some temporary construction positions to be added during expansion.	• Landfill staff expected to remain the same. • Some temporary construction positions to be added during expansion.	• Landfill staff expected to remain the same. • Some temporary construction positions to be added during expansion.
Mitigation		• No mitigation required.		
Net Effects magnitude (M), frequency (F), duration (D), and reversibility (R)		**M**: Low net benefit from increase in short-term construction jobs. **F**: Infrequently – Expansion will be constructed in phases (landfill cells) with new cells added as older cells are filled. Therefore, construction jobs will be added on a short-term basis over several expansion periods. **D**: Short-Term – Expansion construction jobs to be added only during construction. **R**: Reversible – Employment needs may change over the 40-year operational period and can be revised, as necessary.		
Evaluation		**Somewhat Preferred**	**Somewhat Preferred**	**Somewhat Preferred**

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[65] Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

7.3.4 Economic Conditions

Potential Economic Effects

Indicators for this criterion include any changes to revenues, costs, taxes anticipated to local businesses.

It is expected that small businesses that are currently serviced by local curbside waste pick up will not have any service changes. Businesses that currently use a private waste collection service will likely continue to do so. No changes to the way BRA collects waste or operates are expected and the contract with BRA is expected to continue. Funds are being allocated by the Town for expansion requirements and the project is expected to be funded through existing revenue streams without any significant user fee increases at this time.

As such, none of the Alternatives will influence businesses. No mitigation is required, and no net effects are expected.

7.3.5 Social Conditions

Potential Social Effects

There is the potential for social impacts as a result of solution development. Either directly through displaced residences or communal space, or indirectly through opportunity costs or community image. In this case, all of the Alternatives are located on property owned by the Town and no private property will be directly affected. The indicator for this criterion was consideration of the number of residences impacted, along with other types of land uses, including the area impacted.

The site currently operates as a landfill that is well established and has been a long-term fixture in the community. The landfill provides a social service, providing residents with a convenient location to dispose of waste not suitable for curbside pickup. Due to the current landfill and adjacent industrial extraction uses, there is little opportunity for the site to be used for an alternative community purpose.

As per the discussion under the Land Use heading, all adjacent land uses are compatible, and no net effects related to land use are anticipated.

As such, none of the Alternatives will result in any significant change from baseline conditions.

With mitigation, including noise, odour and dust controls and visual screening and measures to ensure that local drop-off options remain open during landfill expansion, no net effects to social conditions are expected.

7.4 Indigenous Connections to the Land

7.4.1 Traditional and Historic Uses and Land Claims/Treaty Rights/Indigenous Rights/Environmental Concerns

The St. Marys Landfill is located within lands subject to the Nanfan Treaty and Treaty 29 (1827). It is believed that six First Nations and the Haudenosaunee Confederacy have Indigenous and Treaty Rights associated with lands in, and around, the landfill. Expansion of the landfill represents a development within a Treaty area.

The St. Marys Landfill is near the Thames River, which was an important travel corridor, source of sustenance and culturally significant feature for the Indigenous people who historically lived in the area.

Impacts to Traditional Uses, Land Claims and Treaty and Indigenous Rights are not quantified as these impacts are difficult to measure. However, it is noted that there will be no opportunity to return lands to a condition under which they could be used for traditional uses in the short-term. Compared to baseline conditions no net effects are expected. Under baseline conditions lands historically used by Indigenous communities have been subject to aggregate extraction and landfilling for nearly a century, removing any potential for traditional use. There will be no opportunity to return lands to a condition under which they could be used for traditional uses in the short-term. None of the Alternatives would result in a change from the current baseline.

The Town will continue to consult with Indigenous communities to identify measures to mitigate potential effects.

A summary of potential impacts is provided in Table 7-14.

Table 7-14: Effects on Traditional Uses and Treaty and Indigenous Rights

		Comparison to the Do Nothing Alternative [66]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Presence of traditional uses of the land identified by Indigenous communities**	Traditional uses may occur in the vicinity but have not occurred on the landfill property since before St. Marys Cement was active on the site. There would be no opportunity for traditional uses to be re established in the next 40 years if the landfill is expanded.		
	Presence of known or active land claims or Treaties related to the site or its vicinity	The St. Marys Landfill is located within lands subject to the Nanfan Treaty and Treaty 29 (1827). It is believed that six First Nations and the Haudenosaunee Confederacy have Indigenous and Treaty Rights associated with lands in, and around, the landfill. Expansion of the landfill represents a development within a Treaty area.		
Mitigation		The Town will continue to consult with Indigenous communities to identify measures to mitigate potential effects.		

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[66] Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

	Comparison to the Do Nothing Alternative [66]		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Net Effects magnitude (M), frequency (F), duration (D), and reversibility (R)	**M**: Unknown – The magnitude of the loss of traditional uses cannot be quantified by the authors of this report. It is understood that loss of traditional uses as a result of development such as the original landfill construction may continue to be felt by Indigenous communities. No changes from the current baseline are expected. **F**: Once – The ability to use the lands for traditional uses was lost during the original development of the site long ago. **D**: Long-Term – Loss of traditional and historical uses can be expected over the life of the landfill and beyond. **R**: Irreversible – Traditional and historical uses are not expected to be re-established at the site.		
Evaluation	**Equally Preferred**	**Equally Preferred**	**Equally Preferred**

7.5 Financial Factors

A cost estimate for expanding the St. Marys Landfill was provided in Section 3.8.6, under the sub-heading: *St. Marys Landfill Expansion Costs.* This cost estimate was based on a configuration similar to Alternative 3, namely a horizontal and vertical expansion.

The following sections discuss the capital and operational costs of Alternatives 2 and 5 relative to the Alternative 3 estimate.

7.5.1 Capital Costs

Capital costs for the landfill expansion are those costs associated with development of the site's infrastructure. Examples include the relocation of existing public drop-off area and construction to begin using the new expansion capacity, such as building roads, excavating the landfill base (preparing the engineered liner) and building the leachate collection system. The capital costs also include the cost for decommissioning the site and placing final closure cover.

Per Section 3.8.6, the cost for capital works was estimated to be $7,360,000 based on the conceptual design of Alternative Method 3 – a combination of vertical and horizontal expansion. For this Alternative, the expanded footprint is approximately 3.6 ha, meaning that much of the site's existing base, with its leachate collection system, can be utilized for the expansion. However, this Method incurs costs to:

- Upgrade the existing leachate collection system – mainly to extend existing maintenance hole structures;
- Extend and replace part of the stormwater management facilities; and
- Relocate the existing watercourse.

Compared to Alternative 3:

- Alternative Method 2 is expected to have a higher capital cost as the horizontal expansion will require a new base area of approximately 7.0 ha. The additional cost for the larger leachate collection system is only partly offset by not requiring extension of the site's existing maintenance hole structures of the existing leachate collection system. The larger footprint still requires the relocation of the existing watercourse. It will also require additional ditching and a larger stormwater management pond to control the larger footprint. Overall, Method 2 is expected to be costlier than Alternative 3.
- Alternative Method 5 is also expected to have a higher capital cost than Alternatives 2 and 3. This Alternative is a vertical expansion above the existing waste footprint with development of a new footprint, up to 6.1 ha, elsewhere on the

landfill property. Building above the CKD pile will require some preliminary testing to confirm stability when the new waste is placed above. A more significant base preparation is needed as a natural clay liner does not exist. Stability issues may further increase capital costs. From a capital cost perspective verses the baseline (Alternative 3) cost estimate, Alternative 5 is inefficient. The only savings is that the watercourse realignment is not required. This savings will be lost when considering the bridge and additional site roads that will be needed. Overall, Method 5 is expected to be costlier than Alternative 3.

A comparison of capital costs is provided in Table 7-15.

7.5.2 Operating Costs

As with the capital costs, an initial estimate for operational and maintenance costs has been created assuming the Alternative 3 design, discussed in Section 3.8.6. Operational and monitoring costs are incurred annually. They include staffing the site, equipment to operate the site (including fuel and maintenance), leachate disposal, monitoring and general maintenance. The cost estimate assumes an annual cost for operations and maintenance of $425,000 annually. That is, on average, $425,000 will be spent each year over the operating life (which is the 40-year planning period of this EA) of the expansion.

Additionally, there are closure and post-closure costs that will occur when the expansion stops receiving waste. The closure cost is for decommissioning the site and placing final closure cover – these are capital costs. Following closure though, there is a post-closure care period to ensure the waste placed at the site does not become an environmental problem. Post-closure care will include:

- Continued operation of the leachate collection system.
- Maintenance of the site facilities, including:
  - Stormwater management system; ensuring sediments and excessive vegetation is controlled so the system functions correctly.
  - Closure cover; providing good grass cover and repair of any eroded areas.
  - Leachate collection system; maintaining pumps, preventing fouling, etc.
- Monitoring the landfill's performance; testing ground and surface water at the site, essentially a continuation of the typical annual monitoring programs.

These post-closure care costs are considered operational costs. We have assumed post-closure care will be required for a 50-year period following closure of the expansion, regardless of the Alternative Method selected. We have estimated a present value of $70,000 for each year of the post-closure care period.

Summing annual present value costs for the expansion life and post-closure care period results in a total estimated operating cost of $17,510,000.

For most operational items during the site's lifespan or following closure, there is essentially no difference between the Alternative Methods. For example, staffing and equipment requirements are expected to be the same between Methods as the same amount of waste will require disposal each year regardless of the Alternative Method selected. Monitoring will also be essentially the same, with spring and fall sampling and preparation of an annual monitoring report. The differences are related to items like:

- Quantity of leachate requiring disposal: a smaller waste footprint generates less leachate than a larger footprint.
- Maintenance requirements: the length of ditches and the leachate collection system piping, and the size of stormwater ponds are related to the size of the expansion footprints. A larger footprint will require more maintenance than a smaller footprint.

Compared to the operations and maintenance costs for Alternative 3, described above:

- Alternative Method 2 is a horizontal expansion. This expansion requires approximately 7.0 ha of new landfill footprint. There will therefore be more length of leachate and stormwater facilities as well as more leachate generated than would be anticipated by the Alternative 3 operational cost estimate.
- Alternative Method 5 is a vertical expansion plus a new footprint that's up to 6.1 ha. Compared to Alternative 3, there is more leachate requiring disposal and the maintenance required for the leachate and stormwater systems will be higher as well. As a result, Method 5 is expected to cost more than Alternative 3.

A comparison of capital costs is provided in Table 7-15.

Table 7-15: Summary of Capital and Operational Costs[67]

		Comparison to the Do Nothing Alternative		
		Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Impact Indicators	**Capital Cost to expand the landfill**	Expected to be costlier than the Alternative 3 as more leachate collection and stormwater infrastructure is required.	Capital costs for expansion estimated to be $7,360,000.	Expected to be costlier than the Alternative 2 and 3 as an entire new footprint will be developed above the CKD pile. This will also require new roads, a bridge, and significant surface water controls (entire perimeter).
	Operational and maintenance costs to expand the landfill	More length of leachate and stormwater facilities as well as more leachate generated than would be anticipated by Alternative 3 operational cost estimate.	Operational costs estimated to be $17,510,000.	There is more leachate requiring disposal and the maintenance required for the leachate and stormwater systems will be higher as well. As a result, Alternative 5 is expected to cost more than Alternative 3 for operations.
Evaluation		**Less Preferred**	**Somewhat Less Preferred**	**Less Preferred**

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[67] Baseline conditions described in Section 6.6 are not expected to change with the Do Nothing option.

7.6 Technical Factors

The Do Nothing alternative does not offer a technically sound solution. Doing Nothing is not feasible, based on Ontario's regulations related to waste management. Therefore, all Alternatives are considered to be preferable to Doing Nothing.

Landfill expansion requires extensive permitting and approvals through a variety of agencies. All Alternatives will require completion of this EA followed by MECP authorization with an Environmental Compliance Approval (ECA) related to landfill operations, stormwater controls and the leachate collection system. All Alternatives will also require completion of further studies with respect to Cultural Heritage Landscapes and acceptance of a Cultural Heritage Impact Assessment from MTCS. Differences lie in the permitting required in relation to natural features.

Alternatives 2 and 3 require relocation of the unnamed watercourse. These Alternatives require the submission of a request for project review to the DFO for assessment and approval under the *Fisheries Act*. Authorization from the UTRCA is also required under O. Reg. 157/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

Alternatives 3 and 5 will result in the loss of habitat for Eastern Meadowlark, a threatened species. The proposed works on the Site are eligible for exemptions under O. Reg. 242/08, Section 23.2 of the ESA 2007 for Eastern Meadowlark. Specific conditions must be met prior to, and during, development activities that will damage or destroy Eastern Meadowlark habitat. These include registration and documentation of the habitat to be removed and creation of compensation habitat on the site or in an alternate location in the watershed. Any newly created habitat must be monitored and protected.

With respect to ease of engineering, all Alternatives are technically feasible. The infrastructure and engineering requirements differ for each Alternative, with some Alternatives requiring more extensive infrastructure upgrades, as summarized in Table 7-16.

More specifically, the proposed height of the landfill expansion will have impacts on the engineering designs required to achieve the expansion. For example, increasing the height of filling in the area of the existing leachate collection system maintenance holes, puts additional stress on the liner and collection system and the base of those maintenance holes. Generally, additional waste thickness, synonymous with height, can also cause more technical difficulties with leachate seeps, hydraulic conductivity, landfill gas migration and overall geotechnical stability of the landfill.

Alternatives 2, 3 and 5 require a combination of new and existing footprints. Existing infrastructure, such as the leachate collection system or road network, will require revisions to address requirements of *Alternatives* 2, 3, and 5.

The main existing infrastructure upgrades come in two forms. Vertical expansion of the existing landfill will require extensions to the existing manholes to ensure that the access to the existing leachate collection system is retained. Horizontal expansion of the landfill will require tie-ins and modifications to the leachate handling works to handle the additional leachate quantities. In addition, the existing infrastructure of access roads and surface water management ditches and control ponds will be modified or replaced depending on the *Method* of landfill expansion.

Table 7-16: Infrastructure Requirements

Alternative	Infrastructure Required	Complexity of Engineering
2	• New footprint requires liner, leachate collection systems, stormwater controls. New roads required. • The existing leachate collection system will need to be tied into the proposed expansion footprint. The location of the existing leachate collection system intersects with this expansion concept. As such, the leachate collection system will need to be reviewed to determine the level of upgrades which are required.	Moderate
3	• New footprint requires liner, leachate collection systems, stormwater controls, although the size of this infrastructure is less than needed for Alternative 2. • New roads and public drop-off area required. • Existing manholes need to be extended to allow continued access to the access to the existing leachate collection system for maintenance. The collection system needs to be extended between Phase I and Phase II/III. May require some sizing upgrades. Stormwater management basins must be relocated.	High

Alternative	Infrastructure Required	Complexity of Engineering
5	• New footprint requires liner and leachate collection systems, including modifications to the leachate handling infrastructure. • New roads and public drop-off area required. • Manholes need to be extended to allow continued access to the access to the existing leachate collection system for maintenance. The collection system needs to be extended between Phase I and Phase II/III. May require some sizing upgrades.	High

The final indicator is to identify whether the Alternative provides sufficient volume to meet the Town's waste disposal needs over the next 40 years. An estimate of the volume provided by each Alternative is presented in Table 6-1. The total required landfill volume is 708,000 m^3. Alternatives 2, 3 and 5 are larger than required, this merely indicates that the Alternative can accommodate the required capacity for the EA planning period. It is expected that, during the *Environmental Protection Act* approval process, the preferred Alternative will be refined to provide a capacity closer to 708,000 m^3.

A summary of technical factors is provided in Table 7-17.

Table 7-17: Summary of Technical Factors

		Comparison to the Do Nothing Alternative [68]		
		Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion	Alternative 5: Vertical Expansion plus a New Footprint
Impact Indicators	**Permitting and Approvals required**	• MECP authorization with an Environmental Compliance Approval (ECA) related to landfill operations, stormwater controls and the leachate collection system. • Completion of further studies with respect to Cultural Heritage Landscapes and acceptance of a Cultural Heritage Impact Assessment from MTCS. • For relocation of the unnamed watercourse, requires submission of a request for project review to the DFO for assessment and approval under the Fisheries Act.	• MECP authorization with an Environmental Compliance Approval (ECA) related to landfill operations, stormwater controls and the leachate collection system. • Completion of further studies with respect to Cultural Heritage Landscapes and acceptance of a Cultural Heritage Impact Assessment from MTCS. • For relocation of the unnamed watercourse, requires submission of a request for project review to the DFO for assessment and approval under the Fisheries Act.	• MECP authorization with an Environmental Compliance Approval (ECA) related to landfill operations, stormwater controls and the leachate collection system. • Completion of further studies with respect to Cultural Heritage Landscapes and acceptance of a Cultural Heritage Impact Assessment from MTCS. • Specific conditions must be met prior to, and during, development activities that will damage

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[68] Baseline conditions were described in Section 6.6. No changes from baseline conditions are expected with the Do Nothing option.

		Comparison to the Do Nothing Alternative [68]		
		- Authorization from the UTRCA required under O. Reg. 157/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.	- Authorization from the UTRCA required under O. Reg. 157/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. - Specific conditions must be met prior to, and during, development activities that will damage or destroy Eastern Meadowlark habitat.	or destroy Eastern Meadowlark habitat.
	Ease of Engineering	Moderate complexity	High complexity	High complexity
	Ability of the Alternative to serve the Town's needs for the full term of the study period (i.e., 40 years)[69]	733,000 m^3 >40 years Capacity	756,000 m^3 >40 years Capacity	974,000 m^3 >40 years Capacity
Evaluation		**Preferred**	**Somewhat Preferred**	**Somewhat Preferred**

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[69] The preferred Alternative will be refined to provide a capacity closer to 708,000 m^3.

7.7 Summary of Net Effects

The evaluation of net effects relative to Doing Nothing is presented in Table 7-18. All rankings are relative to the Do Nothing Alternative.

Table 7-18: Summary of Net Effects

Criteria	**Comparison to the Do Nothing Alternative**		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Natural Environment			
Potential Impacts to Air Quality	Equally Preferred	Equally Preferred	Equally Preferred
Potential Effects due to Odour	Equally Preferred	Less Preferred	Somewhat Less Preferred
Potential Effects of Noise	Equally Preferred	Equally Preferred	Equally Preferred
Potential Impacts to Groundwater	Equally Preferred	Equally Preferred	Less Preferred
Potential Impacts to Surface Water Quality	Equally Preferred	Equally Preferred	Somewhat Less Preferred
Potential Impacts to Surface Water Quantity	Equally Preferred	Equally Preferred	Equally Preferred
Potential Impacts to Biology	Somewhat Less Preferred	Preferred	Less Preferred
Cultural Environment			
Potential Impacts to Built Heritage Resources	Equally Preferred	Equally Preferred	Equally Preferred
Potential Impacts to Cultural Heritage Landscapes	Equally Preferred	Somewhat Less Preferred	Less Preferred
Potential Impacts to Archaeological Resources	Equally Preferred	Equally Preferred	Equally Preferred

Criteria	**Comparison to the Do Nothing Alternative**		
	Alternative 2: Horizontal Expansion of the Existing Landfill	**Alternative 3: A Combination of Vertical and Horizontal Expansion**	**Alternative 5: Vertical Expansion plus a New Footprint**
Socio-economic Environment			
Potential Impacts to Transportation Routes	Equally Preferred	Equally Preferred	Equally Preferred
Land Use	Somewhat Preferred	Preferred	Somewhat Preferred
Employment Effects	Somewhat Preferred	Somewhat Preferred	Somewhat Preferred
Economic Conditions	Equally Preferred	Equally Preferred	Equally Preferred
Social Conditions	Equally Preferred	Equally Preferred	Equally Preferred
Indigenous Connections to the Land			
Traditional and Historic Uses/Land Claims/ Indigenous and Treaty Rights/Environmental Concerns	Equally Preferred	Equally Preferred	Equally Preferred
Financial Factors			
Capital and Operational Costs	Less Preferred	Somewhat Less Preferred	Less Preferred
Technical Factors			
Technical Ability to Carry Out Each Alternative	Preferred	Somewhat Preferred	Preferred
Overall Preference	**Somewhat Preferred**	**Preferred**	**Less Preferred**

7.8 Advantages and Disadvantages of the Alternative Methods

Based on the discussion of net effects in Section 7.0, the advantages and disadvantages of the proposed Alternative Methods are summarized in Table 7-19.

Table 7-19: Summary of Advantages and Disadvantages

Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion	Alternative 5: Vertical Expansion plus a New Footprint
Advantages			
• Does not have any effect on the natural, cultural, or social environment beyond baseline conditions. • Does not affect Indigenous connections to the land beyond baseline conditions. • Does not have a capital or operational cost.	• Does not require compensation for loss of Eastern Meadowlark habitat. • Low elevation minimizes impacts to Cultural Heritage Resources and reduces aesthetic and enjoyment of life concerns for adjacent residents. • Moderate complexity with respect to engineering required. • Provides sufficient landfill volume. • Waste footprint is not above the CKD pile. • Moves the majority of the watercourse away from the active landfill area.	• Low elevation minimizes impacts to Cultural Heritage Resources and reduces aesthetic and enjoyment of life concerns for adjacent residents. • Provides sufficient landfill volume. • Waste footprint is not above the CKD pile. • Moves the majority of the watercourse away from the active landfill area. • This is the baseline for capital and operating costs (neither an advantage or disadvantage).	• Does not require relocation of the watercourse. • Provides sufficient landfill volume.
Disadvantages			
• Does not provide a solution to the Problem Statement.	• Requires relocation of the watercourse which will require: – Mitigation and monitoring to ensure potential impacts from the CKD pile are minimized (footprint of CKD pile may be encroached by watercourse realignment). – Additional permits and approvals from DFO and UTRCA. • Reduces separation between waste and bedrock. • Requires compensation for loss of Eastern Meadowlark habitat. • Results in the permanent loss of terrestrial crayfish habitat. • Larger waste footprint results in higher capital and operating costs.	• Requires relocation of the watercourse which will require: – Mitigation and monitoring to ensure potential impacts from the CKD stockpile are minimized (footprint of CKD pile may be encroached by watercourse realignment). – Additional permits and approvals from DFO and UTRCA. • Reduces separation between waste and bedrock. • Requires compensation for loss of Eastern Meadowlark habitat. • High complexity with respect to engineering required.	• Results in the permanent loss of terrestrial crayfish habitat. • Requires compensation for loss of Eastern Meadowlark habitat. • High elevation likely to results in: – Impacts to Cultural Heritage Resources. – Additional concerns with respect to aesthetics and noise, dust, and odour for adjacent residents. • High complexity with respect to engineering required: – Reduces separation between waste and bedrock. • Waste footprint is above the CKD stockpile, potentially resulting in: – Liner and leachate collection system failure due to settlement. – Chemical interactions between the leachate and CKD material. • Larger waste footprint results in higher capital and operating costs.

Input from Stakeholders, Agencies, Indigenous Communities, and the Public

A Public Information Centre was held at the end of Phase 5 of the EA process. In addition, information was posted to the Town's website and notification was provided to the public, agencies, and Indigenous communities.

No input was received from agencies or Indigenous communities with respect to the evaluation of Alternative Methods. Several comments were received from the public and interested stakeholders and are summarized in Table 7-20.

Table 7-20: Comments Received from the Public Regarding the Alternative Methods

Comment	Study Team Response	Where Addressed in EA
Concerned with drinking water well quality	Groundwater quality is monitored on a regular and ongoing basis as part of the current landfill operations. To date, there are no concerns related to the landfill's impact on off-site groundwater quality. Landfill monitoring reports are available online at the Town's website. Based on the draft preferred expansion method, no waste placement closer to residential wells is being considered. Neighbouring property owner was generally satisfied with this approach, and with current monitoring program including well sampling.	Mitigation measures were included to address groundwater concerns, including measures to manage leachate and continue the site's ongoing annual monitoring. Five private wells are currently being monitored and will continue to be monitored. Impacts and mitigation are addressed in Section 7.1.4 and Section 9.0
Concerned with site Odours	Neighbouring residents identified intermittent issues with landfill odour impacts during conditions of NE-E wind direction. Project Team members discussed recent challenges to operations as a result of equipment operations and challenging spring weather conditions, as well as mitigation measures. Additionally, the results of the site air modelling for the expansion alternatives were discussed which indicated that current conditions represent the worst-case scenario for potential for impacts.	Mitigation measures were provided to minimize odour, including to implement Best Management Practices and daily cover. Odour will be re-evaluated and modeled based on detailed design plans during preparation of the ECA application as noted in Section 9.0.

Comment	Study Team Response	Where Addressed in EA
Concerned with Traffic Speeds on County Road 123.	Discussion with homeowner focused on sightlines of any relocated entrance and posted speed limit outside of St. Marys (80 km/h dropping to 50 km/h within the Town). Any change in entrance location will require sightline analysis, and updates to Traffic Impact Study. Resident plans to contact County to review posted speed limit along road section.	A Traffic Impact Study was completed. As a result of modeling, it was determined that current and future conditions are projected to be safe, and no changes are required. The Traffic Impact Study can be found in Volume III, Appendix H.

It was determined that concerns raised by stakeholders (i.e., drinking water quality and odour) can be addressed through standard landfill design, operational procedures and regular monitoring. Concerns associated with traffic were studied in the Traffic Impact Study which can be found in Volume III, Appendix H. The study did not identify the need for any changes due to present or future conditions.

Preferred Undertaking

Based on the evaluation presented in Table 7-18, the advantages and disadvantages of each alternative and input from the public, it was determined that:

- Doing Nothing does not address the Town’s waste management needs and obligations and is not a feasible solution to the Problem Statement.
- Alternative 2 is preferred from a cultural heritage perspective as it is lower topographically and will have fewer visual effects. However, this Alternative is costlier as it requires a larger infrastructure footprint and does not make use of the existing leachate collection system.
- Alternative 3 is preferred as it makes the most efficient use of the existing infrastructure and land. There are opportunities to improve the unnamed watercourse as it is relocated. This Alternative is the least costly.
- Alternative 5 is least preferred. Although the watercourse will remain as is, the layout makes an inefficient use of the land and the entirely new footprint is costly and requires a significant amount of new infrastructure.

Overall, expanding the St. Marys Landfill both vertically and horizontally, per Alternative Method 3, is preferred.

8.0 Description of the Undertaking

The Undertaking involves a combination of partial vertical expansion, alongside horizontal expansion of the landfill footprint as shown in Figure 6-3 (Alternative Method 3 – Combination of Vertical and Horizontal Expansion). The following section provide a more detailed description of the Undertaking than was presented in Section 6.1. This plan may be altered and refined further as part of future EPA permitting processes, following EA approval.

We also note that interim operation of the landfill has filled above Phase II/III. This fill, described in Section 3.1.3.8, will become the new base for the expanded landfill. The expansion design must incorporate this interim fill while achieving the intended planning period capacity (ending December 31, 2056).

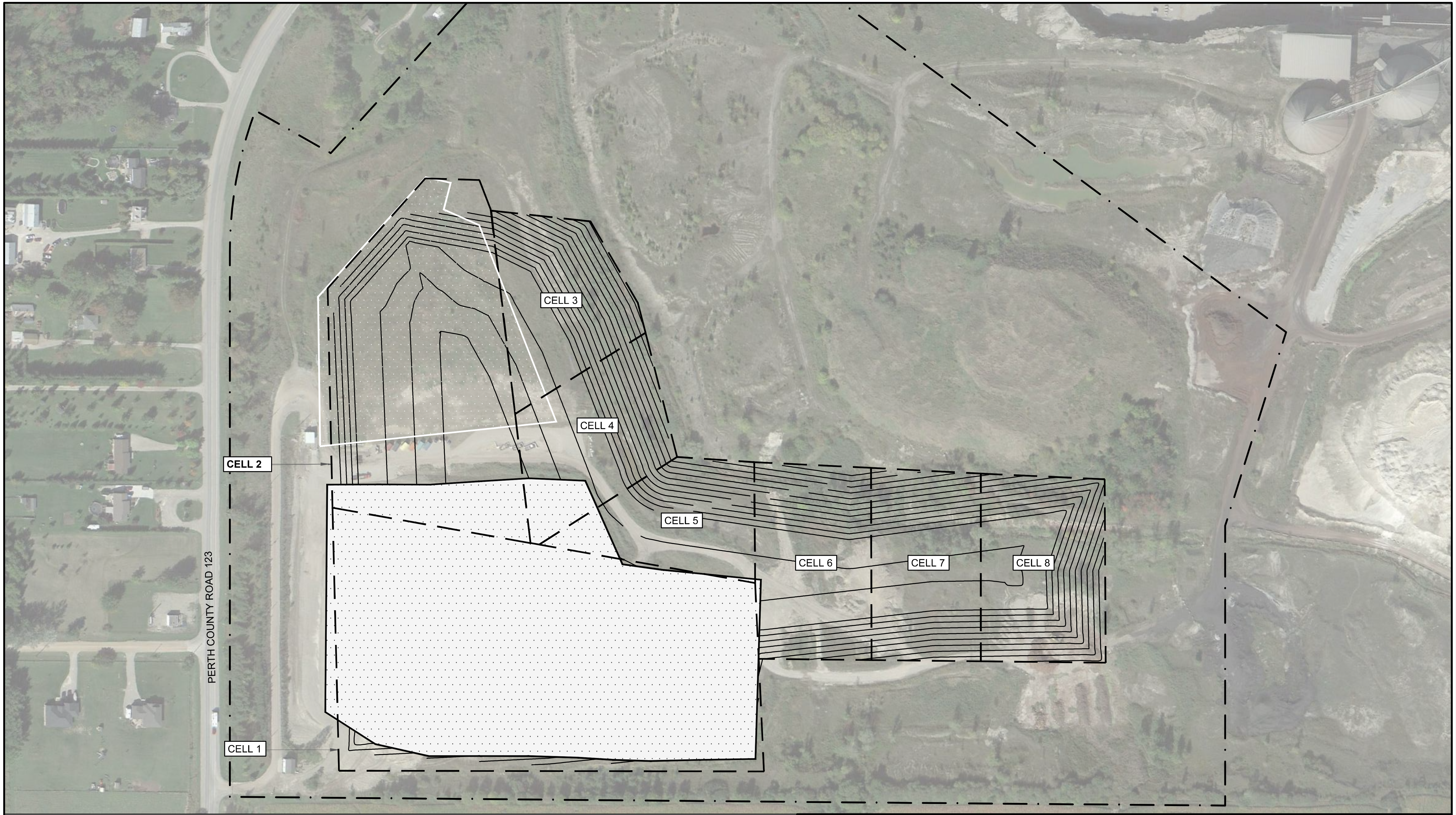
8.1 High Level Design Concept

Historically, the eight cells for Phase II/III of the landfill have had an average lifespan of 1.5 to 3 years each. The construction of the cells comprising the proposed expansion will involve horizonal and vertical cells constructed. The vertical expansion will take place above the existing Phase I and Phase II/III areas. The method efficiently uses the existing landfill footprint, as it fills the site through vertical expansion over the already existing phases, including filling in the area between the existing phases. This vertical expansion allows for the use of existing leachate collection systems (as there will be minimal impact on the volume of leachate due to horizontal expansion), minimizing the proposed footprint resulting from the horizontal expansion. After vertical expansion of the existing cells, newly constructed horizontal cells would be added, starting at the existing landfill and extending eastward. Ultimately, this expansion is estimated to add 3.6 ha of additional footprint area to the landfill site.

8.1.1 Project Phasing

Following the identification of the preferred method (Alternative Method 3), a phasing sequence has been developed. The described cell sequencing is what is currently anticipated to occur for the landfill expansion, though the final landfill design and operational considerations will dictate the final cell staging and sequencing. Determining the cell development and filling sequence is an effort that will ultimately be completed as part of the Environmental Protection Act approval process.

For the Method 3 (preferred) conceptual design we have developed a cell operating sequencing shown on Figure 8-1. The sequence assumes the first two cells will be constructed over Phase II/III and Phase I. Following this, six more cells will be constructed horizontally from the existing footprint, eastward in direction, to minimize the initial infrastructure development. To build these latter six cells, the existing watercourse through the site will need to be relocated, and a newly constructed perimeter roads and stormwater management facilities will be needed. These are discussed in more detail below.



NOTES:

EXPANSION VOLUME IS ATTAINED FROM A 4:1 SIDESLOPE FROM THE EDGE OF THE WASTE TO ELEVATION OF 323m, FOLLOWED BY A 20:1 SLOPE ON THE PEAK. COMBINED WITH A 5m VERTICAL EXCAVATION (CKD PILE EXCLUDED).

MINIMUM MECP SETBACK FROM PROPERTY BOUNDARY = 30 m, GUIDELINE SETBACK = 100 m

THE PROPOSED EXPANSION SEQUENCE DESCRIBED ON THIS FIGURE REPRESENTS ONLY ONE POTENTIAL DESIGN FOR THE LANDFILL EXPANSION. THE ACTUAL DESIGN AND SEQUENCE OF FILLING CHANGE DURING THE *ENVIRONMENTAL PROTECTION ACT (EPA) REGULATED DESIGN PROCESS.*

LEGEND:

▨	EXISTING PHASE 2/3 LANDFILL AREA
■	EXISTING PHASE 1 LANDFILL AREA
☐	METHOD 3 PROPOSED CELL BOUNDARIES
☐	LANDFILL PROPERTY LIMIT

OBTAINED CAPACITY - 756,000 m³
ABOVE GRADE - 506,000 m³
BELOW GRADE- 250,000 m³

BURNSIDE

Client

TOWN OF ST. MARYS

Figure Title

ST. MARYS LANDFILL

PROPOSED UNDERTAKING

Drawn ZM	Checked JRH	Date JUNE 2021	Figure No. 8-1
Scale 1:2500		Project No. 300032339	

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The phasing sequence and size of cells have been chosen to:

- Minimize the visibility of landfill operations from the landfill to its surroundings;
- Allow for the construction of subsequent cells including Landfill liners;
- Allow for progressive application of final cover;
- Allow for the construction of on-site access roads; and
- Optimize on-site traffic.

Site preparation work will involve removing excavation and grading of the horizontal expansion footprint. The excavated soils will be temporarily stockpiled for use during operation of the expansion area. Some of these soils may be used as operational and closure cover for the existing waste footprint.

It is expected that each cell will provide approximately 5 years of disposal capacity (eight cells, each at 5-years capacity, equals the 40-year EA Planning Period). The conceptual sequencing of cells, shown on Figure 8-1, is not intended to constrain the final sequencing (or cell sizes/lifespans) developed for the Environmental Protection Act approval process. The landfill design will be further considered during the ECA application process to determine if modification to the phasing sequence is required to aid site operations, further limit visibility from the surrounding properties or address other nuisance effects.

A characterization of the future and existing transportation conditions was completed in support of this EA. The assessment is documented in the Transportation Impact Study (TIS) Report, provided in Volume III, Appendix H of this EA Report. In general, though, existing waste deliveries are expected to continue, so current truck volumes will continue.

8.2 Existing Site Facilities

Much of the site infrastructure already exists under the current approval. This includes the site entrance, weigh scale, scale house, internal access roads, public drop-off facility and buffer areas. Existing site facilities may or may not need to be relocated as part of the development of the expansion. Initially, there is no requirement to relocate the existing public drop-off and MHSW depot situated between Phase I and Phase II/III. The depot will need to be moved before Cell 2 begins operation. We note that the Town may upgrade the depot area for more efficient operation without seeking an EA amendment.

Facilities such as the scale and scale house, and even the site entrance from Water Street South/Perth Road 123, may be relocated to improve site operations. Such site revisions may or may not occur in-step with a specific cell development – they could occur at any time during the EA Planning Period (expansion site life).

8.3 Leachate Collection System

The landfill expansion will include the use of the site's native clays as the liner system, consistent with the Phase I and Phase II/III design. This non-permeable lining has been found by the Study Team to be sufficient in limiting, if not entirely stopping, the flow of leachate from leaving the landfill cell and entering groundwater.

In addition to the native liner beneath the proposed expansion site, there will also be a leachate collection system designed. Based on the Phase II/III site design, an associated underlying leachate collection pipe network would be installed in compliance with O. Reg. 232/98, as well as other Ministry requirements such as the Ontario Water Resources Act, for the expanded site to prevent contamination to the surrounding environment. The inclusion of this system requires that proposed landfill cells be graded to maintain leachate flow to areas allowing for its removal.

Additionally, the base of each expansion cell must be graded to provide a slope towards the leachate collection pipes. This will direct leachate toward the collection pipes to minimize the leachate head on the liner.

Direct vertical expansion over the existing landfill cells will utilize the existing landfill liner and collection system present, to minimize the environmental impacts of construction. A few of the existing leachate collection system maintenance holes, particularly between Phase I and Phase II/III and along the northeastern perimeter of Phase II/III, will need to be extended vertically, so that access can be maintained as disposal (filling) progresses.

8.3.1 Leachate Disposal

The site's existing leachate system drains into the Town's sewer system. This will continue upon expansion of the site. Burnside prepared the *Leachate Treatment and Disposal Report* (Appendix I) to consider the volumetric quantity and chemical quality (leachate strength) of leachate that will be generated by the expansion of the St. Marys Landfill Site. The assessment considers how leachate from the expanded site may impact the Town's sewer system and wastewater treatment plant.

Based on the leachate assessment, the preferred leachate disposal solution is for St. Marys WWTP to continue receiving the leachate from the Site. Parts of the sewer collection system might require capacity upgrades after Cell 1 and Cell 2 are filled and closed. It is during construction and operation of Cell 3 where the leachate flow increase is expected to begin. Any leachate collection system upgrades would be determined during detailed design for site expansion.

It is noted that the St. Marys landfill may also be used to temporarily store leachate within the prepared base of the landfill. Several days of leachate volume could be stored in this manner without compromising the landfill liner or having leachate seeps. With proper design and operating plans developed during the EPA approval stage, temporary storage in the landfill base could be used during periods of particularly high flows to reduce the quantity of leachate being sent to the St. Marys WWTP. In turn, this would provide the sewer or the WWTP some time to alleviate a temporary over capacity condition.

The Town of St. Marys owns and operates both the landfill and the WWTP. This provides them with an ongoing understanding of both facilities, as well as knowledge of planned upgrades or overall needs. With this knowledge, it is expected that the Town will make improvements to the WWTP as may be required to allow future landfill leachate flows (quality or quantity). Although unexpected, should the St. Marys WWTP prove incapable of handling the landfill leachate, it will be necessary to handle the wastewater using another approach. In that case, the following procedure would be followed:

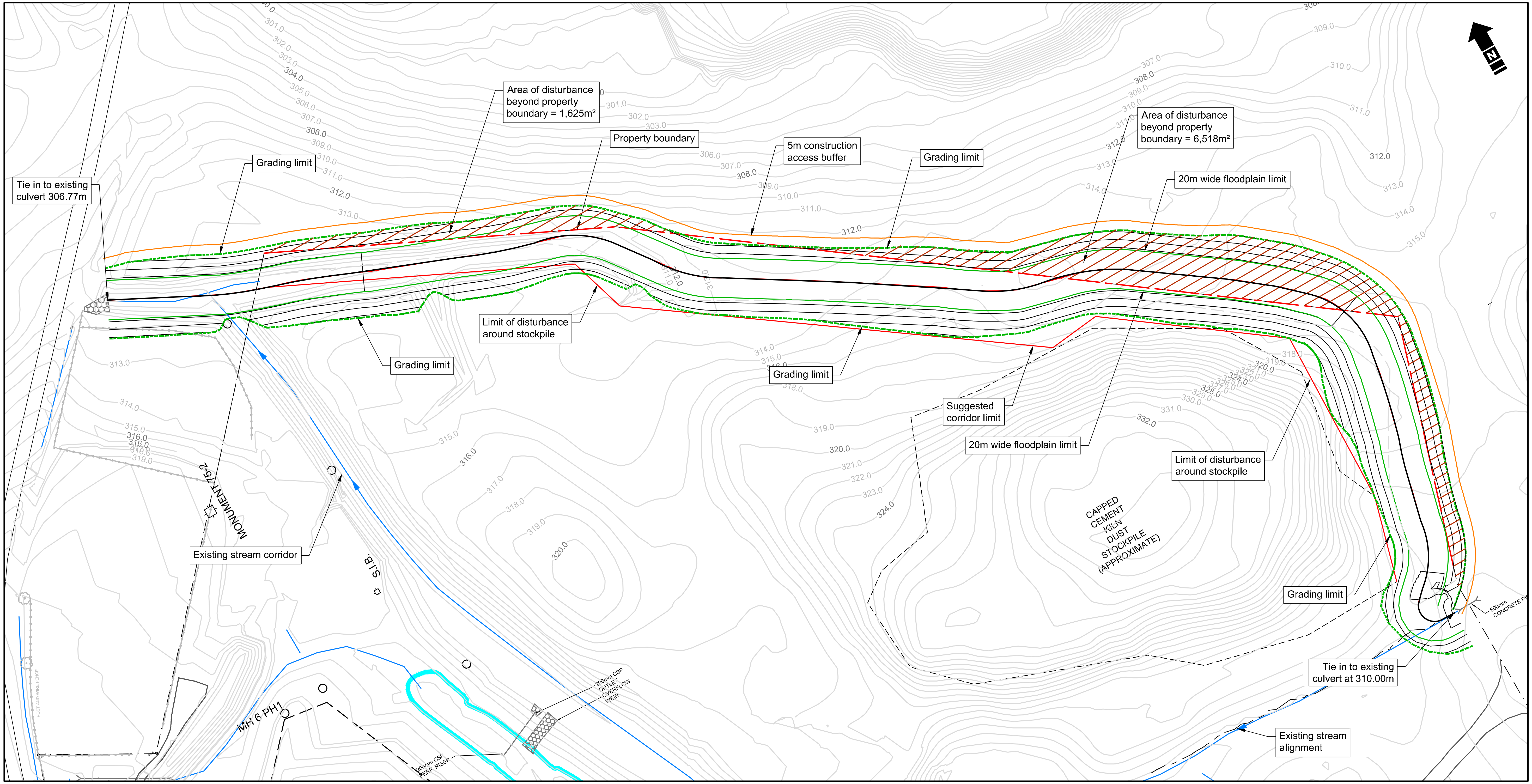
- MECP would be notified that, under the unanticipated circumstances, the St. Marys WWTP is not able to handle the Landfill leachate.
- Other options would be considered, including the on-site wastewater treatment and discharge, trucking the leachate to other neighboring wastewater treatment plants that might be suitable, such as London, Mitchell and Stratford, and any possible additional options available at that time would be identified and evaluated.
- An ECA application would be filed for the updated approach, as required.

8.4 Watercourse Relocation

The existing watercourse runs through the area to be used for the expanded waste footprint. It must therefore be relocated (realigned) so that the preferred expansion option (Method 3) can be implemented. Due to the CKD Pile, the watercourse will be realigned to flow north from where it currently enters the site at the east property line. The watercourse will then flow westward along the site’s north property line until it meets-up with the existing watercourse where it exits the site (northwest corner of the site). The relocation of this watercourse is discussed in the Hydrogeology Study, included as Volume III, Appendix C of this EA Report. The proposed alignment is shown on Figure 8-2.

Plot 1:1 = Tabloid (L)

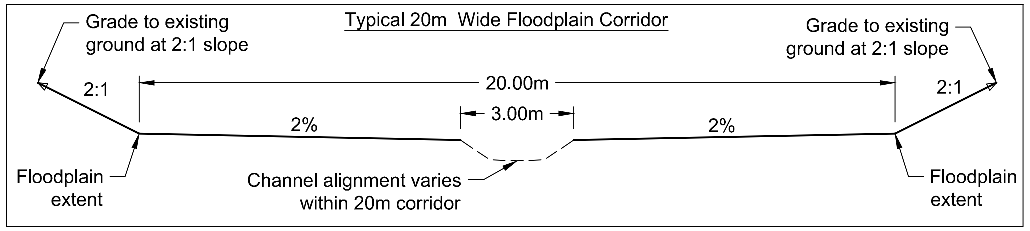
N:\PROJECTS\01-14-41 RJ Burnside - St. Mary's Landfill\03 Data\Matrix CAD\140935-21680-522_01-14-2016 expanded.dwg - Corridor Grading Plan - Friday, January 15, 2016 2:50:30 PM - Eric Drost



▬ ▬	Property Limit
▬	Suggested corridor limit
▪▪▪▪	Proposed corridor grading limit
▬	Proposed corridor floodplain limit
▨	Disturbance beyond town property
▬	5m Construction buffer

Total cut volume = 108,032m³

Notes:
1. Base mapping provided by others.
2. Tie in elevations based on Survey completed by Matrix Solutions Inc. in May 2015.


Typical 20m Wide Floodplain Corridor

1:2000 Meters
20 0 20 40
Datum

Reference:

REVISION					
00	01-14-2016	Draft for client review	ESD	CC	ESD
No.	DATE	DESCRIPTION	BY	CHK.	DRN.

PARISH aquatic services
A Division of Matrix Solutions Inc.

R.J. Burnside and Associates
St. Marys Landfill

St. Marys Municipal Landfill Stream Realignment Corridor

Date:	Project:	Technical:	Reviewer:	Drawn:
14 01 2016		E. Drost/D. Relyea	C. Cummings	E. Drost

01

The watercourse realignment associated with the Undertaking will require compliance with the Fisheries Act, administered by the Department of Fisheries and Oceans Canada (DFO). The Undertaking was preliminarily screened to determine if the proposed works would require an assessment by the DFO prior to conducting the works. Since the watercourse is connected to a watercourse that provides habitat to a variety of fish species and several aquatic SAR, the proposed works must be submitted to the DFO under the request for project review process. During the detailed design phase, a request for project review will be required to be submitted to the DFO for review and approval of the proposed works and realignment.

During the final channel design, monitoring wells can be installed between the CKD stockpile and the watercourse channel to assess the presence of groundwater and the groundwater quality. Little impact is expected if the boreholes encounter the glacial till. If necessary, the design can incorporate additional measures to protect against groundwater impacts on the realigned watercourse. Potential mitigation measures include:

1. Channel Design:

    a) Prior to channel design and construction, an investigation will be completed within the grading limits. This will determine soil adjacent to and below the watercourse and if there is any CKD or other material that must be relocated.

    b) Groundwater monitoring wells can be installed between the CKD and the watercourse channel to measure groundwater quality adjacent to the watercourse. This will determine if further mitigation measures are needed. These may be temporarily added to the Site’s monitoring program to confirm the watercourse design is operating as expected.

2. Stormwater Runoff and Sediment:

    a) Any area between the CKD and the new watercourse disturbed during construction must be stabilized and vegetated to prevent sediment from entering the watercourse.

    b) No further surface disturbance can take place on the CKD stockpile. This is to prevent exposure of the CKD or creation of erosion channels.

    c) If stabilization and vegetation is not sufficient along specific sections of the proposed watercourse, shallow stormwater ditches or drains can be incorporated into the watercourse construction to divert runoff to a stormwater basin. The basin will allow for sediment settlement and if needed, water quality testing prior to release to the watercourse.

3. Groundwater Discharge to Watercourse:

    a) A collection drain can be constructed where warranted between the CKD stockpile and the watercourse to prevent groundwater discharge from entering the watercourse. This is not necessary if the watercourse is constructed in the glacial till as it will act as a natural barrier.

    b) Improvements to the CKD stockpile cover can be considered to reduce precipitation infiltration. This in turn will reduce the head level within the CKD and therefore the driving force for (CKD contaminated) discharge into the watercourse.

The proposed mitigation measures are expected to produce a neutral net effect for the watercourse. The existing watercourse is not being impacted by the landfill or CKD stockpile under current conditions. Moving the watercourse away from the landfill eliminates future impacts. Mitigation measures, where warranted around the CKD stockpile, will control future impacts.

As for the timing of these efforts, it is expected that the realignment will occur during the operation of Cell 2, though work could begin immediately following receipt of appropriate approvals. This provides some time for completion of the realignment and construction of the base of Cell 3.

8.5 Stormwater Management

On the current St. Marys Landfill site, there are two stormwater management basins present, referred to as Basin A and Basin B. These basins are responsible for collecting runoff from the site, as well as controlling sediment before releasing the stormwater into the onsite watercourse. Basin A is located east of Phase I and Basin B is found northeast of Phase II/III. The existing ponds were designed to control runoff from the entire landfill property.

Basins A and B can remain in place and operational during the filling of Cell 1 (above Phase II/III) and Cell 2 (above Phase I). Basin A will need to be replaced when construction of the Cell 3 area begins. This will involve developing a perimeter ditch that leads to a new stormwater management pond. Basin B will be incorporated into the base of Cell 4 (or perhaps, Cell 5). Perimeter ditches currently draining into Basin B will be replaced such that they flow into the new stormwater management pond. Ultimately, a perimeter ditch system will surround the entire waste footprint, capturing and controlling runoff from the site. The perimeter ditches and the pond will control contaminants and sediments from the waste footprint before they are discharged into the site’s watercourse.

If appropriate, a parallel ditch system may be added to prevent surface water flows that originate outside the waste footprint from entering the above noted stormwater system. In this way, clean surface water from outside the waste footprint will not be added to the stormwater management pond. This will minimize the size required for the pond as well as minimize the likelihood of diluting potential landfill contaminants detected in the pond.

The perimeter of the site provides at least 30 m from the waste footprint to the nearest property line. This area is more than adequate to accommodate the perimeter ditches and access road (see below). There will remain room to make the ditches larger if required to address larger than anticipated storm events, possible due to climate change.

8.6 Groundwater Monitoring

During the various stages of cell construction for Alternative 3, the following eight wells, shown on Figure 8-3 and Figure 8-4, are expected to require decommissioning:

Table 8-1: Groundwater Monitoring Wells to be Decommissioned

Overburden	OW3-84, OW4-84, OW5-84, OW6-84, OW8B-10 and OW36
Bedrock	OW7-91 and OW8A-91

The interpreted overburden groundwater flow direction is shown on Figure 8-3; the interpreted bedrock flow direction is shown on Figure 8-4. The six areas for future monitoring well construction is discussed below.

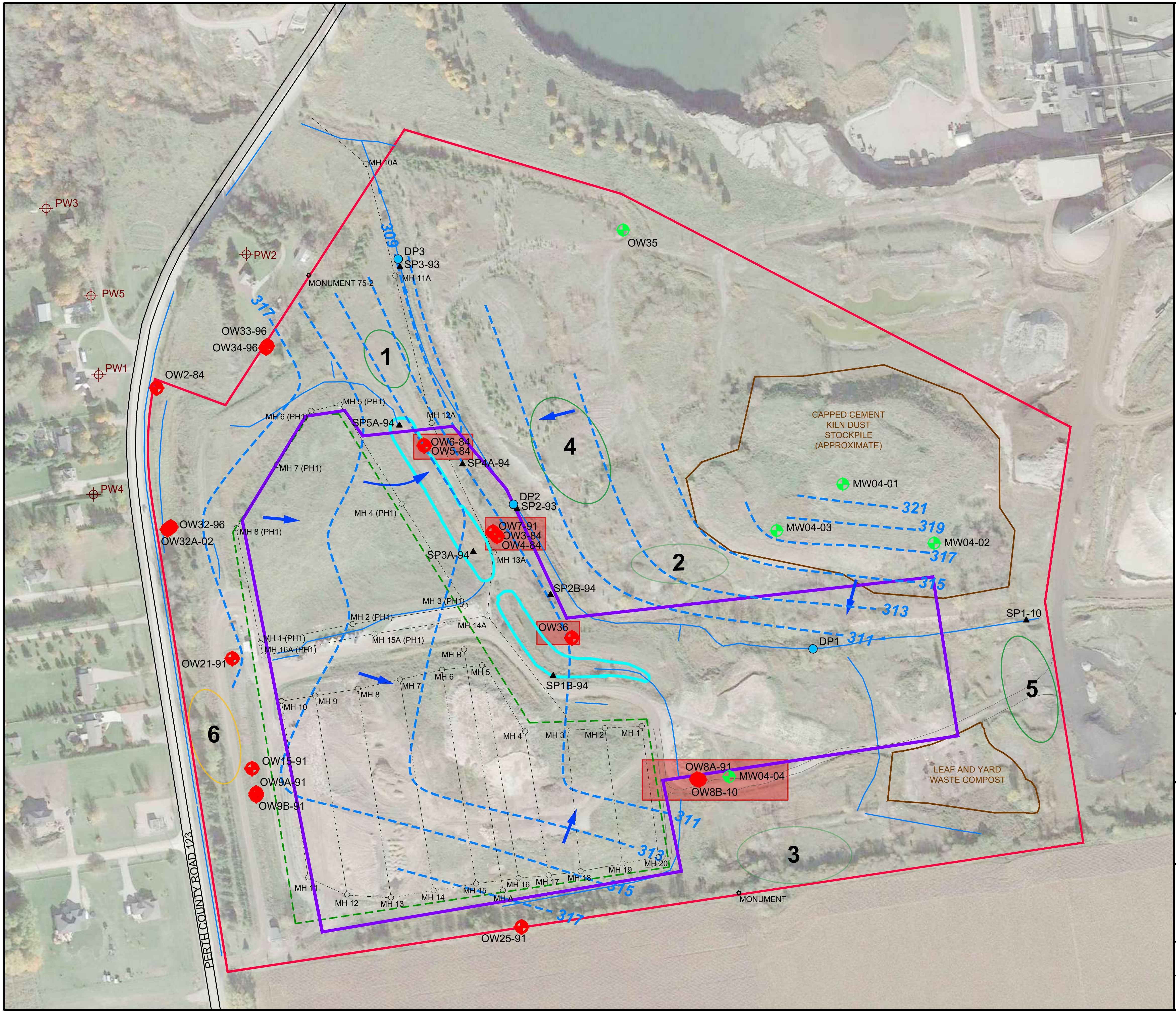
8.6.1 Shallow Water Table Wells

Figure 8-3**,** Areas 1, 2 and 3 are recommended for the installation of shallow water table wells. The depth of these wells will vary depending on the water bearing zone found at the time of drilling. The purpose of these wells is to provide water level data for determining groundwater contours and flow direction at the site. They will also provide cross-gradient and/or downgradient groundwater quality data for identifying any leachate migration.

8.6.2 Overburden and Bedrock Well Nests

Two locations, Areas 4 and 5 on Figure 8-3 and Figure 8-4, are recommended for the installation of a monitoring well nest. Each nest should consist of, at minimum, a shallow water table well and a bedrock well. In addition, any permeable water-bearing seams (inter-till deposit) encountered should be screened with a monitoring well. The purpose of the bedrock wells is to provide an upgradient well and cross-gradient well for groundwater flow mapping and water quality sampling. The overburden wells will also provide additional data for flow mapping, as well as cross-gradient or downgradient water quality data.

At this time, the four wells located just west of the existing footprint (OW9A-91, OW9B-91, OW15-91 and OW21-91) are not expected to be removed during Alternative 3 construction. However, if these wells must be removed, the sixth area shown on Figure 8-3 and Figure 8-4 is recommended for a replacement well nest. Just like Areas 4 and 5, each nest should consist of a shallow water table well, a bedrock well and a well installed in any permeable water-bearing seams (inter-till deposit) encountered during drilling.



LEGEND

▬	PROPERTY BOUNDARY
- - -	LIMIT OF REFUSE DISPOSAL
▬	WATERCOURSE
— — —	LEACHATE COLLECTION SYSTEM
▬	STORM WATER MANAGEMENT BASIN
⊕	LANDFILL OBSERVATION WELL
⊕	EA MONITORING WELL
⌖	PRIVATE DOMESTIC WELL (APPROXIMATE LOCATION)
▲	SURFACE WATER MONITORING LOCATION
●	DRIVE POINT PIEZOMETER
▭	ALTERNATIVE 3 FOOTPRINT
- - -	INTERPRETED GROUNDWATER CONTOUR - masl (Based on April 2017 water levels in overburden wells)
←	INTERPRETED GROUNDWATER FLOW DIRECTION
🟥	EXISTING MONITORING WELLS TO BE DECOMMISSIONED
◯	PROPOSED AREA FOR FUTURE MONITORING WELLS
◯	PROPOSED AREA FOR FUTURE MONITORING WELLS (IF REQUIRED)

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BURNSIDE

Client / Report
TOWN OF ST. MARYS

ENVIRONMENTAL ASSESSMENT

Figure Title
PROPOSED AREAS FOR NEW OVERBURDEN MONITORING WELLS

Drawn	Checked	Date	Figure No.
SK	CF	June 2021	8-3
Scale		Project No.	
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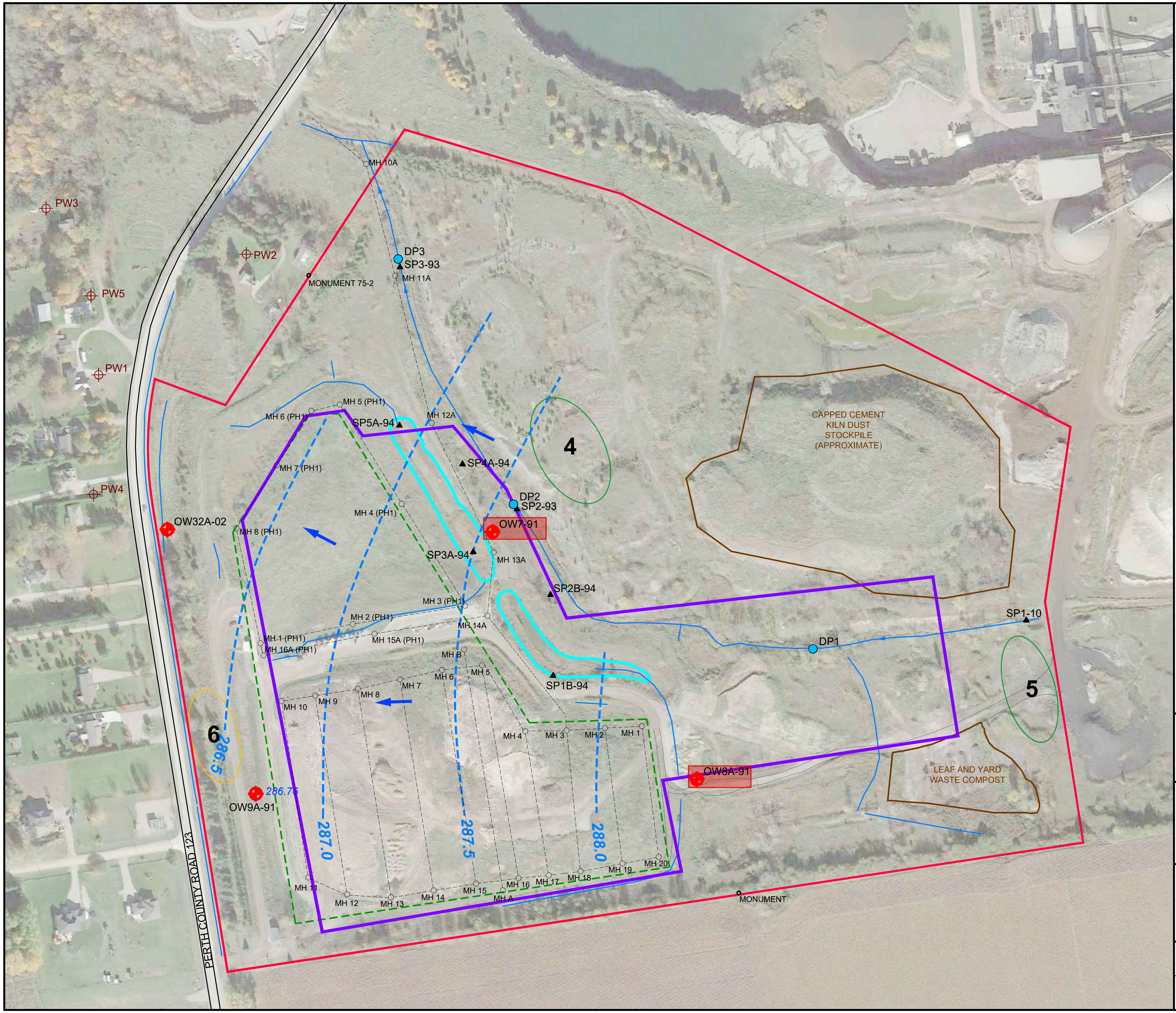

LEGEND

▬	PROPERTY BOUNDARY
- - -	LIMIT OF REFUSE DISPOSAL
─	WATERCOURSE
— — —	LEACHATE COLLECTION SYSTEM
▬	STORM WATER MANAGEMENT BASIN
●	LANDFILL OBSERVATION WELL
⌖	PRIVATE DOMESTIC WELL (APPROXIMATE LOCATION)
▲	SURFACE WATER MONITORING LOCATION
●	DRIVE POINT PIEZOMETER
▭	ALTERNATIVE 3 FOOTPRINT
- - -	INTERPRETED GROUNDWATER CONTOUR - masl (Based on April 2017 water levels in bedrock wells)
←	INTERPRETED GROUNDWATER FLOW DIRECTION
🟥	EXISTING MONITORING WELLS TO BE DECOMMISSIONED
○	PROPOSED AREA FOR FUTURE MONITORING WELLS
○	PROPOSED AREA FOR FUTURE MONITORING WELLS (IF REQUIRED)

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BURNSIDE

Client / Report
TOWN OF ST. MARYS

ENVIRONMENTAL ASSESSMENT

Figure Title
PROPOSED AREAS FOR NEW BEDROCK MONITORING WELLS

Drawn	Checked	Date	Figure No.
SK	CF	June 2021	8-4
Scale		Project No.	
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File Name: Elmo/gis/Projects/300/032339 St Marys/032339 EA 2020 HG Study Appendix 1.dwg Date Plotted: June 14, 2021 - 3:38 PM

8.6.3 Cement Kiln Dust (CKD) Stockpile Wells

It is also recommended that the monitoring wells previously installed in the CKD Stockpile (MW04-01, MW04-02 and MW04-03) be maintained and water level measurements collected for determining groundwater contours and flow direction at the site. Periodic sampling of these wells (i.e., once every 3 years) could be considered, though if sampling results remain relatively stable or are predictable, such monitoring can be discontinued.

8.7 Perimeter Access/Maintenance Road

A perimeter access/maintenance road will parallel the perimeter ditches. This road may be used for disposal vehicles accessing Cells 3 to 8, so some sections of the perimeter road may need to be two-lanes wide.

It is expected that the perimeter road will be made with gravel and/or a combination of recovered material like crushed concrete, crushed glass, and asphalt grindings. It is also possible that other recovered materials, like chipped or ground tires, could be used. The Town may also decide to pave some or all of the perimeter road to minimize dust or maintenance requirements.

During operations, the access road leading to the current tipping face may need to be moved or extended periodically. This road too may be gravel or recovered materials. When no longer required, the road material may be removed by the Town and stockpiled or used to build a new road.

The Town will maintain these roads to minimize ruts, potholes, and dust. Water or special surface treatments may be used to limit dust, though the Town must be aware of the potential to impact surface water or the groundwater if too much or the incorrect treatments are used. In winter, site roads required for access will be plowed. Use of salt or salt brine will be avoided as chloride is a primary indicator of landfill contamination; sand (without salt) is frequently used instead. Further, the Town will continue enforcing the site speed limit (20 km/h) to minimize dust and noise while promoting site safety.

8.8 Waste Pile Slopes

Maximum and minimum slopes for the landfill will be as required by O. Reg. 232/98, namely 25% (4 m horizontal run for every 1 m of rise, or 4:1) and 5% (20:1). These slopes will be developed to minimize the chance for climate change related impacts of slope failure and will also minimize cover erosion while promoting surface drainage.

Slopes for working face (tipping area) and areas awaiting further fill will be similarly arranged with a maximum of 33% (3:1) and a minimum of 5% (20:1) slopes. The maximum slope would be reduced if filling is not expected to continue for several months.

In the expansion of the landfill, cells will be created utilizing maximum slopes at the perimeter of the waste fill area. These maximum slopes account for the safety and protecting the landfill works, workers and members of the public at the site. Slopes that are too steep (i.e., steeper than 3:1) often have stability issues and can fail in a landslide-like manner.

The maximum slopes selected for the expansion are expected to minimize the change for cover erosion and account for climate change considerations. In this regard:

- Erosion often occurs where slopes converge, draining large areas into a small swale-like channel. Erosion can provide a preferential pathway for surface water infiltration into the waste, creating additional leachate.
- With respect to climate change, it is anticipated that trends of dry weather followed by intense rainfalls will occur. If slopes are too steep, the dramatic change in the drying and then wetting of the slope can result in slope stability issues and cover erosion. These are not anticipated to be a concern with short-term slopes filled to 3:1. Similarly, slopes filled to a maximum of 4:1 are expected to remain stable, with good protection from erosion, through any wet/dry cycles that may occur.

As above, the minimum slope values account for surface water control. Maintaining a minimum 20:1 slope ensures that drainage will continue across the surface, even as the site experiences differential settlement due to waste degradation and compression. This minimum slope is important for controlling leachate production; it helps keep rainwater or snow melt from infiltrating the cover and becoming leachate.

8.9 Site Buffer

Stated within Section 7.0 of O. Reg. 232/98, the MECP specifies the buffer area surrounding the landfill site must be at least 100 m wide at every point, except under conditions in which the buffer area is at least 30 m wide yet allows adequate space for vehicle usage, operations and activities which ensure there is no operation negatively impacting areas outside of this buffer zone.

For the preferred expansion alternative, we have assumed the following buffer widths:

North: The limit of fill matches approximately the northern limit of the existing Phase I waste footprint, which is 30 m or more. There is no additional encroachment upon the existing buffer as a result. This will be adequate to install the perimeter road and ditch as well as upgrade the existing leachate collection system (if required). Further, should the ditch need additional capacity to address future climate change related flows, there remains room to widen or deepen (or both) the ditch.

East: A minimum of 60 m setback is provided to the east. This is more than adequate to provide space for the required perimeter facilities. As the adjacent land is used by St. Marys Cement and is licensed for aggregate extraction, this buffer distance is sufficient to prevent impacts on future use of the adjacent land.

South: The existing Phase II/III footprint approximately 30 m from the southern property line. This is sufficient for the perimeter road and ditches as well as any necessary upgrades to the existing leachate collection system or to address climate change related surface water flows. New areas of the waste footprint have been set-back 60 m in the concept plan to provide space for the future location of the leaf and yard waste composting area as well as the ditch and road perimeter features. This may be adjusted down to just 30 m by the final (Environmental Protection Act) design to minimize the overall waste footprint. Doing so would likely result in additional buffer area to the east.

West: The 60 m wide existing buffer between the property line and the Phase I and Phase II/III footprints will remain. As with the other buffer dimensions, this provides sufficient space for perimeter facilities as well as the existing site access road, scale, and scale house.

In all directions, and at all points, the buffer meets or exceeds the parameters outlined in Section 7.0 of O.Reg. 232/98. It is noted however that these may be refined further during the *Environmental Protection Act* approval process.

8.10 Life Cycle

The entirety of the lifecycle for the expansion will follow all required regulations, including O. Reg. 232/98 *Landfilling Sites* made under Part V of the *Environmental Protection Act*, which details the lifecycle requirements (including design and post-closure care) of municipal, non-hazardous, waste landfilling sites. In addition, the development and maintenance of the proposed alterative will also follow the 2012 MECP guideline document, *Landfill Standards: A guideline on the regulatory and approval requirements for new/expanding land*.

These regulations ensure the expansion will be designed prioritizing surface water and groundwater protection, protection to the surrounding environment from site operations and creation of a site closure/post-closure care program. In addition, under these regulations, a design report is required to address:

- Site boundaries and buffer areas;
- Waste contours and slopes;
- Surface water and stormwater control works;
- On-site roads and structures;
- Design of leachate collection systems;
- Monitoring facilities; and
- Contingency planning for leachate.

An Annual Operations Report is required as a condition within the Site's ECA. These reports provide information that outlines the sites development, monitoring, capacity usage, phase progression and other operational concerns. These will continue to be completed throughout the implementation and operation of the expansion, ensuring protection to the surrounding environment.

The undertaking lifecycle is as follows:

a) Environmental Protection Act (and other approvals) Design (Approximately One Year):

   The site's detailed design will be refined from the conceptual design contained within this EA Report. Operations are expected to continue atop Phase II/III (i.e., in Cell 1, during the development of this detailed design).

b) Construction (Approximately ½ Year, estimated to commence January 1, 2022):

   Construction of the proposed expansion will occur with the vertical portion including the existing landfill cells, and between the different sites to further reduce the proposed footprint. Horizontal expansion will occur to the east of the Phase II/III site. All construction will involve mitigation measures (i.e., maximum and minimum slopes) to improve structural stability. The entirety of the cells' lifecycle, including post-closure, will follow all applicable regulations, such as O. Reg. 232/98.

c) Operation (During the remaining 40-year planning period, until December 31, 2056):

The site will continue to operate as it has historically. There are no proposed changes to site services, or the types of wastes accepted. Cell 1 will be built upon the Phase II/III footprint. Cell 2 will be built above Phase I and will fill-in the valley between Phase II/III and Phase I. Cells 3 through 8 will start at the north end of the waste footprint and extend east from the existing waste (Cells 1 and 2). The cells are expected to have a lifespan of approximately 5-years. As cells are filled, the subsequent cell will be under construction. Once full, the cell will be covered and the subsequent cell will begin accepting waste.

The cells will have operational cover applied to mitigate the effects on wildlife, controlling litter and odour and facilitating vehicular access to the tipping face.

During the operational phase (EA Planning Period), maintenance and monitoring of the site will be undertaken. This includes maintenance on the leachate collection system and the surface water management system. There will be regular inspections of the site, including frequent observation of site conditions by staff which may lead to efforts such as blown litter collection, repair of erosion area, and removal of excess vegetation in ditches. A monitoring report (typically annual or some other approved frequency, such as every third year) will be compiled to discuss site operations and monitoring, particularly:

- Environmental performance of the site based on groundwater, surface water and landfill gas monitoring.
- Operational performance, such as volume of disposal capacity consumed verses mass of waste received and overall diversion (disposal avoidance) rates for the Town.

All of this is typically required as part of an Environmental Compliance Approval issued by the MECP.

d) Closure and Post-Closure Care (modelled as 50 years after landfill closure; however, the actual duration will be determined through monitoring results):

Closure of the landfill involves covering of the cells as they are filled. A progressive closure of the site is envisioned where final cover is placed on any area of the site that has reached final contours and is not expected to be extended when a subsequent cell is filled. Essentially, the exterior perimeter of the cells will receive final cover while interior areas will receive an interim cover that can be removed before additional waste placement occurs. Only when the final cell is complete will the closure cover be completed. As the site is closed, surrounding areas will be revegetated with native species to the land.

As with the operational period, an annual (or longer period) monitoring report will be required for the site during the post-closure period (estimated to be 50-years in this EA Report). During this time, the Town will need to maintain the site's surface water and leachate facilities, plus inspect and repair areas of settlement, erosion, or leachate seeps.

8.11 Potential Contingency Facilities

The Environmental Protection Act design for the site will include a list of contingency measures that may be required for the site. The design will also indicate the conditions when such contingencies must be implements. These might include noise barriers, leachate purge wells and groundwater cut-off wells. Other contingencies already discussed above include upgrading site roads with pavement and increasing the capacity of site ditches and the stormwater management pond(s).

9.0 Potential Impacts, Mitigation Measures, and Net Effects

Construction, operation and decommissioning of the landfill expansion are expected to result in a number of impacts to the natural, cultural, social and built environments.

Potential impact resulting from the *Undertaking*, mitigation measures and net effects are identified in Table 9-1.

Monitoring requirements and contingency measures have also been identified to ensure that:

- Predicted net effects are not exceeded;
- Unexpected negative effects are addressed; and
- Predicted mitigation effects are realized.

Table 9-1: Impacts, Mitigation, Net Effects, and Monitoring Requirements

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Natural Environment					
Air Quality and Odour	• Changes to emissions of methane, NMOCs, dust and particulates and odour relative to regulated limits as a result of construction, operation and decommissioning activities.	• Emissions of methane and NMOCs are not expected to increase significantly.	• Odour will be re-evaluated and modeled based on detailed design plans during preparation of the ECA application. • Operational Best Management Practices will continue to be practiced.	• No monitoring required.	• No net effects anticipated.
		• There is potential for increased dust emission due to construction vehicle traffic during construction of new landfill cell areas as well as decommissioning activities.	• During construction, the following mitigation measures shall be used: – The roads shall be graded as required to remove potholes, ruts and ripples in the road surface. Efforts to prevent contamination of the road surface, such as spilling sands, silts and clays, will also help to minimize dust. – The roadway shall be sprayed with water as required to minimize dust generation. • An Environmental Management Plan (EMP) that specifically addresses dust controls, and contingency plans will be prepared before construction to mitigate dust when it occurs.	• The construction contractor shall visually inspect the road and implement dust mitigation measures where required. • A qualified Environmental Inspector shall regularly monitor construction activities to confirm the requirements outlined in the EMP are being followed. • Inspections and monitoring efforts will be recorded in a log book or similar manner. • An updated Complaint-Response Protocol will be developed.	• No net effects anticipated.
		• There is potential for increased dust emission due to vehicle traffic during operations.	• Operational dust and odour would continue to be monitored and mitigated to the extent possible. Operation setbacks and adjustments to operating plans (relocate portable litter fencing, cease operations temporarily, water access roads, etc.) could be made depending on prevailing weather conditions, material processing activities and visual aesthetics. • All internal site roads would be wetted and/or treated with approved dust suppressants when necessary. • This site would be managed to avoid potential odour-producing materials and/or operating conditions. Cover material would be applied to the waste to reduce odours. Should odour problems develop, consideration would be given to temporarily suspend or revising operating procedures or adding additional cover in problem areas. Should odour problems continue for several working days, the responsible operations would be suspended until the problem can be addressed.	• Ongoing monitoring and mitigation of operational dust and odour. • An updated Complaint-Response Protocol will be developed. • Complaints will be reported in the Annual Landfill Monitoring Reports.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Noise	• Changes in noise levels as a result of construction activities.	• There is potential for increased noise through the use of large equipment for construction of the expansion area.	• Construction equipment shall be well maintained. The number of hours that the equipment is in use shall be limited and will adhere the Town's Noise By-law. The noise produced by the equipment can be limited through proper equipment maintenance. All construction activities shall conform to the criteria set out in Noise Pollution Control (NPC) 115 of 83 dB. • An EMP will be developed prior to construction that specifically addresses noise controls, mitigation to be implemented and frequency of equipment inspection.	• A Qualified Environmental Inspector shall regularly monitor construction activities to confirm the requirements outlined in the EMP are being followed. • Inspections and monitoring efforts will be recorded in a log book or similar manner. • An updated Complaint-Response Protocol will be developed.	• No net effects anticipated.
	• Changes in noise levels as a result of operational activities.		• Operational noise levels would continue to be monitored and mitigated to the extent possible. Operation setbacks and adjustments to operating plans (relocate equipment, cease operations temporarily, etc.) could be made depending on prevailing weather conditions and material processing activities. • The municipality and its operators would continue to ensure that heavy equipment would be operated respecting noise emissions, operator safety, cost-effective performance, etc.	• Ongoing monitoring and mitigation of operational noise. • An updated Complaint-Response Protocol will be developed. • Complaints reported in Annual Landfill Monitoring Reports. • Noise bylaw requirements observed at site.	• No net effects anticipated.
Groundwater	• Potential for spills during construction.	• Potential for localized water quality impacts as a result of spills from construction equipment.	• Refueling and maintenance of construction equipment shall occur within designated areas only. Any hazardous materials used for construction shall be handled in accordance to appropriate regulations. • A Construction Emergency Response and Communications Plan shall be developed prior to and followed throughout the construction phase (includes spill response plans). The Contractor shall develop spill prevention and contingency plans for the construction of new landfill cells and general site preparation for the landfill expansion. Personnel shall be trained in how to apply the plans and the plans shall be reviewed to strengthen their effectiveness and continuous improvement. Spills or depositions into watercourses shall be immediately contained and cleaned up in accordance with provincial regulatory requirements and the contingency plan. A hydrocarbon spill response kit shall be on-Site at all times during the work. Spills shall be reported to the Ontario Spills Action Centre at 1-800-268-6060.	• A Qualified Environmental Inspector shall regularly monitor construction activities to confirm the requirements outlined in the SMP and ESC are followed Workers shall report any instances of spills to their supervisors. The Inspector shall document the process from spill detection, immediate actions taken, reporting to the Ontario Spills Action Centre through to completion of the spill clean-up process.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
	• Proximity of construction work to the CKD pile and potential for slope failure or leaching of CKD contaminants.	• Stability of the CDK pile is unknown. Work in the vicinity of the CKD pile has the potential to disturb the pile resulting in slope failure and release contaminants.	• Geotechnical stability of the CKD pile will be determined by a geotechnical engineer. Measures will be put in place in accordance with the Engineer's recommendations to prevent slope failure.	• Monitor for settlement and subsidence during construction and for a period of 2 years following construction (or as may be recommended by the Geotechnical Engineer that assessed the CKD pile stability).	• No net effects anticipated.
		• Increased infiltration into waste (increased leachate generation). • Potential for migration of leachate/storm water downward or laterally into sand/silt seam. • Could intersect saturated soil or sand/silt seam. • Potential for migration of storm water downward into sand/silt seam. • Potential to change flow direction in shallow groundwater.	• Design and operations to limit work/tipping area, with site grading and operational & interim cover placement to promote clean runoff. • Evaluate leachate generation potential against sewage treatment plant capacity. • Map presence and, if warranted, remove sand/silt seams below the waste footprint, or improve the landfill liner. • Extend leachate collection system. • Map depth to water table and maintain landfill base above water table. • Induce groundwater from sand/silt seam toward leachate collection system. • Create conceptual model of groundwater flow direction given expanded landfill footprint. • Consider designing the leachate collection system to induce flow from CKD stockpile toward former (pre-relocation) watercourse.	• Post-construction (as-built) monitoring requirements will be implemented as outlined for surface water, Item f). Annual Landfill Monitoring Reports.	• No net effects anticipated.
Surface Water	• Potential for changes to surface water quality or quantity as a result of construction.	• Potential for sediments to enter the watercourse as a result of: – Site clearing; – Stockpiling; – Cut/fill activities; and – Excavation (including potential to encounter contaminated materials).	• The Town is required to comply with the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40 with respect to the quality of water discharging into natural receivers. • An Erosion and Sediment Control (ESC) Plan shall be developed in consultation with the UTRCA. • Implementation of the ESC measures shall conform to recognized standard specifications such as Ontario Provincial Standards Specification (OPSS) and the requirements of the UTRCA. • Stockpiled material shall be stored at least 30 m from any waterway to prevent the discharge of deleterious substances into the water. • ESC measures (silt curtains, silt fence, temporary sedimentation basins) shall be installed and maintained during the construction phase and until the site has been stabilized. ESC measures shall be inspected to confirm	• A qualified Environmental Inspector shall regularly monitor construction activities to confirm the requirements outlined in the ESC Plans are followed. • Ground and surface water monitoring program will be implemented, refining/expanding existing Environmental Compliance Approval requirements.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
			they are functioning and are maintained as required. If control measures are not functioning properly, work in the area may be limited until the problem is resolved. • Any temporary mitigation measures shall be installed prior to the commencement of any site clearing, grubbing, excavation, filling or grading works and shall be inspected and maintained on a regular basis, prior to and after runoff events. • Wet weather restrictions shall be applied during site preparation and excavation. Whereby work will be avoided near watercourses during periods of excessive precipitation and/or excessive snow melt.		
		• Potential for localized water quality impacts as a result of spills from construction equipment.	• All equipment fueling and maintenance shall be carried out at a minimum distance of 30 m from the water to prevent the discharge of deleterious substances into the waterway. The Contractor shall develop spill prevention and contingency plans for the construction phase of the Project. Personnel shall be trained in how to apply the plans and the plans shall be reviewed to strengthen their effectiveness through continuous improvement. Spills shall be immediately contained and cleaned up in accordance with provincial regulatory requirements and the contingency plan. A hydrocarbon spill response kit will be on-site at all times during the work. Spills will be reported to the Ontario Spills Action Centre at 1-800-268-6060. • Design and operations to limit work area, with site grading and operational and interim cover placement to promote clean runoff.	• A Qualified Environmental Inspector shall regularly monitor construction and ensure that spill prevention measures are followed.	• No net effects anticipated.
	• Any predicted changes to short-term and long-term water quality or quantity resulting from drain relocation and changes to stormwater management.	• Expansion will require changes to the stormwater management system and relocation of the existing stormwater basins.	• During detailed design, grading, storm water and erosion control to redirect, slow or control runoff.	• Post-construction monitoring requirements may be required and will be determined during the detailed design process.	• No net effects anticipated.
		• Potential impacts to hydrology of new watercourse and conveyance capacity.	• The relocated channel will be designed by a Qualified Fluvial Geomorphologist. • Design criteria will be reviewed and approved by MECP and UTRCA staff.	• Post-construction monitoring requirements may be required and will be determined during the detailed design process.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
	• Proximity of work to the CKD pile and potential for slope failure or leaching of CKD contaminants to watercourses.	• The watercourse will be relocated closer to the CKD pile increasing the risk of slope failure or CKD contaminants entering the watercourse.	• The relocation of the watercourse may necessitate acquisition of additional land from St. Marys Cement or relocating CKD material along the north side of the stockpile. CKD relocation efforts, including re-establishing cover materials, would need to be completed prior to relocation of the watercourse. Runoff from the surface of the stockpile does not appear to be a significant issue. Of more importance is ensuring that the realigned watercourse is separated from the actual CKD material and that groundwater discharge from the stockpile to the watercourse is minimized.	• Post-construction monitoring requirements may be required and will be determined during the detailed design process. • The site's annual monitoring program will be updated and will include measures associated with the new watercourse and any CKD leachate.	• No net effects anticipated.
	• Potential for changes to surface water quality or quantity as a result of operational activities.	• Potential degradation of water quality due to accidental spills or releases, and leachate. • Potential deposition of sediment into watercourses through erosion and during operational/maintenance activities.	• Spill contingency and response plans, spill response training, proper notification procedures and necessary cleanup materials and equipment shall be developed and implemented by the Town, during the operations phase. Spills with the potential to create an impact to the environment will be reported to the MECP as required by the provincial spills legislation. Materials used during the operations phase of the Project shall be stored in appropriate containers within a secure storage area, a minimum 30 m away from sensitive environments (i.e., watercourses, wetlands, etc.). • Where reasonable, retaining walls and other ESC measures will be employed to minimize potential slumping, erosion, and deposition. During maintenance activities where excavation is proposed, work sites will be isolated from nearby watercourses using silt fence and appropriate ESC measures will be employed.	• Environmental inspections should take place to monitor and confirm that activities do not impact surface water quality and that chemical/fuel storage and usage is conducted properly. • Surface water quality monitoring may be required in aquatic features on-site during the operation phase of the Project as directed by the MECP. • Qualified Sediment and Erosion Control personnel are required to inspect, and suggest and confirm, the repair of ESC measures as needed. Inspections shall ensure proper spill containment and response kits are on-hand. • Annual Landfill Monitoring Reports.	• No net effects anticipated.
Vegetation	• Area, type, and quality of natural features removed.	• Invasive species establishment within areas cleared of vegetation.	• Revegetation of areas with native groundcover vegetation species as portions of the landfill are closed. Installation of woody plants adjacent to the realigned watercourse to enhance watercourse shading, fish, and wildlife habitat, as well as improve tree cover within the watershed. • Revegetate disturbed areas as soon as possible to minimize potential for reseeding of non-native and/or invasive species.	• Post-construction monitoring by an Environmental Inspector who shall regularly monitor watercourse plantings for vegetation success. Replacements may be necessary where vegetation does not survive.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Migratory Birds	• Area, type, and quality of natural features removed.	• Potential for disturbance or destruction of migratory breeding birds and their habitat by the landfill expansion (prohibitions under the MBCA, 1994).	• To reduce the risk of contravening the MBCA, 1994, timing constraints shall be applied to avoid vegetation clearing (including grubbing) and/or structure works (construction, maintenance) during the breeding bird period – broadly from end of March to end of August for most species (regardless of the calendar year). • Active nests (nests with eggs or young birds) of protected migratory birds, including SAR protected under the ESA, 2007, cannot be destroyed at any time of the year. The destruction of inactive nests for some species may also be prohibited (e.g., Barn Swallow, Osprey, Great Blue Heron). • If a nesting migratory bird (or SAR protected under ESA, 2007) is identified within or adjacent to the construction site and the construction activities are such that continuing construction in that area would result in a contravention of the MBCA, 1994 or ESA, 2007, all activities will stop and the Contract Administrator (with assistance from an Avian Biologist) shall discuss mitigation measures with the Town. The Ministry of Natural Resources and Forestry (MNRF), Ministry of Environment, Conservation and Parks (MECP), and Environment Canada shall be contacted to discuss mitigation options. The Contractor Administrator shall instruct the Contractor on how to proceed based on the mitigation measures established through discussions with the Town, the MNRF, MECP, and/or Environment Canada.	• An Avian Biologist may be required on-site should a nesting migratory bird (or SAR protected under ESA, 2007) be identified within or adjacent to the construction site. • The Avian Biologist may be required to confirm the presence and identification of an active nest and/or breeding bird (i.e., Eastern Meadowlark, Bank Swallow), prior to contacting MNRF and/or MECP for further advice.	• No net effects anticipated.
Removal of Confirmed Midland Painted Turtle Basking Habitat/Movement Corridor, Potential Snapping Turtle Basking Habitat/ Corridor and Confirmed Amphibian Breeding Habitat	• Area, type, and quality of natural features removed.	• Removal of basking habitat and movement corridor (watercourse realignment and/or stormwater basin). • Removal of amphibian breeding habitat (stormwater basin and wetted areas). • Mortality from construction activities.	• Educational material shall be provided by a Biologist to construction personnel prior to commencement of construction works to assist personnel in identifying SAR turtle species, should they be encountered. These materials shall also include protocols to be followed to prevent contravention of the ESA 2007, should SAR be encountered. • Prior to construction works commencing, and prior to emergence from hibernation (i.e., early spring), exclusion fencing shall be installed along the watercourse and stormwater basins to prevent any turtles from attempting to access these habitats within the Study Area during	• A Biologist may be required on-site as needed should a species that is protected under the ESA 2007 be identified within or adjacent to the construction site. • The Biologist may be required to confirm the presence and identification of a particular species prior to contacting the MNRF and/or MECP for further advice.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
			construction works. Please refer to MNRF Best Practices Technical: – Note Reptile and Amphibian Exclusion Fencing (Version 1.1) July 2013 for more details: ▪ http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_tx_rptl_amp_fnc_en.pdf. • An Environmental Inspector will inspect fenced areas. If any turtles are trapped within the fencing, they will be relocated to an appropriate location. A Wildlife Scientific Collectors Authorization will be obtained prior to the erection of fencing to ensure the necessary permit is in place should any turtles be found. The area for relocation will be determined at that time. • Given the proximity of the Study Area to the Thames River and the known presence of SAR reptiles in the general area, exclusion fencing shall also be erected around active work areas, such as temporary storage/equipment areas. Equipment refueling shall be excluded from areas that have the potential for transfer of materials to the watercourse and storm water basins via surface water drainage. • Should nesting features be identified during construction works, consultation with the MNRF and/or MECP may be warranted to confirm appropriate mitigation measures are in place to protect this feature. • If designated areas are created during construction for the stockpiling of materials, especially fill, soil and gravel, the Contractor shall install exclusion fencing around the perimeter of these areas to prevent any turtle species from entering the area and attempting to nest (turtles are attracted to these materials for nesting).	• Fencing should be monitored on a regular basis to ensure there is no damage that may result in a decrease in function or opportunities for injury or death to wildlife species.	
Disturbance to Potential Midland Painted Turtle Hibernation Habitat	• Area, type, and quality of natural features removed.	• Direct removal of potential hibernation habitat within existing watercourse	• In-water works should be avoided during the turtle hibernation period (i.e., October to May). • If works cannot be avoided during winter months, MNRF should be consulted prior to in-water works for appropriate mitigation measures related to hibernating turtles.	• Should in-water works be conducted during the winter months, a Biologist may be required on-site during in-water works to inspect the substrate for turtles. Relocation of turtles may be required pending MNRF consultation.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
			• Refer to notes on fencing, inspections and relocation if required. A Wildlife Scientific Collectors Authorization will be obtained prior to the erection of fencing to ensure the necessary permit is in place should any turtles be found. • In the event that SAR are found within the study limits all activities will stop and mitigation options shall be discussed with the Town, whereby an MECP SAR Biologist may be contacted for advice as these animals are protected under ESA 2007.		
Disturbance to Terrestrial Crayfish Habitat	• Area, type, and quality of natural features removed.	• The habitat will not be removed; however, there is potential for it to be disturbed during construction or site operation. • Construction works will likely alter the habitat's hydrology; therefore, ecological function may be reduced or lost.	• Consultation with MNRF prior to construction activities should occur in order to determine whether this population is considered "significant" given the historical disturbance to the existing property and ongoing disturbance as an active landfill. • Should this population be considered by the MNRF as "significant", MNRF will provide guidance on appropriate mitigation measures suitable to the proposed expansion activities. • Relocation of the Study Area's watercourse to reside further from the landfill will alleviate the effects of construction works and landfill operations on their habitat. • Hydrological assessment during Environmental Protection Act regulated design and construction of the landfill and watercourse relocation (alongside other approvals) shall provide guidance for protection of the ground and surface water features.	• Subject to MNRF consultation, and assessment during Environmental Protection Act regulated design and construction of the landfill. Impacts of hydrology on these burrows will be further assessed with implemented ground and surface water programs.	• No net effects anticipated.
Removal of Habitat for Wildlife Species of Conservation Concern and Rare Species: • Monarch	• Area, type, and quality of natural features removed.	• Direct removal of potential breeding/foraging habitat located within ELC community MEGM3 as a result of vegetation removals.	• For Monarch, vegetation removals shall occur during the fall and winter periods outside of the growing season for Milkweed, the larval plant of Monarch. Compensatory plantings/seed mixes within buffer areas and along berms should include plant species for butterflies, including milkweed species.	• No monitoring required.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Removal of Habitat for Endangered and Threatened Species: - Eastern Meadowlark - Bank Swallow - Barn Swallow	- Number and populations of species at risk affected.	- Habitat for Eastern Meadowlark, Bank Swallow and Barn Swallow will be removed.	All species: - Refer to the mitigation measures noted above for “Migratory Birds”. - Receive general habitat protection under the ESA, 2007 – prohibitions apply to the species and their habitat (specifically killing, harming, harassing and habitat destruction). - Educational material and training shall be provided by a Biologist to construction personnel prior to commencement of construction works to assist personnel in identifying SAR species, should they be encountered. These materials shall also include protocols to be followed to prevent contravention of the ESA, 2007, should a SAR species be encountered.	- An Avian Biologist may be required on-site should a nesting migratory bird (or SAR protected under ESA, 2007) be identified within or adjacent to the construction site as per details outlined under Construction Mitigation. The Avian Biologist may be required to confirm the presence and identification of an active nest and/or breeding bird prior to contacting the MNRF and/or MECP for further advice.	- No net effects anticipated.
		Eastern Meadowlark: - Direct removal of Category 3 habitat (although in subsequent years this area may be used by a nesting pair).	Eastern Meadowlark: - Specific development exemptions for Eastern Meadowlark are addressed under the ESA, 2007 in Ontario Regulation 242/08, Section 23.2. Mitigation and compensation requirements are outlined under this Regulation and will be followed.		
		Bank Swallow: - Potential removal of nesting habitat at any temporary stockpile/compost pile locations should nesting be confirmed within the Study Area during the active breeding window for this species immediately prior to construction works (i.e., May to August). Based on field observations in 2015, potential nesting habitat could potentially be affected. - Direct removal of foraging habitat confirmed within the Study Area.	Bank Swallow: - Avoid the creation of temporary vertical or near-vertical spoil piles within the landfill that are prone to frequent disturbance from landfill operations in order to reduce the chance of attracting nesting Bank Swallow. - If construction activities occur during the breeding bird window, and breeding evidence is observed (i.e., excavated nests, adults on nest, young on nest), construction activities must stop in the location where evidence is observed and a no-disturbance 50 m setback from the nesting site shall be placed around the site until no further evidence of breeding is observed.		
		Barn Swallow: - Direct removal of foraging habitat confirmed within the Study Area (specifically, ELC community MEGM3).	Barn Swallow: - Foraging habitat for Barn Swallow is not included in the development exemptions in Ontario Regulation 242/08 (nesting habitat only). Therefore, destruction of foraging habitat is dealt with on a case-by-case basis with MECP.		

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Species at Risk: • Bank Swallow	• Potential impact to SAR habitat during operational activities.	• Potential for attracting nesting Bank Swallow.	• Avoid the creation of temporary vertical or near-vertical spoil piles within the landfill that are prone to frequent disturbance from landfill operations in order to reduce the chance of attracting nesting Bank Swallow. • If operational activities occur during the breeding bird window, and breeding evidence is observed (i.e., excavated nests, adults on nest, young on nest), activities should stop in the location where evidence is observed and a no-disturbance 50 m setback from the nesting site shall be placed around the site until no further evidence of breeding is observed.	• No monitoring required.	
Snake Hibernaculum	• Number and populations of species at risk affected.	• Potential for disturbance to this feature in the Study Area during construction works (e.g., drilling, grading, digging) if habitat present.	• In consultation with the MNRF, additional monitoring during the appropriate season by a Biologist may be warranted prior to the commencement of construction to confirm key areas where Significant Wildlife Habitat (SWH) may be impacted by construction activities. • Avoid intrusive construction activities (to the extent practical) into areas where there may be potential habitat for snake hibernacula. • Should snake hibernacula features be identified during construction works, consultation with the MNRF and/or MECP may be warranted to confirm appropriate mitigation measures are in place to protect this feature. • Educational material shall be provided by a Biologist to construction personnel prior to commencement of construction works to assist personnel in identifying SAR, should they be encountered. These materials shall also include protocols to be followed to prevent contravention of the ESA 2007, should SAR be encountered. • If the construction activities are such that continuing construction in the area would result in harm to wildlife, construction activities in that location will temporarily stop and the MNRF or MECP shall be contacted for direction. • In the event that SAR is found within the study limits, all activities will stop, and mitigation options shall be discussed with the Town, whereby an MECP SAR Biologist may be contacted for advice.	• A Biologist may be required on-site as needed to advise on potential SWH sites. • A Biologist may be required on-site as needed should a species that is protected under the ESA, 2007 be identified within or adjacent to the construction site. • The Biologist may be required to confirm the presence and identification of a particular species prior to contacting the MNRF and/or MECP for further advice.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Special Concern and Rare Wildlife Species: - Eastern Milksnake (Confirmed Refuge Habitat)		- Encroachment/disturbance into potential oviposition/refuge/ foraging/hibernation habitat. A location for Eastern Milksnake refuge habitat confirmed in 2015 – Alternatives 1, 3 and 5 would directly remove this habitat. - Mortality from construction activities, including road mortality.	- Consultation with MECP prior to construction activities should occur in order to determine whether this population is considered "significant" given the historical disturbance to the existing property and ongoing disturbance as an active landfill. Critical habitat has not been identified using ELC codes because the species was observed on the edge of an active portion of the landfill and MEGM3 (Dry-Fresh Graminoid Meadow). - Given that the entire On-Site Study Area may provide habitat for this species, educational material shall be provided by a Biologist to construction personnel prior to commencement of construction works to assist personnel in identifying SAR species, should they be encountered. These materials shall also include protocols to be followed to prevent contravention of the ESA, 2007, should SAR be encountered. - See mitigation measures noted above for "Snake Hibernaculum".	- A Biologist may be required on-site as needed should a species that is protected under the ESA, 2007 be identified within or adjacent to the construction site. - The Biologist may be required to confirm the presence and identification of a particular species prior to contacting the MNRF and/or MECP for further advice.	- No net effects anticipated.
Fish and Fish Habitat	- Predicted changes to the quality of fish habitat present as a result of watercourse relocation.	- Potential impacts to downstream fish habitat from water quality and quantity impairments as a result of near and in-water construction works (sediment loading; fuels and lubricants from machinery; contaminated sediment from landfill).	- Refer to mitigation noted above for "Surface Water". - The effects of the watercourse relocation will be further studied during the detailed design phase. Should there be a risk of impact to downstream provincial and/or federal species at risk, the MECP and/or DFO will be contacted as required. - In-water works timing windows shall be followed to avoid/minimize interference with potential downstream spawning fish species. Prior to conducting near or in-water works, all necessary approvals under the *Fisheries Act* will be obtained.	- An Environmental Inspector shall regularly monitor construction activities to confirm the requirements outlined in the ESC Plan are followed.	- No net effects anticipated.
		- Fish habitat will be disrupted during relocation of the watercourse.	- The UTRCA shall be consulted during detailed design with regard to potential works within flood regulated areas. - Watercourse base flow will be continued downstream throughout construction to provide habitat to fish downstream. - The Contractor(s) shall minimize any in-water operation of heavy equipment and minimize operation of the same on the banks of the watercourse. All disturbed areas at the work site shall be stabilized immediately and re-vegetated as soon as conditions allow.	- An Environmental Inspector will be on-site and conduct regular inspections during watercourse relocation.	- No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
Cultural Environment					
Archaeological Resources	• Presence of or likelihood to disturb Archaeological Resources.	• An archaeological assessment determined that it is unlikely for any archaeological resources to be present; however, there remains a very small risk that previously undocumented archaeological resources may be uncovered.	• Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a Licensed Consultant Archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the Ontario Heritage Act. In the event that archaeological remains are found during subsequent construction activities, the Consultant Archaeologist, approval authority, and the Cultural Programs Unit of the Ministry of Tourism, Culture and Sport should be immediately notified. Indigenous communities will also be notified if the resources appear to pertain to Indigenous groups.	• None	• No net effects anticipated.
Cultural Heritage Landscapes	• Presence of, or likelihood to disturb Cultural Heritage Landscapes.	• Change to the views associated with adjacent cultural heritage farm and streetscapes.	• During detailed design, the cultural heritage report will be updated with a confirmation of impacts of the undertaking on cultural heritage resources identified within and/or adjacent to the study area and will recommend appropriate mitigation measures. Mitigation measures may include, but are not limited to, completing a heritage impact assessment or documentation report, or employing suitable measures such as landscaping, buffering or other forms of mitigation, where appropriate. In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken as necessary. • Should future work require an expansion of the study area then a Qualified Heritage Consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.	• The need for monitoring and contingency measures will be determined during subsequent cultural heritage studies.	• No net effects anticipated.
Socio-economic Environment					
Land Use	• Compatibility of the proposed change with the existing site and surrounding land uses	• The landfill is compatible with surrounding land uses. No impacts are anticipated.	• No mitigation required.	• None required.	• No net effects anticipated.

Environmental Component	Indicators of Effects on the Environment	Potential Impacts	Mitigation Measures	Recommended Monitoring Activities and Contingency Measures	Net Effects (After Mitigation)
	• Effects of the changes on land use at the site or its adjacent lands.	• The landfill is not expected to affect or alter the land use of adjacent land lands. No impacts are anticipated.	• No mitigation required.	• None required.	• No net effects anticipated.
	• Consistency with Official Plan policies related to waste disposal and land use surrounding landfills.	• The Township of South Perth zoning by-law does not include appropriate restrictions for adjacent land uses.	• The Town of St. Marys will work with the Township of South Perth to include appropriate land use restrictions in the Township's Official Plan and Zoning By-law.	• None required.	• No net effects anticipated.
Transportation Routes	• Changes to the amount/type of traffic generated.	• No significant changes to traffic are anticipated during construction.	• No mitigation required.	• None required.	• No net effects anticipated.
Employment Effects	• Number, type, duration of changes to local workforce.	• A small number of new jobs may be created during construction.	• No mitigation required.	• None required.	• No net effects anticipated.
Economic Conditions	• Changes to revenues and costs anticipated to local businesses. • Changes to industries and businesses using private haulers.	• No changes to economic conditions are anticipated.	• No mitigation required.	• None required.	• No net effects anticipated.
Enjoyment/Quality of Life	• Changes to the aesthetics/ability for surrounding residents to enjoy their properties.	• There may be increased dust and noise during construction which may impact surrounding residents.	• Refer to mitigation listed under "Air Quality and Odour" and "Noise".	• Refer to monitoring requirements listed under "Air Quality and Odour" and "Noise".	• No net effects anticipated.
Indigenous Connections to the Land					
Treaties, Rights and Interests	• Presence of known or active land claims or other claims related to the site or its vicinity.	• The landfill site is subject to one or more Treaties. The site has not been used for traditional purposes for over a century. There may be indigenous interests in site and surrounding natural features which may be disrupted.	• The Town will continue to engage with interested Indigenous communities throughout detailed design.	• Monitoring and contingency measures may be identified during ongoing consultation.	• Net effects to be determined in conjunction with Indigenous communities.

9.1 Climate Change Considerations

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 MECP 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 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.

9.1.1 Effect of the Preferred Alternative on Climate Change

The landfill's impact on climate change is most directly linked to the fugitive emissions of landfill gas (LFG). This is created by the decomposition of the waste in the landfill. LFG is roughly half carbon dioxide (CO_2) and half methane (CH_4) with a small amount of other gasses. LFG is a Greenhouse Gas that impacts Climate Change (see Section 3.1.3.2). Ontario Regulation 232/98 under the *Environmental Protection Act* states that landfill sites containing 1.5 million cubic meters (1.5 Mm^3) of landfill capacity or more are required to install an LFG capture and destruction system. The proposed total capacity of the St. Marys Landfill if the expansion is constructed will remain below this threshold. Further the Regulation recognizes low LFG generation rates, generally associated with low rates of disposal, as a reason to avoid installation of an LFG management system even if the site capacity exceeds the 1.5 Mm^3 threshold. The age of waste already contained within the St. Marys Landfill, the anticipated rate of fill, and thus the ultimate rate of LFG generation, is relatively low. Therefore, on both counts (total capacity and rate of fill), the site does not require an LFG management system.

Ontario's annual emission rate for GHG's is approximately 143,000,000 tonnes CO_2e with approximately 8,500,000 tonnes/year CO_2e coming from solid waste landfills[70]. The Preferred Alternative for the facility expansion with 708,000 m^3 estimated waste (over the 40-year EA Planning Period) will produce a total of approximately 79,000 tonnes CO_2e. Averaged over the site's life, this represents approximately 2,000 tonnes CO_2e per year, or just which would contribute approximately 0.24% of Ontario's annual solid waste related GHG emissions and approximately 0.001% of the total annual GHG emissions from Ontario.

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[70] Environment and Climate Change Canada, report, National Inventory Report 1990-2014: Greenhouse Gas Sources and Sinks in Canada.

The total GHG emission rate for Canada is approximately 732,000,000 tonnes/year CO_2e with approximately 56,000,000 tonnes/year CO_2e generated from solid waste and other sources. In the national context, expanded landfill will contribute approximately 0.004% of Canada's annual solid waste related GHG emissions, or approximately 0.0003% of the country's total annual GHG emissions.

LFG emissions are expected to increase proportionally with the volume of waste landfilled. Based on the LandGEM model, which predicts LFG generated by a site, it is estimated that approximately 1,279 tonnes CO_2e from LFG was generated at the St. Marys Landfill in 2017. The model projects this will increase to about 2,183 tonnes CO_2e in 2057, following placement of the last loads of waste at the site. LFG will then begin decreasing again during the site's post-closure period. The progressive placement of the final, low-permeability cover will help control fugitive LFG releases.

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*. While the Town will not be required to implement the organics ban it is likely that some organics will still be diverted. 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 decreasing the overall contribution of fugitive and combustion emissions from the St. Mary's Landfill.

Given recent discussions on greenhouse gases and their impacts on Climate Change, there is a general drive in Ontario to lower emissions. In the long run, this may result in the Town installing an LFG system in the future. Such a system may be voluntarily installed based on beneficial economics, community recognition of benefit(s) or to mitigate a currently unanticipated LFG issue. Regulatory changes could also result in installation of an LFG system.

9.1.2 Effect of Climate Change on the Preferred Alternative

Increased severity of storm events, more intense but less frequent 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 capture volume for ditches and ponds, as well as additional erosion protection as more intense storm events result in higher flow velocities across the landfill cover, in ditches and swales and at discharge points.

Climate Change and Water Management Infrastructure

The changes in extreme weather events due to climate change are particularly relevant in the design and surface 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 external diversion channels, ditches, and conveyance structures. Generally, stormwater control facilities must be sized to accommodate the peak flow generated from the higher of the prevailing Regional Storm Event. The Environmental Protection Act design is expected to include:

- 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 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.
- 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 or the 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 will address the MECP design criteria for approval for an ECA under the OWRA, in addition to the landfill-specific requirements in O. Reg. 232/98.

Additional storage areas will be added to the existing stormwater management system to satisfy quantity and quality requirements for the Preferred Alternative.

Climate Change and Slope Stability

Climate Change should also be considered in the site’s design. It is anticipated that periods of dry weather followed by intense rainfall could result in slope stability issues and cover erosion. Ensuring the maximum slope is no greater than 25% (4 m run for every 1 m rise, or 4:1), as required by O. Reg. 232/98, will help to mitigate this Climate Change effect.

Climate Change and Leachate Generation

There may be changes in the precipitation patterns that result in less frequent yet more intense rain. If this occurs as expected, leachate generation could be reduced. Leachate is generated when precipitation infiltrates the landfill cover and the moisture mixes with the waste below. Infiltration though is a function of the steady wetting of the cover and occurs slowly. Intense rain events result in more runoff than infiltration.

Further, dry cover soils are more likely to initially resist infiltration, further reducing leachate generation.

Once the landfill reaches its approved capacity, it will be closed and capped in accordance with O. Reg. 232/98. This will further decrease infiltration of precipitation and the leachate volumes generated.

Climate Change and Landfill Fill Rates

As discussed in Section 3.1.3.2, severe weather events influenced by Climate Change can have a direct impact on landfill utilization. These events can result in increased property damages from excessive wind, precipitation or even fires. Subsequently, Climate Change results in an increase in the amount of materials being received at landfills in the form of food waste (i.e., from power outages), clean-up debris, construction and demolition debris and reconstruction scrap.

In order to assess the potential for waste generation from the Town of St. Marys as a result of Climate Change related severe weather events, the Study Team incorporated the U.S. Army Corps of Engineers debris model for a single Category 1 hurricane. This is intended to represent the cumulative effect of more severe storms and resulting damages (disposal needs) that may occur due to Climate Change. Based on the model, approximately 5 months or 1% of additional capacity could be utilized in dealing with the storm debris.

9.2 Cumulative Impacts

Environmental impacts from specific projects do not occur on a singular basis. Other projects and activities in an area may have cumulative impacts on those same environments. These cumulative impacts need to be carefully considered in the evaluation process.

Methodology

Cumulative effects were assessed by:

- Identifying the net effects of the Undertaking;
- Defining at Study Areal;
- Describing existing development and future development in the Study Areal;
- Assessing how the net effects of the project may combine with the effects of other development to create a cumulative impact; and
- Identifying mitigation measures to minimize cumulative effects.

Net effects of the Undertaking

The net effects of the Project, after mitigation is applied were summarized in Table 9-1. The assessment determined that the effects of the landfill expansion can be mitigated and minimized such that no net effects are expected. However, further assessment of climate change impacts in Section 9.1 identified that greenhouse gas emissions will not be fully mitigated, and the landfill will be a net emitter of GHGs.

Cumulative Effects Study Area

While greenhouse gas emissions are a global concern, a reasonable Study Area for consideration of cumulative effects was limited to Ontario. It was assumed that a reasonable study could consider the effects of emissions from other landfills and other significant sources within Ontario.

Existing and Future GHG Emissions in the Study Area

As noted in Section 9.1, 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 is estimated to produce approximately 79,000 tonnes CO_2e over it's entire (40-year) life. This is less than one quarter of a percent of the Province's solid waste related GHG emissions and approximately 0.001% of the Province's total GHG emissions on an annual basis.

There are several other landfill expansions currently being proposed, including the 29 Mm^3 expansion of the Ridge landfill in Chatham-Kent, 1.1 Mm^3 expansion of the Biggars Landfill in the County of Brant and the 17 Mm^3 new Southwestern Landfill in Ingersoll. Landfill sites containing 1.5 Mm^3 of landfill capacity or more are required to install a landfill gas capture and destruction system. As such, some, but not all of the GHGs emitted from these larger landfills will be captured.

GHGs are emitted from many other sources as well, including industrial processes, energy production, vehicle use, agricultural production and residential and commercial heating and cooling, among others. To reduce the effects of Climate Change and improve energy efficiency, many sectors are working to reduce process which emit GHGs. According to the Government of Ontario[71], the province's GHG emissions have dropped 22% since 2005 and there are future goals to reduce emissions by 30% below 2005 levels by 2030.

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[71] Source: https://www.ontario.ca/page/climate-change

Cumulative Effects Assessment

Although the landfill is responsible for a relatively low percentage of GHG's in Ontario (approximately 0.001%), when combined with all other sources, there may be a cumulative effect in the quantity of GHGs in the atmosphere which can influence Climate Change.

Recommended Mitigation

It is recommended that the Town continue to work with residents and businesses to increase waste diversion. The Town will meet requirements under the *Waste-Free Ontario Act* and will work to improve composting and recycling rates.

There is also potential for methane production in the landfill to decrease over time because 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. The landfill may generate less LFG during filling of its final cells if there are changes in organics as a result. This will decrease the overall contribution of fugitive and combustion emissions from the St. Mary's Landfill.

As noted in Section 9.1, there may be potential for the Town to install an LFG system in the future. Such a system may be voluntarily installed based on beneficial economics, community recognition of benefit(s) or to mitigate a currently unanticipated LFG issue. Regulatory changes could also result in installation of an LFG system.

It is recommended that the Town continue to work to reduce GHG emissions from the landfill. Ongoing updates to the Town's waste reduction strategy is recommended.

10.0 Consultation Summary

Consultation with potentially affected and other interested parties is a key component of the Environmental Assessment process (MOE, 2008). A plan for consultation during the preparation of the EA was provided in the approved TOR and completed in accordance with Section 4.3.1 of the *Code of Practice – Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (MOE, October 2009[72]).

In accordance with Section 4.3.7 of the *Code of Practice – Preparing and Reviewing Environmental Assessments in Ontario* (MOE, January 2014) the Record of Consultation is to include information about the consultation process and consultation activities that took place including methods, schedule of events, notification that was given about the activities and the materials used. The Study Team has documented all communications

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[72] The *Code of Practice - Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* was updated in January 2014, following submission of the TOR for this Project.

in the Record of Consultation Report including copies of all letters, emails, faxes and other correspondence that the Study Team sent to and received from members of the public, government agencies, public utilities, Indigenous communities and other interested parties; as well as minutes from meetings held and copies of written comments received; records of public information events, including information about the event locations and layout/programs, copies of materials provided, sign-in sheets, comment sheets, news media communications, notices published, etc.

The following sections offer a brief list of contacted parties and key notifications and opportunities for consultation presented at various project milestones. Details and copies of all correspondence are included in the Record of Consultation Report (Volume IV).

10.1 Project Notices

Project Notices were published at the following project milestones:

- Notice of Acceptance of the Terms of Reference and Commencement of the EA (February 9, 2015);
- Notice of Public Information Centre (PIC) #1 (July 27, 2015);
- Notice of PIC #2 (May 25, 2016);
- Notice of first Draft EA for Inspection (July 5, 2017);
- Notice of revised Draft EA for Inspection – PENDING; and
- Notice of Submission of the EA – PENDING.

Each Notice was published in two consecutive editions (weeks), respectively, of the following newspapers:

St. Marys Journal Argus[73]
115 Queen Street
St. Marys, ON
Phone: (519) 284-2440

St. Marys Independent
36 Water Street
St. Marys, ON
Phone: (519) 284-0041

Copies of all Notices were emailed/mailed to all contacts on the Project Contact List, specifically:

- Landowners/members of the public who declared an interest during the TOR process, or subsequently;
- Applicable agencies;
- Potentially affected Indigenous communities; and

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[73] The St. Marys Journal Argus ceased publishing in November 2017.

- Landowners within the Study Area Vicinity.

A copy of the Project Contact List and Project Notices are provided in Volume IV, Appendix K.

10.2 Public Consultation

10.2.1 Public Information Centres

Two Public Information Centres (PICs) were held at key milestones, as shown in Table 10-1.

Table 10-1: Public Information Centres

PIC	Timing
PIC #1	Upon completion of the draft evaluation of *Alternatives to the Undertaking,* held August 26, 2015.
PIC #2	Upon completion of draft evaluation of *Alternative Methods to the Undertaking,* held June 23, 2016.

All PICs were conducted in a drop-in format and knowledgeable staff were on hand to answer questions. Materials included are as follows:

- A series of display boards describing the EA process and work conducted to date.
- Sign-in sheets to document participation.
- Comment sheets to allow participants to submit comments.
- Copies of draft documents and supplementary information available for review.

Copies of material are included in Record of Consultation Report (Volume IV).

10.2.2 Project Information Posted to the Town's Website

Project information, including Notices and draft documents were posted to the Town's website: https://www.townofstmarys.com/en/living-here/Landfill-Environmental-Assessment.aspx.

10.3 Summary of Public Comments

A summary of comments made during the PICs is provided in Table 10-2. Most comments were made verbally. One written comment sheet was received. Comments were made by neighbouring landowners and generally related to quality-of-life issues including dust, odour, traffic, and drinking water.

Details and copies of all correspondence are included in the Record of Consultation Report (Volume IV).

Table 10-2: Public Comments Received During Public Information Centre #1 and #2

Comment	Comment Type	Study Team Response	Where Addressed in EA
Comments Received During PIC #1			
Concerned with drinking water well quality.	Verbal	Groundwater quality is monitored on a regular and ongoing basis as part of the current landfill operations. To date, there are no concerns related to the landfill's impact on off-site groundwater quality. Landfill monitoring reports are available online at the Town's website. Further to the existing site monitoring, the draft *Hydrogeological Work Plan* will consider the likely impacts of *Alternative Methods* for the expansion of the landfill, helping to determine a preferred *Method*. Recommendations will be made for the preferred *Method* to minimize groundwater (and surface water) impacts.	Mitigation measures were included to address groundwater concerns, including measures to manage leachate and continue the site's ongoing annual monitoring. Impacts and mitigation are addressed in Section 7.1.4 and Section 9.0
Concerned with dust from site entrance.	Verbal	Through discussion with the resident, it was found that a significant dust concern occurred a few years ago during the reconstruction of Hwy 7. Excess soils from that project were brought to the landfill for use as cover, to build berms, etc. The truck traffic on the access road caused excessive dust until calcium chloride was spread. Regular site operations have not been as problematic, though some dust from the site access road is occasionally generated. Relative to current operations, dust concerns are taken seriously by the Town. The resident was encouraged to contact the Town if dust becomes an issue again. For the EA process we discussed the draft *Air, Noise and Vibration Work Plan*. This work plan includes an assessment of dust generation by each *Alternative Method* for landfill expansion. Recommendations will be made for the preferred *Method* to minimize and mitigate dust generation for the expanded facility.	Mitigation measures were included to address concerns with dust. Specifically, efforts to prevent contamination of the road surface, such as spilling sands, silts, and clays, will also help to minimize dust. The roadway shall be sprayed with water as required to minimize dust generation. Impacts and mitigation are addressed in Section 9.0
Concerned that thermal treatment has been discarded as an alternative at this stage in the study. Offered suggestion that kiln at St. Marys Cement could be used for a waste-to energy solution.	Verbal	Thermal treatment was discarded because it is not financially feasible for the Town based on the quantities of waste generated. St. Marys Cement is not at a stage where it could begin accepting waste within the timeframe required by the Town. Also, there are questions as to what portions of the waste disposal stream would be acceptable in the kiln. It is unclear whether such a facility could be financially or technically viable. The Town is always open to discussions with St. Marys Cement.	Thermal treatment was discarded as a feasible alternative during the TOR. Additional details can be found in the TOR.

Comment	Comment Type	Study Team Response	Where Addressed in EA
Comments Received During PIC #2			
Concerned with drinking water well quality.	Verbal	Groundwater quality is monitored on a regular and ongoing basis as part of the current landfill operations. To date, there are no concerns related to the landfill's impact on off-site groundwater quality. Landfill monitoring reports are available online at the Town's website. Based on the draft preferred expansion method, no waste placement closer to residential wells is being considered. Neighbouring property owner was generally satisfied with this approach, and with current monitoring program including well sampling.	Mitigation measures were included to address groundwater concerns, including measures to manage leachate and continue the site's ongoing annual monitoring. Five private wells are currently being monitored and will continue to be monitored. Impacts and mitigation are addressed in Section 7.1.4and Section 9.0
Concerned with site Odours	Written Comment	Neighbouring residents identified intermittent issues with landfill odour impacts during conditions of NE-E wind direction. Project Team members discussed recent challenges to operations as a result of equipment operations and challenging spring weather conditions, as well as mitigation measures. Additionally, the results of the site air modelling for the expansion alternatives were discussed which indicated that current conditions represent the worst-case scenario for potential for impacts.	Mitigation measures were provided to minimize odour, including to implement Best Management Practices and daily cover. Odour will be re-evaluated and modeled based on detailed design plans during preparation of the ECA application as noted in Section 9.0.
Concerned with Traffic Speeds on County Road 123.	Verbal	Discussion with homeowner focused on sightlines of any relocated entrance and posted speed limit outside of St. Marys (80 km/h dropping to 50 km/h within the Town). Any change in entrance location will require sightline analysis, and updates to Traffic Impact Study. Resident plans to contact County to review posted speed limit along road section.	A Traffic Impact Study was completed. As a result of modeling, it was determined that current and future conditions are projected to be safe, and no changes are required. The Traffic Impact Study can be found in Volume III, Appendix H.

10.4 Agency Consultation

Agencies on the Project Contact List were provided with all Project Notices. Direct consultation through email, phone calls and meetings with agencies were also ongoing throughout the EA.

10.4.1 Work Plan Review

As described in Section 6.3, Work Plans were created to provide a detailed framework for the technical studies to be completed. The various Work Plans were issued to the agencies identified in Table 10-3 on April 24, 2015.

Work Plans were also provided to the public for review during PIC #1 and were available on the Town's website.

Table 10-3: Agency Review and Comment on Work Plans

Work Plan	Agency Circulated	Comments Received	How Comments were Addressed
Air Quality, Noise and Vibration	MOECC	MOECC: • Suggested using Study Area wider than 1 km beyond the existing landfill boundary. • Suggests that the landfill will close after the 40-year period. However, some options allow for future expansion beyond 40 years. The option for future expansion should be acknowledged. • No part of the Work Plan focuses on current air quality. On-site monitoring should be included. A list of dust management practices must be presented. • The list of factors influencing air quality includes the number of vehicles but not the vehicle type of weight. They should look at the effect of track out or vehicle emissions on air quality. • The Work Plan notes that they will be modelling landfill gas. The list should include all species recommended by the ministry. Any final work should include landfill monitoring as an ongoing part of site operation. A monitoring plan should be included. • Contrast both possible scenarios with current conditions. • The Work Plan does not address specific impacts due to noise.	The Landfill Expansion Noise Impact Assessment, and Landfill Expansion Emission Summary and Dispersion Modelling Report were completed in accordance with the draft Work Plan and considered the reviewer's comments. Air dispersion models assessed maximum off-property impacts at receptors up to 10 km from the property boundary ESR indicates that future expansion is possible. The existing conditions were compared to each alternative method for both air and noise impacts. The site Best Management Practise Plan (BMPP) is provided to detail dust management plans. The road dust model uses average vehicle weight on each road segment. Road dust is not tracked off-property because of BMPP and paved entry way.

Work Plan	Agency Circulated	Comments Received	How Comments were Addressed
			All MECP recommended contaminants were considered. A complete noise impact assessment was completed for the facility. Monitoring is not recommended for the facility.
Archaeological and Cultural Heritage Studies	MOECC MTCS	MTCS: • If Stage 2 Archaeological Assessment work is necessary, it should be carried out as part of the EA. • The criteria listed in O. Reg. 9/06 should be used to identify Built Heritage Resources and Cultural Heritage Landscapes.	A Stage 2 Archaeological Assessment was not required. The Built Heritage Resources and Cultural Heritage Landscapes were identified in accordance with O. Reg. 9/06. The Cultural Heritage Resource Assessment is provided in Volume III, Appendix E.
Ecological Assessment	MOECC MNRF UTRCA	MOECC: • Benthic biomonitoring should be added to the assessment of the watercourse. UTRCA: • Noted that 1 year of milksnake surveys is insufficient to confirm species absence. • Spiny softshell noted downstream in the Thames River but not likely to be affected by this Project. • Basking surveys are not the best method to sample for snapping turtles. Wading through ponds is more productive. • Fish records were provided.	Benthic biomonitoring was not included. A discussion is provided in Section 3.7.1. The status of milksnake has been downgraded since Work Plans were developed. Milksnake are no longer a Special Concern species. Surveys were completed as documented in Section 6.6.1. Wading surveys through landfill SWM ponds were not conducted for health and safety reasons.

Work Plan	Agency Circulated	Comments Received	How Comments were Addressed
Hydrogeological Assessment	MOECC UTRCA	MOECC: • Section 3.2 Monitoring Results doesn't identify any issues with the current surface water monitoring program. • Indicated that program proposed seemed suitable since it was understood that the method was an iterative approach, and that the study can change as information becomes available. However, it was noted that some component of drilling may be requested if needed. • Pond B appears to be accepting groundwater from Manhole B which is apparently a groundwater interceptor underdrain. Elevated groundwater/ leachate related water chemistry variables are being detected at the Pond B inlet. The EA should include further monitoring of groundwater flow to Pond B. UTRCA: • Work Plan appears complete but noted that UTRCA has completed significant groundwater studies as part of the Source Water Protection Plan.	On August 31, 2015 Burnside responded indicating comments would be incorporated into the draft Hydrogeological Work Plan efforts. Ultimately an updated Work Plan was not prepared but comments were incorporated into the EA report. An additional monitoring well was installed in November 2016. The results of this work are detailed in the Hydrogeological Assessment. Ongoing monitoring of Pond B and Manhole B is a requirement of the site's existing Annual Monitoring Report (AMR). Source Water Protection Plan background documents were reviewed as part of the EA.

Work Plan	Agency Circulated	Comments Received	How Comments were Addressed
Socio-economic Assessment	MOECC	MOECC: • Several comments were provided with regard to terminology and the order of different stages of the assessment. • There was a question regarding the evaluation and whether any criteria would be weighted and how the advantages and disadvantages would be determined and assessed. • There was some confusion regarding which criteria listed in the TOR referred to the evaluation of Alternatives To the Undertaking and which to the evaluation of Alternative Methods. This needs to be clarified. • The land use planning control criteria should include compatibility with the Official Plan and compatibility with the MOE's Land Use Planning Guideline D-4.	The assessment of advantages and disadvantages is provided in Sections 3.10 and 7.8. There was no weighting to any of the criteria. The detailed criteria listed in the TOR referred to the evaluation of Alternative Methods. The evaluation of Alternatives to the Undertaking was intended to be a qualitative, high-level assessment based on available information. Compatibility with Land Use Planning Guideline D-4 is addressed in Section 7.3.2.

10.4.2 Agency Comments to Draft EA Submission

Comments were received from a number of agencies during the EA process. Comments received to point of submission of the draft EA are summarized in Table 10-4. Comments received as a result of the draft EA report submission are described in Section 10.4.3.

Details and copies of all correspondence are included in the Record of Consultation Report (Volume IV).

Table 10-4: Agency Comments Received Prior to Draft EA Submission

Agency	Received Comment	Study Team Consultation Activity/Response	Where Addressed in Report
Ministry of Environment and Climate Change	April 14, 2016 MOECC provided written correspondence to the Study Team with guidance on meaningful Indigenous community consultation and encouraged continued communication with HDI through the EA process and directed Burnside to communicate with Mr. Wright.	March 2, 2016 Burnside provided the MOECC (via Mr. Wright) a summary of a meeting with HDI and the Town regarding the EA and requested guidance from the MOECC and MAA on the discussions. March 22, 2016 Burnside responded to MOECC.	Section 10.5
Ministry of Environment and Climate Change	June 27, 2016 Mr. Header Merza sent correspondence to Burnside, with comments specific to the Landfill Expansion Noise Impact Assessment Report within the EA. Comments noted that construction-related noise should be included in the noise report as well as any additional equipment beyond that noted, pest control devices and other ancillary facilities.	October 28, 2016, Burnside responded to note that construction noise may exceed noise by-laws for short periods of time during daylight hours, very little equipment is used at the site and all equipment was addressed. Pest control devices are not used on site and there are no additional facilities beyond waste collection bins.	Section 6.6.1.2
Ministry of Environment and Climate Change	July 29, 2016 Mark Harris provided review comments as follows: Comment responses 1-4 have properly captured the main concerns, ministry needs to be satisfied that groundwater is protected; Is premature for Ministry to approve EA as preferred alternative was not available; now that preferred is #3 this reduces some uncertainty of proposal and potential impacts; however, there is only one down-gradient monitoring well of use, which is insufficient. Request that additional information be obtained, possibly by installing wells. Consultants suggests in #2, that preferred alternative would include a liner and LCS, as well as shallow ground water controls just beyond the liner, this would allow for more advanced modeling of contaminant migration may not be necessary, thus enabling the site to meet the Reasonable Use Guideline. This concept could be identified and described in EA, covering this critical component of groundwater protection. Furthermore, there would need to be discussion/evaluation of the effectiveness of the liner/LCS. July 29, 2016 Wesley Wright sent Burnside an email, as follows: Please note from Mark's previous email that, especially in light of his now knowing that there will be a LCS for the preferred alternative/proposed expansion, as I understand it there may not be a definitive need for on-site monitoring wells that will then have to be removed prior to construction (so long as it can be demonstrated that the site can be developed in a manner that is protective of groundwater resources).	There was a follow-up phone conversation that is summarized as follows: 1) A need to clearly state which alternative is the preferred Method; 2) A discussion of the impacts, modelling and mitigation measures associated with the preferred Method; 3) Monitoring requirements for the preferred expansion Method; 4) Existing/Historic Monitoring Results.	Section 7.1.4

Agency	Received Comment	Study Team Consultation Activity/Response	Where Addressed in Report
Ministry of Environment and Climate Change	N/A	Ms. Shirali was informed of the new monitoring well (OW36) was installed in late November 2016, as part of the on-going monitoring program to address the potential for impacts downgradient from the existing waste footprint and to address outstanding Annual Monitoring Report questions from the MOECC (dated back to 2009, Burnside's site involvement started in 2013). As this well had not yet produced water for sampling; the draft EA Report completion was delayed. Continued monitoring of the well was based on the following: If the well did not produce a sample in February, Burnside would re-evaluate the situation (It was noted that insufficient water in the well still provided data that could be interpreted by our Hydrogeologist): • Whether well produced a sample by mid-February, it would take a couple weeks for the lab and another 2 weeks (+/-) for the Hydrogeologist's assessment. • Subject to sampling results and EA Team (Town/Burnside) discussion, the draft EA Report may be ready in late March 2017. March 23, 2017 a voice message was left after a call from Jamie Hollingsworth to Ms. Shirali was unanswered. Ms. Shirali returned the call on March 24, 2017 and was informed that Burnside's Hydrogeologist had spoken to the Ministry's Hydrogeologist (Mark Harris) and that the EA report preparation was now proceeding. It was reiterated that the installation of monitoring well (OW36) had been completed to address Annual Monitoring Report comments (from the Ministry) that dated back to 2009, and that Burnside's site involvement started in 2013. Ms. Shirali noted the anticipated mid-to-late April schedule for receipt of the updated Draft Hydrogeology Report and the Draft EA Report and agreed to distribute the reports to the Government Review Team, in keeping with the previous Project Officer's (Wesley Wright's) similar review coordination efforts.	Section 6.6.1.3
Ministry of Natural Resources and Forestry	February 24, 2015 email from MNRF (Mr. Marriott), response to Notice of EA Commencement, indicating data sources and MNRF requirements. MNRF also recommended that Burnside contact Mr. Art Timmerman to obtain fisheries information, and to contact the local conservation authority and municipality for any additional information or data. • March 5, 2015 email from MNRF (Mr. Marriott), recommending a meeting be scheduled to discuss the *Aggregate Resource Act* (ARA) License that applies to the landfill property. • February 17 and 29, 2016 email from MNRF (Mr. Marriott) to Burnside, follow-up regarding the ARA License of the site.	February 29, 2016, Burnside responded informing MNRF that a request for the site visit was forwarded to the Town for implementation. Burnside responded in a March 6, 2016 email that such a meeting could be arranged but should wait until snow melted. Burnside and the Town engaged with St. Marys Cement (SMC) as holders of the ARA License. SMC reviewed aggregate resources on the Town lands and, in August 2016, determined that they will apply to remove the license from the Town lands.	The removal of the aggregate resources licence is noted in Section 3.7.1.

Agency	Received Comment	Study Team Consultation Activity/Response	Where Addressed in Report
Upper Thames Region Conservation Authority	On August 15, 2016 UTRCA sent an email with letter (dated September 7, 2016), provided Burnside with comments on the Draft Natural Heritage Assessment Report and also regarding the Draft Hydrogeological Assessment Report. General comment UTRCA currently preferred Alternative #3 (note a permit would be required from UTRCA for works proposed in Option #3). Additional information is required to assess potential impacts of the various alternatives on Natural Heritage. In addition to SWH information provided various areas/locations should be provided; list the two threatened species and one special concern species that will be directly impacted by Alternative #2; explain why the shallow marsh/willow thicket swamp was not surveyed for amphibians; Include discussion about the likelihood of creating/enhancing areas where potential SWH for the species listed in point #1 (above) as potential mitigation measures; follow construction timing windows under the Migratory Birds Act; Ensure water quality monitoring includes both chemistry and benthic sampling. Monitoring should occur before the alternative is selected, and throughout the life of the landfill expansion. Given the fact that the site is adjacent to softshell habitat, we do not recommend alteration of the watercourse or the shoreline. • MOECC is the official hydrogeologic review agency, UTRCA simply providing comments on this section given that our office has extensive information related to the St. Marys area given our involvement with Drinking Water Source Protection Studies.	• On September 7, 2016 Burnside responded by email with letter addressing comments from UTRCA. • Burnside commented that UTRCA's comment on Method #3 is correct that a UTRCA permit will be required to relocate the watercourse and will be documented in the EA. • Burnside noted that updates have been made to Figure 6-10; however, there were areas/locations which were not mapped or updated. • The report has been updated to include confirmed and candidate habitat for a threatened species. • No amphibian calls were observed; therefore, these areas were not considered potential amphibian breeding habitat, and not included as survey station. • Given site is active landfill, any habitat creation/enhancement activities may not be permanent. There are opportunities in preferred Alternative Method 3. • Appendix H has been revised to address comments. • Burnside staff spoke with UTRCA staff by phone to discuss comments. • Relocation of the watercourse for the preferred *Method 3* will require restoration of existing habitats in the new location. We are therefore not concerned that alteration of the watercourse will have any long-term impacts to this species. • Burnside has accessed hydrogeological data available through UTRCA. (10) Burnside used both regional and local data to assess the site. • A response was sent to UTRCA on August 31, 2015 indicating that the comments will be distributed to the requested Study Team members and incorporated into the Work Plans where necessary. This was confirmed by Burnside on October 7, 2015 when an email to UTRCA confirmed that comments have been incorporated in the draft Hydrogeological Work Plan. Burnside also requested the provision of source protection data available as well as mapping on vulnerability and water budget.	Consultation with UTRCA was ongoing throughout the EA with submissions of draft reports.

10.4.3 Draft EA Review

The draft EA was provided to the MECP for review and comment prior to final submission. MECP circulated the draft report to additional agencies, including MNRF, MTO and MTCS. Comments were provided on September 22, 2017. Comments were transcribed into a table which lists each comment and how it was addressed. Comments covered a range of topics, many of which related to the need to bring more information from technical reports (appendices) into the main EA document.

The document was revised and resubmitted on January 8, 2020. Additional comments were provided by MECP on March 20, 2020.

A revised draft report was submitted in December 2020 which was followed by additional MECP comments on February 8, 2021. MECP's initial comment letters and the three summary comment-response tables are provided in Volume IV, Appendix E.

10.4.4 Meetings

Several meetings were held with MECP to review comments and discuss the Project. These meetings were held to review and discuss the comments provided on the first draft EA report. Meeting minutes were not specifically taken by discussion topic, but notes capturing the discussions are provided in Volume IV, Appendix C. Meetings were held on the following dates:

- May 7, 2018 – Teleconference with MECP
- October 12, 2018 – Meeting at MECP office, 135 St. Clair Ave. West, Toronto
- November 21, 2018 – Meeting at MECP office, 135 St. Clair Ave. West, Toronto
- February 5, 2019 – Meeting at MECP London District Office
- September 24, 2020 – Teleconference with MECP
- January 29, 2021 – Teleconference with MECP

Several phone calls and emails between the MECP and the Study Team were also undertaken to prepare the comment-response tables provided in Volume IV, Appendix E.

10.5 Indigenous Community Consultation

The Consultation activities included:

- Mailing of all Project Notices;
- Follow-up phone calls and/or emails to confirm level of interest;
- Responses to comments and questions posed by Indigenous communities; and

- Additional consultation (e.g., meetings with Chief and Council, community meetings, etc.), as required based on interest.

This process was initiated with the July 2017 (first draft) submission. Given the time that passed and the extensive revisions to this EA Report following MECP reviews, the process was reinitiated in March 2021 with a revised draft of this EA Report.

10.5.1 Notices

Following the Notice of Acceptance of the Terms of Reference and Commencement of the EA, seven communities expressed an interest in the EA and requested they be kept informed. These included:

- Aamjiwnaang First Nation (Formerly Chippewas of Sarnia First Nation);
- Caldwell First Nation;
- Chippewas of Kettle and Stony Point First Nation;
- Chippewas of the Thames First Nation;
- Haudenosaunee Development Institute;
- Six Nations of the Grand River; and
- Walpole Island First Nation (Bkejwanong Territory).

10.5.2 Site Visit

On April 24, 2015 Burnside emailed to interested Indigenous communities a copy of the Draft Ecological Work Plan for review and invited representatives to participate in a Site Visit and observe fieldwork to be conducted as part of the Ecological Work Plan. Two subsequent telephone contacts with these communities, and follow-up emails on June 18 and 22, 2015 solicited attendance.

A few Indigenous communities responded to the invitation to the Site Visit indicating possible attendance or an inability to confirm attendance. Ultimately, no representatives from these communities attended the Site Visit on June 23, 2015. It was further noted to interested communities that other opportunities for a Site Visit were available; however, none of the communities attempted to arrange a subsequent Site Visit.

10.5.3 Meeting with HDI

A meeting was held with the Haudenosaunee Development Institute on February 29, 2016 at the HDI office in Hagersville. HDI described the Nanfan Treaty and the associated rights held by the community. HDI requested that the Town complete HDI's project application form and submit a permit fee. It was noted that the application information had been submitted but not the application fee.

Communications with the MOECC were initiated following the meeting seeking guidance on the consultation process with the HDI. The MOECC response indicated efforts toward consultation should continue though payment of the HDI's application fee is not a MOECC requirement. Based on this advice, the Town sent a letter to HDI indicating that, in the interest of good governance and fiscal responsibility, the Town would require a (review) Work Plan in order to negotiate funding of HDI's review. The Town reiterated that they would support reasonable costs in keeping with their August 2015 letter. There have been no further communications from HDI.

10.5.4 Work Plans

CDs containing all Work Plans were provided to the following Indigenous communities and agencies:

- Aamjiwnaang First Nation;
- Caldwell First Nation;
- Chippewas of Kettle and Stony Point First Nation;
- Chippewas of the Thames First Nation;
- Haudenosaunee Development Institute;
- Walpole Island First Nation (Bkejwanong Territory); and
- Six Nations of the Grand River.

No comments were received with respect to the specific content or proposed methodologies outlined in the Work Plans.

10.5.5 Draft EA Review

A link to the draft EA was sent to Indigenous communities in 2016 asking for your input on the draft EA. Follow-up phone calls were made.

The updated EA Report and Subject Area Reports was also re-shared with the communities through email with a download link on February 25, 2021, after the Town of St. Marys and R.J. Burnside & Associates Limited (Burnside) undergone significant efforts to update the EA Report which involved continued communication with the Ministry of the Environment, Conservation and Parks. The changes have been minimal required for the associated Supporting Studies Reports, which outlined the impact of the expansion on the surrounding environment.

A set of follow up calls were made in February 2021. During our calls, it became clear that the communities are generally on a slower pace on reviewing and responding due to the pandemic. Therefore, a second round of follow up calls/emails were made/sent in

March 2021 (records of these emails and calls are included in the Record of Consultation Report (Volume IV)).

To date no comments have been received form Indigenous communities in response the above.

10.5.6 Comments Receive from Indigenous Communities

Several comments were received form Indigenous communities throughout the EA process. These are summarized in Table 10-5.

Details and copies of all correspondence are included in the Record of Consultation Report (Volume IV).

Table 10-5: Indigenous Communities Comments Received

Community	Comment	Project Team Response
Aamjiwnaang First Nation	On April 24, 2015 Aamjiwnaang sent an email to Burnside, acknowledging receipt of Draft Ecological Work Plan for review and invitation for community representatives to participate in a site visit and observe the fieldwork, Aamjiwnaang First Nation expressed interest in observing this fieldwork and will send an environmental review representative, but noted that a fee would be required for monitors to attend, and inquired whether this was discussed with the Town or Burnside.	On June 22, 2015 Burnside responded to Aamjiwnaang by email and encouraged the community to participate on June 23, 2015. Burnside addressed the April 24, 2015 email and expressed that the Town is prepared to fund appropriate costs but does not have financial resources to fund several separate participation, review, and comment efforts. Town is proposing that interested communities (list supplied by Project Team) agree among themselves and prepare a work program (plan) that allows their individual and shared interests to be recognized in the EA. Town is prepared to pay reasonable costs incurred to develop plans. All Notices have been provided to this community in keeping with Section 3.2.

Community	Comment	Project Team Response
Caldwell First Nation	On February 26, 2015 Caldwell FN, sent an email correspondence from Ms. Carrie Ann Peters on behalf of Chief Louise Hillier and Council, acknowledging receipt of Burnside's February 26, 2015 email and requested to be notified when process begins and to possibly set up a meeting. As a follow-up on March 18, 2015 Ms. Peters emailed and requested on behalf of Chief, further information on the EA, and a consultation meeting.	On March 19, 2015, Burnside responded providing background information on the project and the purpose of the Notice of EA Commencement (NOCm) and information as to what Phase I entails was also provided. All Notices have been provided to this community. Caldwell First Nation did not respond to the offer to attend the site visit, nor to the Town's offer to support EA review.
Chippewas of Kettle and Stony Point FN	On September 28, 2015 Chippewas of Kettle and Stony Point FN sent a letter to the Town, in response to the Town's EA process participation letter dated August 20, 2015. The community noted that the Town project will impact on Traditional Territory. The community indicated an interest in consultation and requested notification if the scope of the project changes and/or if amendments are made.	On October 20, 2015, the Town responded indicating that the community will be kept informed as the EA work advances. All Notices have been provided to this community.

Community	Comment	Project Team Response
Chippewas of the Thames First Nation (COTTFN)	In December 2013, shortly following the end of the Terms of Reference (TOR) comment period, the COTTFN contacted the MOECC to indicate that they intended to review and may provide comment on the proposed TOR in January 2014.	The Study Team suggested that COTTFN comments could be considered following TOR approval as the EA progressed, and recorded as part of the EA Record of Consultation (i.e., this report). A meeting was held with representatives of the COTTFN and members of the Study Team on February 4, 2014. Meeting notes are provided in Supplement H. The Supplement also provides record of the action items completed following this meeting, namely: that the Town would provide background history of the landfill site, including annual monitoring reports. A request was also made for the COTTFN to provide a copy of their traditional land use plan if possible. On August 20, 2015, the Town sent a letter with a twofold intention as follows: • To address the action items that came out of the February 2014 meeting.

Community	Comment	Project Team Response
		• To invite COTTFN to participate in a comprehensive EA review. The Town indicating that they could not afford individual and repeating reviews financed by the Town. Instead, the Town suggested that a combined review process, jointly defined by the interested communities, could be developed.
Haudenosaunee Development Institute (HDI)	On August 7, 2015 Ms. Tracey L. General (Admin Assistant) sent a letter and an Application for Consideration and Engagement for Development to Burnside and the Town. The letter provided information on HDI rights and interest in the area and indicated that the Project will have a significant impact and infringement upon those rights and interests. Comments included discussion of the process being undertaken by the Town and a request for a meeting. On January 28, 2016, HDI sent further correspondence, requesting availability for a meeting to be held to discuss the EA project.	On August 20, 2015, the Town responded to HDI's comments and provided a completed Application (excluding fee, noting that the Town is approximately 55 km (straight line distance, centre to centre) west of Waterloo. This moves the project well outside the area indicated on the Haudenosaunee Green Plan1 mapping. Town of St. Marys is prepared to fund appropriate costs in this regard. The Town indicating that they could not afford individual and repeating reviews financed by the Town. Instead, the Town suggested that a combined review process, jointly defined by the interested communities, could be developed.

Community	Comment	Project Team Response
	On February 29, 2016, a letter was sent to Mr. Kittmer, Town of St. Marys, from HDI lawyer Aaron Detlor indicating that the Project will impair and interfere with the treaty rights of the Haudenosaunee. HDI is requesting further consultation, noting that HDI's application has been received but the application fee has not.	On February 9, 2016, the Town sent via email a letter. Dated, February 9, 2016 appreciated response to the dated August 20, 2015. In keeping with your response letter of January 28, 2016, the Town and Burnside, are available to discuss the Town's EA, including the current status of the Archaeological and Cultural Heritage Work Plan reporting. On February 11, 12 and 17 emails were exchanged to coordinate dates for the meeting, which subsequently occurred on February 29, 2016. On February 29, 2016, a meeting was held with members of HDI, representatives, the Town and Burnside. During the meeting HDI indicated the need for the Town to follow HDI's application process, submitting an application form and paying the initial fee to allow for their review process. It was noted that the application information had been submitted but not the application fee. This was followed up with an email from HDI to the Town on the same day.

Community	Comment	Project Team Response
		Communications with the MOECC were initiated as a result of the meeting with HDI and Burnside sent an email on March 2, 2016 requesting guidance on the consultation process with the HDI. The MOECC responded on April 14, 2016, providing guidance on meaningful consultation and communication with HDI through the EA process. Following-up on the meeting and based on the advice provided by the MOECC, the Town replied June 13, 2016. The Town's letter to HDI indicated that, in the interest of good governance and fiscal responsibility, the Town would require a (review) Work Plan in order to negotiate funding of HDI's review. The Town reiterated that they would support reasonable costs in keeping with their August 2015 letter. All Notices have been provided to this community. There have been no further communications from HDI.

Community	Comment	Project Team Response
Six Nations of the Grand River	Ms. Joanne Thomas emailed Burnside on June 25, 2015 to explain the absence of a representative from their community at Site Visit. She asked to be kept informed of the project moving forward. On September 21, 2015, the community sent a letter to the Town acknowledging receipt of the Town's August 20, 2015 letter (per Section 4.5.2). this project is within Six Nation's Treaty Lands. The response provided information on the consultation policy and process of the Six Nations of the Grand River to which they are bound and obligated to use in discussions with any projects affecting their rights and interests. The letter provided links to policies, processes, land rights, and interests and it was requested that they be allowed to review the archaeological work once completed.	Burnside responded on June 26, 2015 confirming receipt of the correspondence, indicating that questions about the project could be submitted at any time and assuring that Six Nations Council would be kept informed as the project proceeded. The Town responded on October 20, 2015, to ensure that Six Nations would be kept informed of the EA work including the Archaeological and Cultural Heritage Work Plan reporting (as requested), and that other reports and opportunities for feedback would be provided. All Notices have been provided to this community.

Community	Comment	Project Team Response
Walpole Island	On June 18, 2015, Dean Jacob sent an email notifying Burnside that he will be unable to attend the site visit; however, will notify them if Jared Macbeth is available.	All Notices have been provided to this community.

10.6 Review of Updated Draft Environmental Assessment

The updated draft EA was submitted to agencies and Indigenous communities for review and has been placed on the Town's website. All interested parties were notified that the update draft report was available for review for a 5-week period.

10.7 Submission of Environmental Assessment

A Notice of Submission of Final EA Report will be prepared and circulated to all parties on the Project Contact List advising them of the availability of the Final EA Report on the Town's website for the prescribed 7-week public review period.

11.0 Future Commitments and Environmental Compliance

11.1 Additional Studies and Design Considerations

In addition to design of the landfill infrastructure, the following design-related considerations will be incorporated into the overall landfill design and will be submitted as part of the ECA amendment application:

- Design Plans, including:
  - A closure report for the existing monitoring wells which are located within the expansion footprint and a plan to install new monitoring wells prior to completion of the site construction.
  - Development of a watercourse relocation plan for approval by DFO and UTRCA. Should any potential impacts to downstream SAR be identified, MECP will be contacted.
  - Plans to remove and relocate the stormwater management basins.
  - Plans to extend the manholes so they can continue to be accessed after vertical expansion.
  - Development of a decommissioning plan to document site closure procedures and post-closure monitoring and contingency measures.
- Further assessment of the CKD pile, including:
  - Consideration of the need for a subsurface drain to be placed in the existing location of the watercourse as a means to further limit any interaction between the landfill and the CKD stockpile.
  - Review of the potential effects of the CKD pile on the watercourse.
  - Development of a monitoring and adaptive management plan to address potential impacts during construction and operation.
- Update of the odour modeling results based on the detailed design plans.
- Development of an Environmental Management Plan which will include all previous commitments and approval conditions associated with construction, operation, closure, and post-closure of the site.

- Review and update of the site's complaint-response framework and procedures and communication plan.
- Review and update the site's Emergency Response, spill management and contingency plans related to leachate management.
- Review and update the site's Annual Monitoring Program and procedures.
- Assess the need/value for future benthic analysis as part of the post-expansion monitoring program.

11.2 Required Approvals

In addition to approval of the EA under the *Environmental Assessment Act*, additional approvals under a number of provincial statutes may also apply. The Table below identifies the approvals and the rationale.

Table 11-1: Required Approvals and Rationale

Approval	Rationale
Environmental Protection Act	Approval required for expanded landfill, per O. Reg. 232/98.
Ontario Water Resources Act	Approval required for revise site surface water management system.
Conservation Authorities Act	Work within a UTRCA Regulated Area including the realignment of the unnamed watercourse.
Planning Act	Official Plan/Zoning By-law conformity. The Town will work with the Township of Perth South/County of Perth to incorporate provisions for lands adjacent into the County's Official Plan and Township's zoning by-law.
Endangered Species Act	Registration of impacted Eastern Meadowlark habitat under O. Reg. 242/08, Section 23.2 of the Endangered Species Act.
Fisheries Act	In-water work within a watercourse that could potentially cause a HADD to downstream fish habitat in the Thames River.
Fish and Wildlife Conservation Act	Wildlife Scientific Collector Authorization for potential wildlife relocation during construction (i.e., turtle, snake, etc.).

A Source Water Protection Risk Management Plan is not required as the Site is not within a Municipal Wellhead Protection Area or Intake Protection Zone.

11.3 Commitments to Ongoing Consultation

The Town has made commitments to continue consultation through the final EA, design, operations, closure, and post-closure of the landfill. Those commitments include:

- Consulting with DFO on the final EA.

- Working with applicable agencies through the permitting process, including contact with DFO, UTRCA and MECP to obtain the permits and approvals listed in Section 11.2.
- Providing an opportunity for adjacent residents and interested members of the public to review the design plans prior to completion, to obtain landfill-related updates throughout the landfill operation, closure, and post-closure. This will be accomplished by posting applicable information to the Town's website, enacting the Town's complaint-response protocols, issuing notices related to any changes to the landfill's ECA or closure plans and any emergency or spill-related situations, as required, and communicating with individual landowners on any specific issues that may arise.
- Contacting Indigenous communities during the detailed design process and providing interested communities with an opportunity to review and comment on design plans prior to completion.
- Continuing discussions regarding accommodation with respect to the project where Indigenous rights or interests are affected throughout the detailed design and permitting process. This will involve consultation on the detailed design and discussion with Indigenous communities about how, and where, accommodations could be incorporated into the design and/or operation of the facility.
- Continuing to communicate with interested Indigenous communities throughout the operations, closure, and post-closure of the landfill. This will be accomplished by notifying interested Indigenous communities of the landfill's closure and any emergency or spill-related situations, as required. Indigenous communities will also be notified of any changes to the landfill's ECA throughout the operational period.
- Updating existing Emergency Response and Communications Plans and Complaint-response protocols to ensure clear and transparent communications during emergency situations and when addressing complaints.

The Town is committed (e.g., through implementation of the EA Consultation Program) to ensuring that the proposed waste management *Undertaking*, resulting from this EA process, is in the best interests and reflects the values and priorities of the Town's residents, the general public, government agencies, Indigenous communities and other interested persons. The Town is committed to working with all interested parties to address and resolve concerns to the greatest extent possible.

11.4 Commitment for Ongoing Waste Diversion System Improvements

As a part of the Town's commitments for public engagement and environmental compliance, the Town commits to review every 10 years the waste diversion opportunities available for implementation.

In addition, the Town currently reviews their waste diversion operations on an annual basis as part of the Landfill's Annual Monitoring Report (AMR). The AMR includes detail on current diversion programs such as the Blue Box, leaf and yard waste, wood waste, e-waste, and MHSW programs (now call Hazardous and Special Products, or "HSP"). Elements included in this review are:

- Historic and current waste diversion rates;
- Waste diversion goals/targets (set by Provincial guidelines, regulations, and sector advocacy agencies);
- New diversion programs that may aid in increasing the Town's waste diversion rate; and
- Assessment of the current diversion systems, identifying areas for improvement.

The Town commits to review available diversion programs that may be introduced during the EA planning period, for example, programs that are created through implementation of the Resource Recovery and Circular Economy Act and the transition of diversion programs to a IPR model. The Town will commit to meeting provincial diversion targets over the landfill's 40-year planning period.

11.5 Compliance Monitoring

A compliance monitoring framework has been developed to guide the remaining design, permitting, construction, operation, and decommissioning phases of the Project.

Table 11-2 provides a summary of commitments, actions and additional tasks required to ensure the landfill expansion proceeds in a manner that is compliant with this EA. This table will be updated with additional EA approval conditions and permitting requirements as they are identified.

Some of the commitments will be carried out by the Town, while others will be the responsibility of various engineering and construction contractors. Any contractor responsibilities will be clearly specified in bid and tender documents to ensure they are carried out. The Town will ultimately be responsible for ensuring that contractors complete all required commitments.

Table 11-2: Compliance Monitoring Plan

Category	EA Report Reference	EA Commitment	Timing	Compliance Monitoring *(How Compliance will be Confirmed and Documented)*	Status of Completion[74]
Mitigation Measures and Monitoring Activities	Section 8.11 and Table 9-1	Following approval of the EA, the Town will ensure that all mitigation measures and monitoring activities identified in this EA Report for both Pre-Construction/Construction and Operations and Maintenance Phases of the Project are followed and appropriated conveyed in EPA design plans, instructions to future contactors and landfill operations staff, as appropriate.	Design, Construction, Operations, Closure and Post-closure.	• Table 9-1 and this table will be incorporated into tender documents for design and construction of the landfill expansion. • During construction, Town staff and/or contracted construction administrators/inspectors will be responsible for monitoring and documenting the implementation of all commitments. • A hold-back will be maintained on all payments to design and construction contractors until it can be demonstrated that all commitments have been addressed.	
Design Plans	Section 11.1	Design Plans, including: • A plan for closure of the existing monitoring wells which are located within the expansion footprint and a plan to install new monitoring wells prior to completion of the site construction. • Development of a watercourse relocation plan for approval by DFO and UTRCA. • Design of a subsurface drain, if required to be placed in the existing location of the watercourse as a means to further limit any interaction between the landfill and the CKD stockpile. • Plans to remove and relocate the stormwater management basins. • Plans to extend the manholes so they can continue to be accessed after vertical expansion. • Review and re-modeling of potential odour impacts based on the detailed design plans. • Development of a decommissioning plan to document site closure procedures and post-closure monitoring and contingency measures. • Development of a Communications Plan, as described below.	Design and Permitting stage.	• All design plans will be submitted to MECP as part of the ECA approvals process. • Watercourse relocation plans will be submitted to DFO and UTRCA in conjunction with Fisheries Act and UTRCA permitting requirements. • Design plans will not be deemed compliant until approved by MECP, DFO and UTRCA, as applicable.	

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[74] To be entered here as each commitment is completed.

Category	EA Report Reference	EA Commitment	Timing	Compliance Monitoring *(How Compliance will be Confirmed and Documented)*	Status of Completion[74]
Permits and Approvals	Section 10.2 and Table 11-1	Acquire all necessary permits and/or approvals for the undertaking, including: • Environmental Protection Act • Ontario Water Resources Act • Conservation Authorities Act • Planning Act • Endangered Species Act • Fisheries Act • Fish and Wildlife Conservation Act	Design	• The Town will work with MECP to identify all necessary permits through the ECA process. • The Town will be responsible for ensuring that the project does not proceed without all necessary permits in place.	
Consultation with the Public	Section 11.3	The Town will continue to engage with stakeholders and interested indigenous communities throughout detailed design, operation and decommissioning of the landfill. A Communications Plan will be developed to outlined how ongoing communications will be managed, including who will be contacted, when contact will occur and how contact will be made. Ongoing communications will include: • Posting applicable information to the Town's website. • Enacting the Town's complaint-response protocols. • Issuing notices related to any changes to the landfill's ECA or closure plans and any emergency or spill-related situations, as required. • Communicating with individual landowners on any specific issues that may arise.	Design, Construction, Operations, Closure and Post-closure.	• The Communications Plan will be submitted as part of the ECA package and will be approved by MECP as part of the ECA application process. • Ongoing communications will be documented in the landfill's Annual Monitoring Reports.	
Consultation with Indigenous Communities	Section 11.3	Communication with Indigenous communities will be identified in the Communications Plan and will include: • Contacting Indigenous communities during the detailed design process and providing interested communities with an opportunity to review and comment on design plans prior to completion. • Continuing discussions regarding accommodation with respect to the project where Indigenous rights or interests are affected throughout the detailed design and permitting process. This will involve consultation on the detailed design and discussion with Indigenous communities about how, and where, accommodations could be incorporated into the design and/or operation of the facility. • Notifying interested Indigenous communities of the landfill's closure and any emergency or spill-related situations, as required. Indigenous communities will also be notified of any changes to the landfill's ECA throughout the operational period.	Design, Construction, Operations, Closure and Post-closure.	• The Communications Plan will be submitted as part of the ECA package and will be approved by MECP as part of the ECA application process. • Ongoing communications will be documented in the landfill's Annual Monitoring Reports.	

Category	EA Report Reference	EA Commitment	Timing	Compliance Monitoring *(How Compliance will be Confirmed and Documented)*	Status of Completion[74]
Environmental Management Plan	Section 11.1	Prepare EMP to include: • All mitigation measures, monitoring requirements, and commitments identified in the EA. • Conditions of approval outlined in all permit and approvals. • Operations Plans, including Best Management Practices (BMPs). • An Erosion and Sediment Control (ESC) Plan which shall be developed in consultation with the UTRCA. • This Compliance Monitoring Table to be updated with all other commitments identified through ongoing agency, stakeholder and Indigenous community consultation and permitting processes.	Design	• The EMP will be submitted to MECP as part of the ECA approvals process. • The EMP will not be deemed compliant until approved by MECP and UTRCA, as applicable.	
Complaint-Response Framework	Section 11.1	Review, update (if required) and enact the site's complaint-response framework and procedures and communication plan.	Design, Construction, Operations, Closure and Post-closure.	• The complaint-response framework will be submitted to MECP as part of the ECA approvals process. • The ECA will not be issued until all documentation is deemed complete by MECP. • Ongoing complaints and Town responses will be documented in the landfill's Annual Monitoring Reports.	
Emergency Response and Communications Plan	Section 11.1	Review, update (if required), and enact the site's Emergency Response, spill management and contingency plans related to leachate management.	Design, Construction, Operations, Closure and Post-closure.	• The emergency response and communication plans will be submitted to MECP as part of the ECA approvals process. • The ECA will not be issued until all documentation is deemed complete by MECP. • Any emergency responses will be documented in the landfill's Annual Monitoring Reports and/or will be communicated to MECP immediately, as required by-law.	
Annual Monitoring Program	Section 11.1	Review, update and enact the site's Annual Monitoring Program and procedures.	Design, Construction, Operations, Closure and Post-closure.	• Any changes to the landfill's Annual Monitoring Program will be submitted to MECP as part of the ECA approvals process. • Annual Monitoring Reports will be required to be submitted each year in order to continue operating the landfill.	
Ongoing Waste Diversion	Section 11.4	The Town commits to review available diversion programs that may be introduced during the EA planning period. The Town will commit to meeting any future diversion targets set out in provincial policy.	Operations	• Waster diversion targets and achievements will be documented in the landfill's Annual Monitoring Reports.	

12.0 Compliance with Terms of Reference

This EA has been prepared in accordance with the approved Terms of Reference. Compliance with the Terms of Reference is documented in Table 12-1.

Table 12-1: Concordance with Approved Terms of Reference

Commitment ***(Location of Where Commitment was Made)***	**Commitment Status**	**Commitment Completion Timeline**	**Documentation Addressing Commitment**	
Phase 1				
The remaining "Alternative To" Methods for providing additional landfill disposal capacity at the St. Marys Landfill will be more detailed assessed, with consideration of increasing diversion in conjunction with these remaining Alternatives. (ToR Section 5.1)	**Completed.** The EA completed the Evaluation of Alternatives to the Undertaking, including (1) Do Nothing; (2) Landfilling at an Expansion of the Existing Landfill Site in St. Marys; (3) Exporting Waste to Another Jurisdiction.	Completed during EA	Volume I	Sections 3.4, 3.5, and 3.8
As part of waste diversion potential evaluation, a survey will be administered to the operators of a number of potential waste disposal facilities, expected to be mainly landfills, which may be able to accept the Town's waste. (*ToR Section 5.1.2*)	**Completed.** The municipal survey was sent to 14 municipalities that operate landfills within approximately 100 km of St. Marys.	Completed during EA	Volume I	Section 3.4.1.1
The EA consultation program will be open by making all reasonable efforts to ensure that potentially affected or interested parties have full information made available to them and are given the opportunity to make their views known. (*ToR Section 6.0*)	**Completed.** Consultation with potentially affected and other interested parties was completed according to the plan for consultation prepared during the preparation of the EA (provided in the approved TOR).	Completed during EA	Volume I Volume IV	Section 10.0
All comments from the public, agencies, Indigenous communities, and other interested persons will be documented and summarized in the EA. All other consultation activities, such as PICs and agency and Indigenous meetings, will also be documented. (*ToR Section 6.4*)	**Completed.** The Study Team has documented all communications in the Record of Consultation Report including copies of all letters, emails, faxes and other correspondence that the Study Team sent to and received from members of the public, government agencies, public utilities, Indigenous communities and other interested parties; as well as minutes from meetings held and copies of written comments received; records of public information events, including information about the event locations and layout/programs, copies of materials provided, sign-in sheets, comment sheets, news media communications, notices published, etc.	Completed during EA	Volume I Volume IV	Section 10.0
Conflict Resolution: The Town is committed to working with all interested parties to address and resolve concerns to the greatest extent possible. (*ToR Section 6.5)*	**Completed.**	Completed during EA	Volume I Volume IV	Section 10.0
Phase 2				
Depending on the Preferred *Alternative to the Undertaking*, the Individual EA process may continue, it may be halted, or it may trigger an alternate environmental approval process. This will be reassessed in Phase 2.	**Completed.**	Completed during EA	N/A	N/A
Phase 3				
Once it is clear that the Individual EA process will continue, the definition of the Undertaking as well as its purpose and rationale will be re-defined. A detailed description and statement of rationale for the Undertaking will be provided in the EA based on the findings of the work completed through the EA process, in Phases 1 and 2. (*ToR Section 5.3)*	**Completed.** A detailed description and statement of rationale for the Undertaking was be provided in the EA based on the findings of the work completed through the EA process, in Phases 1 and 2.	Completed during EA	Volume I	Section 5.0

Commitment ***(Location of Where Commitment was Made)***	**Commitment Status**	**Commitment Completion Timeline**	**Documentation Addressing Commitment**	
Phase 4				
Six Alternative Methods (including 'Do Nothing') will be reviewed (plus any additional potential alternatives identified during EA) as identified in Table 5.3 of the TOR document. (*ToR Section 5.4.1)*	**Completed.** Based on the consideration of each of the design factors, the Study Team developed and identified five conceptual Alternative Methods (+ Do Nothing).	Completed during EA	Volume I	Section 6.1
Work Plans will be developed during the EA, specific to each component of the environment or discipline that will outline in further detail the methodology to be used to characterize and assess each component. (*ToR Section 5.4.5)*	**Completed.** Work Plans were created in the early stages of the EA process. They provided a detailed methodology for characterizing each component of the environment and how the evaluation would be carried out.	Completed during EA	Volume I Volume II	Section 6.5 Appendices A though E
Draft Work Plans will be available for public, Indigenous and agency comments prior to the initiation of field studies and survey programs. (*ToR Section 5.4.5)*	**Completed.** Work Plans were circulated to relevant agencies for review and comment. Work Plans were also circulated to Indigenous communities and presented to the public at the first Public Information Centre.	Completed during EA	Volume I Volume IV	Section 6.5
The EA will consider the potential effects on various environmental components over two time periods: Construction and operation of the expanded landfill, and Closure and post-closure of the landfill. (*ToR Section 5.4.3)*	**Completed.** Potential impact resulting from the Undertaking during construction, operation, and decommissioning (closure and post-closure) of the landfill expansion to the natural, cultural, social and built environments as well as mitigation measures and net effects were identified during the EA.	Completed during EA	Volume I	Section 9
The Existing Environment will be Characterized for Natural Environment, Cultural Environment, Indigenous Connections to the Land, and Socio-Economic Environment, with the sub-components listed in Section 5.4.5 of the TOR document. (*ToR Section 5.4.5)*	**Completed.** The Existing Environment was completed in both Phase 1 and Phase 5. In Phase 5 of the EA, additional field investigations were undertaken to characterize the environment in greater detail and in accordance with the sub-components listed in Section 5.4.5 of the TOR document.	Completed during EA	Volume I	Sections 3.7 and 6.6
The Alternative methods will be evaluated based on the criteria including Natural Environment, Cultural Environment, Indigenous Connections to the Land, and Socio-Economic Environment, and the sub-criteria identified under Section 5.4.7 of the TOR document. *Criteria may be further refined as a result of comments received from the public, Aboriginal communities and agencies during the EA process.* (*ToR Section 5.4.5)*	**Completed.** The Alternative methods were evaluated using the criteria including Natural Environment, Cultural Environment, Indigenous Connections to the Land, and Socio-Economic Environment, and the sub-criteria identified under Section 5.4.7 of the TOR document. Note: The TOR included "Geology-Aggregate Extraction Considerations" as one of the evaluation criteria with "Remaining reserves in the vicinity of the landfill property" and "Status of the license and any attached conditions" as key indicators. The entire St. Marys Landfill property is now unencumbered by the aggregate extraction license. As such, this criterion has been removed from the evaluation.	Completed during EA	Volume I	Section 6.4
The site will be reviewed by a qualified person to determine if the site, accounting for its past land use, has the potential for archaeological findings. If this is the case, a Cultural Heritage and Archaeological Assessment of the site will be undertaken. (*ToR Section 5.4.6)*	**Completed.** An Archaeological Assessment Study and a Cultural Heritage Assessment Study has been completed as part of the EA Study.	Completed during EA	Volume I Volume III	Section 6.6.2.2 Appendices F and E

Commitment ***(Location of Where Commitment was Made)***	**Commitment Status**	**Commitment Completion Timeline**	**Documentation Addressing Commitment**	
Additional information will be gathered through consultation process with the identified communities in Section 5.4.6 of the TOR document during the EA consultation process. (*ToR Section 5.4.6)*	**Completed.**	Completed during EA	Volume I Volume IV	Section 10.5.5
Phase 5				
Positive and negative environmental effects that could potentially arise from the undertaking and from *Alternative Methods* will be identified and described for each of the Alternatives. (*ToR Section 5.5.1)*	**Completed.** The advantages and disadvantages of the proposed Alternative Methods were identified based on the net effects identified for each of the Methods.	Completed during EA	Volume I	Section 7.7
Measures for mitigating potential negative environmental effects from the undertaking and from *Alternative Methods* will be identified and described. Any residual impacts that cannot be fully mitigated will be identified. (*ToR Section 5.5.2)*	**Completed.** Potential impact resulting from the Undertaking during construction, operation and decommissioning (closure and post-closure) of the landfill expansion to the natural, cultural, social and built environments as well as mitigation measures and net effects were identified during the EA (including Land Use).	Completed during EA	Volume I	Section 9 (including Table 9.1)
Phase 6				
The EA process will be fully documented and available for public, Indigenous and agency review at various stages throughout the process. (*ToR Section 5.6)*	**Ongoing.**	Ongoing		
A draft EA report will be submitted to the MOE, Government Review Team and other interested stakeholders, if applicable, prior to final submission in order to ensure that it meets all requirements. (*ToR Section 5.6)*	**Completed.** Draft EA report has been submitted for MECP review on June 5, 2017, Feb 10, 2020 and Dec 9, 2020.	Completed during EA	N/A	N/A

13.0 References

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BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Waste Reduction and Diversion Assessment

THE CORPORATION OF THE TOWN OF ST. MARYS

WASTE REDUCTION & DIVERSION ASSESSMENT

AUGUST 2018

The Corporation of the Town of St. Marys

Public Works Department

August 2018

Disclaimer

This Waste Reduction and Diversion Assessment for the Town of St. Marys has been prepared by the Environmental Services Supervisor and has been reviewed and approved by the Director of Public Works. This document provides an overview of the current waste streams within the Town of St. Marys and identifies potential initiatives for advanced diversion and the impacts additional programs may have on the Town. Information presented within this report is understood to be factual and correct and Town staff shall not be held liable for inaccurate or improper data relied upon herein.

This report has been prepared in support of the Environmental Assessment for Future Solid Waste Management Needs within the Town of St. Marys as per the Terms of Reference Approval from the Ministry of Environment and Climate Change.

Contents

Tables

Appendices

1.0 Introduction

In most Canadian municipalities, the number one challenge is how to do more with less. Departments and Agencies must contend with increasingly tight budgets, yet still strive to deliver frontline programs and services to growing populations (The Corporation of the Town of St. Marys, 2011).

The following assessment was completed with the Resource Recovery and Circular Economy Act, 2016 in mind, which establishes the outcomes-based producer responsibility regime. In establishing waste reduction and diversion initiatives based on the Resource Recovery and Circular Economy Act, 2016, the Town will be better positioned to consider end-of-life materials as resources rather than waste, resulting in fewer raw materials being used and working to maximize the life expectancy of the landfill site. In addition to the Resource Recovery and Circular Economy Act, 2016 is the Waste Diversion Transition Act, 2016, which will facilitate a seamless transition from the current waste diversion programs to the new producer responsibility framework.

Certain steps are encouraged in order to achieve and maintain a zero-waste economy. By the year 2020, it is anticipated to begin transition of existing programs such as the e-waste recycling and Blue Box program. Development as well as implementation of the Food and Organic Waste Action Plan and 3Rs Regulations are also projected to commence during this time period. By 2050, the Circular Economy targets an 80% diversion rate while building towards a zero-waste economy. This coincides with the Town’s current plans and strategy for Future Solid Waste Disposal Needs with the anticipated expansion of the existing landfill site into the 2050’s.

As the Town positions itself for a long term waste disposal solution, the ability to divert and reduce the volume of waste destined for final disposal will be vital. This assessment looks at the current waste reduction and diversion programs administered by the Town, as well as investigating programs which may be considered to improve waste reduction and diversion as strategies administered from the Provincial Government come to fruition.

2.0 Background

The St. Marys Landfill Site opened in December 1984 and was designed to be constructed and filled in three phases, referred to as Phases I, II and III. Each phase of the original design was to be separated by an earth berm, and each disposal area was anticipated in 1982 to provide approximately 15 to 20 years of landfilling capacity for the Town of St. Marys, depending on population growth rates (Design and Operation Report, Phase II/III, St. Marys Landfill Site, St. Marys, Ontario, Ref. No. 0645(9) prepared by Conestoga Rovers & Associates dated November 1992).

Phase I was designed for a maximum volumetric capacity of 104,000 cubic metres, including daily cover. Phase II/III required the design to be re-assessed and upgraded due to new environmental standards at the time and resulted in a total combined volumetric capacity of 276,000 cubic metres with 140,000 cubic metres for Phase II and 136,000 cubic metres for Phase III. Phase II/III was designed to be developed in eight (8) stages, with each stage supplying approximately 1.5 to 3 years of landfilling capacity. This estimation was based on utilizing a fill rate seen in Phase I of 15,000 cubic metres per year. The design of Phase II/III had an estimated life projection of only 18.5 years.

Phase I of the Site filled up significantly quicker than originally projected, and was full by late 1992, which represented a fill life cycle half that which was originally projected. As a result of the fill rates observed in Phase I, as well as the requirement to re-assess and upgrade the design of Phase II/III, Phase II/III was given a fill life cycle of 18.5 years in 1992 and was projected to close in circa 2011.

As the environmental movement took effect in the late 1990's and early 2000's, the Town of St. Marys evolved its waste management system to begin to incorporate numerous waste diversion programs into normal operation as a way to divert material from final disposal at the landfill, thus extending the life of the landfill site. Currently, the Town administers the following programs related to waste reduction and diversion:

- Automated Curbside Collection
- Municipal Hazardous and Special Waste Depot
- Leaf and Yard Waste Collection
- Scrap Metal Recycling
- Blue Box Recycling
- Electronic Waste
- Concrete and Asphalt Recycling
- Wood and Brush Grinding

Please refer to Appendices A1-A8 for specific details regarding each of the above noted Reduction or Diversion Program, as well as near, mid and long term initiatives for improving waste diversion.

3.0 Waste Disposal Rates

As stated in Section 2.0, the St. Marys landfill site opened in the winter of 1984. Initial estimates were that each Phase of the site would provide approximately 15-20 years' worth of disposal capacity. Unfortunately, Phase I of the Site filled up much more quickly than originally estimated. The average fill rate experienced for Phase I was 16,000 cubic metres per year and this portion of the Site was closed in late 1992.

Environmental requirements changed between the time that Phase I opened and Phase II/III were to open, and as stated in Section 2.0, the design was required to be reassessed. It was at this time that the design for Phase II/III was set for an annual volumetric fill rate of 15,000 cubic metres per year with a site life projection of 18.5 years. Through the time that Phase II/III was in operation, the Town made significant strides in waste reduction and diversion programs aimed at extending the life of the remaining approved landfill. Between 1992 and 2017, the Town has averaged approximately 12,000 cubic metres per year in disposal for Phase II/III, or approximately 3,000 cubic metres less than the original design estimates for the Site.

In 2017, the Town utilized approximately 13,161 cubic metres of approved landfill space for final disposal of material. Although this is slightly above the average fill rate over the life of these Phases, the Town's population has increased approximately 1,300 individuals, excluding IC&I additions to the waste stream, than that which was originally projected when the Site was designed.

Table 1 details the historical disposal rates experienced at the landfill site for the Town of St. Marys from 1984 through 2017.

4.0 Waste Reduction & Diversion

Waste Reduction and Diversion programs can be found all across the Town of St. Marys, to not only maximize the useful life of existing infrastructure, but while also being mindful of the environment and delivering programs that meet or exceed residential expectations.

Current Waste Reduction and Diversion Programs:

At the current time, the Town administers approximately eight (8) waste reduction and diversion programs consisting of, but not limited to: the Blue Box Program, Leaf and Yard Waste, Municipal Hazardous and Special Waste, etc.

For a complete list of current waste reduction and diversion programs, along with a general program summary, please refer to ***Appendix A***.

Over the last three years (2015-2017), the various diversion programs administered by the Town, excluding Concrete and Asphalt recycling, have successfully diverted approximately 5,500 metric tonnes of waste from the landfill site. This equates to a residential diversion rate of approximately 44%.

Please refer to ***Table 2*** – Historical Waste Reduction & Diversion Rates for a complete summary of program diversion values, and the Towns annual residential diversion rate.

However, there is always the potential to improve existing program, enhance material collection and diversion in an effort to capture as much of the material as possible to reduce the volume that is placed in the landfill for final disposal.

For each program noted in Appendix A, near-term, mid-term and long-term initiatives have been proposed as part of this assessment in an effort to improve existing programs, and maximize waste reduction and diversion.

The following table depicts initiatives which may be found within Appendix A for existing programs and may be found at the bottom of each individual reduction and diversion program summary:

Example - Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	*Initiatives (Mid Term)*	*Initiatives (Long Term)*
Incentive Programs should be considered to promote at home diversion initiatives such as backyard composters and digesters. *Education and Outreach programs should be developed and implemented to ensure residents are aware of reduction and diversion programs for enhanced utilization.*	*Consideration should be given to standardizing on a single 35 gallon container size for curbside collection. Such a standardization would promote diversion and reduction by limiting the volume of waste which can be disposed through the program.*	*Consideration should be given to an effective implementation of a Food & Organics Collection Program.*

It is the intent of this Assessment to propose initiatives which can be considered now, to enhance existing programs, while also being mindful of the future by proposing longer-term initiatives that may be considered as the Town grows, demographics change, new technology emerges or regulatory requirements amended.

Potential Waste Reduction and Diversion Programs:

While the Town has positioned itself well based on the implementation of historical waste reduction and diversion programs, new waste streams, and aftermarket uses continue to be developed, which opens up additional diversion programs for consideration.

As part of this Assessment, an additional Eight (8) waste reduction or diversion programs have been identified for consideration by the Town. Programs for consideration include, but are not limited to: Food and Organics Collection, Asphalt Shingles Recycling, textile recycling and landfill optimization.

For a complete list of potential waste reduction and diversion programs, along with a general program summary, please refer to ***Appendix B***.

Similar to Appendix A, for each program noted in Appendix B, near-term, mid-term and long-term initiatives have been proposed as part of this assessment in an effort to facilitate discussions surrounding additional waste reduction and diversion programs, considerations for the Town and aligning initiatives with provincial government goals and strategies, as necessary.

As the Town positions itself for a long-term waste disposal facility via the Environmental Assessment for Future Solid Waste Disposal Needs, it will be the opportune time to consider new, modified or expanded waste diversion programs to position the Town to maximize infrastructure now and into the future. The inclusion of diversion programs into the detailed design of the landfill site will be vital to the success of the programs.

5.0 Implementation

Throughout this assessment, various near-term, mid-term and long-term initiatives were documented as a means for consideration in potentially enhancing diversion programs within the Town of St. Marys. Initiatives should be reviewed and investigated prior to any implementation based on the changing landscape of the Town as well as the implementation of strategies, frameworks and goals from the Provincial Government.

Implementation of any waste reduction and / or diversion program should be duly considered by the Town in collaboration with its Strategic Plan and the six (6) key pillars to ensure the overall outcome of positive net effects that benefit the community as a whole.

Due to the recent transition at a Provincial Level to move towards a waste free Ontario and a circular economy in the waste management sector, the long term fate of diversion programs, as well as potentially new initiatives are largely unknown and limit the ability to predict how initiatives will impact waste management practices within the Town. Initiatives detailed herein should be monitored along with broader provincial initiatives to evaluate the effectiveness of any waste reduction or diversion program. However, with the town currently undertaking an Environmental Assessment for Future Solid Waste Disposal Needs, and the identification of the preferred alternative of Landfill expansion, the Town will be well positioned to incorporate enhanced diversion programs into the long term planning and design of the St. Marys Landfill Site, pending provincial approval.

6.0 References

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TABLES

The Corporation of the Town of St. Marys
Environmental Services

Table 1

HISTORICAL FINAL WASTE DISPOSAL RATES FOR THE ST. MARYS LANDFILL SITE

Waste Management System - 1984 Through 2017

Year	Volume (m^3)
1984	10600
1987	25700
1988	21600
1989	8800
1990	21400
1991	13400
1993	9500
1994	12100
1995	10000
1996	9200
1997	10300
1998	11200
1999	11550
2000	13951
2001	10060
2002	19600
2003	11450
2004	10096
2005	10096
2006	7700
2007	9751
2008	13350
2009	9765
2010	13400
2011	13615
2012	17268
2013	18452
2014	13671
2015	11076
2016	11,457
2017	13161

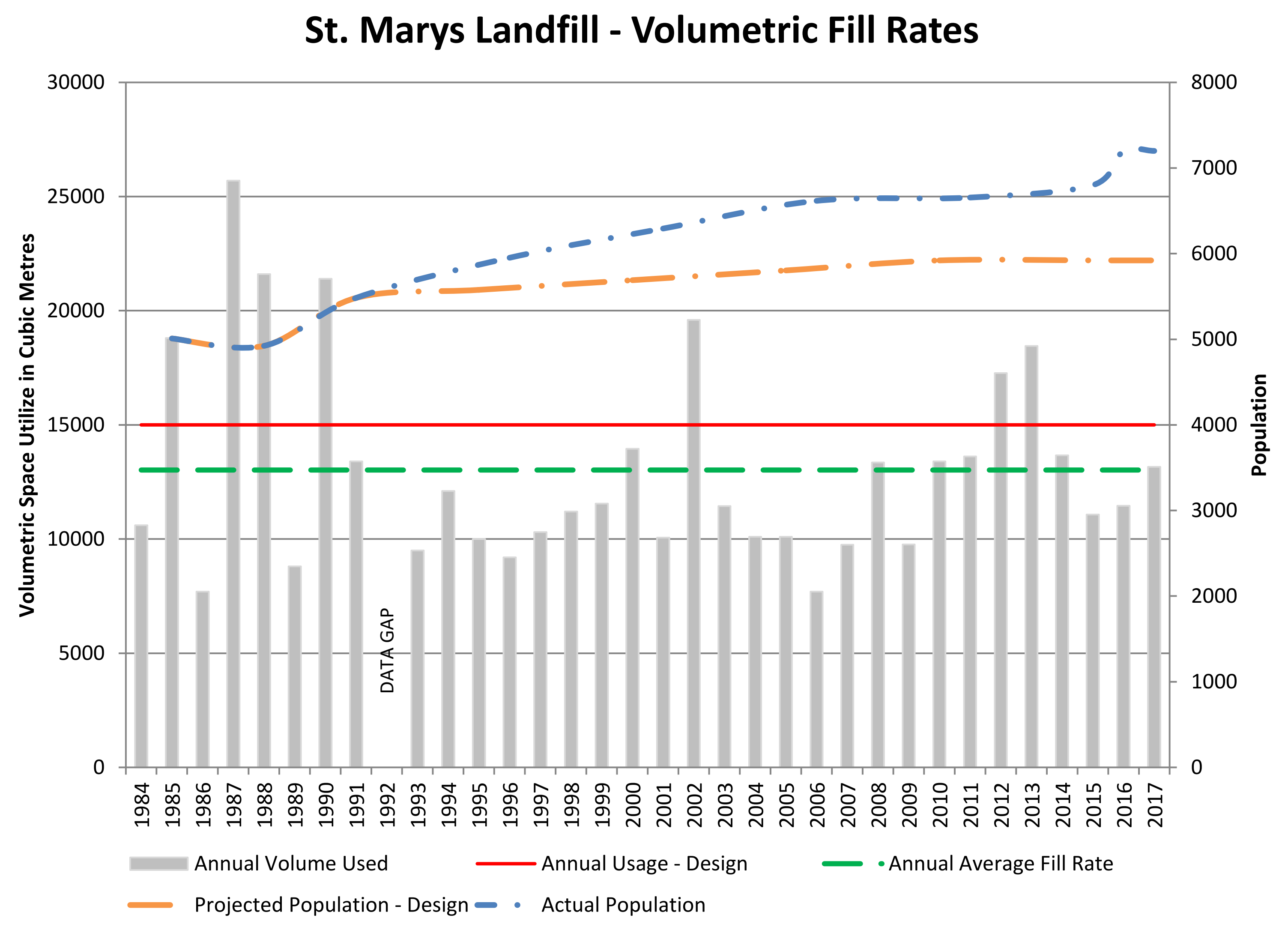

Table 2

HISTORICAL WASTE REDUCTION & DIVERSION RATES

Waste Management System - 2010 through 2017

	Annual Weight							
Material Category	**2010 (Tonnes)**	**2011 (Tonnes)**	**2012 (Tonnes)**	**2013 (Tonnes)**	**2014 (Tonnes)**	**2015 (Tonnes)**	**2016 (Tonnes)**	**2017 (Tonnes)**
Curbside Collection - Landfill Disposal	1260	1268	1273	1475	1589.15	1374.8	1290.1	1309.41
Mars Environmental Curbside Collection	NA	NA	NA	212.58	287.55	339.51	421.35	441.7
Public Drop-off - Landfill Disposal	358	360	365	375	388.68	409	376.32	400
Curbside Collection - Blue Box Recycling	884	995.41	1095	1074	1078	1070	1049	1063
Brush Material	380	178	178	178	86.45	196	370.86	69.94
Wood Waste	NA	NA	NA	NA	79.31	85	188.61	114.51
Scrap Metals	NA	NA	NA	NA	6.63	4.29	4.53	1.95
Leaf & Yard Waste	611	419	294.7	229	374.71	444	390.08	400.55
MHSW Materials	12	4	4	2.04	2.47	6.05	9.21	3.71
Batteries	NA	0.5	0.5	0.512	0.407	N/A	N/A	N/A
Electronic Waste	24	20.49	14.16	9.2	9.8	38.54*	5.17	21.65
Total Residential Waste	**3529**	**3245.4**	**3224.36**	**3555.332**	**3903.157**	**3928.65**	**4105.23**	**3826.42**
Curbside Collection - Landfill Disposal (exclu. Public Drop-off)	**1260**	**1268**	**1273**	**1687.58**	**1876.7**	**1714.31**	**1711.45**	**1751.11**
Total Diverted Waste	**1911**	**1617.4**	**1586.36**	**1492.752**	**1637.777**	**1805.34**	**2017.46**	**1675.31**
Diversion Rate	**54%**	**50%**	**49%**	**42%**	**42%**	**46%**	**49%**	**44%**

Notes:

NA	Not Applicable
☐	Data estimated due to lack of reliable weights
	Diverted waste reported above represented residential waste diversion only. IC&I excluded
*	7.88 Tonnes collected at landfill site, 30.66 tonnes collected at PRC site.

APPENDIX A

Existing Waste Reduction and Diversion Program

Appendix No.	Waste Reduction & Diversion Program
Appendix A1	Residential Curbside Collection Program
Appendix A2	Blue Box Recycling Program
Appendix A3	Municipal Hazardous & Special Waste Collection
Appendix A4	Electronic Waste
Appendix A5	Leaf and Yard Waste Collection
Appendix A6	Concrete and Asphalt Crushing
Appendix A7	Scrap Metal Recycling
Appendix A8	Wood and Brush Grinding

APPENDIX A-1

Residential Curbside Collection Program

The Town of St. Marys provides all single family residential homes with weekly curbside collection of refuse (garbage). Refuse is subject to non-collectable waste provisions set out in the Town's By-Law No. 71-2012 which includes various items which are not permitted within the curbside collection program such as but not limited to auto parts, white goods, tires and household hazardous waste.

The curbside collection program within the Town is administered by the Bluewater Recycling Association whom utilizes an automated collection system for waste placement and collection. Through the Association, qualifying properties can select from three (3) container sizes to suit their needs. The three sizes for selection are 35, 65 and 95 gallon containers. An annual fee is paid by the resident based on the size of container selected.

As part of the waste collection program, the Town imposes mandatory recycling, and will not accept refuse for curbside pick-up, or at the landfill which contained more than 5% recyclable material, which is defined as any material which the Town accepts in the curbside recycling program.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Incentive Programs should be considered to promote at home diversion initiatives such as backyard composters and digesters. Education and Outreach programs should be developed and implemented to ensure residents are aware of reduction and diversion programs for enhanced utilization.	Consideration should be given to standardizing on a single container size for curbside collection. Such a standardization could promote diversion and reduction by limiting the volume of waste which can be disposed through the program.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario as well as consideration to "Ontario's Food and Organic Waste Framework". Consideration should be given to a Food and Organics Collection program through municipal partnerships or as local third party facilities materialize.

APPENDIX A-2

Blue Box Recycling Program

Prior to October of 2008, the Town of St. Marys recycling program consisted of a dual stream system in which residents were required to sort recyclables in a single blue box. Recycling was collected weekly by Bluewater Recycling Association (BRA).

In 2008, the Town in conjunction with BRA implemented an automated, single stream collection program for recyclables. Curbside collection now occurs on a bi-weekly basis, year-round, for a total of 26 recycling collection days. Residents typically use a 95 gallon container / wheelie-bin to set out their recycling. Residents are not allowed to place overflowing carts at the curbside. Material that will not fit into the carts can be taken to a recycling depot or held onto until the next collection day.

Industrial, Commercial and Institutional (IC&I), as well as multi-residential units are provided with large overhead bins placed in central locations. BRA is also tasked, in some instances with the collection of these containers.

In 2016, the Province of Ontario enacted the Resource Recovery and Circular Economy Act which aims to moves recycling responsibility to producers. As various targets and milestones are achieved and / or implemented through the phase in of this Act, it will be important for the Town and our service provider to meet any new requirements which may be adopted.

For additional information related to the automated program from BRA, please visit the following website:

http://www.bra.org/recycling/

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario which may include goals such as but not limited to: Standardize promotional and educational materials *[Initiative to be developed and driven by the Ontario Government]*	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario which may include goals such as but not limited to: Begin designating new materials under producer responsibility regulations. *[Initiative to be developed and driven by the Ontario Government]*	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario which may include goals such as but not limited to: Complete transition of Blue Box program to producer responsibility. Continue to designate additional materials under producer responsibility regulations. *[Initiative to be developed and driven by the Ontario Government]*

APPENDIX A-3

Municipal Hazardous and Special Waste Collection

Household hazardous materials can be dangerous to people as well as the environment. It is because of this, that the Town of St. Marys administers a Municipal Hazardous and Special Waste Depot for residents of the Town of St. Marys as well as the Municipality of Perth South whereas unwanted or unused household products can be safely diverted from landfill and properly disposed and / or recycled.

The depot is operated at the St. Marys Landfill Site during normal operating hours where residents can dispose of this material at no charge. Material, once inspected and received by landfill staff, is then properly sorted into containers for transportation to a suitable recycling, reuse or disposal facility.

Materials accepted under this program are as follows:

Acids
Aerosol Cans
Antifreeze
Bases
Bleach
Light Bulbs
Fertilizers
Paints / Stains
Garden Chemicals
Household Cleaners
Motor Oil
Pesticides
Pool Chemicals
Propane Tanks
Solvents
Batteries

The depot administered by the Town is currently for residential use only and is not designed or permitted for Industrial, Commercial or Institutional (IC&I) utilization. IC&I properties, whom produce specific waste on regular intervals are required to contract and dispose of their waste properly through third party suppliers.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Develop Education and outreach material to better inform residents of the diversion program, which materials are included, which are not and the requirements for acceptance of material, such as containers, labels, etc.	Follow the “Strategy for a Waste Free Ontario” developed by the Province of Ontario. Program / materials should be reviewed and updated as materials are transitioned or designated to producer responsibility.	Follow the “Strategy for a Waste Free Ontario” developed by the Province of Ontario. Consideration should be given to implementing disposal bans on materials under existing waste diversion programs.

APPENDIX A-4

Electronic Waste

In circa 2005, the Town of St. Marys banned the disposal of electronic equipment (E-waste) from the landfill site. The Town currently has an Agreement with Greentec, located in Stratford, Ontario to provide a collection container, and receive e-waste collected at the landfill.

The E-waste depot is located at the landfill site for residents of the Town of St. Marys where qualifying old, unused or damaged electronic equipment can be safely and properly disposed. The depot is open during normal site operations at no charge to residents.

The program accepts a large variety of materials such as, but not limited to:

Computers, printers, pagers, DVD players, radios, etc. For a complete list of materials accepted under the program, please visit the Towns official website at: http://www.townofstmarys.com/en/living-here/E-waste.aspx .

The Town receives revenue from the program based on the value of material collected. This revenue is utilized by the Town to assist in funding waste management initiatives and operations.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Develop Education and outreach material to better inform residents of the diversion program, which materials are included and which are not.	Consideration should be given to expanding access to the E-waste depot to ensure a more convenient experience for program users while being mindful of theft and scavenging which can occur at less secure locations.	Follow the "Strategy for a Waste Free Ontario," developed by the Province of Ontario. Modify program as required based on provincial initiatives.

APPENDIX A-5

Leaf and Yard Waste Collection

In 2001, the Town of St. Marys introduced the yard waste collection program, which provided curbside collection of yard waste from April until November of each year. Residents were required to place collectibles in compostable paper bags, cardboard boxes, reusable containers or bundled stacks. Acceptable items include organic materials such as: yard plants, weeds, hedge and shrub trimmings, tree limbs (10 cm diameter maximum), lawn cuttings, etc.

Food wastes are not currently accepted.

Additionally, leaf and yard waste could be dropped off at the landfill free of charge. Weekly or twice weekly curbside collection was completed by the Town, depending on weekly needs.

In circa 2013, the Town reduced the leaf and yard waste program, limiting the curbside collection to 5 weeks in the spring and 5 weeks in the fall. Residents could still bring material to the landfill site free of charge. In 2014, the Town again made modifications to this program due to strong public opinion on changes implemented the prior year. The program administered in 2014 included 11 collection days, consisting of weekly collection in the spring and fall, and once per month throughout the summer. In addition to this change, the Town also opened a new convenience depot for Leaf and Yard waste material located at the Municipal Operations Centre, located at 408 James Street South where residents could drop-off acceptable material at their convenience.

In 2017, the Town made additional enhancements to the leaf and yard waste program which consisted of bi-weekly collection from May through November. Yard waste is delivered to the landfill and composted in open windrows.

Compost material derived from the materials collected is stockpiled at the Site to assist in site alterations, soil additives for final cover, etc. Material generated from this program is not transported off-site.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Develop Education and outreach material to better inform residents of the diversion program, which materials are included and which are not. Enhance awareness of collection days to improve program utilization.	Consideration should be given to modifying the program on a year-by-year basis to enable curbside collection of materials based on weather. For instance, an early spring means residents are required to dispose of material on their own, or hold onto material until collection starts later in May. Similarly, an early winter means no material for collection days.	Look for partnerships and economies of scale to enable the addition of materials to the program.

APPENDIX A-6

Concrete and Asphalt Crushing

In circa 1993, the Town of St. Marys started separating concrete and asphalt materials. The material is crushed, screened and stockpiled to be re-used as gravel for many different municipal projects. In 2009, an estimated 12,000 tonnes of concrete and asphalt was crushed and stockpiled, which represented approximately 8 years' worth of material. In 2014, the Town replenished the stockpile of this material and crushed, screened and separated years' worth of material again.

This program diverts material from household renovations, construction projects and private demolition and allows the Town to secure an economical source of aggregates. There is no cost for residents or contractors to utilize this program.

Materials which are accepted under this program consist of, but not limited to:

Asphalt (rubble, grindings, millings), bricks and paving stones, concrete, gravel, etc.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Develop Education and outreach material to better inform residents and contractors of the diversion program, which materials are included and which are not.	--	--

APPENDIX A-7

Scrap Metal Recycling

The Town of St. Marys has a couple of different scrap metal diversion programs within the Town. Scrap metal can be dropped off at the landfill site, free of charge where it is taken to a recycling facility. Since 2014, the Town has diverted approximately 17.5 tonnes of scrap metal from the landfill through this drop-off depot.

In addition to this program, the volunteer fire department for the Town has undertaken a "spring clean-up" which allows residents to place refuse to the curb for collection. All scrap metal is collected separately by the volunteers and recycled accordingly. In 2010, it is estimated that approximately 13 tonnes of scrap metal was collected and diverted through this program (The Corporation of the Town of St. Marys, 2011).

The Scrap metal drop off depot, as well as the volunteer firefighters collection events allows the Town to properly separate and dispose of scrap metal which is easily diverted from landfill.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Develop Education and outreach material to better inform residents and contractors of the diversion program, which materials are included and which are not.	Consideration should be given to collaborations with local scrap metal recovery centres to promote material separation and drop off.	--

APPENDIX A-8

Wood and Brush Grinding

The Town of St. Marys currently administered a scrap wood and brush program aimed at reducing the impact that this material has on landfill capacity. Currently, scrap wood and brush are diverted from landfill operations and stockpiled at the landfill site (or Municipal Operations Centre for Brush). Once stockpiled materials warrant, typically once per year, the material is ground into chips and stockpiled at the St. Marys Landfill Site for use as alternative daily cover during winter operations.

The heat emitted by the chipped material prevents freezing throughout the winter, and allows for the mixing with soil to improve the effective daily covering of waste at the landfill site. The application of wood chips as an alternative daily cover is typically administered from November 15th to April 1st of each year, or as weather conditions warrant.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Develop Education and outreach material to better inform residents and contractors of the diversion program, which materials are included and which are not.	Consideration should be given to relocate the brush pile at the MOC. During landfill site designs consideration to allow for expanded access to wood and brush drop-off to consolidate drop-off areas and limit redundancy.	Consideration should be given to alternative cover solutions instead of wood-chips for winter operations to permanently divert material from landfill / landfill operations.

APPENDIX B

Potential Waste Reduction and Diversion Programs

Appendix No.	Waste Reduction & Diversion Program
Appendix B1	Food and Organics Collection
Appendix B2	Cigarette Waste Recycling Program
Appendix B3	Asphalt Shingles Recycling Program
Appendix B4	Mattress & Box Spring Program
Appendix B5	Landfill Optimization
Appendix B6	Backyard Composting Initiatives
Appendix B7	Textile Recycling
Appendix B8	IC&I Diversion

APPENDIX B-1

Food and Organic Waste Diversion Program

The Town of St. Marys has many programs aimed at diverting or reducing the volume of waste received at the landfill site for final disposal. However, one program which is not yet implemented, that would have a significant impact on volume utilization and diversion is the use of a Food and Organic Waste diversion program.

Not only does managing resources efficiently benefit the people of our community, it also aids our environment and economy. Ontario's Food and Organic Waste Framework Action Plan relates back on growing a circular economy, outlining commitments constructed by the province in regards to food and organic waste. The Framework states that food and organic waste must be considered a resource rather than a waste.

The Provincial Framework strives towards the achievement of the following objectives; reduce food waste, recover resources from food and organic waste, support resource recovery infrastructure and promote beneficial uses.

The first and most crucial objective is to prevent and scale down the amount of food that becomes waste. The environment, economy and society of the province will benefit greatly from this step, ensuring that edible food does not end up as waste. Education is one key way in cutting down food and organic waste. Other ways to improve the reduction of food and organic waste is by using web-based platforms (such as social media), incorporating waste reduction within schools and supporting research that aims to reduce organic food waste.

Increasing resource recovery of organic food waste will help towards reaching the goals of zero waste and zero greenhouse gas emissions from the waste sector, more specifically from the Industrial, Commercial and Institutional (IC&I) sector. Amending the 3Rs Regulations will help decrease the amount of wastage created by the IC&I sector, which presents some of the best opportunities to increase resource recovery and build a circular economy. Banning food and organic waste from ending up in disposal sites would also improve the recovery of food and organic waste. Management practises are recommended to support effective use of public waste receptacles, going hand-in-hand with the resource recovery of food and organic waste. This would beneficially impact the landfill, treatment sites and transfer stations.

Another way to recognize the economic profits of a circular economy is by turning food and organic wastes into valuable end-products. It is essential for Ontario to possess a sufficient infrastructure with modernized technology to process food and organic waste into valuable resources. Reviewing present resource recovery systems and updating them will help with this. Training for new or refined technology may be required.

Being able to endorse end-products of food and organic waste is just as critical to possessing a sufficient infrastructure with technology. Soil health, crop growth, renewable natural gas, and carbon storage are some of the examples of end-products to promote. The province is to review regulatory approaches to soil amendments as well as encourage the on and off-farm end-use of soil amendments made from recovered organic resources (ex. Compost, Digestate and Biosolids).

Benefits and Losses

There are multiple benefits towards Ontario's Food and Organic Waste Framework, especially for causes that are long-term. One of the more evident benefits being that the Framework will improve greenhouse gas emissions. In 2015, greenhouse gas emissions which originated from the waste sector accounted for 8.6Mt of carbon dioxide. By carrying out the Framework, greenhouse gas emissions will decrease substantially over the long-term. The Framework will save both consumers and businesses money, while improving access to healthy and fresh food for the province. Food and Organic Waste can be turned into compost or Digestate, which helps better the health of the soil, reduce erosions as well as improve water quality.

Although there are a large number of benefits relating to Ontario's Food and Organic Waste Framework, there are some losses that may arise during the execution phase. Many larger municipalities have implemented Source Separated Organics (SSO) programs as a way to divert food and organic waste from final disposal in landfills. Recycling food waste for compost results in upstream benefits related to the creation of nutrient rich soil supplements, thus reducing the total volume required for final disposal. Unfortunately, SSO programs are extremely costly to administer in smaller communities, however, could have a significant impact on diversion initiatives within the Town. The implementation of an SSO program is not something that could be implemented and administered quickly, however is a program which should be considered in the future for the Town as technologies, general acceptance, and local third party facilities come online.

According to the Food and Organic Waste Policy Statement, municipalities that have a population of over 50,000 and greater than or equal to 300 persons per square kilometre are required to provide a food and organic waste collection. Based on this information, the Town of St. Marys is not required to provide a food and organic waste collection, but does have the option of doing so in the future.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Incentive Programs should be considered to promote at home diversion initiatives such as backyard composters and digesters. Education and Outreach programs should be developed and implemented to ensure residents are aware of reduction and diversion programs for enhanced utilization.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario as well as consideration to "Ontario's Food and Organic Waste Framework". Assess Town needs and requirements along with regulatory requirements for potential enhancements to the Leaf and Yard Waste Program.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario as well as consideration to "Ontario's Food and Organic Waste Framework". Consideration should be given to a Food and Organics Collection program through municipal partnerships or as local third party facilities materialize.

APPENDIX B-2

Cigarette Waste Recycling Program

The Town of St. Marys has been approached about investigating and implementing a Cigarette Waste Recycling program via TerraCycle.

TerraCycle's cigarette program allows participants to administer the recycling of cigarette waste. Excluding the cardboard packaging of the box, the program accepts every portion of the cigarette. This includes the filter, outer plastic, cigar stubs, inner foil, rolling paper and ash.

After collecting the cigarette waste in canisters', it must then be shipped out for recycling. The waste is sent in a sturdy plastic container that should be completely dry. Once collected, cigarettes and packaging are separated by composition. The waste is then melted into hard plastic that can be remodeled to create industrial products such as plastic pallets. Ash and tobacco are separated out and composted in a specialized process.

Through the TerraCycle program, points can also be accumulated and redeemed for a variety of charitable gifts or a payment of $0.01 per point to a non-profit organization or school. Any shipments over 3lbs will receive $1.00 per pound of waste while anything lower will amount to $0.00.

Currently, the Town as well as various merchants have grey pedestals which collect cigarette butts located around Town buildings as well as outside various stores. There is no cost to participate in TerraCycle's cigarette program; however, there is a cost for the receptacles which amounts to $100.00. In addition, it may prove to be difficult to find locations that are optimal to dispose cigarette waste. Public areas such as municipal buildings, playgrounds, etc. have strict no-smoking policies in place which limit the distance smoking is permitted around areas, or entrances. The placement of a canister near these areas to maximize use may give the impression that smoking is permitted in these locations. In addition to the above, the placement of a canister in an inopportune location would limit the effectiveness of the program, and program utilization.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Consideration should be given to investigating the potential adoption of the Terracycle program. A thorough review of the program as well as review of case studies where the program has been adopted elsewhere should be completed and presented to Council for consideration.	Mid-term and Long-term initiatives to be determined based on completion of program review and recommendation.	Mid-term and Long-term initiatives to be determined based on completion of program review and recommendation.

APPENDIX B-3

Asphalt Shingles Recycling Program

An asphalt shingles recycling program should be considered by the Town of St. Marys as a means to divert material from the landfill and maximize current and future volume within the landfill site. The Town has historically consulted with various other local municipalities whom currently administered an asphalt shingle recycling program as well as industry leaders in shingles recycling to gain a full and complete understanding of how a program may be implemented and administered within the Town of St. Marys.

Unfortunately, shingles have never been tracked separately at the landfill as to provide accurate annual tonnages, but instead were lumped in with Construction & Demolition waste. As a result, accurate material weights / volumes are not currently known for this material stream.

Additionally, the current design and set-up at the St. Marys Landfill Site is not equipped for a shingles diversion program. Based on discussions with area municipalities and industry leaders, there are two types of transfer stations which could be constructed to accommodate such a program. One being an elevated platform, roll-off bin transfer facility and the other being a bunker style transfer facility which would be similar to the current leaf and yard waste transfer facility located at the Municipal Operations Centre. Both transfer station options would require a significant capital investment.

It is also important to note that the current Environmental Compliance Approval (ECA) for the landfill site does not include provisions for an asphalt shingle recycling program to be administered. Currently, the Transfer facility at the landfill site is limited to: electrical and electronic equipment, cardboard, scrap metal and blue box recycling material and is based on the design and operation of the facility as presented within an ECA application circa 2008. For a shingles program to be administered within the Town of St. Marys, an application would need to be made and subsequently, approved by the Ministry of Environment, Conservation and Parks (MECP), and would require updates to the design and operations material previously submitted.

An Asphalt Shingles recycling program should be considered by the Town as a means to increase diversion from the St. Marys landfill site. With the pending completion of the Environmental Assessment for Future Solid Waste Management Needs, and the identified preferred alternative of Landfill Expansion, the Town will be ideally situated to incorporate such a program, and the capital infrastructure requirements into the future design, and operations of the landfill site. Council for the Town of St. Marys will need to determine if the expenses of implementing and operating such a program are worthwhile for the Town, Businesses and Residents.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Modify waste tracking system to identify asphalt shingles to assist in diversion program cost estimates. Stakeholder consultation with residents, contractors, etc. on the merits of such a program, and its potential development.	Develop an economically viable and sustainable asphalt shingles recycling program, and incorporate its implementation into any future site design and alterations.	Follow the “Strategy for a Waste Free Ontario” developed by the Province of Ontario. Consideration should be given to banning shingles from the Landfill Site should a sustainable diversion program be established.

APPENDIX B-4

Mattress and Box Spring Recycling

The Town of St. Marys currently accepts mattresses and box spring for final disposal at the Landfill Site, and represents another potential waste stream for diversion. Mattresses and Box Springs are a low density high volume product that are known to cause significant operational difficulties in their waste placement, compaction and covering processes, while also causing significant maintenance and / or damage to compaction equipment due to the metal springs found within the material which can become entangled on equipment.

Diversion programs are available for these materials which could fully redirect them from the landfill site. Various neighbouring municipalities currently offer mattress and box spring recycling programs that redirect the material to third party processors.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Consideration should be given to investigating the merit of a Mattress and Box Spring recycling program for the Town, and how such a program could be delivered.	Develop a cost effective and sustainable Mattress and Box Spring recycling program. Consideration should be given to potential municipal partnerships, or Public Private Partnerships for a cost effective program delivery.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario. Consideration should be given to future banning of Mattresses and Box Springs from the St. Marys Landfill.

APPENDIX B-5

Landfill Optimization

How a landfill is managed on a daily basis can have a significant impact on the long term utilization of the Site. Optimization activities could be implemented at the St. Marys Landfill Site which would benefit the current Site, as well as any future approved filling capacity.

Along with daily cover material, the Landfill Site is currently operated with compaction equipment utilized to position and place refuse (garbage). In 2013, the Town, in partnership with the Sites Engineering Consultant completed mandatory landfill operator training for all personnel within the Public Works Department. This provided all staff with renewed knowledge of landfill operations, compaction techniques, etc. Over the last several years, in-situ density at the landfill site has ranged from a low of 343 Kg/m3 to as high as 519 Kg/m3, for an average in-situ density over the last three (3) years of 425 Kg/m3. Although this can be seen as a positive increase over historical operations, the in-situ density is still less than that which would be anticipated with the use of compaction equipment.

While improvements have been made, additional work can be completed to further improve Site operations. The in-situ densities referenced above are still less than what would be expected for a landfill that utilizes compaction equipment. Part of this may be related to various IC&I material that does not compact well within the Site. Town staff has been working with local industry on potentially diverting specific waste from the landfill site to assist with in-situ densities. However compaction techniques and filling practices will allow for the most significant optimization at the Site.

Another optimization at the Site would be additional earth moving equipment. Currently all operations are completed by utilizing compaction equipment which includes the placement of daily cover. Compaction equipment is not intended to move earth on and off of material and as such creates operational challenges in both placing cover material, and removing at the start of each working day. Significant volume utilization savings could be realized with the consideration of the purchase or utilization of appropriate earth moving equipment going forward.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Continue to provide refresher training for operators on landfill operations and compaction techniques. Provide front line staff with enhanced direction, guidance and training to maximize operational techniques and waste densities through waste placement strategies and filling plans.	Pending approval for landfill expansion, systematically plan placement of refuse to maximize infrastructure and in-situ density. Consideration should be given to purchase GPS system and software to maximize operations. Consideration should be given to the purchase of a suitable earth moving equipment for daily cover operations.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario related to IC&I diversion initiatives. Investigate the use of alternative cover systems such as tarps to reduce and limit the volume of earth material used at the Site.

APPENDIX B-6

Backyard Composting Initiatives

Backyard composting is a cost-effective tool for waste diversion, but typically results in a smaller percentage of overall diversion. This is attributed to difficulty in getting public involvement and portions of the organics stream which cannot be composted in such a manner for instance, dairy, meats, fish, etc. According to Ontario Regulation 101/94, a local municipality that has a population of at least 5, 000 shall establish, operate and maintain a leaf and yard waste system. That system must include:

a) The provision of home composters to residents by the municipality at cost or less;
b) The provision of information to residents;
    - Publicizing the availability of home composters;
    - Explaining the proper installation and use of home composters and the use of compost; and,
    - Encouraging home composting.

In circa 2008, the Town in association with BRA, distributed backyard digesters to residents. This partnership turned out to be largely successful, so much so that the original 100 composters were sold out within 30 minutes. The Town funded approximately 50% of the cost of the digester.

The Green Cone is an at-home composting system which offers an alternative means of disposing of organic kitchen waste to Anaerobic Digestion (AD) and In-Vessel Composting (IVC). The advantage to the Green Cone over traditional techniques is that it takes all types of food waste (meat, dairy, bones, vegetables and even animal feces). Essentially, it allows residents to take everything from the kitchen table and dump it directly in. Advantages to this system are that it does not need to be turned or emptied more than once every few years. In addition, as an enclosed system, it does not attract vermin or other animals.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Continue to publicize and encourage at home diversion via composting and digestion. Develop educational material to promote such programs.	Consideration should be given to developing a long term, sustainable incentive program for composters and/ or digesters. Seek assistance in funding for at home programs such as grants, sponsors and or donations.	Follow the “Strategy for a Waste Free Ontario” developed by the Province of Ontario as well as consideration to “Ontario’s Food and Organic Waste Framework”. Consideration should be given to a Food and Organics Collection program through municipal partnerships or as local third party facilities materialize.

APPENDIX B-7

Textile Recycling

According to Value Village, approximately 85% of textiles are disposed into the landfill. Most of these textiles that are disposed of could avoid the landfill entirely by being recycled or reused by industries and consumers.

There are already multiple locations within the Town of St. Marys where one can donate their clothing for reuse. Places include the downtown Thrift Store in association with the Salvation Army as well as red bins which are provided by the Canadian Diabetes Association. In addition, the Canadian Diabetes Association periodically contacts the residents of the Town to ask for any unwanted or used clothing. Donating clothing is at no cost to residents and textiles will be picked up at their doorstep within a few days.

Through these donation programs, various textiles, such as but not limited to the following can be donated:

Accessories and bags, clothing, curtains, blankets, towels, sheets, shoes, sleeping bags, etc.

However, donating material is only addressing one stream of textile waste, and the question becomes what to do with material that is not in a condition to be donated. A recently launched program in the neighbouring City of Stratford aims to tackle the textile material that is not in a condition for donation. The Town should consider such a program for its own waste management programs for increased diversion.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Education and Outreach programs should be developed and implemented to ensure residents are aware of reduction and diversion programs for enhanced utilization.	Consideration should be given to developing a textile diversion program to collect and divert material that is not suitable for donation. The Town should seek municipal partnerships and or Public Private Partnerships for an economically sustainable program delivery.	Consideration should be given to banning the disposal of textiles at the landfill. Look for and implement more programs to recycle textiles.

APPENDIX B-8

Increase Industrial, Commercial & Institutional (IC&I) Diversion

In order to strive for a zero-waste economy, the industrial, commercial and institutional (IC&I) sector must increase its diversion rates. According to the Ontario's Food and Organic Waste Framework Action Plan, the IC&I sector is accounted for approximately 45% of all food and organic waste in Ontario, which opens a large potential for improvement. Additionally, only 25% of the food and organic waste created by the IC&I sector is diverted.

Based on the Provincial goal of establishing a circular economy, the IC&I sector will be required to focus on the following procedures to drive higher resource productivity, innovation and economic growth;

1. **Fewer Materials** - Using fewer raw materials in the beginning will decrease the amount of extra wastage.
2. **Design** - Products and packaging should be designed to be more durable which will make it last longer. They should also be able to be recycled once its lifecycle terminates. New materials should be designated to ensure that the producers are entirely responsible for recovering more materials from products and packaging.
3. **Produce** - Businesses should collaborate and coordinate across sectors to reduce greenhouse gas production and fossil fuel use.
4. **Reuse, Repair and Recycle** - Implement programs for the collection of products in order to reuse repair or recycle them.

The above targets for developing a circular economy, and a zero waste footprint in Ontario will be largely driven by regulations and requirements from the Provincial Government, which will in turn have beneficial impacts on the waste reduction and diversion efforts of the Town. In addition to provincial goals and objectives, the Town can also work with local industrial partners at reducing or redirecting waste from the landfill site by sourcing alternative disposal or recovery options.

Opportunities for Improved Waste Reduction & Diversion:

Initiatives (Near Term)	Initiatives (Mid Term)	Initiatives (Long Term)
Consideration should be given to working with the local IC&I section to reducing or diverting low weight, high volume material which may have alternative uses, or recovery options. Develop Education and Outreach material to promote IC&I diversion initiatives.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario as well as consideration to "Ontario's Food and Organic Waste Framework". Assess Town needs and requirements along with regulatory requirements for potential enhancements to IC&I waste diversion.	Follow the "Strategy for a Waste Free Ontario" developed by the Province of Ontario as well as consideration to "Ontario's Food and Organic Waste Framework".

ENVIRONMENTALLY SUSTAINABLE SOLUTIONS FOR WASTE REDUCTION & DIVERSION FOR TODAY, TOMORROW AND FUTURE GENERATIONS

AUGUST 2018

The Corporation of the Town of St. Marys

Public Works Department

August 2018

Appendix B

Survey of Landfill Operators

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Waste Export Alternatives Surveys

St. Marys Future Solid Waste Disposal Needs Environmental Assessment

R.J. Burnside & Associates Limited
292 Speedvale Avenue West Unit 20
Guelph ON N1H 1C4 CANADA

December 2019
300032339.0000

Waste Export Alternatives Surveys
December 2019

Table of Contents

Appendices

Disclaimer

1.0 Waste Export Alternatives Surveys

Per the Terms of Reference (TOR), some data for evaluation of the export Methods was collected through a survey of municipal and private waste service providers. Private waste service providers were asked a series of questions focussed on their operations, equipment, costs, and contract terms. A separate letter was sent to municipalities that operate landfill sites to determine if they would consider providing disposal capacity to the Town of St. Marys. These surveys, discussed in more detail below, were distributed in March 2015 with responses mostly received during April 2015.

1.1 Municipal Survey

Local (Municipal) Landfills within approximately 100 km of St. Marys are generally operated for the use of the municipality or county in which they are located. The only exception at the time of our surveys that the Study Team was aware is the Green Lane Landfill. The Green Lane Landfill was privately owned until 2007 when it was purchased by the City of Toronto for their waste disposal needs, making it a municipal landfill. A figure showing the location of these landfills is included in Appendix A.

No municipalities (sites) have previously expressed an interest in receiving waste from the Town of St. Marys. However, newspaper reports from early 2015 indicated that at least two municipalities were considering accepting waste from outside their communities as a revenue generating measure. With this in mind, the Town of St. Marys sent a letter asking if the municipality was (or was not) interested, subject to negotiations, in providing disposal capacity.

The survey was sent to 14 municipalities. Ten of these municipalities provided a response, written or by telephone, indicating that they were not interested in accepting St. Marys waste. The mailing list, an example letter/survey and the response summary table is provided as Appendix A.

Despite the apparent lack of interest in accepting the Town’s waste, the Study Team decided to proceed with evaluating Local (Municipal) Landfills as a potential export Method.

1.2 Private Waste Service Providers Survey

The private waste service providers (operators) survey was developed and sent to various disposal sites, transfer facility and waste hauling (trucking) companies. This

---

[1] http://www.lfpress.com/2015/04/16/having-taken-a-big-revenue-hit-when-it-lost-two-major-customers-at-its-landfill-the-city-is-courting-new-clients-a-move-that-could-recoup-500000-of-the-lost-cash, and http://www.mitchelladvocate.com/2015/03/30/taking-others-garbage-discussed-as-revenue-option-for-west-perth. Both accessed May 4, 2015.

survey was intended to collect realistic, locally focused information on a variety of subjects including typical costs, contract length, site capacities, and haulage information. Burnside had identified a number of haulage firms and transfer station owners as well as disposal sites to assist in the preparation and population of the evaluation matrix. The survey and the list of private operators invited to respond are included in Appendix B.

Information collected by this survey was reviewed by the EA Team. The responses were used in evaluating the various export Methods. Numerical responses relating to costs and fuel economies helped determine overall implementation costs and emissions rates as described below.

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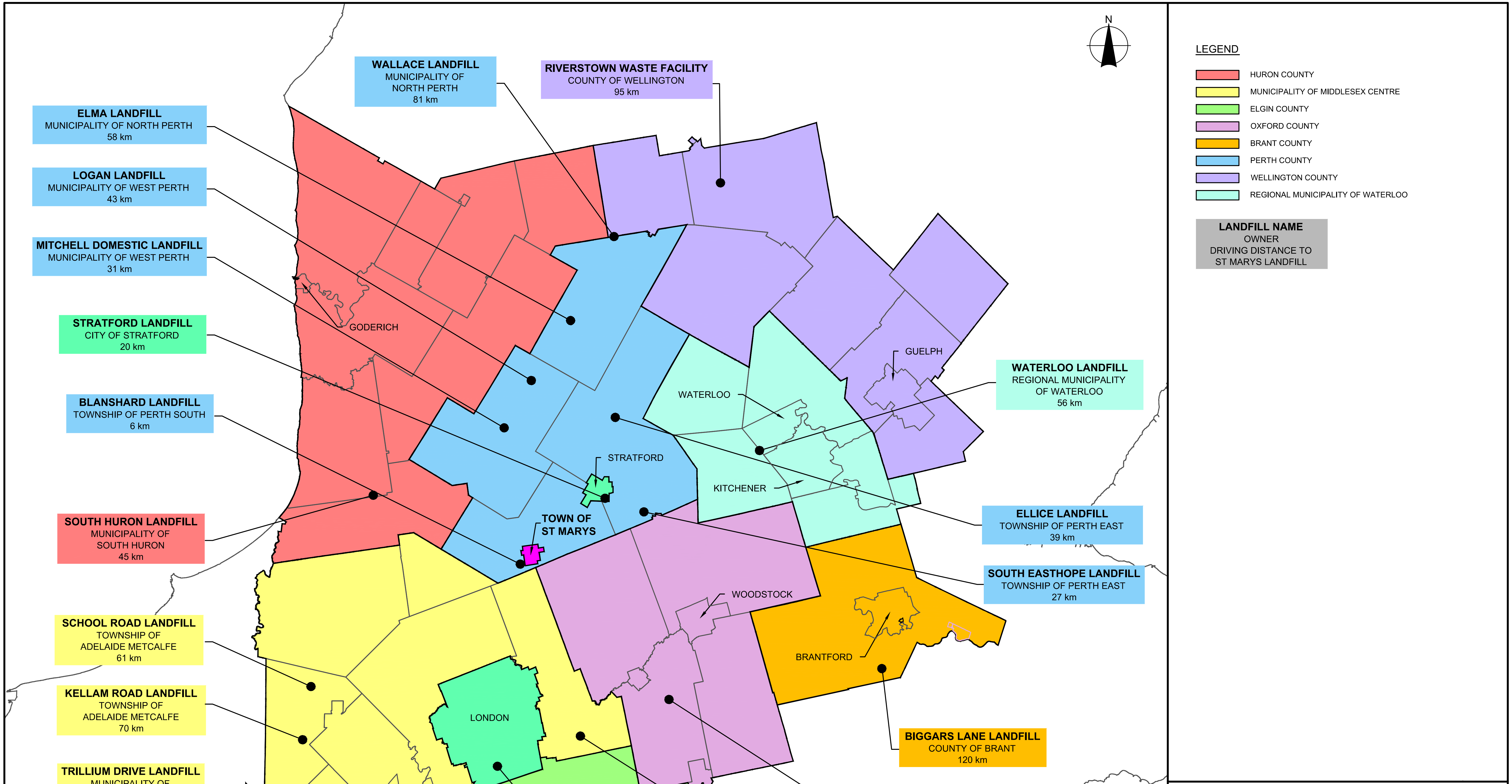
Appendix A

Municipal Survey



BURNSIDE

Client / Report

TOWN OF ST MARYS

FUTURE SOLID WASTE DISPOSAL NEEDS ENVIRONMENTAL ASSESSMENT

Figure Title

MUNICIPAL EXPORT OPPORTUNITIES AREA MAP

File Name: LANDFILL LOCATIONS.dwg Date Plotted: April 23, 2015 - 11:10 AM

ONTARIO CANADA
ST. MARYS

March 24, 2015

Lyndon Kowch
Manager of Public Works
City of Stratford
303 King St.
Stratford ON N5A 4S5

Subject: **Town of St. Marys Solid Waste Disposal Needs Environmental Assessment Export Alternatives Assessment**

The Town of St. Marys is undertaking an Environmental Assessment (EA) for solid waste disposal. The EA Terms of Reference (TOR) has recently been approved by the Minister of Environment and Climate Change. The TOR's problem statement reads:

> *The Town of St. Marys must identify a solution that addresses the Town's post-diversion municipal solid waste disposal needs over a 40 year planning period in a technically and economically feasible manner while minimizing impacts to the environment*

The TOR requires St. Marys to review the possibility of using approved waste disposal capacity owned by others, including municipalities such as your own. To this end, St. Marys would appreciate if you could complete the brief survey form attached to this letter. A written response is requested to facilitate our EA documentation.

As background, during 2014 the St. Marys Landfill accepted a total of 7,325 tonnes of waste; 1,978 tonnes from residents and 5,347 tonnes from industrial, commercial and institutional sources. It is expected that disposal requirements will grow approximately 1% annually. St. Marys is looking for disposal of this entire waste stream for a 40 year period, though shorter periods will be considered. Any disposal arrangement would be subject to further discussion, negotiation, environmental approvals, and so on. With this survey St. Marys is merely looking to see if your municipality is interested in such further efforts. It in no way commits you to accepting our waste.

Should you have any questions please feel free to contact either one of the study team representatives indicated on the form.

Respectfully,

Bruce Grant, CAO
Town of St. Marys

032339 Mun-Disposal Survey
18/03/2015 5:33 PM

St. Marys Survey of Municipal Disposal Opportunities

The information collected by this survey will be made available to the public as part of the Town of St. Marys Environmental Assessment process. Please send the completed survey via mail, fax or email to Burnside. Should you have any questions while preparing your response, please contact one of the study team representatives.

James Hollingsworth
R.J. Burnside & Associates Limited
1465 Pickering Parkway, Suite 200
Pickering ON L1V 7G7
Email: St.Marys.Waste.EA@rjburnside.com
Tel: 289-545-1051   Fax: 905-420-5247

Dave Blake, C.E.T.
The Corporation of the Town of St. Marys
Email: dblake@town.stmarys.on.ca
Tel: 519-284-2340

Municipal contact for any related correspondence: (please indicate corrections or updates)

Name	Lyndon Kowch		
Title:	Manager of Public Works		
Name of Municipality:	City of Stratford		
Address 1:	303 King St.		
Address 2:			
City, Prov. & Postal Code:	Stratford ON N5A 4S5		
Phone:	(519) 271-0250, Ext 255	Fax:	(519) 273-2720
Email:	lkowch@stratfordcanada.ca		
Preference (check one):	☐ mail, ☐ phone, ☐ fax, ☐ email		

Please complete the following statement (place check marks as appropriate):

1. Subject to further discussion, negotiations, environmental approvals, etcetera, we are

   ☐ interested   ☐ not interested

   in providing solid waste disposal capacity to the Town of St. Marys.

2. This has been confirmed/decided by:
   - ☐ Municipal Council, Committee of the Whole or similar decision.
   - ☐ Discussion with the County Warden, Mayor, Reeve or similar.
   - ☐ Discussion with the Chief Administrative Officer, Clerk, or similar.
   - ☐ Other means (please describe) ______________________

3. I am authorized to make these statements on behalf of the municipality.

Signature: ______________________ Date: ____________ mm / dd / yyyy

(print name) ______________________

A response to Burnside by April 17, 2015 would be appreciated.

Town of St. Marys Solid Waste Disposal Needs Environmental Assessment
Export Alternatives Assessment
Potential Municipal Hosts - Mail Merge Listing & Response Table

First	Last	Title	Municipality	Addresss1	Address2	City	PCode	Response				
								From	Title	Date	Method	Yes/No
Das	Soligo	Operations Superintendant	County of Wellington	74 Woolwich Street		Guelph	N1H 3T9					
Pamela	Antonio	Waste Management Coordinator	Oxford County	384060 Salford Road		Salford	N0J 1W0	Peter M. Crockett, P.Eng.	Chief Administrative Officer	21-Apr-15	Email w/ attachment	No
Deanna	Dakin	Waste Management Coordinator	Regional Municipality of Waterloo	925 Erb Street West		Waterloo	N2J 3Z4					
Don	Giberson	Environmental Services Director	Municipality of South Huron	322 Main Street South	P.O. Box 759	Exeter	N0M 1S6	Don Giberson	Environmental Services Director	13-Apr-15	Email w/ attachment	No
Ken	Bettles	Director of Pulic Works	Township of Perth South	3191 Road 122		St. Pauls	N0K 1V0	Ken Bettles	Director of Pulic Works	8-Apr-15	Email w/ attachment	No
Annette	Synowiec	Manager	City of Toronto	25th Fl.E. 100 Queen St.		Toronto	M5H 2N2	Annette Synowiec	Director of Policy, Planning & Support	21-Apr-15	Telephone	No
Mike	Kraemer	Operations Manager	Municipality of West Perth	169 St. David Street,	P.O. Box 609	Mitchell	N0K 1N0					
Lyndon	Cowch	Works	City of Stratford,	82 Erie Street		Stratford	M5A 2M4					
Mark	Hackett	Manager of Environmental Services	Municipality of North Perth	330 Wallace Ave. N		Listowel	N4W 1L3	Patricia Berfelz	Clerk	21-Apr-15	Mail	No
Wes	Kuepfer	Public Works Manager	Township of Perth East	25 Mill St East	P.O Box 455	Milverton	N0K1M0	Theresa Campbell	Municipal Clerk	9-Apr-15	Email & Mail	No
Matthew	D'Hondt	Solid Waste/ Wastewater Operations Manager	County of Brant	26 Park Avenue	P.O. Box 160	Burford	N0E 1A0	Matthew D'Hondt	Solid Waste/ Wastewater Operations Manager	13-Apr-15	Email (attachment) sent to St. Marys	No
Paddy	Thomson	Director of Environmental Services	Municipality of Thames Centre	4305 Hamilton Rd.		Dorchester	N0L 1G3	Jarrod Craven	Director of Environmental Services (Acting)	7-Apr-15	Email w/ attachment	No
Fran	Urbshott	Administrator/Clerk	Township of Adelaide Metcalfe	2340 Egremont Drive	RR #5	Strathroy	N7G 3H6	Fran Urbshott	Administrator/Clerk	21-Apr-15	Email w/ attachment	No
Jaime	Farncisco	Public Works Manager	Municipality of Southwest Middlesex	153 McKellar Street	Box 218	Glencoe	N0L 1M0	Jaime Francisco	Public Works Manager	8-Apr-15	Email w/ attachment	No

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Appendix B

Private Waste Service Providers Survey

Appendix B

R.J. Burnside & Associates Limited 1465 Pickering Parkway Suite 200 Pickering ON L1V 7G7 CANADA
telephone (905) 420-5777 **fax** (905) 420-5247 **web** www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

March 12, 2015

Via: Mail

«First_Name» «Last_Name»
«Title»
«Organization»
«Address_1»
«Address_2»
«City» «Province» «PC_»

Re: Future Solid Waste Disposal Needs Environmental Assessment Study
Waste Disposal Survey
Project No.: 300032339.1000

The Town of St. Marys has identified waste export as a potential solution to meet the Town's future solid waste disposal requirements. R.J. Burnside & Associates Limited, on behalf of the Town, has identified your company as a potential service provider for disposal.

In order to evaluate the suitability of exporting the Town's waste, Burnside is requesting information regarding the services offered by your company. It would be appreciated if you would complete the relevant sections of the attached survey and return it to Burnside. The information will be incorporated into the Environmental Assessment study for evaluation against other alternative methods of solid waste disposal. The study, including information provided by your company, will be made available for public review.

Please complete the attached survey and return it to Burnside by April 3, 2015. Should you have any questions please contact the undersigned at 289.470.1310 or andrew.evans@rjburnside.com.

Yours truly,

R.J. Burnside & Associates Limited

Andrew Evans
EIT, B. Eng biosci
AE:cv

James R. Hollingsworth, P.Eng.
Technical Manager, Solid Waste

Enclosure(s) Waste Disposal Survey

032339 Waste Disposal Surveyc.docx
12/03/2015 5:01 PM

Waste Disposal Survey

The following survey has been designed to collect information regarding the availability of, as well as the environmental and financial implications of the complete scope of private waste disposal options.

This survey has been designed to encompass the complete scope of the activities offered by private waste service providers. In order to assist you, the survey has been broken down into the following sections:

A. Waste Haulage, B. Waste Transfer, C. Landfill disposal and D. Thermal Disposal

Please complete the section(s) appropriate to your firm.

Please send the completed survey via mail, fax or email to:

St. Marys Solid Waste EA
Attn: Andrew Evans

R.J. Burnside & Associates Limited
1465 Pickering Parkway Suite 200
Pickering ON L1V 7G7
Fax: 905-420-5247
Email: andrew.evans@rjburnside.com

Please note that all information collected is for information purposes only and is not considered to represent a quotation or a guarantee on behalf of the provider. The information collected will be made available to the public as part of the Environmental Assessment process and reporting.

From / Contact for any Related Correspondence: (please indicate corrections or updates)

Name: «First_Name» «Last_Name»

Title: «Title»

Organization or Agency: «Organization»

Address 1: «Address_1»

Address 2: «Address_2»

City, Prov. & Postal Code: «City» «Province» «PC_»

Phone: «Phone» Fax:

Email: «Email»

Section A – Waste Haulage

A1. Please provide a typical haulage rate and disposal location? ($/tonne, assuming 2000 – 5000 tonnes/year) ______________________________

A2. Please provide a brief list of disposal sites you currently haul to:

____

____

____

____

A3. What is the service area provided by your company? Does it include St. Marys?

____

A4. What is your Environmental Compliance Approval (ECA), Certificate of Approval (CofA) or Environmental Activity and Sector Registry (EASR) number? ______________________________

A5. Please provide an estimate of your waste haulage fleet average fuel economy (preferably in Litres per Tonne Kilometer or US gallons per Ton Mile). ______________________________

A6. Do you offer haulage services to the U.S. (Y / N)
If yes which States (circle) New York Michigan Ohio Other ______________________________

A7. If yes can you provide an approximate frequency of loads rejected at border? How are these handled/avoided? ______________________________

____

A8. Frequency of load fires (#/year) ______________________________

A9. What is your current fleet size? Trucks: ______________ Trailers: ______________

A10. What is the typical duration of a contract? ______________________________ years

A11. What is the maximum contract duration you are willing to negotiate? ______________ years

A12. How have the tipping fees changed over the past 5 years (list of fees or percentage increases)?

____

A13. What methods are commonly used to adjust contract rates?

☐ CPI ☐ Fuel price surcharges ☐ Other: ______________________________

A14. Is there any other information you think should be considered regarding waste haulage?

____

____

____

Section B – Transfer Stations

B1. Is your site licensed/permitted to receive waste from St. Marys, Ontario (ECA Service Area)? (Y/N)

B2. Do you have capacity to receive 2000-5000 tonnes/year from St. Marys? (Y / N)

B3. What is your Environmental Compliance Approval (ECA) (or Certificate of Approval (CofA)) number? ______________________________

B4. Is waste from your site permitted to be hauled to the U.S.? (Y / N) If yes which States (circle)
New York Michigan Ohio Other ______________________________

B5. If yes can you provide an approximate frequency of loads rejected at border? How are these handled/avoided? ______________________________
____

B6. Please provide a brief list of disposal sites you currently haul to:
____
____

B7. What is the average throughput of your facility? ______________ tonnes/day

B8. What is the maximum ECA permitted throughput? ______________ tonnes/day

B9. What is the current tipping fee at your facility? (assume 2000-5000 tonnes per year)
______________________________ $/tonne

B10. What is the typical duration of a disposal contract? ______________ years

B11. What is the maximum contract duration you are willing to negotiate? __________ years

B12. How have the tipping fees changed over the past 5 years (list of fees or percentage increases)?
____
____

B13. What methods are commonly used to adjust contract rates?
☐ CPI ☐ Fuel price surcharges ☐ Other: ______________________________

B14. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N)

If yes, please explain ____

____

____

B15. Is there any other information you think should be considered regarding waste transfer stations or your site specifically? ____

____

____

Section C – Landfill Sites

C1. Is your site licensed/permitted to receive waste from St. Marys, Ontario (ECA Service Area)? (Y/N)

C2. What is your Environmental Compliance Approval (ECA) (or Certificate of Approval (CofA)) number? ____

C3. Do you have capacity to receive 2000-5000 tonnes/year from St. Marys? (Y / N)

C4. What is the current gate tipping rate? ____ $/tonne

C5. What is the estimated remaining capacity/operating life at your site? (in terms of volume and years) __________________________m^3 ____ years

C6. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)? ____ $/tonne

C7. What is the typical duration of a disposal contract? ________________________________ years

C8. What is the maximum contract duration you are willing to negotiate? __________________ years

C9. How have the tipping rates changed over the past 5 years (list of rates or percentage increases)

____

C10. What methods are commonly used to adjust contract rates?

☐ CPI ☐ Fuel price surcharges ☐ Other: ____

C11. Do you have any LFG collection? If yes please provide the approximate collection efficiency

____

C12. What kind of LFG system do you use? (i.e., flaring, gen-set, etc.) ____________________

____

C13. How does the site handle leachate? ____________________

____

C14. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N)

If yes, please explain ____________________

____

____

C15. Is there any other information you think should be considered regarding landfills or your site?

____

____

____

Section D – Thermal Disposal Sites

D1. What is your Environmental Compliance Approval (ECA) (or Certificate of Approval (CofA)) number? ____________________

D2. Can your site accept waste from St. Marys, Ontario (ECA Service Area? (Y / N)

D3. Do you have capacity to receive 2000-5000 tonnes/year from St. Marys? (Y / N)

D4. What is the current gate fee? ____________________ $/tonne

D5. What is the average throughput of your facility? ____________________ tonnes/day

D6. What is the maximum ECA permitted throughput? ____________________ tonnes/day

D7. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)? ____________________

D8. What is the typical duration of a disposal contract? ____________________ years

D9. What is the maximum contract duration you are willing to negotiate? ____________________ years

D10. How have the tipping rates changed over the past 5 years (list of rates or percentage increases)

____

D11. What thermal technology is used at your facility (incineration, gasification, etc.)?

____

D12. What is the treatment and disposal process (or site) for bottom ash and fly ash?

____

____

D13. Is energy recovery a part of your system, if so what form(s) are used? (Boiler & steam turbine, gas turbine, piston engines, secondary heat recovery, etc.

____

D14. What is the approximate level of efficiency achieved at your facility (explain)?

____

D15. Are there picking lines / material recovery equipment operating at your facility? If so please describe their operations. ____

____

D16. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N)
If yes, please explain ____

____

____

D17. Is there any other information you think should be considered regarding thermal disposal or your site? ____

____

____

Challenger Motor Freight
300 Maple Grove Road
Cambridge ON N3E 1B7

Amanda Tucker
WasteCo
235 Curtis Drive
Guelph ON N1K 1Y3

GFL
16 Centennial Road
Kitchener ON N2B 3G1

Doug Tilford
Bluewater Recycling
415 Canada Avenue
Huron Park ON N0M 1Y0

Progressive Waste Solutions
1209 North Service Road East
Oakville ON L6H 1A7

Kevin Still
Miller Waste
8050 Woodbine Ave.
Markham ON L6G 1B2

Peter Brand
TRY Recycling
21463 Clarke Road
Arva ON N0M 1C0

Chris Elliott
Green Valley Recycling
1200 Green Valley Road
London ON N6N 1E3

Clean Harbors
2258 River Road
London ON N5W 6C2

ECL Carriers
7236 Colonel Talbot Road
London ON N6L 1H8

Walkers Environmental Group
Southwestern Landfill
PO Box 100
Thorold ON L2V 38

Southwestern Landfill
Walker Environmental Group
PO Box 100
Thorold ON L2V 3Y8

Waste Management Inc.
Twin Creeks Landfill
8039 Zion Line
Watford ON N0M 2S0

Republic Services Inc.
Carleton Farms Landfill
28800 Clark Road
New Boston Michigan 43164

BFI Canada Inc.
Ridge Landfill
20262 Erieau Road
Blenheim ON N0P 1A0

Emerald Energy from Waste Inc.
7656 Bramalea Road
Brampton ON L5S 1C4

Brooks Road Environmental
160 Brooks Road
Cayuga ON N0A 1E0

Town of St. Marys
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Survey Responses

Table 1 - Area Waste Hauler Information

First Name	Last Name	Title	Organization	Final Responses
Greg	Hale	Operations Manager	Challenger Motor Freight	Survey completed & emailed to R. J. Burnside & Associates
Amanda	Tucker	General Manager	WasteCo	Contact was made, however, the completed survey has not been provided.
Tony	Lopez	MRC and Centennial Operations Manager	GFL Environmental Inc	Survey completed & emailed to R. J. Burnside & Associates
Francis	Veilleux	President	Bluewater Recycling	No information provided - described as "commercially sensitive" and unavailable for public distribution
			Progressive Waste Solutions	No response to mailed letter or telephone calls regarding the survey
Rick	Vandersluis (	Vice President	TRY Recycling	Survey completed & emailed to R. J. Burnside & Associates
Rick	Declercq	President	Green Valley Recycling	Survey completed & emailed to R. J. Burnside & Associates
Chris	Havens	Field Service Coordinator	Clean Harbors	Informed via email that Clean Harbors London is no longer active.
Ray	Fillion	Director, Business Development	ECL Carriers	Survey completed & faxed to R. J. Burnside & Associates

Table 2 - Waste Disposal Site Information

First Name	Last Name	Title	Organization	Final Responses
Shawn	Jordan	Sales Manager	Walker Environmental Group	Survey completed & emailed to R. J. Burnside & Associates
Luiza	Furtado	Communications Manager	Waste Management Inc., Twin Creeks Landfill	Survey completed & emailed to R. J. Burnside & Associates
Robert	Web	Vice President	Republic Services Inc., Carleton Farms Landill	Survey completed & emailed to R. J. Burnside & Associates
Wes	Belanger	Operations Manager	BFI Canada Inc., Ridge Landfill	Survey completed & emailed to R. J. Burnside & Associates
Joseph	Lyng	General Manager	Emerald Energy from Waste Inc.	Survey completed & emailed to R. J. Burnside & Associates
Richard	Weldon	General Manager	Brooks Road Environmental	Contact was made, however, the completed survey has not been provided.

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Survey Section A - Waste Haulage

Organization: Question:	Challenger Motor Freight	TRY Recycling	ECL Carriers	Walker Environmental Group	Waste Management of Canada Corporation, Twin Creeks Landfill	Emerald Energy from Waste Inc.
A1. Please provide a typical haulage rate and disposal location? ($/tonne, assuming 2000 – 5000 tonnes/year)	$35 - $42 per metric tonne		$26/ mt in the Detroit, MI area	$ 24.50 PMT from St. Marys to WEG Niagra Landfill, assumes 33MT per load	$60 - $80 per MT depending on location and waste type	Disposal at Emerald Energy from Waste in Brampton: $16.50 per tonne (for haulage)
A2. Please provide a brief list of disposal sites you currently haul to:	Green Lane (St Thomas, ON); Carlton Farms (New Boston, MI); Pinetree (Lenox, MI); Walker Bros (Niagra Falls, ON)		Republic Waste (New Boston, MI) and Waste Management (Lenox, MI)	WEG, Niagra Landfill (Ontario) and Covanta WTE (Niagra Falls, N.Y.)	We haul to hundreds of sites but internalize the majority of our volume in Soutwest Ontario to our Twin Creeks Landfill (Lambton, Ontario) or Petrolia Landfill (Lambton, Ontario)	Niagra Waste Landfill (Niagral Falls ON); York-Durham Energy Center (Oshawa ON); Emerald Energy from Waste (Bramption ON)
A3. What is the service area provided by your company? Does it include St. Marys?	Any and all	Ontario and yes	Yes	Southern Ontario. Yes, it would include St. Marys	The service is all Ontario which includes St. Marys	Yes
A4. What is your Environmental Compliance Approval (ECA), Certificate of Approval (CofA) or Environmental Activity and Sector Registry (EASR) number?	A841577	A040146		A8248	Hauling: A840311	A8597
A5. Please provide an estimate of your waste haulage fleet average fuel economy (preferably in Litres per Tonne Kilometer or US gallons per Ton Mile).	4.5 miles per gallon	Service provided by Republic Waste	4.2/MPG	1.8 kilometres per liter		
A6. Do you offer haulage services to the U.S. (Y / N) If yes which States (circle) New York; Michigan; Ohio; Other	Y: New York, Michigan		Y: All	Y: New York, Ohio, Pennsylvania	Y: Haulage availability in each State	N
A7. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)?	1 load in 100. Loads are redirected to Canadian Landfills		D15. Are there picking lines / material recovery equipment operating at your facility? If so please describe their operations	> 5 per year. Loads would be redirected to our Niagra Landfill	Negligable load rejections. Numerous contingency sites are available in Ontario if loads are rejected. If rejected in Michigan, alternate sites are Petrolia or Twin Creeks Landfill	

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Survey Section A - Waste Haulage

Organization: / **Question:**	**Challenger Motor Freight**	**TRY Recycling**	**ECL Carriers**	**Walker Environmental Group**	**Waste Management of Canada Corporation, Twin Creeks Landfill**	**Emerald Energy from Waste Inc.**
A8. Frequency of load fires (#/year)	1 fire in 20 years		D16. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N) If yes, please explain	0	Negligable	None
A9. What is your current fleet size? (Trucks and Trailers)	Trucks: 68; Trailers:90		Trucks: 134; Trailers: 178	Trucks: 17, Trailers: 14, Walking Floors: 11,	In Ontario: Trucks: 10, Trailers: 20	Trucks > 100
A10. What is the typical duration of a contract? (years)	3 - 5 years with extensions		3 - 7	1 - 5	Municipal disposal contracts range from 5 - 25 years	1 - 5
A11. What is the maximum contract duration you are willing to negotiate? (years)	5	10 - 20	10	10	25	10+
A12. How have the tipping fees changed over the past 5 years (list of fees or percentage increases)?	We only do hauling; customer looks after tipping fees		Unaware of this	+/- 5% continual decline with par dollar & cheap fuel, stabilizing now with lower Canadian dollar	Municipal disposal contracts typically include CPI or change of law/tax clauses	Fee changes are dependant on customer and materials; some have risen, some have fallen
A13. What methods are commonly used to adjust contract rates? (CPI, Fuel price surcharges, Other)	CPI, Fuel price surcharges	CPI	CPI, Fuel price surcharges	CPI, Fuel price surcharges	CPI, Fuel price surcharges	CPI, Fuel price surcharges

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Survey Section A - Waste Haulage

Organization: / Question:	Challenger Motor Freight	TRY Recycling	ECL Carriers	Walker Environmental Group	Waste Management of Canada Corporation, Twin Creeks Landfill	Emerald Energy from Waste Inc.
A14. Is there any other information you think should be considered regarding waste haulage?			Transfer station equipment, ie: compactors to maximize trailer payloads	Haulage is generally offered as an extension of disposal and recycling services. This offers an integrated system for waste management and one point of contact for our customers. Our transfer station in Burlington is 1.5 hours away from St. Marys, making it an unlikely candidate for Waste Transfer Service	St. Marys waste volume is small. Therefore, roll-off and curbside collection vehicles should haul direct to a disposal site. A depot should be set up for local volume service in front-load bins	Dumurrage or Wait times may apply if there are delays at either end of the trip in excess of 1 hour. Minimum weight load will apply.

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Survey Section B - Transfer Stations

Organization: **Question:**	**GFL Environmental Inc**	**TRY Recycling**	**Green Valley Recycling**	**Waste Management of Canada Corporation, Twin Creeks Landfill**
B1. Is your site licensed/permitted to receive waste from St. Marys, Ontario (ECA Service Area)? (Y/N)	Y	Y	Y	Y
B2. Do you have capacity to receive 2000-5000 tonnes/year from St. Marys? (Y / N)	Y	Y	Y	Y
B3. What is your Environmental Compliance Approval (ECA) (or Certificate of Approval (CofA) number?	ECA: # A140219	A040146	6751-6DFQ4A	Nearest to St. Marys is our London, Waterloo, Cambridge, Mount Forest or Petrolia transfers
B4. Is waste from your site permitted to be hauled to the U.S.? (Y / N) If yes which States (New York; Michigan; Ohio; Other)	Y. Michigan	Y. Michigan	Y. Michigan	Y. Haulage availability in each state
B5. If yes can you provide an approximate frequency of loads rejected at border? How are these handled/avoided?	No rejection, provided there is no hazardous or radioactive materials present	None to date	None that we are aware of	Negligable load rejections. Numerous contingency sites are availble in Ontario
B6. Please provide a brief list of disposal sites you currently haul to:	Ridge Landfill,ON: Pinetree Landfill, MI	Carleton Farms, Republic Waste	W12A Landfill, City of London; Ridge Landfill, Blenheim; Greenlane Landfill, Toronto	We haul to hundreds of sites but internalize the majority of our waste volume in Southwest Ontario to our Twin Creeks Landfill (Lambton, Ontario) or Pine Tree Landfill (Michigan)
B7. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)?	290 - 340		D15. Are there picking lines / material recovery equipment operating at your facility? If so please describe their operations	Twin Creeks Landfill accepts 3000
B8. What is the maximum ECA permitted throughput? (tonnes/day)	350		D16. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N) If yes, please explain	Twin Creeks Landfill has no daily limit, just 750,000/year limit

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Survey Section B - Transfer Stations

Organization: / Question:	GFL Environmental Inc	TRY Recycling	Green Valley Recycling	Waste Management of Canada Corporation, Twin Creeks Landfill
B9. What is the current tipping fee at your facility? (assume 2000-5000 tonnes per year) $/tonne	waste (ICI) $24.50/ tonne		MSW: $94/ tonne; Mixed C&D: $74/ tonne, see website for others	$70 - $80 for a transfer station
B10. What is the typical duration of a disposal contract? (years)	Negotiable		We review rates yearly	Municipal disposal contracts range from 5 - 25 years
B11. What is the maximum contract duration you are willing to negotiate? (years)	3 - 5	10 - 20	2	25
B12. How have the tipping fees changed over the past 5 years (list of fees or percentage increases)?	First increase of $3 in past 5 years I'm aware of due to Landfill increases	Typically CPI increases	Mixed C&D rates increased from $68 in 2008 to $74 in 2015	Transfer station increases have been minimal, less than 5% over the last 5 years
B13. What methods are commonly used to adjust contract rates? (CPI, Fuel price surcharges, Other)	CPI, Fuel price surcharges	CPI	Fuel price surcharges, labour rates, tipping & landfills	CPI, Fuel price surcharges
B14. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N) If yes, please explain		N		None known
B15. Is there any other information you think should be considered regarding waste transfer stations or your site specifically?				Consideration for transfer offering recyclable mining and CNG offerings

Survey Section C - Landfill Sites

Organization: / **Question:**	**TRY Recycling**	**Walker Environmental Group**	**Waste Management of Canada Corporation, Twin Creeks Landfill**	**Republic Services Inc., Carleton Farms Landfill**
C1. Is your site licensed/permitted to receive waste from St. Marys, Ontario (ECA Service Area)? (Y/N)		Y	Y	Y
C2. What is your Environmental Compliance Approval (ECA) (or Certificate of Approval (CofA) number?		0084-78RKAM	Twin Creeks: A032203	
C3. Do you have capacity to receive 2000-5000 tonnes/year from St. Marys? (Y / N)	Y	Y	Y	Y
C4. What is the current gate tipping rate? ($/ tonne)	Retail rate is $124.65/ tonne	Gate rate is $55 to $70 but able to provide contract rate of $45 to $55/ tonne	$40 - $50 per MT depending on contract	18 CDN
C5. What is the estimated remaining capacity/ operating life at your site? (in terms of volume m^3 and years)		14.5 million & 13	20,000,000 & >25	60,000,000 & 75
C6. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)?	To be negotiated	50	Negligible	Subject to negotiation
C7. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)?		3 - 5	D15. Are there picking lines / material recovery equipment operating at your facility? If so please describe their operations	5 - 20
C8. What is the maximum contract duration you are willing to negotiate?	10 - 20	10	D16. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N) If yes, please explain	10
C9. How have the tipping rates changed over the past 5 years (list of rates or percentage increases)		Same as in A12.	Landfill disposal rates have decreased over the last 5 years in order to compete with the Michigan	Have not increased in 5 years

Survey Section C - Landfill Sites

Organization: / **Question:**	**TRY Recycling**	**Walker Environmental Group**	**Waste Management of Canada Corporation, Twin Creeks Landfill**	**Republic Services Inc., Carleton Farms Landfill**
C10. What methods are commonly used to adjust contract rates? □ CPI □ Fuel price surcharges □ Other	CPI	CPI, Fuel price surcharges	CPI, Fuel price surcharges	CPI. US$ exchange rate subject to negotiation
C11. Do you have any LFG collection? If yes please provide the approximate collection efficiency		Yes, approximately 85%	Full LFG collection including permanent and temporary vertical and horizontal wells. Collection efficiency estimated at 85%	Yes, 14 generators
C12. What kind of LFG system do you use? (i.e., flaring, gen-set, etc.)		- 1 megawatt electrical generation; - 4,500 scfm direct use project (send 1 fg to nearby papermill); - 7,500 scfm of flaring capacity	Current LFG destruction system is flare with LFGTE in planning stage	gen-set
C13. How does the site handle leachate?		Collection system, on-site primary treatment, discharge to sanitary sewer	Leachate collection and bulking with disposal to willing municipal licensed receivers and seasonal disposal to onsite poplar plantation	Leachate is collected ans trucked off site for treatment
C14. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N) If yes, please explain		N	Our Twin Creeks Landfill has a willing host (Township of Warwick), Community Host agreement with Warwick, Impact Benefits Agreement with Walpole First Nation, Impact Benefits agreement with Landfill Neighbours, Property Value Protection, Liaison Comment, etc. Agreements are in place with all stakeholders.	N

Survey Section C - Landfill Sites

Organization: **Question:**	**TRY Recycling**	**Walker Environmental Group**	**Waste Management of Canada Corporation, Twin Creeks Landfill**	**Republic Services Inc., Carleton Farms Landill**
C15. Is there any other information you think should be considered regarding landfills or your site?		Company is currently undertaking a project to site a new landfill in Beachville, ON. If approved, this site could provide a secure & long term waste disposal option for St. Marys at significantly reduced haulage costs.	Twin Creeks is 301 hectares & 101.8 hectares are licensed for landfilling with over 25 years available capacity, leachate collection system, Best management practices for odour, dust, litter, Energy from waste planning. Landfill has a site specific liner including primary (leachate) and secondary (groundwater) collection systems. Between the two layers is a recompacted clay liner, 0.75m thick. Poplar tree plantations are also used by phytoremediation	Carleton Farms has received waste from the City of Toronto, regions of Peel and York. Carlton Farms continues to receive waste from numerous customers in Ontario

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Survey Section D - Thermal Treatment Sites

Organization: / Question:	Emerald Energy from Waste Inc.
D1. What is your Environmental Compliance Approval (ECA) (or Certificate of Approval (CofA))	CofA 4591-56VSTN
D2. Can your site accept waste from St. Marys, Ontario (ECA Service Area? (Y / N)	Y
D3. Do you have capacity to receive 2000-5000 tonnes/year from St. Marys?(Y/ N)	Y
D4. What is the current gate fee? $/tonne	85 to 95
D7. What is the average throughput of your facility?	365
D6. What is the maximum ECA permitted throughput?	455
D7. Please provide an estimate on the contract price/ discount rates for larger contracts (2000-5000 tonnes per year)?	90
D8. What is the typical duration of a disposal contract? (years)	10 - 20
D9. What is the maximum contract duration you are willing to negotiate? (years)	20
D10. How have the tipping rates changed over the past 5 years (list of rates or percentage increases)	

Organization: / Question:	Emerald Energy from Waste Inc.
D11. What thermal technology is used at your facility (incineration, gasification, etc.)?	Two stage gasification
D12. What is the treatment and disposal process (or site) for bottom ash and fly ash?	Bottom Ash: Quench cooling, gravity draining, magnetic separation (ferrous recovery). Fly Ash: Shipped off site for disposal
D13. Is energy recovery a part of your system, if so what form(s) are used? (Boiler & steam turbine, gas	The steam produced is used to generate electricity and for direct use by local recycled paper mill
D14. What is the approximate level of efficiency achieved at your facility (explain)?	Difficult to calculate; in addition to our turbine, we have a direct user for our steam
D15. Are there picking lines / material recovery equipment operating at your facility? If so please describe their operations	No picking is done at our site
D16. Are you aware of any significant environmental features, rare species, Aboriginal Treaties, rights or interests or other factors that currently, or may in the future, affect your operations? (Y / N)	N
D17. Is there any other information you think should be considered regarding thermal disposal or your site?	

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

CKD Stockpile Report

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone: (905) 567-4444
Fax: (905) 567-6561

March 3, 2005 04-1112-047

St. Marys Cement Company
410 Waverley Road, R.R. #2
Bowmanville, Ontario
L1C 3K3

Attention: Austin MacMurdo, Lands Manager

RE: CKD STOCKPILE, ST MARYS PLANTSITE

Dear Sir,

Further to your request, Golder Associates Ltd. (Golder) has prepared the following summary of the results of the investigation of the Cement Kiln Dust (CKD) stockpile located within the potential landfill donation area at the St.Marys plant site. The area is located immediately adjacent to (east of) the existing Town of St Marys municipal landfill as shown on Figure 1.

The purpose of the investigation was to established the stratigraphy and environmental quality of the material comprising the CKS stockpile and the physical nature of the native soil and bedrock that underlies the area.

▪ BOREHOLE DRILLING

The investigation included drilling five boreholes (MW04-01 through MW04-05) between July 30 and August 12, 2004 at the locations shown on Figure 2. Detailed Records of Boreholes are provided in Appendix A. Borehole MW04-01 to MW04-03 were drilled through the CDK stockpile terminating approximately 1.5 m within the underlying native soil. Monitoring wells were installed in each of these boreholes.

Boreholes MW04-04 and MW04-05 were drilled through the base of the former clay pit area directly south of the CKD stockpile and completed 12 to 13 m into the underlying bedrock. A bottom monitoring well was installed in MW04-04 at the existing landfill boundary while MW04-05 was cement grouted from the bottom of the hole to ground surface. The boreholes were surveyed in location and elevation to the geodetic datum.

GEOTECHNICAL SAMPLING

The soil core samples obtained from boreholes MW04-04 and MW 04-05 were analyzed by seive-hydrometer methods to determine the soil granularity (see Figure A-1 through A-7 in Appendix A). Selected samples of the Upper and Lower Glacial Till horizons were also tested for Attenburg limits and the results are presented on plasticity charts on Figures A-8 and A-9 respectively.

ENVIRONMENTAL SAMPLING

The samples from the three boreholes drilled through the CKD stockpile (MW04-01 to MW04-03) were split into upper and lower halves forming six composite samples for chemical analysis. This included total metals by aquarega digestion (Table 1A), total petroleum hydrocarbons by solvent organic extraction (Table 1B), polychlorinated biphenyls (Table 1C) and polyaromatic hydrocarbons (Table 1D).

Groundwater samples were obtained from monitoring wells MW04-01 and MW04-03 in the CKD stockpile and the bedrock monitoring well MW04-04. The samples were analysed for a suite of chemical parameters including major ions and heavy metals as summarized on Table 2A. The water samples were also analyzed for polychlorinated biphenyls (Table 2B) and polyaromatic hydrocarbons (Table 2C).

One soil sample of CKD (MW04-01 Upper) was collected for TCLP leach analyses (Table 3) considering that the sample was the only sample with aquarega leach Table B exeedences for metals.

All soil and water samples were compared to Ministry of Environment Table B guidelines as indicated on the various tables noted.

SUMMARY OF CKD STOCKPILE RESULTS

The CKD material was found to be in the range of 10 to 16 m thick at the location drilled. The material encountered included CKD and some native fill soil. The only refuse material noted was a few paper cement bags. The base of the CKD was encountered between elevations of 313 and 319 m while the crest of the pile is approximately 332 m. The surface of the stockpile has been contoured and a thin 0.2 to 0.3 m layer of topsoil has been placed and vegetated.

The total volume of CKD estimated from the surface continuous and the base was approximately 350,000 to 400,000 m^3.

Saturated conditions were encountered in the CKD stockpile at various depths associated with perched conditions where CDK overlay silt till material. The monitoring walls indicated watertable conditions below depths of 10 to 12 m corresponding to elevations of approximately 317 to 322 m, being at or up to 4 m above the base of the pile.

From an environmental quality perspective, one composite sample of CKD (MW04-01 Upper) encountered minor metal exceedences for cadmium (13.2 and 14.1 µg/g compared to a Table B guidelines of 12 µg/g) and lead (1160 and 1210 µg/g compared to a Table B guideline of 1000 µg/g) as outlined on Table 1A. There were no Table B exceedences for total petroleum hydrocarbons (Table 1B) and no detections (less than 0.05 µg/g) for polychlorinated biphenyls. The test results for polyaromatic hydrocarbons did not encounter any Table B criteria exceedences (Table 1D). There were no TCLP leach test exceedences (Table 3).

The chemistry obtained from the CDK groundwater samples is summarized on Table 2A. The groundwater was characterized by an alkaline pH of 10, high TDS (29,000 to 42,000 µg/L), high sulphate (13,000 to 19,000 µg/L), elevated chloride (2,000 µg/L to 4,000 µg/L) and the primary cations being potassium (12,000 to 19,000 µg/L) and sodium (1,000 to 2,000 µg/L). There were no Table B criteria exceedences except for two apparent exceedences related to detection limits for selenium (<0.2 µg/L compared to 0.05 µg/L criteria) and silver (<0.01 µg/L compared to 0.0012 µg/L criteria) as indicated on Table 2A. It is extremely unlikely that silver is present given the presence of elevated chloride. No polychlorinated biphenyls were detected in the CKD groundwater samples (Table 2B) while only trace levels of the PAH's 2-methylnapthalene and phenanthrene were detected but well below Table B guideline criteria (Table 2C).

▪ SOIL AND BEDROCK CONDITIONS

The general soil and bedrock conditions beneath the potential donation area are shown on Section A-A^1 on Figure 4. The soils consist of an Upper and Lower Glacial Till horizons that may correspond to the St Mary's Till and the Catfish Creek Till respectively. As indicated by the grain size distribution curves on Figure A-1 to A-7 in Appendix A, the tills are well graded and clayey. The clay size formation of the Upper Till is in the range of 15 to 40 percent while in the Lower Till it varies between approximately 8 to 15 percent. The tills are both massive textured and given the granularity, they are also considered to be of quite low permeability.

The inferred overburden thickness within the potential donation area is shown on Figure 5. As indicated, the CKD stockpile sits on approximately 14 to 20 m of overburden comprised of the glacial tills. The donation area to the south of the stockpile is underlain by approximately 14 to 18 m of glacial till with some areas of thin surficial granular fill material.

The underlying bedrock is comprised by fractured dolomitic limestone and dolostone of the Lucas Formation Detailed descriptions are provided on the Record of Borehole sheets in Appendix A.

Both the glacial till and the bedrock have been truncated by the quarry excavation directly north of the site as shown on Figure 4. The groundwater level in the bedrock approximately coincides with the pond level maintained in the quarry. The direction of bedrock groundwater flow northward is toward the quarry pond or northeastward toward the quarry industrial well No. 5 (Figure 2). Groundwater flow in the overlying till is vertically downward in response to the one to one vertical hydraulic gradient.

The groundwater quality in the bedrock, were sampled from MW04-04, is typical of fresh but hard mineralized water from dolostones formations (Table 2A). There is no apparent groundwater quality impact from the existing landfill.

We trust this summary of investigation results meets your requirements and if there are any questions, please contact us.

Yours very truly,

GOLDER ASSOCIATES LTD.

Original signed by:
Robert D. Blair, P.Geo,. P.Eng.
Senior Hydrogeologist, Principal

Attachments: Tables 1A -3
Figures 1-5
Appendix A – Borehole Records and Grainsize Testing
RDB/lh

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TABLE 1A
SOIL ANALYTICAL RESULTS - INORGANICS

			Sample						
Parameter	**Units**	**Table 3 Criteria**	**MW04-01 UPPER**	**MW04-01 UPPER DUP.**	**MW04-01 LOWER**	**MW04-02 UPPER**	**MW04-02 LOWER**	**MW04-03 UPPER**	**MW04-03 LOWER**
Aluminum	ug/g	***NV***	8,080	8,370	5,450	5,700	2,220	8,450	4,330
Barium	ug/g	***2,000***	64	66	33	44	13	60	26
Beryllium	ug/g	***1.2***	0.4	0.4	0.2	0.2	<0.2	0.4	<0.2
Cadmium	ug/g	***12***	**13.2**	**14.1**	6.7	0.5	<0.5	2.3	<0.5
Calcium	ug/g	***NV***	220,000	227,000	155,000	141,000	130,000	137,000	116,000
Chromium	ug/g	***1,000***	19	19	113	14	6	34	8
Cobalt	ug/g	***100***	4	3	2	4	<2	5	3
Copper	ug/g	***300***	15	16	8	11	4	14	7
Iron	ug/g	***NV***	17,300	17,800	8,260	14,800	5,180	17,600	7,720
Lead	ug/g	***1,000***	**1,160**	**1,210**	627	21	<5	138	<5
Magnesium	ug/g	***NV***	20,100	20,700	30,400	33,900	32,100	21,600	28,600
Manganese	ug/g	***NV***	359	372	259	361	207	396	286
Molybdenum	ug/g	***40***	<3	<3	<3	<3	<3	<3	<3
Nickel	ug/g	***200***	13	14	7	9	4	12	6
Phosphorus	ug/g	***NV***	318	323	314	371	275	415	348
Potassium	ug/g	***NV***	3,960	4,030	9,170	1,410	786	4,840	2,090
Silver	ug/g	***50***	2	2	<1	<1	<1	<1	<1
Sodium	ug/g	***NV***	558	586	1,040	174	140	611	287
Strontium	ug/g	***NV***	135	140	99.0	125	79.4	115	79.9
Titanium	ug/g	***NV***	309	320	231.0	252.0	176	285	216
Vanadium	ug/g	***250***	18	19	14	15	9	20	12
Zinc	ug/g	***800***	371	386	168	129	10	100	18
pH	pH	***5.0 to 11.0***	10.9	10.9	10.4	7.96	8.11	8.67	7.90
		No. of Exceedances	**2**	**2**	**0**	**0**	**0**	**0**	**0**

Notes: Table 3 = Ministry of Environment (MOE) "Soil, Ground Water and Sediments Standards for Use Under Part XV.1 of the Environmental Protection Act", revised March 9, 2004, Table 3: Full Depth Site Condition Standards In a Non-Potable Ground Water Condition

< = Below the Estimated quantitation limit

13.2/14.1 = Exceedance of Table "B" Guideline

NV = No value established

prepared by: ACU

checked by: CAB

TABLE 1B
SOIL ANALYTICAL RESULTS - TOTAL PETROLEUM HYDROCARBONS

			Sample					
Parameter	**Units**	**Table B Criteria**	**MW04-01 UPPER**	**MW04-01 LOWER**	**MW04-02 UPPER**	**MW04-02 LOWER**	**MW04-03 UPPER**	**MW04-03 LOWER**
TPH-Heavy Oils	ug/g	***5,000***	470	<100	110	<100	380	<100
TPH-Gas+Diesel	ug/g	***2,000***	<10	<10	<10	<10	<10	<10
TPH-Gas	ug/g	***NV***	<10	<10	<10	<10	<10	<10
TPH-Diesel	ug/g	***NV***	<10	<10	<10	<10	<10	<10
		No. of Exceedances	**0**	**0**	**0**	**0**	**0**	**0**

Notes:

Table B = Ministry of Environment (MOE) "Guideline for Use at Contaminated Sites in Ontario", revised September 1998, Table "B" industrial/commercial criteria, non-potable situation for medium/fine textured soil.
< = Below the Estimated quantitation limit
NV = No value established

prepared by: ACU
checked by: CAB

TABLE 1C

SOIL ANALYTICAL RESULTS - POLYCHLORINATED BIPHENYLS

			Sample					
Parameter	**Units**	**Table 3 Criteria**	**MW04-01 UPPER**	**MW04-01 LOWER**	**MW04-02 UPPER**	**MW04-02 LOWER**	**MW04-03 UPPER**	**MW04-03 LOWER**
PCBs	ug/g	***25***	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		No. of Exceedances	**0**	**0**	**0**	**0**	**0**	**0**

Notes:

Table 3 = Ministry of Environment (MOE) "Soil, Ground Water and Sediments Standards for Use Under Part XV.1 of the Environmental Protection Act", revised March 9, 2004, Table 3: Full Depth Site Condition Standards In a Non-Potable Ground Water Condition

PCBs = Polychlorinated Biphenyls

< = Below the Estimated quantitation limit

prepared by: ACU
checked by: CAB

TABLE 1D
SOIL ANALYTICAL RESULTS - PAHS

				Sample						
Parameter	**Units**	**EQL**	**Table 3 Criteria**	**MW04-01 UPPER****	**MW04-01 UPPER DUP.****	**MW04-01 LOWER**	**MW04-02 UPPER**	**MW04-02 LOWER**	**MW04-03 UPPER**	**MW04-03 LOWER**
Naphthalene	ug/g	0.05	40	ND	ND	ND	ND	ND	ND	ND
2-Methylnapthalene	ug/g	0.05	1,600	ND	ND	ND	ND	ND	ND	ND
1-Methylnapthalene	ug/g	0.05	1,600	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ug/g	0.05	840	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ug/g	0.05	1,300	ND	ND	ND	ND	ND	ND	ND
Fluorene	ug/g	0.05	350	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/g	0.05	40	0.24*	0.21*	ND	ND	ND	ND	ND
Anthracene	ug/g	0.05	28	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/g	0.05	40	0.29	0.23	ND	ND	ND	ND	ND
Pyrene	ug/g	0.05	250	0.35	0.31	ND	ND	ND	ND	ND
Benzo(a)anthracene	ug/g	0.05	40	0.22*	0.23*	ND	ND	ND	ND	ND
Chrysene	ug/g	0.05	19	0.27	0.28	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ug/g	0.05	19	0.26	0.22*	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ug/g	0.05	19	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ug/g	0.05	1.9	0.23*	0.24*	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ug/g	0.05	19	0.19*	0.16*	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ug/g	0.05	1.9	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ug/g	0.05	40	0.24*	0.22*	ND	ND	ND	ND	ND
			No. of Exceedances	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Notes:

Table 3 = Ministry of Environment (MOE) "Soil, Ground Water and Sediments Standards for Use Under Part XV.1 of the Environmental Protection Act", revised March 9, 2004, Table 3: Full Depth Site Condition Standards In a Non-Potable Ground Water Condition

EQL = Estimated Quantitation Limit

ND = Not detected (below EQL)

* = Detected below EQL of 0.25 for MW04-01 AND MW04-01 DUP. but passed compound identification criteria

** = Sample diluted. Refer to Certificates of Analysis, Appendix D

prepared by: ACU
checked by: CAB

TABLE 2A
GROUNDWATER ANALYTICAL RESULTS - INORGANICS

			Sample			
Parameter	**Units**	**Table 3 Criteria**	**MW04-01**	**MW04-01 DUP**	**MW04-03**	**MW04-04**
Aluminum	mg/L	NV	<500	<0.5	0.714	0.007
Antimony	mg/L	16	<50	<0.05	<0.05	0.0007
Arsenic	mg/L	0.48	<200	<0.2	<0.2	<0.002
Barium	mg/L	23	<500	<0.5	<0.5	0.078
Beryllium	mg/L	0.053	<100	<0.1	<0.1	<0.1
Bismuth	mg/L	NV	<0.1	<0.1	<0.1	<0.1
Boron	mg/L	50	0.528	0.573	1.240	0.121
Cadmium	mg/L	0.011	<0.01	<0.01	<0.01	<0.0001
Calcium	mg/L	NV	<50	<50	425	102
Chromium	mg/L	2	<0.5	<0.5	<0.5	<0.005
Cobalt	mg/L	0.1	<0.01	<0.01	<0.01	0.0043
Copper	mg/L	0.023	<0.05	<0.05	<0.05	0.0012
Iron	mg/L	NV	<3	<3	42.5	<0.03
Lead	mg/L	0.032	<0.05	<0.05	<0.05	<0.0005
Magnesium	mg/L	NV	15.5	15.4	162	59.6
Manganese	mg/L	NV	<0.5	<0.5	3.5	0.015
Mercury	mg/L	0.00012	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	7.3	0.553	0.541	<0.1	0.016
Nickel	mg/L	1.6	<0.1	<0.1	<0.1	0.003
Phosphorus	mg/L	NV	<5	<5	<5	<0.05
Potassium	mg/L	NV	19,200	19,200	11,700	41.9
Selenium	mg/L	0.05	**<0.2**	**<0.2**	**<0.2**	<0.002
Silicon	mg/L	NV	5.87	5.79	<5	1.27
Silver	mg/L	0.0012	**<0.01**	**<0.01**	**<0.01**	<0.0001
Sodium	mg/L	NV	1,780	1,780	978	50.8
Strontium	mg/L	NV	<0.1	<0.1	1.75	14.2
Thallium	mg/L	0.4	<0.005	<0.005	<0.005	0.00075
Tin	mg/L	NV	<0.1	<0.1	<0.1	<0.001
Titanium	mg/L	NV	<0.5	<0.5	<0.5	<0.005
Uranium	mg/L	NV	0.0285	0.0278	<0.01	0.0029
Vanadium	mg/L	0.2	0.0921	0.0957	<0.05	0.0011
Zinc	mg/L	1.1	<0.5	<0.5	<0.5	0.011
pH	pH	NV	10.1	10.1	7.18	8.10
Specific Conductivity	umhos/cm	NV	66,000	65,500	42,200	1,180
Alkalinity	mg CaCO3/L	NV	716	696	1,350	165
C-Hardness	mg CaCO3/L	NV	188,800	188,600	1,733,000	500,600
Bromide (Br-)	mg/L	NV	46	46	30	<0.5
Chloride (Cl-)	mg/L	NV	3,830	3,800	2,270	73.6
Fluoride (F-)	mg/L	NV	21.2	32.4	0.7	1.4
Nitrate (NO_3)	mg/L	NV	<2	<2	<2	<0.2
Nitrite (NO_2)	mg/L	2	<2	<2	<2	<0.2
Phosphate (PO_4^{-3})	mg/L	NV	<10	<10	<10	<1
Sulphate (SO_4^{-2})	mg/L	NV	18,700	18,600	13,300	377
Phenols	mg/L	NV	0	0.015	0.003	0.001
TDS	mg/L	NV	41960	45436	29,396	860
No. of Exceedances			**0**	**0**	**0**	**0**

Notes:

Table 3 = Ministry of Environment (MOE) "Soil, Ground Water and Sediments Standards for Use Under Part XV.1 of the Environmental Protection Act", revised March 9, 2004, Table 3: Full Depth Site Condition Standards In a Non-Potable Ground Water Condition

< = Below the Estimated quantitation limit (EQL)

NV = No value established

<200 = EQL exceeds Table B Criteria

prepared by: ACU

checked by: CAB

TABLE 2B
GROUNDWATER ANALYTICAL RESULTS - POLYCHLORINATED BIPHENYLS

			Sample			
Parameter	**Units**	**Table 3 Criteria**	**MW04-01**	**MW04-03**	**MW04-04**	**MW04-04 DUP**
PCBs	ug/L	0.2	<0.05	<0.05	<0.05	<0.05
		No. of Exceedances	**0**	**0**	**0**	**0**

Notes:

Table 3 = Ministry of Environment (MOE) "Soil, Ground Water and Sediments Standards for Use Under Part XV.1 of the Environmental Protection Act", revised March 9, 2004, Table 3: Full Depth Site Condition Standards In a Non-Potable Ground Water Condition

PCBs = Polychlorinated Biphenyls

< = Below the Estimated quantitation limit

prepared by: ACU
checked by: CAB

TABLE 2C
GROUNDWATER ANALYTICAL RESULTS - PAHs

				Sample			
Parameter	**Units**	**EQL**	**Table 3 Criteria**	**MW04-01**	**MW04-01 DUP.**	**MW04-03**	**MW04-04**
Naphthalene	ug/L	***0.2***	6,200	ND	ND	ND	ND
2-Methylnapthalene	ug/L	***0.2***	13,000	0.2	0.2	ND	ND
1-Methylnapthalene	ug/L	***0.2***	13,000	ND	ND	ND	ND
Acenaphthylene	ug/L	***0.2***	2,000	ND	ND	ND	ND
Acenaphthene	ug/L	***0.2***	1,700	ND	ND	ND	ND
Fluorene	ug/L	***0.2***	290	ND	ND	ND	ND
Phenanthrene	ug/L	***0.2***	63	0.8	0.8	0.3	ND
Anthracene	ug/L	***0.2***	12	ND	ND	ND	ND
Fluoranthene	ug/L	***0.2***	130	ND	ND	ND	ND
Pyrene	ug/L	***0.2***	40	ND	ND	ND	ND
Benzo(a)anthracene	ug/L	***0.2***	5	ND	ND	ND	ND
Chrysene	ug/L	***0.2***	3	ND	ND	ND	ND
Benzo(b)fluoranthene	ug/L	***0.2***	7	ND	ND	ND	ND
Benzo(k)fluoranthene	ug/L	***0.2***	0.4	ND	ND	ND	ND
Benzo(a)pyrene	ug/L	***0.2***	1.9	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ug/L	***0.2***	0.27	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ug/L	***0.2***	0.25	ND	ND	ND	ND
Benzo(ghi)perylene	ug/L	***0.2***	0.2	ND	ND	ND	ND
No. of Exceedances				**0**	**0**	**0**	**0**

Notes:

Table 3 = Ministry of Environment (MOE) "Soil, Ground Water and Sediments Standards for Use Under Part XV.1 of the Environmental Protection Act", revised March 9, 2004, Table 3: Full Depth Site Condition Standards In a Non-Potable Ground Water Condition
EQL = Estimated Quantitation Limit
mbgs = Meters below ground surface
ND = Not detected (above EQL)
NV = No value established
NA = Not analyzed

prepared by: ACU
checked by: CAB

TABLE 3
TCLP LEACH ANALYTICAL RESULTS

			Sample	
Sample Date	**Units**	**Schedule 4 (mg/L)**	**MW04-01-UPPER**	**MW04-01-UPPER REPEAT**
Arsenic	mg/L	2.5	<0.2	<0.2
Barium	mg/L	100	0.6	0.6
Boron	mg/L	500	0.1	0.2
Cadmium	mg/L	0.5	0.08	0.08
Chromium	mg/L	5	<0.1	<0.1
Lead	mg/L	5	1.0	0.5
Mercury	mg/L	0.1	<0.01	<0.01
Selenium	mg/L	1.0	<0.1	<0.1
Silver	mg/L	5	<0.01	<0.01
Uranium	mg/L	10	<0.01	<0.01
Floride (F-)	mg/L	150	1.9	2.4
Nitrate & Nitrite (as Nitrogen)	mg/L	1000	<0.2	<0.2
Cyanide (Free)	mg/L	20	<0.01	<0.01
PCBs	mg/L	0.3	<0.0002	<0.0002
		No. of Exceedances	**0**	**0**

Notes:

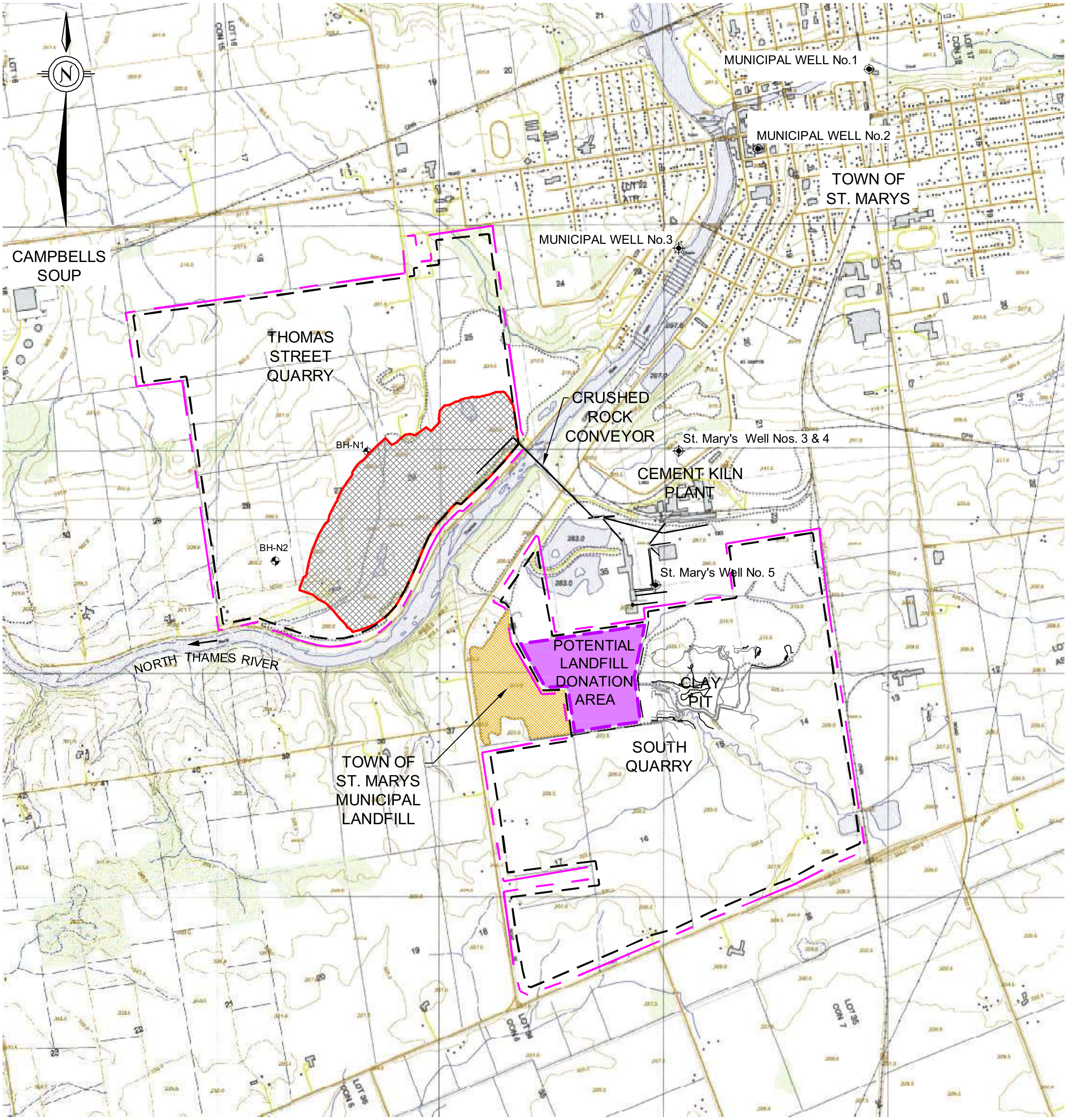
Schedule 4 = Environmental Protection Act, Revised Regulations of Ontario, Regulation 374, amended to O.Reg. 501/01 leach quality criteria in Schedule 4

75 = Exceedance of Schedule 4 Criteria

NV = No value established

prepared by: CB

checked by: EK



REFERENCES:

OBM SHEET 10 17 4850 47850,
MINISTY OF NATURAL RESOURCES, 1995

500 0 500 1000

SCALE 1:25000 METRES

LEGEND

- — · — QUARRY LICENCE BOUNDARY
- — — — QUARRY EXCAVATION SETBACK
- MUNICIPAL WELL No.3 ⊕ MUNICIPAL AND INDUSTRIAL WATER SUPPLY WELLS

Golder Associates
Mississauga, Ontario, Canada

SCALE	AS SHOWN
DATE	FEB. 22, 2005
DESIGN	
CAD	KD
CHECK	R.B.
REVIEW	
FILE No.	04111204701.dwg
PROJECT No.	04-1112-047
REV.	A

TITLE

SITE LOCATION PLAN

ST. MARYS CEMENT Co.

FIGURE 1

PLOT DATE: March 03, 2005
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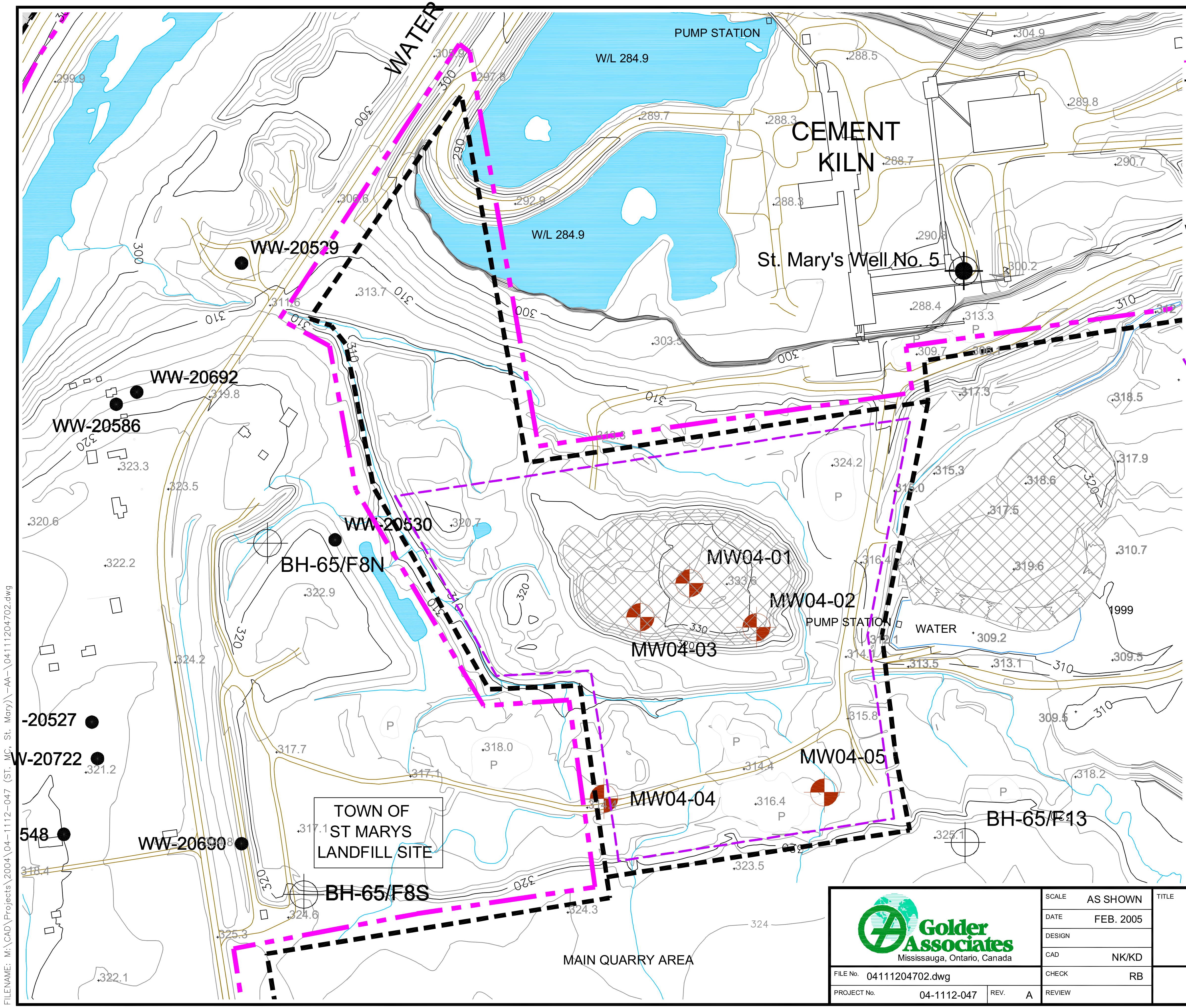


LEGEND

‒ · ‒ ·	QUARRY LICENCE BOUNDARY
‒ ‒ ‒	QUARRY EXCAVATION SETBACK
MW04-04	BOREHOLE LOCATION FROM CURRENT INVESTIGATION FOR LANDFILL AREA, REPORT GOLDER NO. 04-1112-047
CPSA # 3	TEST PITS LOCATION FROM CURRENT INVESTIGATION, 2004
BH-S1	BOREHOLE LOCATION DRILLED BY GOLDER, 2000
WW-20618 ●	WATER WELL SUPPLY LOCATION - MINISTRY OF ENVIRONMENT (MOE) WWIS DATABASE
BH-65/F8	BOREHOLE LOCATION - DRILLED BY ST. MARYS CEMENT, 1965
	MUNICIPAL / INDUSTRIAL WATER SUPPLY WELLS
▨	CKD STOCKPILE
	POTENTIAL LANDFILL DONATION AREA

NOTES

1. THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ATTACHED REPORT.

2. THE CURRENT EXCAVATION FACE AT THE QUARRY WAS SURVEYED BY AGM SURVEYING AND ENGINEERING, DRAWING No. SM 0412T1.dwg (OCTOBER, 2004).

3. THE TEST PITS WERE SURVEYED BY AGM SURVEYING AND ENGINEERING BY REPORT No. SM-CEM-34 (SEPTEMBER, 2004).

5. LOCATIONS OF 1958, 1965 AND 1974 BOREHOLES AND MOE WELLS ARE APPROXIMATE ONLY.

REFERENCE

BASE MAP FROM ST. MARYS CEMENT INC. TOPOGRAPHIC SURVEY UPDATED SEPTEMBER 2004, DRAWING No. MP 001 V.01 (3D CONTOURS), UTM NAD83.

OCTOBER 2004 SURVEY OF THOMAS ST. QUARRY FACE AND OVERBURDEN STRIPPING FACE AND SOUTH QUARRY CLAY PIT OBTAINED FROM AGM, FILE NAME SM0412T1.DWG, DATED OCT. 7, 2004, SCALE 1:2000.

Golder Associates
Mississauga, Ontario, Canada

FILE No.	04111204702.dwg		
PROJECT No.	04-1112-047	REV.	A

SCALE	AS SHOWN
DATE	FEB. 2005
DESIGN	
CAD	NK/KD
CHECK	RB
REVIEW	

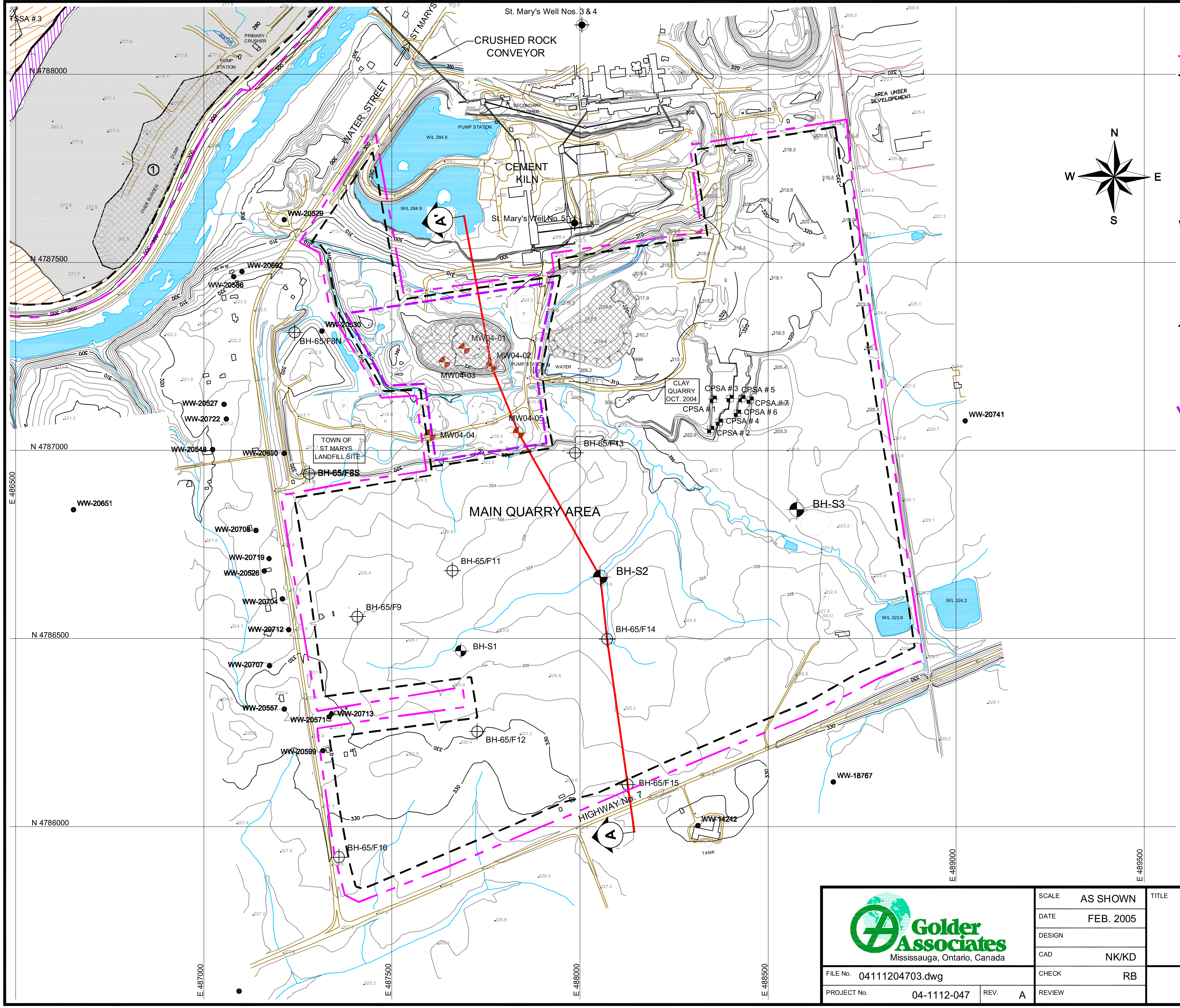
TITLE

DONATION AREA SITE PLAN

ST. MARYS CEMENT Co.

FIGURE 2

PLOT DATE: March 03, 2005
FILENAME: M:\CAD\Projects\2004\04-1112-047 (ST. MC, St. Mary)\-AA-\04111204702.dwg



LEGEND

━ · ━	QUARRY LICENCE BOUNDARY
━ ━ ━	QUARRY EXCAVATION SETBACK
MW04-04 ⊕	BOREHOLE LOCATION FROM CURRENT INVESTIGATION FOR LANDFILL AREA, REPORT GOLDER NO. 04-1112-047
CPSA # 3 ⊞	TEST PITS LOCATION FROM CURRENT INVESTIGATION, 2004
BH-S1 ⊕	BOREHOLE LOCATION DRILLED BY GOLDER, 2000
WW-20618 ●	WATER WELL SUPPLY LOCATION - MINISTRY OF ENVIRONMENT (MOE) WWIS DATABASE
BH-65/F8 ⊕	BOREHOLE LOCATION - DRILLED BY ST. MARYS CEMENT, 1965
⊕	MUNICIPAL / INDUSTRIAL WATER SUPPLY WELLS
A — A'	LOCATION OF CROSS-SECTIONS
▨	CKD STOCKPILE
⌐ ⌐	POTENTIAL LANDFILL DONATION AREA

NOTES

1. THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ATTACHED REPORT.

2. THE CURRENT EXCAVATION FACE AT THE QUARRY WAS SURVEYED BY AGM SURVEYING AND ENGINEERING, DRAWING No. SM 0412T1.dwg (OCTOBER, 2004).

3. THE TEST PITS WERE SURVEYED BY AGM SURVEYING AND ENGINEERING BY REPORT No. SM-CEM-34 (SEPTEMBER, 2004).

4. FOR CROSS-SECTIONS A-A' SEE FIGURE 4.

5. LOCATIONS OF 1958, 1965 AND 1974 BOREHOLES AND MOE WELLS ARE APPROXIMATE ONLY.

REFERENCE

BASE MAP FROM ST. MARYS CEMENT INC. TOPOGRAPHIC SURVEY UPDATED SEPTEMBER 2004, DRAWING No. MP 001 V.01 (3D CONTOURS), UTM NAD83.

OCTOBER 2004 SURVEY OF THOMAS ST. QUARRY FACE AND OVERBURDEN STRIPPING FACE AND SOUTH QUARRY CLAY PIT OBTAINED FROM AGM, FILE NAME SM0412T1.DWG, DATED OCT. 7, 2004, SCALE 1:2000.

200 0 200 400

SCALE 1:10000 METRES

Golder Associates
Mississauga, Ontario, Canada

SCALE	AS SHOWN	TITLE	
DATE	FEB. 2005		
DESIGN			
CAD	NK/KD		
CHECK	RB		
REVIEW			

FILE No. 04111204703.dwg

PROJECT No. 04-1112-047 REV. A

SITE PLAN
SOUTH QUARRY

ST. MARYS CEMENT Co.

FIGURE 3

PLOT DATE: March 03, 2005
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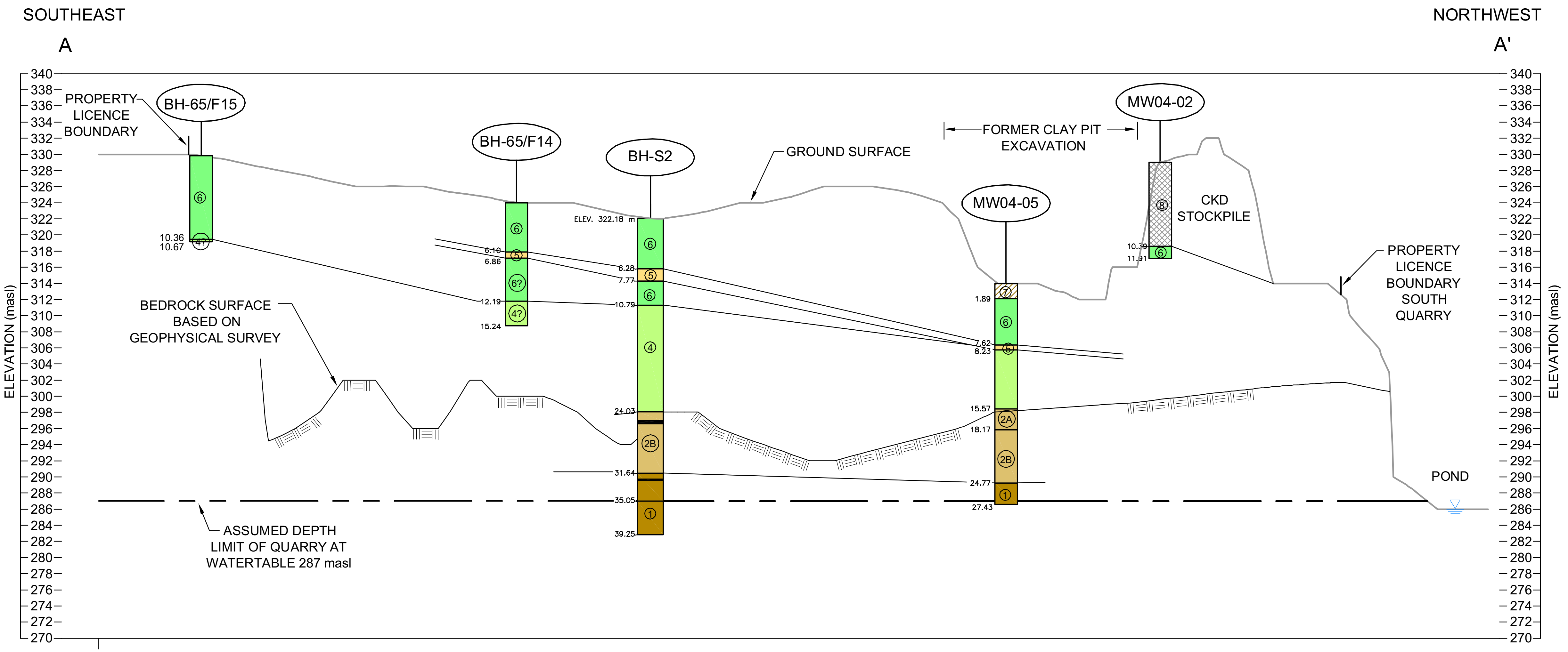

STRATIGRAPHY

SURFICIAL DEPOSITS

⑧	FILL, loose to compact, grey, silt to sand, cement kiln dust
⑦	FILL, loose to compact, brown, silty sand to sand and gravel
⑥	UPPER GLACIAL TILL Very stiff to hard, medium dark grey, moist, massive textured, well graded SILTY CLAY with sand and trace to some matrix support gravel and occasional cobbles of limestone, dolostone, igneous composition.
⑤	MIDDLE GLACIOLACUSTRINE SILT Firm to compact, light grey, moist to wet, dialatent, massive textured, well graded to thinly bedded SILT and CLAYEY SILT.
④	LOWER GLACIAL TILL Hard, medium brownish grey, moist to dry appearing, massive textured SILTY CLAY to CLAYEY SILT with sand and trace to some matrix supported gravel, occasional cobbles and boulders of limestone, dolostone and igneous composition. Cobbles and boulders increase to 10 to 20 percent near base of sequence.

BEDROCK DEPOSITS

③	DUNDEE FORMATION LIMESTONE Fresh, weathered on open bedding partings, light creamy grey to light tan grey, very fine to fine grained, non-porous, thin to medium bedded, partly fossiliferous (rugose corals) LIMESTONE.(3A) and Dolomitic Limestone(3B) Limestone tends to separate on open bedding partings.
②	UPPER LUCAS FORMATION DOLOMITIC LIMESTONE Fresh, weathered on open bedding partings, light to medium tan to brownish grey, interbedded very fine to fine grained, non-porous to faintly porous, locally pitted to vuggy, thin to medium bedded, laminar textured (stromatolitic) in part and locally oolitic, weakly stylolitic, partly fossiliferous LIMESTONE(2A) and Dolomitic Limestone(2B) with dark tan sections of porous, faintly petroliferous limestone.
①	LOWER LUCAS FORMATION DOLOSTONE Fresh, faintly weathered in some beds, moderately weathered on open bedding partings, light to medium tan to brownish grey, very fine to fine grained, faintly to moderately porous, thin to medium bedded, laminar textured DOLOMITIC LIMESTONE to DOLOSTONE with faintly petroliferous beds.

NOTE

FOR LOCATION OF SECTION A - A' REFER TO FIGURE 3

120 0 120 240
SCALE Horizontal 1:6000 METRES

12 0 12 24
SCALE Vertical 1:600 METRES

LEGEND

STATIC GROUNDWATER LEVEL
BH-S1 MEASURED AUGUST 22, 2003
BH-S3 MEASURED AUGUST 18, 2003

Golder Associates
Mississauga, Ontario, Canada

FILE No.	04111204704.dwg
PROJECT No.	04-1112-047
REV.	A
SCALE	AS SHOWN
DATE	FEB. 2005
DESIGN	
CAD	KD
CHECK	RB
REVIEW	

TITLE
SUB-SURFACE CONDITIONS SECTION A-A'

ST. MARYS CEMENT Co.

FIGURE 4

PLOT DATE: March 03, 2005
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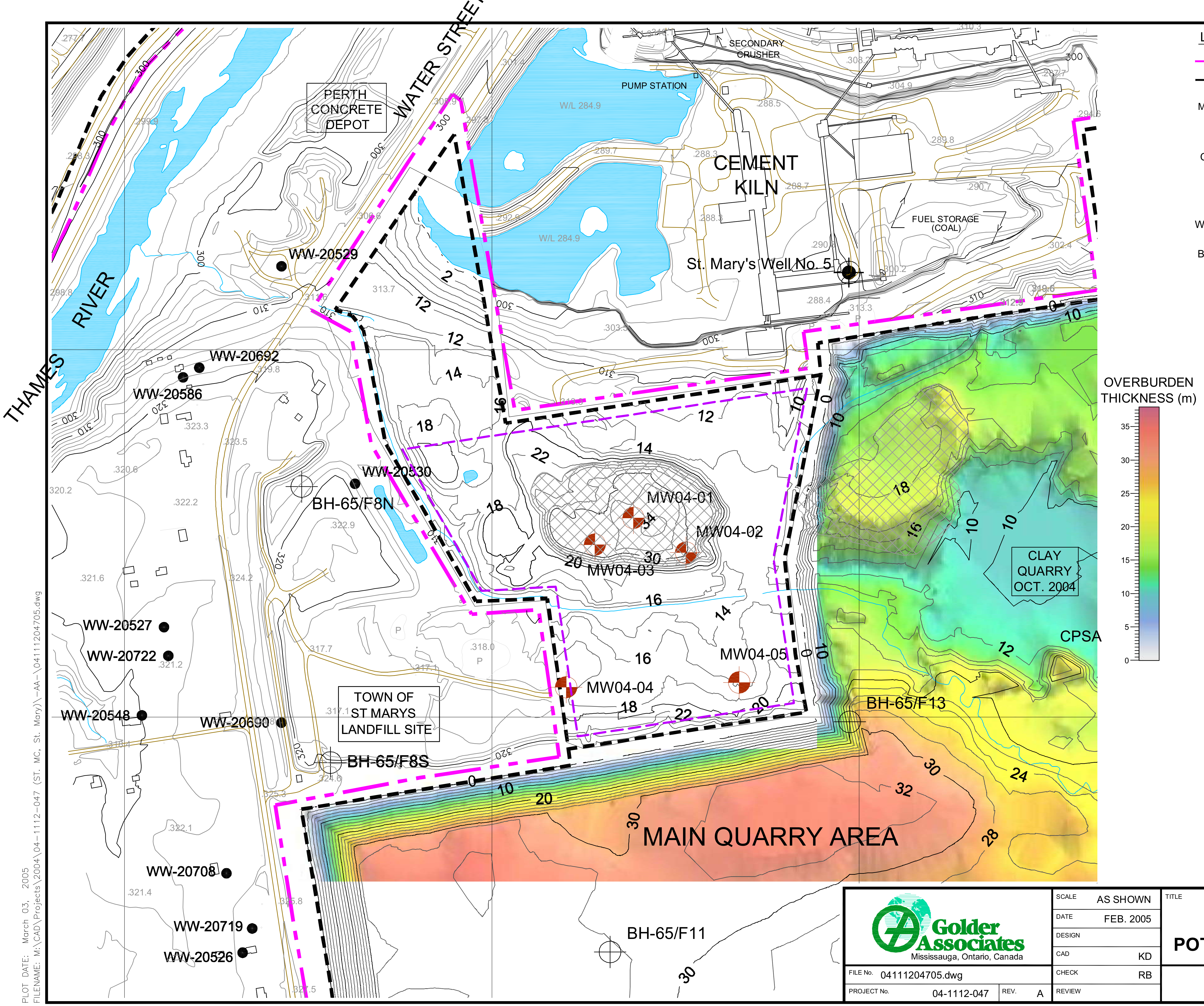


LEGEND

	QUARRY LICENCE BOUNDARY
	QUARRY EXCAVATION SETBACK
MW-04-04	BOREHOLE LOCATION FROM CURRENT INVESTIGATION FOR LANDFILL AREA, REPORT GOLDER NO. 04-1112-047
CPSA # 3	TEST PITS LOCATION FROM CURRENT INVESTIGATION, 2004
BH-S1	BOREHOLE LOCATION DRILLED BY GOLDER, 2000
WW-20618 ●	WATER WELL SUPPLY LOCATION - MINISTRY OF ENVIRONMENT (MOE) WWIS DATABASE
BH-65/F8	BOREHOLE LOCATION - DRILLED BY ST. MARYS CEMENT, 1965
	MUNICIPAL / INDUSTRIAL WATER SUPPLY WELLS
20	OVERBURDEN THICKNESS CONTOUR IN METRES
▨	CKD STOCKPILE
	POTENTIAL LANDFILL DONATION AREA

NOTES

1. THIS FIGURE IS TO BE READ IN CONJUCTION WITH THE ATTACHED REPORT.
2. THE CURRENT EXCAVATION FACE AT THE QUARRY WAS SURVEYED BY AGM SURVEYING AND ENGINEERING, DRAWING No. SM 0412T1.dwg (OCTOBER, 2004).
3. THE TEST PITS WERE SURVEYED BY AGM SURVEYING AND ENGINEERING BY REPORT No. SM-CEM-34 (SEPTEMBER, 2004).
4. LOCATIONS OF 1958, 1965 AND 1974 BOREHOLES AND MOE WELLS ARE APPROXIMATE ONLY.
5. TONNAGE ESTIMATES BASED ON VOLUMES WITH BULK DENSITY OF 2.3 T/m^3 FOR SOIL.

REFERENCE

BASE MAP FROM ST. MARYS CEMENT INC. TOPOGRAPHIC SURVEY UPDATED SEPTEMBER 2004, DRAWING No. MP 001 V.01 (3D CONTOURS), UTM NAD83.

OCTOBER 2004 SURVEY OF THOMAS ST. QUARRY FACE AND OVERBURDEN STRIPPING FACE AND SOUTH QUARRY CLAY PIT OBTAINED FROM AGM, FILE NAME SM0412T1.DWG, DATED OCT. 7, 2004, SCALE 1:2000.

100 0 100 200

SCALE 1:5000 METRES

Golder Associates
Mississauga, Ontario, Canada

SCALE	AS SHOWN
DATE	FEB. 2005
DESIGN	
CAD	KD
CHECK	RB
REVIEW	

FILE No. 04111204705.dwg

PROJECT No. 04-1112-047 REV. A

TITLE

INFERRED TOTAL OVERBURDEN THICKNESS POTENTIAL LANDFILL DONATION AREA

ST. MARYS CEMENT Co.

FIGURE 5

PLOT DATE: March 03, 2005
FILENAME: M:\CAD\Projects\2004\04-1112-047 (ST. MC, St. Mary)\-AA-\04111204705.dwg

APPENDIX A
RECORD OF BOREHOLES & GRAINSIZE TESTING

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-01

SHEET 1 OF 2

LOCATION: N 4787271.1 ;E 487692.7

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: July 30, 2004

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

JN - Joint	BD - Bedding	PL - Planar	PO - Polished	BR - Broken Rock
FLT - Fault	FO - Foliation	CU - Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR - Shear	CO - Contact	UN - Undulating	SM - Smooth	
VN - Vein	OR - Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB - Mechanical Break	

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE % 80 60 40 20	RECOVERY SOLID CORE % 80 60 40 20	R.Q.D. % 80 60 40 20	FRACT. INDEX PER 1m 5 10 15 20	DISCONTINUITY DATA B Angle 0 90 180 270	DISCONTINUITY DATA DIP w.r.t. CORE AXIS 0 30 60 90	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec 10^{-6} 10^{-5} 10^{-4} 10^{-3}	Diametral Point Load Index (MPa) 2 4 6	RMC -Q' AVG.	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE		332.83															
0	12" Hollow Stem Augers with 6 1/4" CME Sapler	TOPSOIL		0.00															Cement Hole plug
		Loose, dry, grey SILT, trace to little gravel CKD		332.60 0.23															
1		Stiff to very stiff, dry, grey sandy SILT to silty SAND, trace gravel, trace cobbles (FILL)		332.30 0.53	1														
		Very stiff, moist, grey sandy SILT to silty SAND (FILL)		331.59 1.30															
		Very stiff to loose, moist, grey sandy SILT to silty SAND, trace gravel (FILL)																	
2		Stiff, moist, white SILT CKD		331.16 1.67	2														Benseal
3		Loose, moist, grey SAND CKD		329.68 3.15															
		Stiff, moist, brown silty SAND CKD		3.28	3														
4		Stiff to compact, moist, brown silty SAND, trace gravel Moist paper cement bags, from 3.70 m to 3.75 m depth		329.12 3.71															
		Very stiff, moist, black SILTY CLAY CKD		328.31 4.52															
5		Stiff, moist, brown CLAYEY SILT to SILTY CLAY (FILL)		4.65															
		Stiff, moist,red SILT CKD		327.78 5.05	4														Hole plug
6 7		Soft, wet, red silty SAND to medium SAND with gravel and cobbles Mixed FILL and CKD		326.89 5.94	5														
8 9		Soft, moist, red SILT to CLAYEY SILT, trace cobbles Mixed FILL and CKD		325.39 7.44	6 7														Sand
10																			
		CONTINUED NEXT PAGE																	

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RDB

CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-01

SHEET 2 OF 2

LOCATION: N 4787271.1 ;E 487692.7

DRILLING DATE: July 30, 2004

DATUM: NAD 83

INCLINATION: -90° AZIMUTH: ---

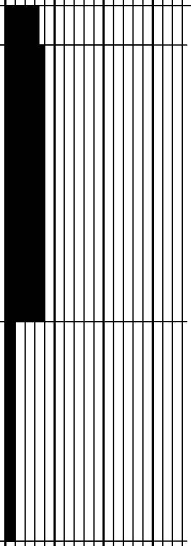
DRILL RIG: CME 75 TRUCK MOUNT

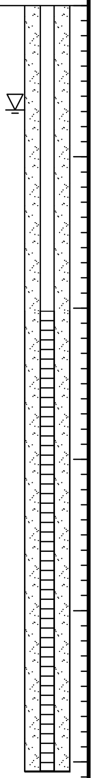
DRILLING CONTRACTOR: All Terrain

JN - Joint	BD - Bedding	PL - Planar	PO - Polished	BR - Broken Rock
FLT - Fault	FO - Foliation	CU - Curved	K - Slickensided	
SHR - Shear	CO - Contact	UN - Undulating	SM - Smooth	
VN - Vein	OR - Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB - Mechanical Break	

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	RECOVERY TOTAL CORE % 80 60 40 20	RECOVERY SOLID CORE % 80 60 40 20	R.Q.D. % 80 60 40 20	FRACT. INDEX PER 1m 5 10 15 20	DISCONTINUITY DATA B Angle 0 90 180 270	DISCONTINUITY DATA DIP w.r.t. CORE AXIS 0 30 60 90	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec 10^{-6} 10^{-5} 10^{-4} 10^{-3}	Diametral Point Load Index (MPa) 2 4 6	RMC -Q' AVG.	NOTES WATER LEVELS INSTRUMENTATION
		--- CONTINUED FROM PREVIOUS PAGE ---																	
10	12" Hollow Stem Augers with 6 1/4" CME Sapler			322.57	7														
		Loose, wet, grey brown silty SAND to sandy SILT, trace gravel CKD		10.26	8														
11																			Sand
12																			
13					9														
		Loose, wet, black grey silty SAND to SAND, trace gravel, mottled CKD		319.49 13.34															
		UPPER GLACIAL TILL Hard, brown to grey, moist, well graded SILTY CLAY, sandy, trace to some gravel		319.29 13.54	10		<<												Screen
14																			
15		End of Borehole Note: CKD - Cement Kiln Dust		317.77 15.06															Note: Well Stickup 0.73m above ground surface Water level at 10.69m below ground surface
16																			
17																			
18																			
19																			
20																			





DEPTH SCALE

1 : 50

LOGGED: RDB

CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-02

SHEET 1 OF 2

LOCATION: N 4787224.0 ;E 487764.2

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 3, 2004
DRILL RIG: CME 75 TRUCK MOUNT
DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

JN - Joint	BD - Bedding	PL - Planar	PO - Polished	BR - Broken Rock
FLT - Fault	FO - Foliation	CU - Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR - Shear	CO - Contact	UN - Undulating	SM - Smooth	
VN - Vein	OR - Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB - Mechanical Break	

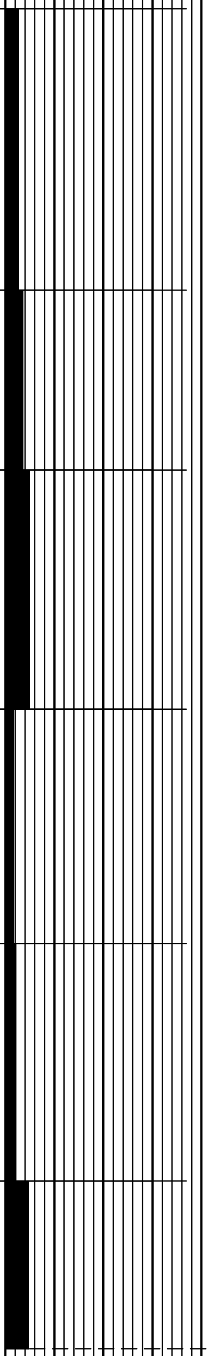
DRILLING RECORD: 12" Hollow Stem Augers with 6 1/4" CME Sapler

DESCRIPTION	SYMBOLIC LOG	ELEV. (m)	DEPTH (m)
GROUND SURFACE		329.41	
TOPSOIL			0.00
Firm, dry, brown silty SAND to coarse SAND, some gravel, CKD			0.15
Firm, moist, grey silty SAND to sandy SILT, trace coarse sand CKD		328.11	1.30
Stiff, moist, grey and brown mottled clayey SILT to sandy SILT, trace gravel, CKD		326.67	2.74
Stiff, moist, light brown SAND, trace organics, trace coarse sand and silt, CKD		324.84	4.57

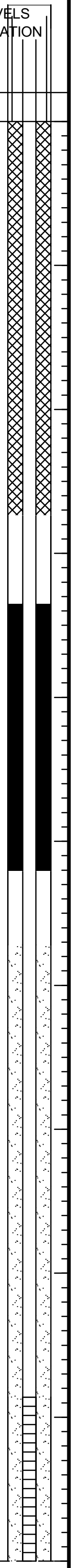
CONTINUED NEXT PAGE

RUN No.	PENETRATION RATE (m/min)	COLOUR / % RETURN	FLUSH
1			<<
2			
3			
4			
5			
6			
7			

RECOVERY: TOTAL CORE %, SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 1m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION; HYDRAULIC CONDUCTIVITY K, cm/sec (10^{-6} 10^{-5} 10^{-4} 10^{-3}); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.



NOTES WATER LEVELS INSTRUMENTATION



NOTES
Backfill
Hole plug
Benseal
Hole plug
Sand
Screen

DEPTH SCALE METRES: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RDB
CHECKED: RDB

MISS-ROCK-2 041112047AARCK.GPJ GAL-CANADA.GDT 3/3/05 DD

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-02

SHEET 2 OF 2

LOCATION: N 4787224.0 ;E 487764.2

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 3, 2004

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

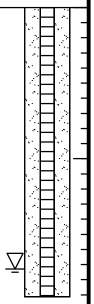
DATUM: NAD 83

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. DEPTH (m)	RUN No.	NOTES WATER LEVELS INSTRUMENTATION
		--- CONTINUED FROM PREVIOUS PAGE ---			
10	12" Hollow Stem Augers with 6 1/4" CME Sapler	Stiff, moist, light brown SAND, trace organics, trace coarse sand and silt, CKD	319.02	7	
11		UPPER GLACIAL TILL Hard, brown to grey, moist, well graded SILTY CLAY, sandy, trace to some gravel	10.39 317.50	8	Screen
12		End of Borehole Note: CKD - Cement Kiln Dust	11.91		Note: Well Stickup 0.71m above ground surface Water level at 11.73m below ground surface
13					
14					
15					
16					
17					
18					
19					
20					

Other column headings: SYMBOLIC LOG; PENETRATION RATE (m/min); COLOUR % RETURN; FLUSH; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 1m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION; HYDRAULIC CONDUCTIVITY K, cm/sec (10^{-6} 10^{-5} 10^{-4} 10^{-3}); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.



DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RDB

CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-03

SHEET 1 OF 2

LOCATION: N 4787234.8 ;E 487640.2

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 4, 2004

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

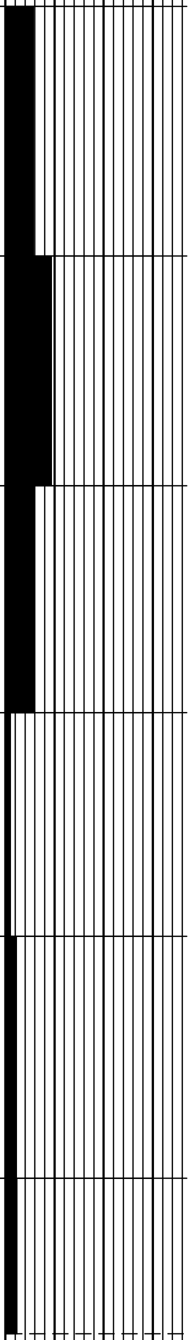
JN - Joint	BD- Bedding	PL - Planar	PO- Polished	BR - Broken Rock
FLT - Fault	FO- Foliation	CU- Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR- Shear	CO- Contact	UN- Undulating	SM- Smooth	
VN - Vein	OR- Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB- Mechanical Break	

Column headings: DEPTH SCALE METRES; DRILLING RECORD; DESCRIPTION; SYMBOLIC LOG; ELEV. DEPTH (m); RUN No.; PENETRATION RATE (m/min); COLOUR % RETURN; FLUSH; RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20); R.Q.D. % (80 60 40 20); FRACT. INDEX PER 1m (5 10 15 20); DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION; HYDRAULIC CONDUCTIVITY K, cm/sec (10^{-6} 10^{-5} 10^{-4} 10^{-3}); Diametral Point Load Index (MPa) (2 4 6); RMC -Q' AVG.; NOTES WATER LEVELS INSTRUMENTATION

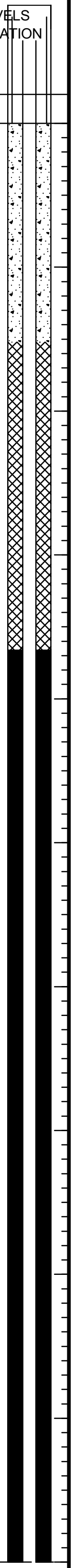
DRILLING RECORD: 12" Hollow Stem Augers with 6 1/4" CME Sapler

DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	329.34
TOPSOIL	0.00
Firm, dry, light brown silty fine SAND to sandy SILT, trace to some gravel (FILL)	329.09 0.25
Firm, moist, brown clayey silty SAND, some gravel, trace wood and debris, intermixed FILL and CKD	328.48 0.86
Soft, moist, light brown silty fine to medium SAND,CKD	324.92 4.42
Firm, moist, brown clayey silty SAND, some coarse sand, some gravel, wood, debris and cobbles, FILL and CKD	4.57
Firm to stiff, moist, brown silty clayey medium to coarse SAND, CKD	323.45 5.89
Firm to stiff, moist, brown with black staining, silty clayey SAND, CKD	322.69 6.65
Firm, moist, light brown SAND, some gravel, CKD	321.97 7.37
Stiff, moist, brown CLAYEY SILT to SILTY CLAY, trace coarse sand, trace gravel, (FILL)	321.06 8.28
Firm, moist, light brown SAND, some gravel, trace clinker balls, trace organics, CKD	320.37 8.97

RUN No.: 1, 2, 3, 4, 5, 6, 7



NOTES: Cement; Backfill; Benseal



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DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RDB

CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-03

SHEET 2 OF 2

LOCATION: N 4787234.8 ;E 487640.2

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 4, 2004

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

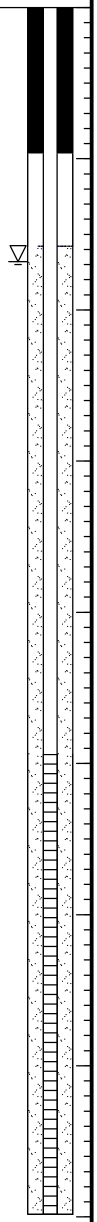
BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DRILLING RECORD: 12" Hollow Stem Augers with 6 1/4" CME Sapler

--- *CONTINUED FROM PREVIOUS PAGE* ---

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)	RUN No.	FLUSH	NOTES WATER LEVELS INSTRUMENTATION
10	Firm, moist, light brown SAND, some gravel, trace clinker balls, trace organics, CKD	318.85 10.49	7		Benseal
	Loose to compact, wet, light brown SAND, trace gravel, trace organics, CKD		8		Grout
12			9		
13			10		Sand
15		313.47 15.87	11		
16	Firm, moist, dark brown sandy SILT, trace organics, Topsoil Fill	312.75 16.59			Screen
	Wet, brown medium SAND, some coarse sand (FILL)	312.55 16.79	12		
17	Moist, brown CLAYEY SILT, some organics, Topsoil Fill	16.97			
	Wet, brown medium SAND				
	UPPER GLACIAL TILL Hard, brown to grey, moist, well graded SILTY CLAY, sandy, trace to some gravel	311.36 17.98	13	<<	
18	End of Borehole Note: CKD - Cement Kiln Dust				Note: Well Stickup 0.75m above ground surface Water level at 11.68m belowground surface



DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RDB

CHECKED: RDB

MISS-ROCK-2 04111204 7AARCK.GPJ GAL-CANADA.GDT 3/3/05 DD

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-04

SHEET 1 OF 4

LOCATION: N 4787040.7 ;E 487600.1

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 7-8, 2004

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

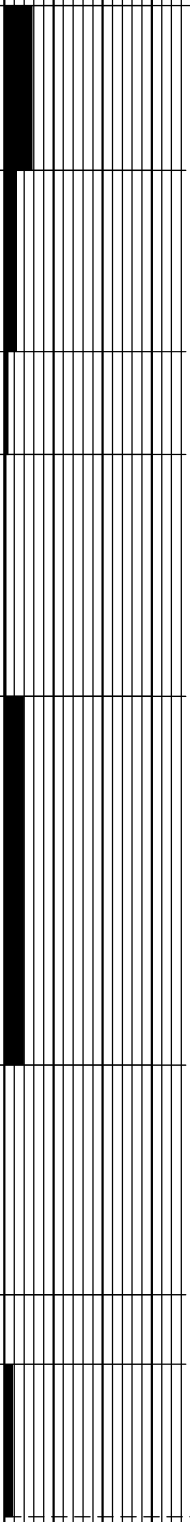
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. DEPTH (m)	RUN No.	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE	314.19			
0	PQ Soil Coring	Brown sand and gravel (FILL)	0.00			
		UPPER GLACIAL TILL Very stiff to hard, medium to dark grey, moist, massive textured, well graded, SILTY CLAY TILL some sand, trace to some gravel, occasional cobbles and boulders of limestone, dolostone and igneous composition (coarse gravel, cobbles and boulders estimated to comprise 5 to 10% of sample).	0.10	1		
1				2		
2				3	Sample 1,, 2.21m-2.29m,, Sieve and Hydrometer,,	
3				4		
4				5	Sample 2,, 4.50m-4.57m,, Sieve and Hydrometer,,	Bentonite grout
7				6		
8				7	Sample 3,, 8.46m-8.53m,, Sieve and Hydrometer,,	
9		LOWER GLACIAL TILL	305.33 8.86	8	Sample 4,,	
10						



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DEPTH SCALE
1 : 50

LOGGED: RDB
CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-04

SHEET 2 OF 4

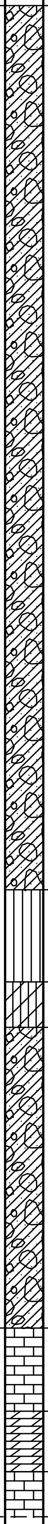
LOCATION: N 4787040.7 ;E 487600.1
INCLINATION: -90° AZIMUTH: ---

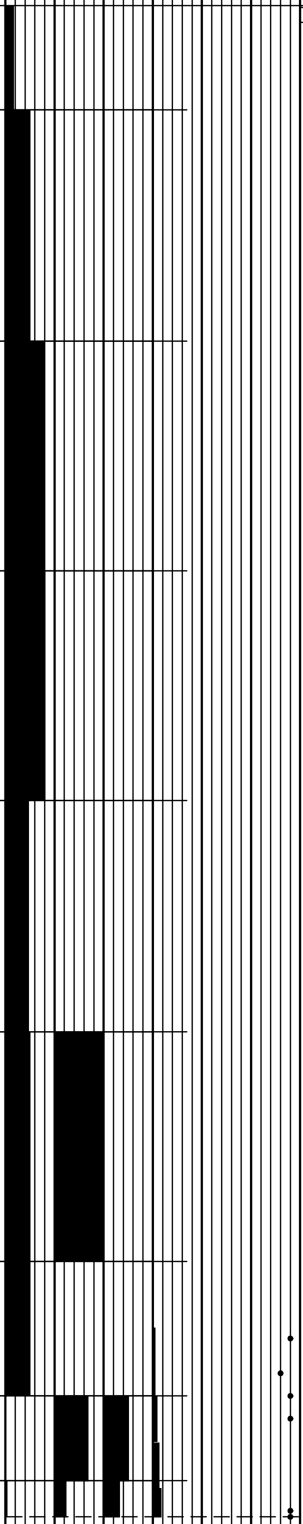
DRILLING DATE: August 7-8, 2004
DRILL RIG: CME 75 TRUCK MOUNT
DRILLING CONTRACTOR: All Terrain

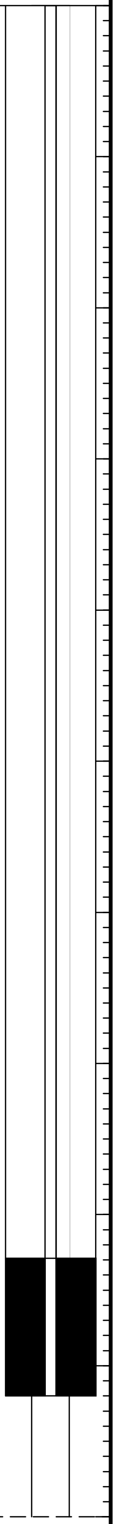
DATUM: NAD 83

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. DEPTH (m)	RUN No.	TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
		--- CONTINUED FROM PREVIOUS PAGE ---				
10		LOWER GLACIAL TILL Hard, medium brownish grey, moist to dry appearance, massive textured, well graded, CLAYEY SILT TILL with sand, some gravel, occasional cobbles and boulders of limestone, dolostone and igneous composition. Limestone cobble at upper contact. Coarse gravel, cobble and boulder content estimated to comprise 10 to 20% below 10.5 m depth. Poor sample recovery below 12 m depth due to cobbles and boulders.		8	9.91m-10.06m,, Sieve and Hydrometer,,	
11				9		
12						
13				10		
14						Bentonite grout
				11		
15	PQ Soil Coring					
			298.34 15.85			
16		At 15.85 m to 16.46 m depth, bedded silty sand to sandy silt.		12	Sample 6,, 15.85m-16.00m,, Sieve and Hydrometer,,	
		At 16.46 to 16.76 m depth, brown, moist, layered clayey silt and brownish grey silty clay. At 16.76 m to 18.75 m depth, no sample recovery, probably clayey silt till with numerous cobbles and boulders.	297.73 16.46 297.43 16.76		Sample 7,, 16.61 m-16.76m,, Sieve and Hydrometer,,	
17						
				13		
18						
		Bedrock Surface	295.44 18.75	14	FR,PL,Ro	
19		UPPER LUCAS FORMATION LIMESTONE			FR,PL,Ro FR,PL,Ro	
	HQ Coring		294.89 19.30	15	FR,PL,Ro	
			294.49 19.70	16		
20					FR,UE,Ro	
		CONTINUED NEXT PAGE				







DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RDB
CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-04

SHEET 3 OF 4

LOCATION: N 4787040.7 ;E 487600.1

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 7-8, 2004

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

JN - Joint	BD - Bedding	PL - Planar	PO - Polished	BR - Broken Rock
FLT - Fault	FO - Foliation	CU - Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR - Shear	CO - Contact	UN - Undulating	SM - Smooth	
VN - Vein	OR - Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB - Mechanical Break	

Columns: DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE (m/min) | COLOUR % RETURN | FLUSH | RECOVERY: TOTAL CORE % (80 60 40 20), SOLID CORE % (80 60 40 20) | R.Q.D. % (80 60 40 20) | FRACT. INDEX PER 1m (5 10 15 20) | DISCONTINUITY DATA: B Angle (0 90 180 270), DIP w.r.t. CORE AXIS (0 30 60 90), TYPE AND SURFACE DESCRIPTION | HYDRAULIC CONDUCTIVITY K, cm/sec (10^{-6} 10^{-5} 10^{-4} 10^{-3}) | Diametral Point Load Index (MPa) (2 4 6) | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION

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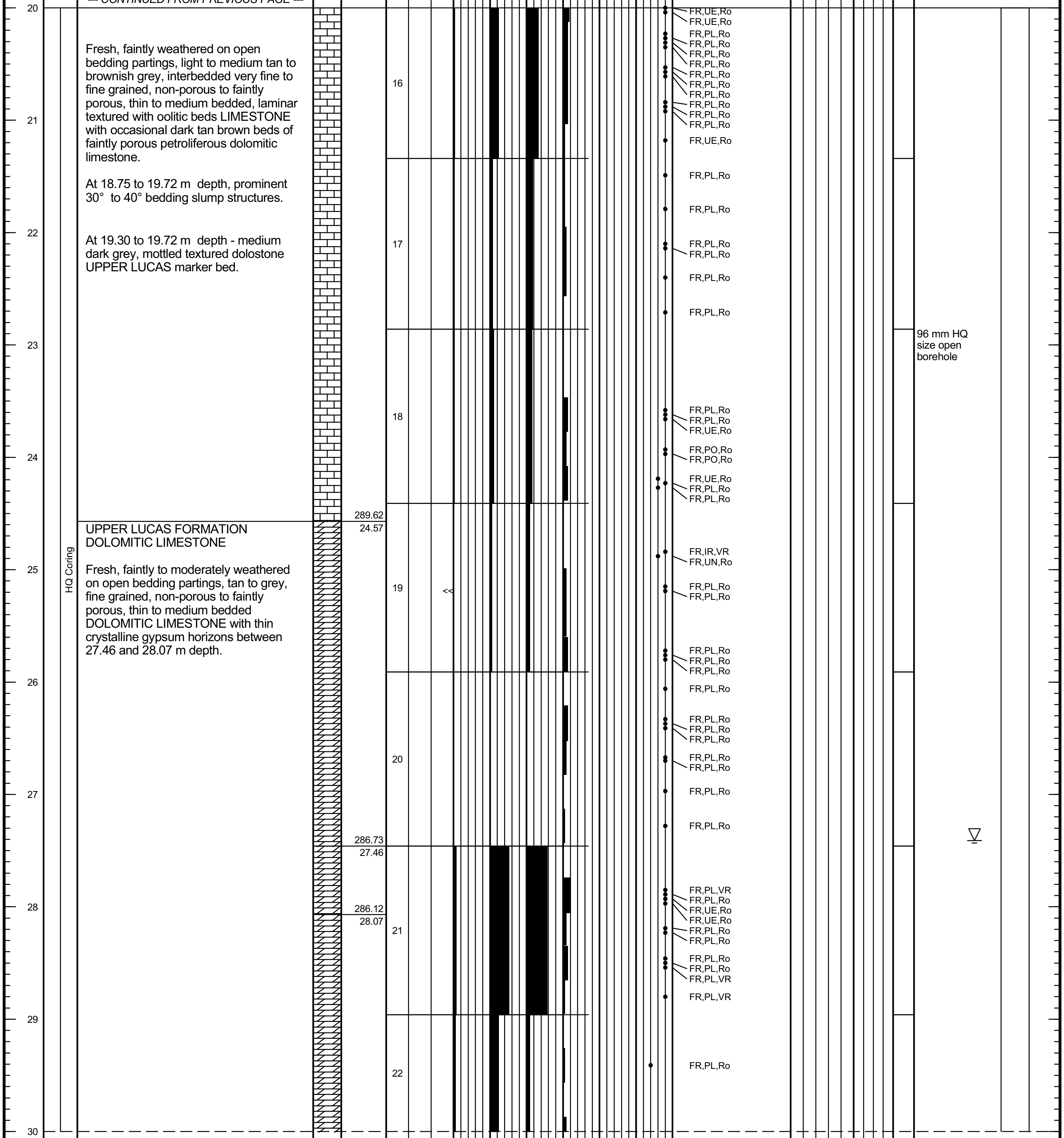

Fresh, faintly weathered on open bedding partings, light to medium tan to brownish grey, interbedded very fine to fine grained, non-porous to faintly porous, thin to medium bedded, laminar textured with oolitic beds LIMESTONE with occasional dark tan brown beds of faintly porous petroliferous dolomitic limestone.

At 18.75 to 19.72 m depth, prominent 30° to 40° bedding slump structures.

At 19.30 to 19.72 m depth - medium dark grey, mottled textured dolostone UPPER LUCAS marker bed.

289.62
24.57

UPPER LUCAS FORMATION
DOLOMITIC LIMESTONE

Fresh, faintly to moderately weathered on open bedding partings, tan to grey, fine grained, non-porous to faintly porous, thin to medium bedded DOLOMITIC LIMESTONE with thin crystalline gypsum horizons between 27.46 and 28.07 m depth.

286.73
27.46

286.12
28.07

RUN No.	TYPE AND SURFACE DESCRIPTION
16	FR,UE,Ro FR,UE,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,UE,Ro
17	FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro
18	FR,PL,Ro FR,PL,Ro FR,UE,Ro FR,PO,Ro FR,PO,Ro FR,UE,Ro FR,PL,Ro FR,PL,Ro
19	FR,IR,VR FR,UN,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro
20	FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro
21	FR,PL,VR FR,PL,Ro FR,UE,Ro FR,UE,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,VR FR,PL,VR
22	FR,PL,Ro

96 mm HQ size open borehole

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MISS-ROCK-2 041112047AARCK.GPJ GAL-CANADA.GDT 3/3/05 DD

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RDB
CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-04

SHEET 4 OF 4

LOCATION: N 4787040.7 ;E 487600.1

DRILLING DATE: August 7-8, 2004

DATUM: NAD 83

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

JN - Joint	BD - Bedding	PL - Planar	PO - Polished	BR - Broken Rock
FLT - Fault	FO - Foliation	CU - Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR - Shear	CO - Contact	UN - Undulating	SM - Smooth	
VN - Vein	OR - Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB - Mechanical Break	

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE % 80 60 40 20	RECOVERY SOLID CORE % 80 60 40 20	R.Q.D. % 80 60 40 20	FRACT. INDEX PER 1m 5 10 15 20	DISCONTINUITY DATA B Angle 0 90 180 270	DISCONTINUITY DATA DIP w.r.t. CORE AXIS 0 30 60 90	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec 10^{-6} 10^{-5} 10^{-4} 10^{-3}	Diametral Point Load Index (MPa) 2 4 6	RMC -Q' AVG.	NOTES WATER LEVELS INSTRUMENTATION
		--- CONTINUED FROM PREVIOUS PAGE ---																
30	HQ Coring													FR,PL,Ro FR,PL,Ro				
		LOWER LUCAS FORMATION DOLOSTONE Fresh, light tan to grey, fine grained, non-porous to faintly porous thin to medium bedded DOLOSTONE. Top of unit marked by thin, grey mottled porous dolostone bed between 30.27 and 30.39 m.		283.92 30.27	22									FR,UE,VR FR,PL,Ro				
31					23		<<							FR,PL,Ro FR,PL,Ro				
														FR,PL,Ro				
32		End of Borehole		282.19 32.00														Note: Monitoring well riser n pipe stickup 0.95 m above ground surface water level at 27.41 m below ground surface on August 8, 2004
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		

DEPTH SCALE

1 : 50

LOGGED: RDB

CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-05

SHEET 1 OF 3

LOCATION: N 4787047.3 ;E 487836.7

DRILLING DATE: August 12, 2004

DATUM: NAD 83

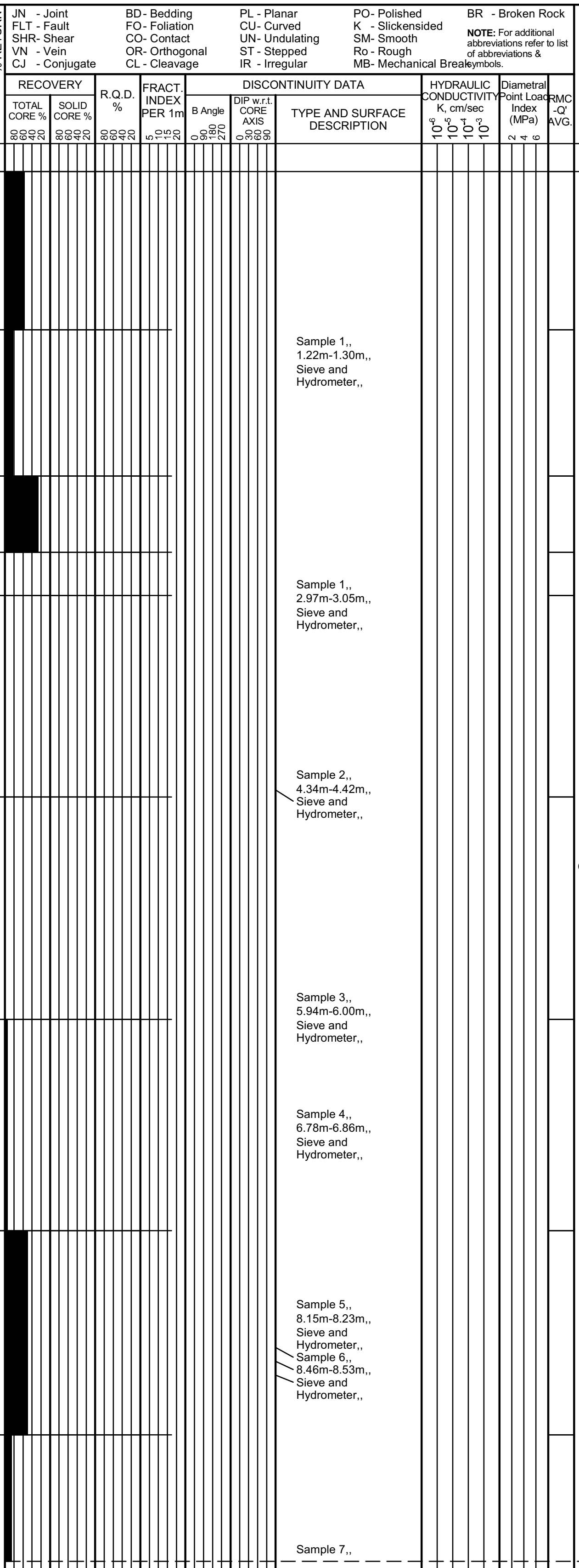
INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 75 TRUCK MOUNT

DRILLING CONTRACTOR: All Terrain

JN - Joint	BD- Bedding	PL - Planar	PO- Polished	BR - Broken Rock
FLT - Fault	FO- Foliation	CU- Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR- Shear	CO- Contact	UN- Undulating	SM- Smooth	
VN - Vein	OR- Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB- Mechanical Break	

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE	314.13			
0	PQ Soil Coring	Loose, brown, moist, intermixed SILTY SAND AND GRAVEL, SILT AND SAND, and SILTY CLAY (FILL)	0.00	1 2	Sample 1,, 1.22m-1.30m,, Sieve and Hydrometer,,	
2		UPPER GLACIAL TILL Very stiff to hard, medium to dark grey, moist, massive textured, well graded, SILTY CLAY (TILL), some sand, trace gravel grading to CLAYEY SILT (TILL) some sand trace gravel below 5.5 m depth. Coarse gravel, cobbles and boulders of limestone, dolostone and igneous composition comprise approximately 5 to 10% of sample.	312.24 1.89	3 4 5 6 7	Sample 1,, 2.97m-3.05m,, Sieve and Hydrometer,, Sample 2,, 4.34m-4.42m,, Sieve and Hydrometer,, Sample 3,, 5.94m-6.00m,, Sieve and Hydrometer,, Sample 4,, 6.78m-6.86m,, Sieve and Hydrometer,,	Grout
		MIDDLE LACUSTRINE SILT Stiff, brownish grey, moist to wet, thinly bedded SILT some sand to CLAYEY SILT.	306.51 7.62	8		
		LOWER GLACIAL TILL Hard, medium brownish grey, moist to dry appearance, massive textured, well graded, CLAYEY SILT TILL with sand, trace to some gravel. Coarse gravel, cobbles and boulders of limestone, dolostone and igneous composition estimated to comprise 10 to 20% of sample below depth of 12 m resulting in poor sample recovery.	305.90 8.23	9	Sample 5,, 8.15m-8.23m,, Sieve and Hydrometer,, Sample 6,, 8.46m-8.53m,, Sieve and Hydrometer,, Sample 7,,	
10						



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DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RDB

CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-05

SHEET 2 OF 3

LOCATION: N 4787047.3 ;E 487836.7

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: August 12, 2004

DRILL RIG: CME 75 TRUCK MOUNT

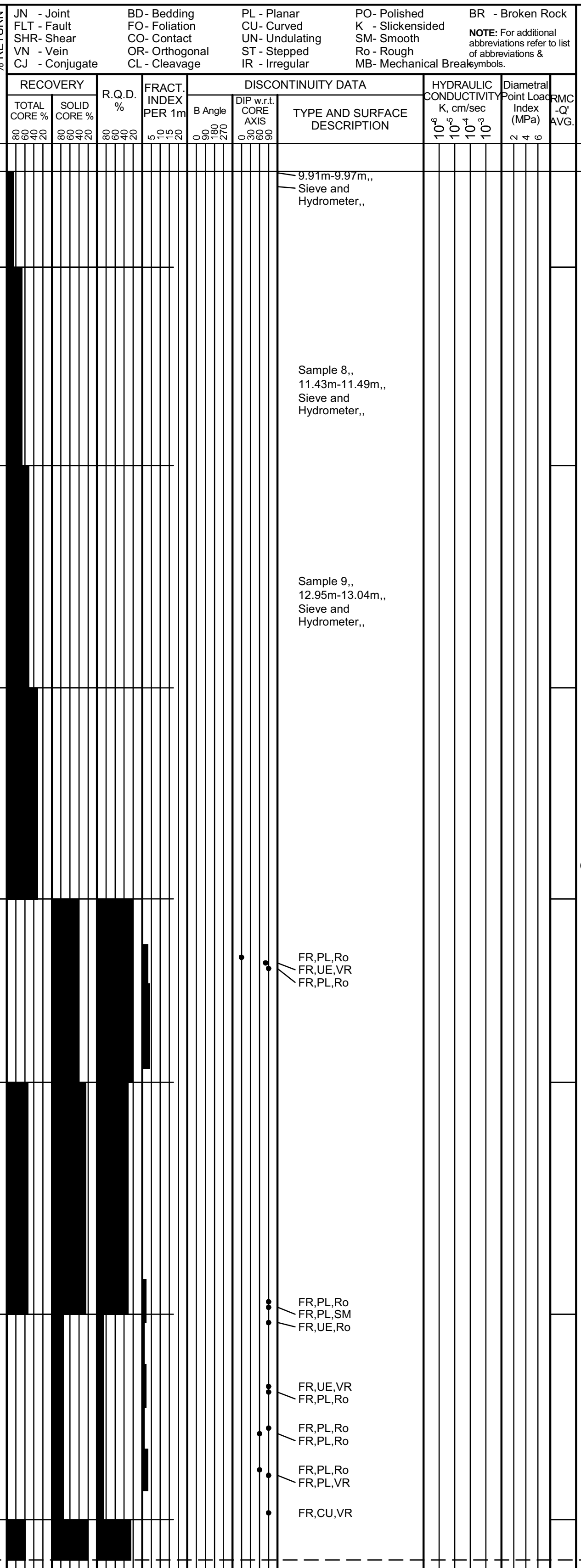
DRILLING CONTRACTOR: All Terrain

DATUM: NAD 83

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	TYPE AND SURFACE DESCRIPTION	NOTES WATER LEVELS INSTRUMENTATION
		--- CONTINUED FROM PREVIOUS PAGE ---				
10	PQ Soil Coring	LOWER GLACIAL TILL Hard, medium brownish grey, moist to dry appearance, massive textured, well graded, CLAYEY SILT TILL with sand, trace to some gravel. Coarse gravel, cobbles and boulders of limestone, dolostone and igneous composition estimated to comprise 10 to 20% of sample below depth of 12 m resulting in poor sample recovery.		9	9.91m-9.97m,, Sieve and Hydrometer,,	
11				10	Sample 8,, 11.43m-11.49m,, Sieve and Hydrometer,,	
12–13				11	Sample 9,, 12.95m-13.04m,, Sieve and Hydrometer,,	
14–15				12		Grout
15.57		Bedrock Surface UPPER LUCAS FORMATION LIMESTONE Faintly to moderately weathered on open bedding partings, grey to brownish grey, fine grained, faintly porous, thin bedded LIMESTONE.	298.56 15.57	13	FR,PL,Ro FR,UE,VR FR,PL,Ro	
16–18	HQ Coring			14	FR,PL,Ro FR,PL,SM FR,UE,Ro	
18.17		UPPER LUCAS FORMATION DOLOMITIC LIMESTONE Fresh, faintly to moderately weathered on open bedding partings, tan to grey, fine grained, non-porous to faintly porous, thin to medium bedded DOLOMITIC LIMESTONE with thin crystalline gypsum horizons.	295.96 18.17	15	FR,UE,VR FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,VR FR,CU,VR	
20				16		
		CONTINUED NEXT PAGE				



DEPTH SCALE
1 : 50

Golder Associates

LOGGED: RDB
CHECKED: RDB

PROJECT: 04-1112-047

RECORD OF DRILLHOLE: MW 04-05

SHEET 3 OF 3

LOCATION: N 4787047.3 ;E 487836.7

DRILLING DATE: August 12, 2004

DATUM: NAD 83

DRILL RIG: CME 75 TRUCK MOUNT

INCLINATION: -90° AZIMUTH: ---

DRILLING CONTRACTOR: All Terrain

JN - Joint	BD- Bedding	PL - Planar	PO- Polished	BR - Broken Rock
FLT - Fault	FO- Foliation	CU- Curved	K - Slickensided	**NOTE:** For additional abbreviations refer to list of abbreviations & symbols.
SHR- Shear	CO- Contact	UN- Undulating	SM- Smooth	
VN - Vein	OR- Orthogonal	ST - Stepped	Ro - Rough	
CJ - Conjugate	CL - Cleavage	IR - Irregular	MB- Mechanical Break	

DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. DEPTH (m) | RUN No. | PENETRATION RATE (m/min) | FLUSH | COLOUR % RETURN | RECOVERY: TOTAL CORE % 80 60 40 20, SOLID CORE % 80 60 40 20 | R.Q.D. % 80 60 40 20 | FRACT. INDEX PER 1m 5 10 15 20 | DISCONTINUITY DATA: B Angle 0 90 180 270, DIP w.r.t. CORE AXIS 0 30 60 90, TYPE AND SURFACE DESCRIPTION | HYDRAULIC CONDUCTIVITY K, cm/sec 10^{-6} 10^{-5} 10^{-4} 10^{-3} | Diametral Point Load Index (MPa) 2 4 6 | RMC -Q' AVG. | NOTES WATER LEVELS INSTRUMENTATION

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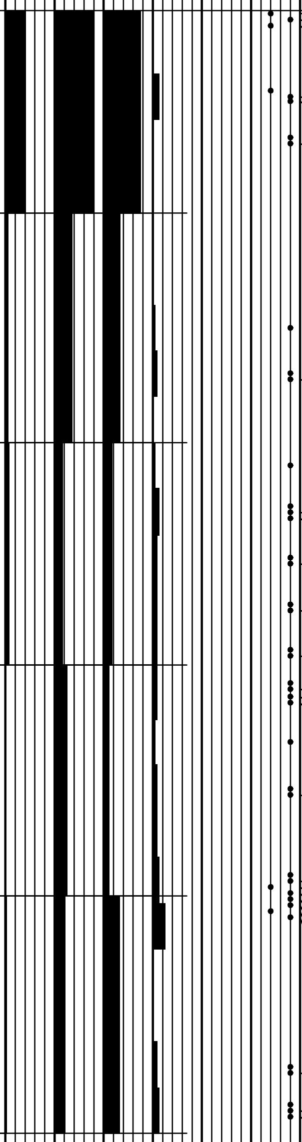

Depth (m)	Drilling record	Description	Elev. / Depth (m)	Run No.	Type and surface description	Notes
20	HQ Coring	UPPER LUCAS FORMATION DOLOMITIC LIMESTONE Fresh, faintly to moderately weathered on open bedding partings, tan to grey, fine grained, non-porous to faintly porous, thin to medium bedded DOLOMITIC LIMESTONE with thin crystalline gypsum horizons.		16	FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro	
21						
22				17	FR,PL,VR FR,PL,SM FR,UE,Ro	
23				18	FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro	Grout
24					FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,VR FR,PL,VR	
		LOWER LUCAS FORMATION DOLOSTONE Fresh, light tan to grey, fine grained, non-porous to faintly porous, thin to medium bedded DOLOSTONE. Top of unit marked by thin, grey mottled porous dolostone bed between 27.17 and 27.38 m depth.	289.36 24.77	19	FR,UE,Ro FR,UE,Ro FR,PL,Ro	
25					FR,PL,Ro FR,PL,Ro	
26				20	FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,CU,Ro	
27					FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro FR,PL,Ro	
		END OF BOREHOLE	286.70 27.43			Note: Borehole bentonite grouted to surface on completion of drilling
28						
29						
30						

MISS-ROCK-2 041112047AARCK.GPJ GAL-CANADA.GDT 3/3/05 DD

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: RDB

CHECKED: RDB

R.J. Burnside & Associates Limited