7.0 Phase 5: Assess Alternative Methods for Carrying Out the Undertaking

This Section documents the assessment of Alternative Methods or Alternative landfill designs.

This Section has been modified from the final EA document submitted in August 2021. Government Review Team (GRT) comments on the August 2021 EA raised several concerns regarding Alternative 3 particularly the proximity to, and the potential effects of, the Cement Kiln Dust (CKD) Pile on the relocated watercourse. In an effort to address these concerns the Town re-engaged with St Mary's Cement (SMC) to discuss the watercourse realignment and how far onto SMC lands it might extend. As a result of those discussions, SMC undertook further review and indicated that encroachment onto their lands would not be possible without affecting their *Aggregate Resources Act* license. Therefore, the Town has sought another solution.

Reflecting on both the comments on the August 2021 EA and the limitations with respect to SMC lands, the study team revisited Alternative 3. The team was challenged to determine if refinements to the preferred alternative could minimize the need to realign the watercourse while maintaining the target capacity of the preferred alternative and its attributes. To this end, the team identified a refinement to the preferred alternative, Alternative 3A which has been added to the evaluation of alternatives described in the chapter and which is described in Section 7.1 below.

The technical information to support the development and assessment of Alternative 3A is described in Appendix D of this report.

7.1 Alternative Methods to be Assessed

Alternative Methods (hereafter referred to as "Alternatives") are different ways to implement the preferred alternative solution, expansion to landfill as determined in Section 3.12, to address the revised Problem Statement. In this case, the Alternatives are different ways in which the landfill could be expanded. The expanded landfill will continue to use the existing haul routes and site entrance, landfill liner system and leachate collection system (LCS) with leachate disposal to the St Marys WTTP.

Five conceptual Alternatives were identified and developed. The "Do Nothing" Alternative has also been brought forward as a baseline against which the other Alternatives can be compared.

The Alternatives are as follows:

- Do Nothing:
  - As a requirement of the EA Act, the 'Do Nothing' Alternative must be considered. Do 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.
  - No new capacity is provided with this option beyond the existing capacity, as specified in the current ECA which will expire in September of 2022.
- Alterative 1, Vertical Expansion:
  - This Alternative Method involves an expansion in the vertical direction within the existing footprint of the landfill.
  - Approximately 500,000 m^3 of disposal capacity can be provided. This could sufficiently serve the Town's waste disposal needs for approximately 30 years but not the full 40-year period currently sought by the Town.
- Alternative 2, Horizontal expansion of the existing landfill:
  - This Alternative Method involves an expansion outside of the existing landfill footprint. The watercourse running through the property would be relocated to the northern boundary of the property.
  - With this Alternative, approximately 733,000 m^3 of disposal capacity can be provided which is more than sufficient to meet the Town's waste disposal needs for at least 40 years.
- Alternative 3, Combination of vertical and horizontal expansion:
  - This Alternative Method would involve partial vertical expansion along with some horizontal expansion of the landfill footprint. The watercourse running through the property would be relocated to the northern boundary of the property.
  - With this Alternative, approximately 756,000 m^3 of disposal capacity can be provided which is more than sufficient to meet the Town's waste disposal needs for at least 40 years.
- Alternative 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 landfill property.
  - Approximately 397,000 m^3 of disposal capacity can be provided. This could sufficiently serve the Town's waste disposal needs for approximately 25 years but not the full 40-year period currently sought by the Town.

- Alternative 5, Vertical expansion plus a new footprint:
  - This Alternative Method would involve partial vertical expansion along with development of a new landfill footprint elsewhere on the landfill property.
  - With this Alternative, approximately 974,000 m^3 of disposal capacity can be provided which is more than sufficient to meet the Town's waste disposal needs for at least 40 years.

Alternatives 2 and 3 require relocation of the watercourse to the northern boundary of the property, with some encroachment onto SMC lands. As noted, SMC identified concerns with the encroachment onto their lands and the impact it would have on their Aggregate Resources Licence. In addition, concerns were raised with respect to the proximity of the relocated watercourse to the CKD pile. To address these concerns, the team identified a refinement to Alternative 3, which resulted in a new Alternative (Alternative 3A) which has been added to the evaluation of alternatives described in this chapter. Alternative 3A is similar to Alternative 3, including both vertical and horizontal expansion. However, rather than relocating the watercourse entirely, a short section (approximately 230m in length) will be realigned slightly to the northeast of its current position.

All Alternatives, including Alternative 3A are shown in Figure 7-1 through Figure 7-6.

While the six Alternatives and Do Nothing option were initially considered, Alternatives 1 and 4 do not provide the necessary disposal capacity (708,000 m^3) to meet the Town's needs for the full 40-year planning period. As such, Alternatives 1 and 4 were discarded as possible solutions and were not considered further in this evaluation.

Table 7-1 summarizes the key characteristics of each remaining Alternative (i.e., Do Nothing and Alternatives 2, 3, 3A and 5). Standard mitigation and operating procedures common to all Alternatives are summarized in Table 7-2.

PHASE I

PHASE II / III

CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)

LEAF AND YARD WASTE COMPOST

PERTH COUNTY ROAD 123

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N

0 40 80 160 240 320
Metres

LEGEND

- PROPERTY BOUNDARY
- EXISTING LIMIT OF WASTE
- LANDFILL EXPANSION FOOTPRINT
- WATERCOURSE
- DRAINAGE SWALE
- STORM WATER MANAGEMENT BASIN
- COMPOST AREA
- CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client: TOWN OF ST. MARYS

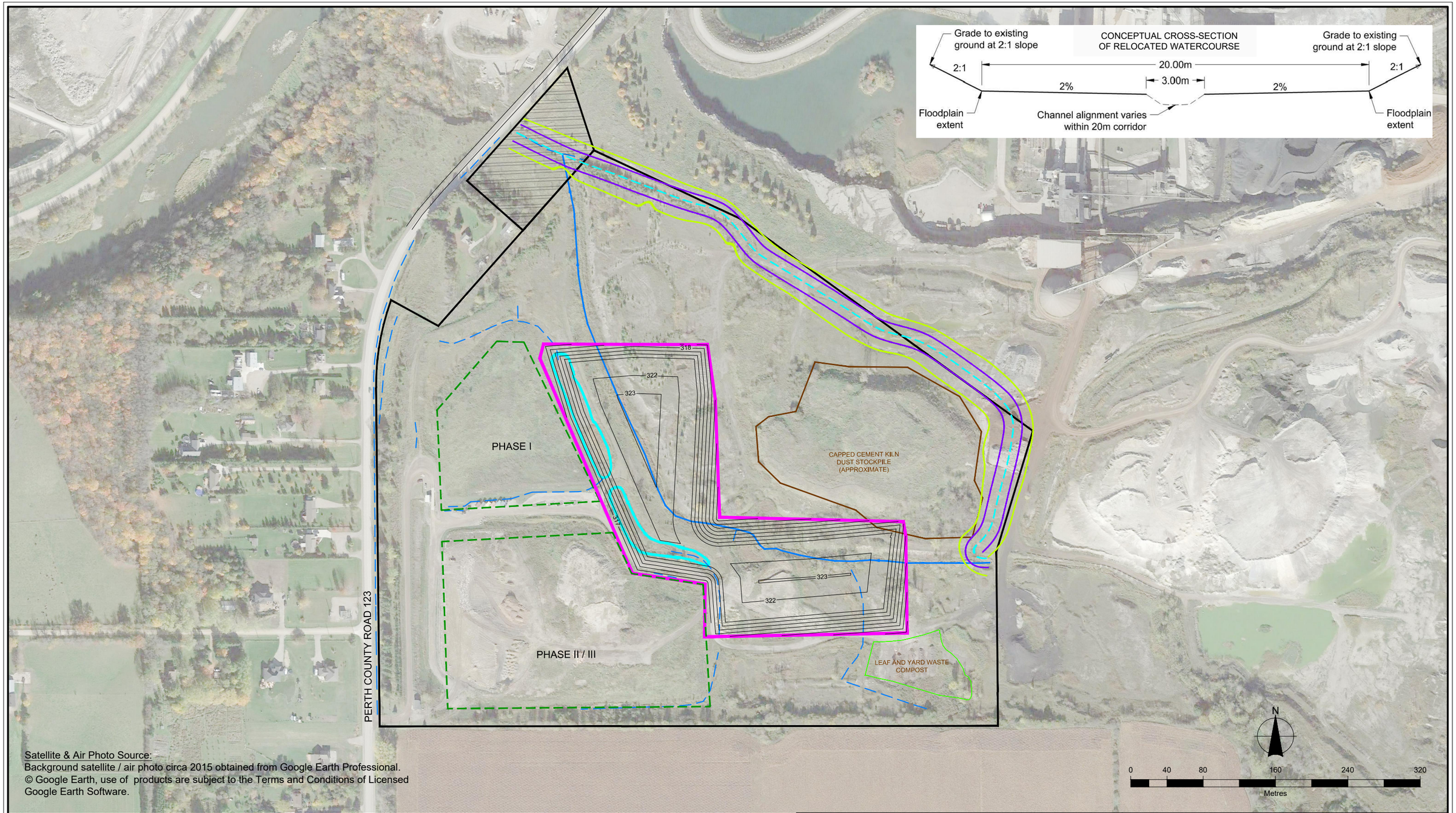
Figure Title

FUTURE SOLID WASTE DISPOSAL EA

ALTERNATIVE 1 - VERTICAL EXPANSION

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	7-1
Scale		Project No.	
1:4,000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figures 7-1 to 7-6.dwg Date Plotted: June 9, 2022 - 1:55 PM



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LEGEND

- PROPERTY BOUNDARY
- EXISTING LIMIT OF WASTE
- LANDFILL EXPANSION FOOTPRINT
- WATERCOURSE
- DRAINAGE SWALE
- STORM WATER MANAGEMENT BASIN
- RELOCATED WATERCOURSE
- CONCEPTUAL WATERCOURSE GRADING LIMIT
- CONCEPTUAL WATERCOURSE FLOODPLAIN
- COMPOST AREA
- CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client: **TOWN OF ST. MARYS**

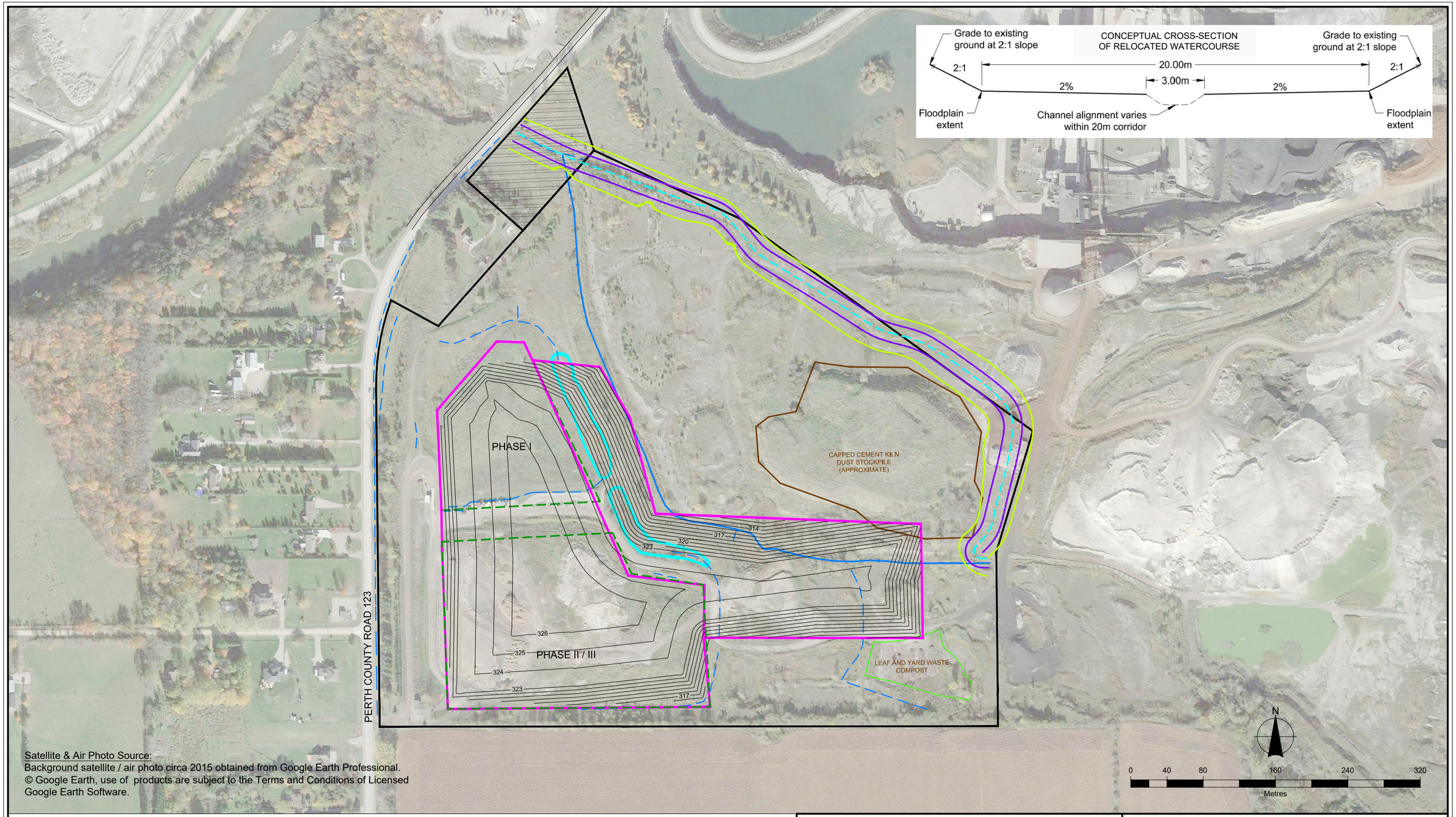
Figure Title

FUTURE SOLID WASTE DISPOSAL EA

ALTERNATIVE 2 - HORIZONTAL EXPANSION

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	**7-2**
Scale: 1:4,000		Project No.: 300032339	

File: C:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figures 7-1 to 7-6.dwg Date Plotted: June 9, 2022 - 1:51 PM



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LEGEND

- PROPERTY BOUNDARY
- EXISTING LIMIT OF WASTE
- LANDFILL EXPANSION FOOTPRINT
- WATERCOURSE
- DRAINAGE SWALE
- STORM WATER MANAGEMENT BASIN
- RELOCATED WATERCOURSE
- CONCEPTUAL WATERCOURSE GRADING LIMIT
- CONCEPTUAL WATERCOURSE FLOODPLAIN
- COMPOST AREA
- CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client: **TOWN OF ST. MARYS**

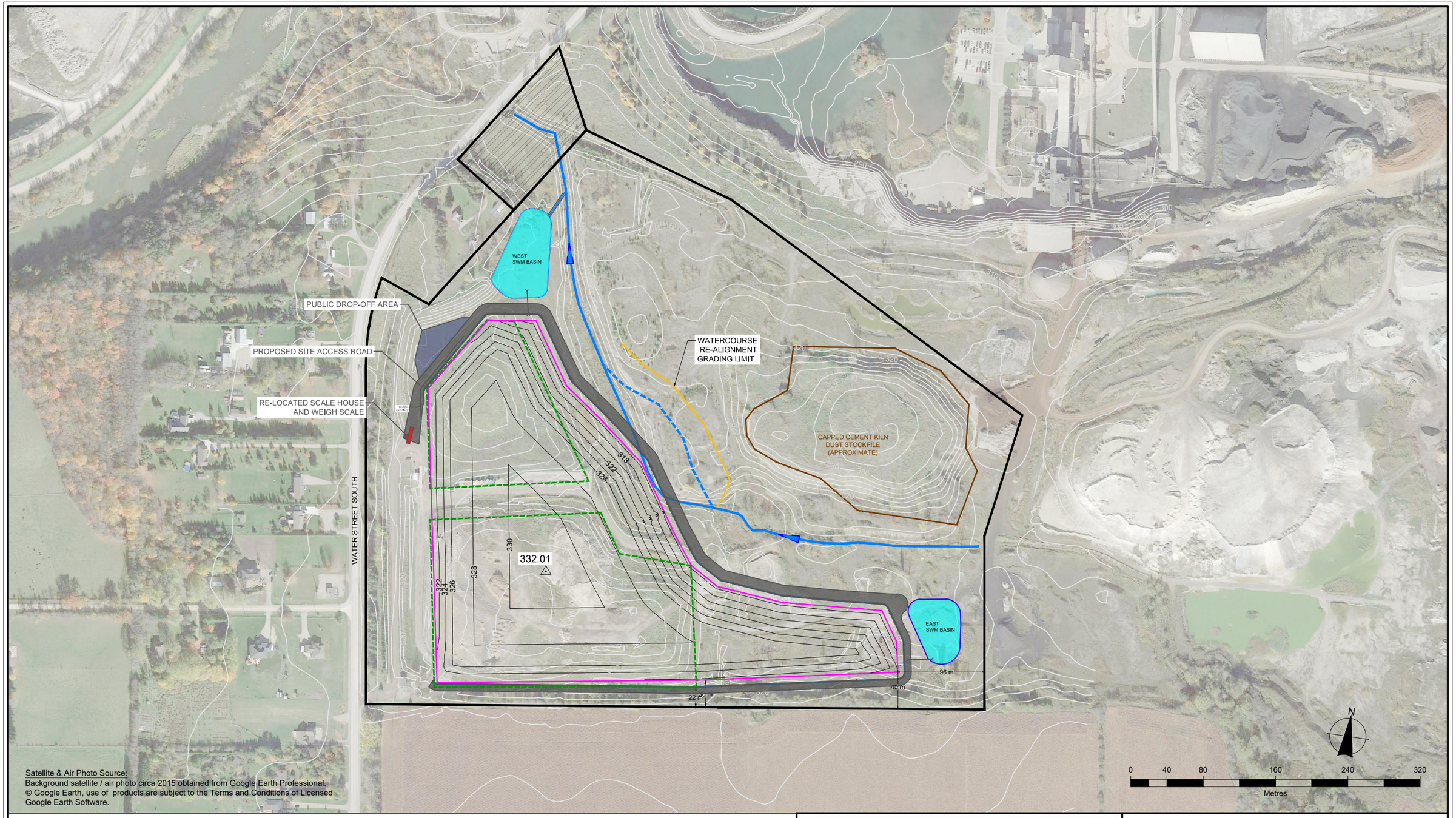
Figure Title

FUTURE SOLID WASTE DISPOSAL EA

ALTERNATIVE 3 - VERTICAL AND HORIZONTAL EXPANSION WITH WATERCOURSE RELOCATION

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	7-3
Scale		Project No.	
1:4,000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figures 7-1 to 7-6.dwg Date Plotted: June 9, 2022 - 1:43 PM



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LEGEND

- PROPERTY LINE
- APPROXIMATE CKD PILE COVER LIMIT
- EXISTING WATERCOURSE
- PROPOSED WATERCOURSE ALIGNMENT
- EXISTING LIMIT OF WASTE
- LANDFILL EXPANSION FOOTPRINT
- EXISTING CONDITIONS CONTOURS (1m)
- PROPOSED WASTE CONTOURS (2m)
- 332.01 APPROXIMATE PEAK OF WASTE (masl)
- STORMWATER FLOW DIRECTION
- RIGHT-OF-WAY AND SEWER EASEMENT
- PROPOSED STORMWATER BASIN (APPROXIMATE)

BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title

FUTURE SOLID WASTE DISPOSAL EA

ALTERNATIVE 3A - VERTICAL AND HORIZONTAL EXPANSION WITH WATERCOURSE RELOCATION

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	7-4
Scale		Project No.	
1:4,000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figure 7-4.dwg Date Plotted: June 10, 2022 - 5:09 PM

AREA OF SUBGRADE EXCAVATION

320

325

330

PHASE I

CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)

330

325

320

PHASE II / III

LEAF AND YARD WASTE COMPOST

PERTH COUNTY ROAD 123

N

0 40 80 160 240 320

Metres

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LEGEND

- PROPERTY BOUNDARY
- EXISTING WASTE FOOTPRINT
- LANDFILL EXPANSION FOOTPRINT
- WATERCOURSE
- DRAINAGE SWALE
- STORM WATER MANAGEMENT BASIN
- COMPOST AREA
- CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client

TOWN OF ST. MARYS

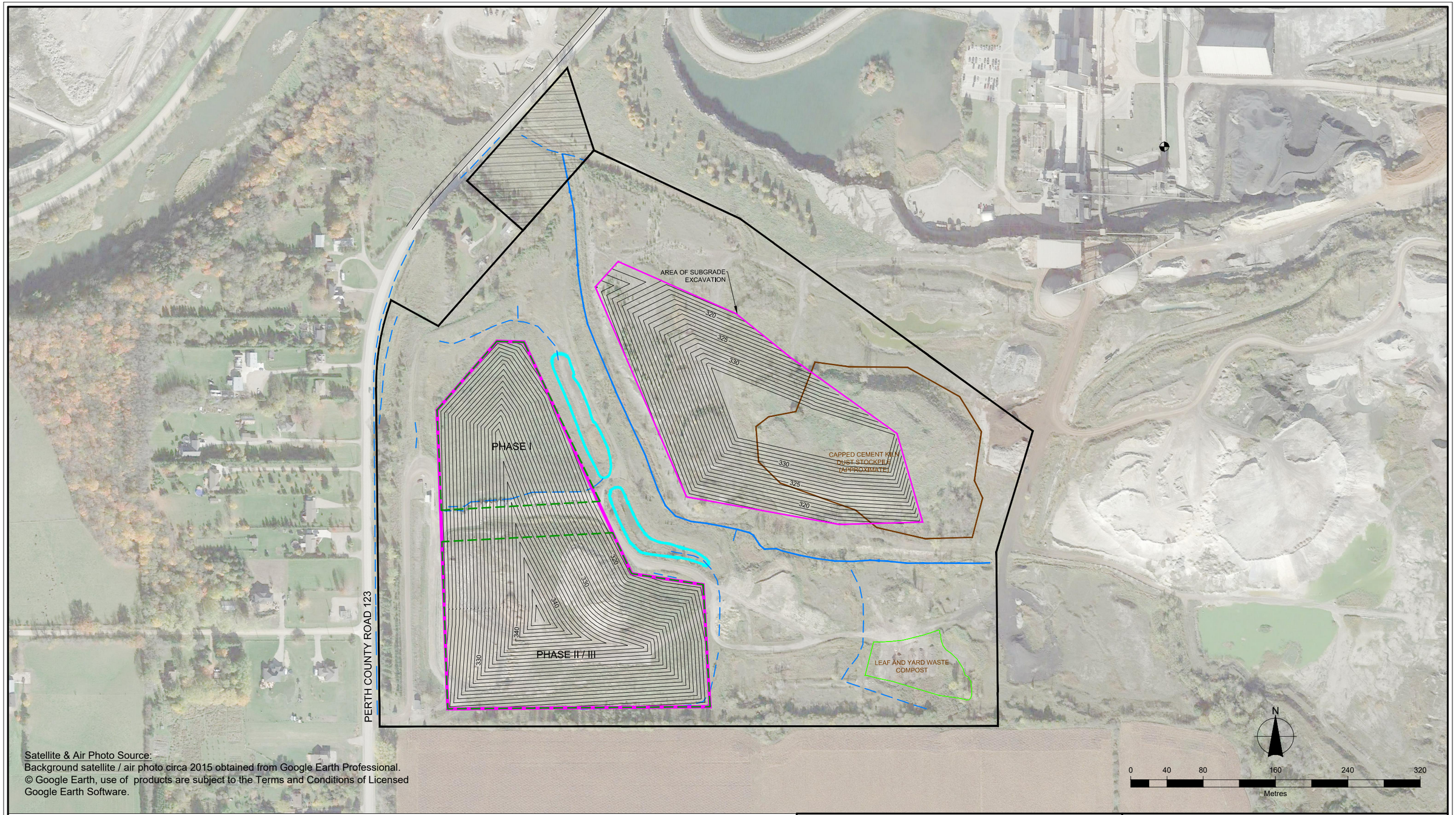
Figure Title

FUTURE SOLID WASTE DISPOSAL EA

ALTERNATIVE 4 - NEW LANDFILL FOOTPRINT

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	**7-5**
Scale		Project No.	
1:4,000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figures 7-1 to 7-6.dwg Date Plotted: June 9, 2022 - 1:57 PM



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LEGEND

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- WATERCOURSE
- DRAINAGE SWALE
- STORM WATER MANAGEMENT BASIN
- COMPOST AREA
- CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title

FUTURE SOLID WASTE DISPOSAL EA

ALTERNATIVE 5 - VERTICAL EXPANSION WITH NEW LANDFILL FOOTPRINT

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	7-6
Scale		Project No.	
1:4,000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figures 7-1 to 7-6.dwg Date Plotted: June 9, 2022 - 1:59 PM

Table 7-1: Key Characteristics of Each Alternative

	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Description	Continue waste collection and disposal using current practices as specified under the current ECA and then cease operations in September 2022 when the ECA expires.	Expand the landfill horizontally to the north and east of the existing landfill footprint. Relocate the watercourse north of the CKD pile.	Expand the landfill vertically, above the existing landfill footprint and horizontally to the north and east of the existing landfill footprint. Relocate the watercourse north of the CKD pile.	Expand the landfill vertically, above the existing landfill footprint and horizontally to the north and east of the existing landfill footprint. Realign a small portion of the watercourse.	Expand the landfill vertically, above the existing landfill footprint and add a new, separate waste footprint on the north side of the watercourse.
Total Footprint [50]	80,000 m^2	150,000 m^2	116,000 m^2	117,000 m^2	141,000 m^2
Total New Disposal Volume [51]	Zero – Only provides currently permitted capacity	733,000 m^3 (>40 years)	756,000 m^3 (>40 years)	709,000 m^3 (40 years)	974,000 m^3 (>40 years)
Highest Final Peak [52]	327 masl	323 masl	327 masl	331 masl	345 masl
Changes to Watercourse	No changes to the watercourse.	The entire watercourse through the site (±790 metres) must be relocated north of the CKD Pile.	The entire watercourse through the site (±790 metres) must be relocated north of the CKD Pile.	The watercourse through the site needs a small (±230 metres) realignment.	No changes to the watercourse.
Changes to Ancillary Facilities	• No changes required.	• No changes to scale, scale house or public drop-off area. • Existing stormwater ponds A and B to be replaced with larger ponds in a new location. • New internal and external ditching required around new waste footprint. • New access road and perimeter road required for waste trucks and site maintenance.	• Scale and scale house to be relocated. New public drop-off area required. • Existing stormwater ponds A and B to be replaced with larger ponds in a new location. • New internal and external ditching required around new waste footprint. • New access road and perimeter road required for waste trucks and site maintenance.	• Scale and scale house to be relocated. New public drop-off area required. • Existing stormwater ponds A and B to be replaced with larger ponds in a new location. • New internal and external ditching required around new waste footprint. • New access road and perimeter road required for waste trucks and site maintenance.	• Scale and scale house to be relocated. New public drop-off area required. • Existing stormwater ponds A and B to be maintained at their current size and location. • New footprint, north of watercourse, requires new separate ponds and ditching. • New access road and perimeter road required for waste trucks and site maintenance. • New bridge/culvert required for access road to cross the watercourse.

[50] Includes footprint of existing landfill in addition to expansion footprint.
[51] The design of Alternatives 2, 3 and 5 is such that more disposal volume can be provided than what is required. Through this EA only 708,000 m^3 will be approved and any excess volume will not be used without further approvals.
[52] Includes final cover. For Alternatives 2, 3 and 5, where excess disposal volume is provided, actual final peak may be 1-2m lower.

Table 7-2: Standard Mitigation and Operating Practices Common to All Alternatives

Phase	Mitigation/Standard Operating Practice
Construction	• Keep construction equipment well maintained and in good working order. • Limit use of equipment to daytime hours and adhere the Town's Noise By-law. • Require contractors to ensure construction activities conform to the criteria set out in Noise Pollution Control (NPC) 115 of 83 dB. • Apply dust suppressants, as required. • Install and maintain erosion and sediment control (ESC) measures prior to any earth works and until the site has been stabilized and then remove them. • Inspect ESC measures to confirm they are functioning and are maintained as required. If control measures are not functioning properly, limit work in the area until the problem is resolved. • Apply wet weather restrictions during site preparation and excavation. Avoid work near watercourses during periods of excessive precipitation and/or excessive snow melt. • Refuel and maintain construction equipment within designated areas only. • Handle hazardous materials used for construction in accordance with best practices and O. Reg. 347. • Store stockpiled material at least 30 m from any waterway to prevent the discharge of deleterious substances into the water. • Immediately contain and clean up spills or depositions into watercourses in accordance with provincial regulatory requirements and the contingency plan. Keep a hydrocarbon spill response kit on-site at all times during construction. • Report spills to the Ontario Spills Action Centre at 1-800-268-6060. • Clear vegetation outside of the bird and bat nesting/roosting season, noted to be April 1 to September 31.

Phase	Mitigation/Standard Operating Practice
	• Compensate for the loss of Eastern Meadowlark by creating habitat elsewhere in accordance with the ESA Regulations, or a species conservation charge paid to the Species at Risk Conservation Trust (effective April 29, 2022). • Erect ESC fencing around work areas to prevent wildlife from entering work zones. Relocate wildlife from within work zones, if required. If a SAR species is encountered in a work zone, cease all work in the area and contact MECP for further instruction. Obtain necessary permitting to relocate salvaged wildlife prior to construction. • Complete a Tree Inventory and Landscape Plan to include restoration and visual buffers. Replant trees at a 10:1 ratio for trees lost during construction. • Manage construction traffic to avoid traffic congestion and safety concerns at the landfill entrance on Water St. S. • Monitor and repair site access roads and perimeter ditching as necessary during construction. • Contact the Archaeology Program Unit and MHSTCI at archaeology@ontario.ca in the unexpected event that archaeological remains are found during construction activities. Indigenous communities will also be notified if the resources appear to pertain to Indigenous groups. • Avoid the creation of temporary vertical or near-vertical spoil piles within the landfill and compost pile that are prone to frequent disturbance from landfill construction to reduce the chance of attracting nesting Bank Swallow. Following Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario (MNRF, 2017).
Operation	• Apply dust control measures, such as water, as required. • Apply daily cover to control landfill gas emissions, odour, dust, reduce blowing litter and control vermin. • Continue to operate the landfill within daylight hours only. Existing operations are only carried out between 8:30 am and 4:30 pm, four days per week. • Maintain and operate a functional LCS to capture leachate for treatment at the Town's wastewater treatment plant (WWTP).

Phase	Mitigation/Standard Operating Practice
	• In the case of a temporary WWTP shut-down or short-term lack of capacity in the system, close the LCS discharge and hold leachate in the landfill until treatment can resume at the WWTP. • Regularly monitor the site for seepage due to leachate mounding. If a seep occurs that escapes the LCS, follow Spills/Leachate Seep Protocols (refer to Section 9.0 and 11.3), including patching seeps, closing outlets in SWM basins (where escaped leachate will collect) and directing contaminated water from the SWM basins to the LCS. • Maintain a network of groundwater and surface water monitoring wells/stations, including monitoring of private drinking water wells and report on findings in Annual Monitoring Reports. Implement Adaptive Management Plans based on monitoring results (refer to Section 11.3). • Maintain existing monitoring wells located within the CKD Stockpile for use in determining groundwater contours and flow direction at the site. Periodically sample these wells (i.e., once every 3 years) until sampling results show stable or predictable results to the satisfaction of MECP and then discontinue monitoring. • Provide and maintain stormwater control measures to direct, slow and retain water, including: – Additional berms against the waste fill area. – Stormwater retention ponds/basins. – Flow control measures for stormwater management ditches (which may include rip-rap or vegetation). – Vegetated buffer areas along waterways. • Manage and direct waste collection vehicles to avoid traffic congestion and safety concerns at the landfill entrance on Water St. S. • Apply contingency measures for bird and vermin control, on an as-needed basis, including the use of noise makers, poisons, traps or professional pest control. • Provide visual barriers, such as berms or tree plantings to block sightlines. • Conduct regular inspections by landfill staff to observe, record any operational issues and implement corrective actions, including: – Fence patrol and litter collection.

Phase	Mitigation/Standard Operating Practice
	– Cover and vegetation inspections. – Erect portable litter fencing. • Continue the existing program to record, investigate, and respond to public complaints and take corrective actions. • Monitor cover placement (application quality and placement schedule) to minimize the attractiveness of the Site to vectors [53] and vermin [54] as well as larger animals. • Avoid the creation of temporary vertical or near-vertical spoil piles within the landfill and compost pile that are prone to frequent disturbance from landfill operations to reduce the chance of attracting nesting Bank Swallow. Following Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario (MNRF, 2017).
Closure	• Prepare a Closure Plan at least two years prior to closure of the landfill site as per ECA A150203 Condition 14.11 and Condition 26.0 and obtain MECP approval prior to closure. • Reseed grassed areas with native grasses and wildflowers, where possible. • Maintain a network of long-term groundwater and surface water monitoring wells/stations and reporting on findings in Annual Post-Operational Monitoring Reports. Implement Adaptive Management measures based on monitoring results (refer to Section 11.3). • Prepare and carry out procedures during post closure including, but not limited to: – Operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; – Inspect and repair areas of settlement, erosion, or leachate seeps; – Record keeping and reporting; – Complaint contact and response procedures; and, – Assessing the landfill's contaminating lifespan based on results of groundwater monitoring programs.

[53] A *vector* is an organism, such as a mosquito or tick, which carries disease-causing micro-organisms from one host to another.
[54] *Vermin* are various small animals or insects, such as rats, gulls or cockroaches, which are destructive, annoying, or injurious to health.

7.2 Evaluation Indicators

Positive and negative environmental effects that could potentially arise were identified and described for each of the Alternatives using the indicators in Table 7-3. The indicators are organized around the natural, social, cultural and man-made components of the environment. Effects were 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 effect is still likely to be felt. Measures for mitigating potential negative environmental effects from Alternative have been identified and described. Any net effects that cannot be fully mitigated were then identified.

The evaluation of Alternative Methods considered 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 effects and the net effects which cannot be mitigated. The Preferred Alternative was selected based on which Alternative was most likely to result in the least number of net effects 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 was identified.

Draft evaluation indicators were provided in the Terms of Reference. Section 5.4.5 of the TOR indicated that, “Criteria [i.e., indicators] may be further refined as a result of comments received from the public, Aboriginal communities and agencies during the EA process”.

Some modifications to the indicators have been made. The final indicators and reason for changes to the indicators are presented in Table 7-3.

Table 7-3: Evaluation Indicators

Environmental Sub-component	Original Indicator	Revised Indicator	Justification
Atmosphere			
Air Quality	• Emissions modelling outputs • Number of people potentially impacted	• Changes in air quality due to construction and closure activities • Changes in air quality due to landfill operations	The indicators have been revised to better articulate if there are changes to air quality effects experienced by receptors as a result of the landfill expansion. This change enhances the ability of the indicators to measure effects. There is no change to the effects assessed as a result of the revision to the indicators.
Odours	• Amount generated by existing operations • Number of potential impacts • Predicted boundary operations	• Number of receptors potentially impacted by odour • Frequency of odour impacts	The indicators have been revised to measure characteristics of odour impacts namely the number of receptors impacted and the frequency with which the impacts may be experienced given odour impacts depend on the proximity of the working face to receptors. The revised indicators are more understandable and combine the original indicators to better articulate impacts. There is no change to the impacts assessed as a result of the revision to the indicators.
Noise	• Amount generated by existing operations • Times noise is anticipated during operations • Number of impacts • Boundary conditions	• Change in noise levels due to construction and closure activities • Number of receptors experiencing noise above provincial criteria due to landfill operations • Number of receptors experiencing a change in noise level due to landfill operations	The indicators have been combined and revised to distinguish between noise related to construction and to operation and to measure the change in noise impact associated with the landfill expansion. This recognizes that impacts are already being experienced at receptors and addresses whether or not those impacts will change and how. There is no change to the impacts assessed as a result of the revision to the indicators.
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	• Risk of increasing leachate generation or strength • Risk of impacting groundwater quality and flow • Risk of altering groundwater flow	The indicators have been revised and combined to better articulate the risks to groundwater associated with the alternatives and, specifically, the risks associated with the proximity of the CKD pile. The new indicators synthesize the information and data measured by the previous indicators. Thus, the indicators are better measures of the potential risks and impacts. The original intent of the indicators is being maintained and the revised indicators better articulate the risks to groundwater from each alternative.

Environmental Sub-component	Original Indicator	Revised Indicator	Justification
Geology – Aggregate Extraction Considerations	• Remaining reserves in the vicinity of the landfill property • Status of the license and any attached conditions	• Indicator removed.	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 and thus, aggregate extraction is no longer potentially impacted by landfill expansion.
Surface Water			
Quality	• Number of watercourses in study area • Size of watercourses in area • Predicted impacts to offsite quality	• Risk of contaminated runoff reaching surface water • Risk of leachate from seeps reaching surface water • Risk of leachate from CKD Pile reaching surface water • Risk of on-site surface water quality impacting Thames River	The indicators have been revised to better articulate the risks to surface water associated with the alternatives and, specifically, the risks associated with the proximity of the CKD pile. The new indicators synthesize the data from monitoring, design information and other data and are better measures of the risks and impacts. The original intent of the indicators is being maintained and the revised indicators better articulate the risks to surface water from each alternative. In particular, one indicator specifically addresses the potential risk to water quality of the Thames River in response to GRT comments.
Quantity	• Duration/frequency/severity of potential on and off site impacts	• Changes to surface water flow	The indicator has been revised to better define the potential effect as a change to surface water flows rather than the previous vague indicator. It is appropriate to focus on changes to flow in order to better capture the effects to surface water quantity of the relocation or realignment of the watercourse and associated site drainage.
Ecology			
Terrestrial	• Impact and duration of site changes on habitat • Number and populations of species at risk present • Potential for interactions	• Impacts to Significant Wildlife Habitat • Impacts to Habitat of Endangered and Threatened Species • Impacts to Other Wildlife	The site has been significantly impacted historically by industrial operations and more recently landfilling. There are few habitat features present on site and what is present is of low quality and poorly connected to larger habitat patches. Furthermore, species using these habitat patches are acclimatized to the landfilling and industrial operations on site. The indicators have been revised to more clearly focus on effects to the remaining habitat patches. The original intent of the indicators is being maintained and the revised indicators better articulate and measure the effects. There is no change to the effects assessed as a result of the revision to the indicator.
Aquatic	• Quantity and variety of SAR present • Changes as a result of site development	• Impacts to fish habitat • Impacts to Aquatic Species at Risk	The aquatic habitat within the watercourse on site is limited by the lack of connectivity to the Thames River. However, the watercourse is connected to the Thames River and contributes to water quality and quantity thus contributes to indirect fish habitat. The indicators have been revised to more clearly address the potential effects associated with the alternative methods. The original intent of the indicators is being maintained and the revised indicators better articulate and measure the effects. There is no change to the effects assessed as a result of the revision to the indicators.

Environmental Sub-component	Original Indicator	Revised Indicator	Justification
Cultural Heritage Resources			
Buildings	• Number of significant buildings present in the local area • Potential impacts to buildings	• Impacts to Built Heritage Resources and Cultural Heritage Landscapes.	Criteria were changed upon advice from MTCS (Now MHSTCI) to address the comments raised and increase the clarity of the assessment. In an August 4, 2017 letter, Dan Minkin of MTCS noted that, "…if the three classes of cultural heritage resources are to be grouped into two subsections, it would make sense to group BHRs and CHLs into one subsection and deal with archaeological resources in another, reflecting the way these types of resources are grouped for the purposes of investigation through technical studies and development of mitigation measures." He also recommended, that, "the headings of subsections B1 and B2 in Section 7.2.2.2 use the terms Built Heritage Resources and Cultural Heritage Landscapes instead of Heritage Structures and Heritage Landscapes." The indicators are changed to align with the headings and to reflect terminology used by MHSTCI. There is no change to the effects assessed as a result of the revision to the indicators.
Viewscapes	• Presence of significant viewscapes	• Combined with criteria above.	
Archaeological Resources	• Presence of or likelihood of archaeological resources	• Impacts to Archaeological Resources	Criteria were changed to measure the potential effects to the resource rather than the presence of the resource. There is no change to the effects assessed as a result of the revision to the indicator.
Transportation			
Local	• Amount/type of traffic generated	• Impacts to traffic on Water St.	The indicator was revised to address the traffic effects more specifically since traffic effects are localized to Water St. S. with all methods proposed. The amount of traffic generated by the landfill is not anticipated to change for any of the alternatives. There is no change to the effects assessed as a result of the revision to the indicator.
Regional	• Amount/type of traffic generated	• Indictor removed.	This indicator had relevance to the evaluation of Alternatives To the Undertaking but not the Alternative Methods as the landfill will only serve the Town therefore all effects are local.
Land Use			
General	• Amount of land required • Current land use • Presence of sensitive lands within study areas	• First two indicators removed as all of the land is currently designated for landfill and is owned by the Town.	There was no change to these indicators.
Agriculture	• Number and type of farms in study area	• Indicator removed.	Dealt with under sensitive land uses above

Environmental Sub-component	Original Indicator	Revised Indicator	Justification
Aggregate Resources	• Conditions and Status of the Aggregate License relevant to this site. • Potential for interference with aggregate extraction operations on-site and within the study area vicinity.	• Impacts to aggregate extraction and processing in the study area vicinity	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. SMC continues to be an adjacent land use however, the portions of the SMC site adjacent to landfilling operations are used for stockpiling of materials and thus, will be unaffected by landfilling operations. SMC has not raised any concerns about landfilling operations to date nor the expansion plans.
Socio-economic conditions			
Employment	• Number, type, duration of changes to local workforce	• Indictor removed.	This indicator had relevance to the evaluation of Alternatives To the Undertaking but not the Alternative Methods. For the alternative methods for landfill expansion there is no difference in the employment created.
Financial	• Short, medium, long term financial costs to the Town, Present Value assessment	• Construction Costs • Operational and Maintenance Costs	Indicators revised to provide a more understandable measure of costs associated with the development and operation of the landfill site.
Economic	• Changes to revenues, costs, taxes anticipated to local businesses	• Indictor removed.	This indicator had relevance to the evaluation of Alternatives To the Undertaking but not the Alternative Methods as it was capturing the economic impact of moving landfill operations out of the Town of St Marys.
Social	• Number of residences impacted, type/ area of impacted land uses etc.	• Impacts to enjoyment of life/private property	The indicator has been revised to better articulate the social effects to residents potentially impacted, including the overall effects of noise, odour, air quality, traffic etc. There is no change to the effects assessed as a result of the revision to the indicators.
Environmental	• Includes activities as discussed in the above sections, with additional emphasis placed on the items brought forward as concerns.	• Relocated under Indigenous component.	This indicator has been moved as environmental concerns described by Indigenous communities are only relevant only to the Indigenous component.

Environmental Sub-component	Original Indicator	Revised Indicator	Justification
Indigenous Communities			
Cultural/ Environmental	• Presence of known sites within the area. Records of previous site disturbances. • Distance to established communities • Expressed concerns	• Impacts to culturally or environmentally significant features identified by Indigenous communities.	The indicator has been revised to more clearly focus on the features and concerns identified by the Indigenous Communities and the potential for effects upon them. The new indicator to synthesizes the results of other technical assessments with respect to how features of cultural or environmental significance to Indigenous communities are impacted
Land Use	• Existing land use focusing on First Nation's significance, size of area, presence of any sensitive uses.	• Indicator removed.	This indicator was not relevant to the Study Area nor to the alternatives for landfill expansion as there are no current uses of the site area by Indigenous peoples.

7.3 Evaluation Framework

The evaluation of Alternatives was carried out in several steps, as follows:

- The effects for each alternative were identified based on each of the indicators identified in Table 7-3. It was assumed that the standard landfill mitigation, design and operational measures listed in Table 7-2 will be implemented. Only effects remaining after standard mitigation is applied were identified.
- Any additional mitigation measures specific to each Alternative were identified. In addition, monitoring may identify unanticipated effects and, using an Adaptive Management approach, additional mitigation measures may be implemented. Where there is uncertainty about the predicted effects these additional mitigative measures that may be implemented have also been identified.
- Finally, any net effects remaining after the additional mitigation is applied were identified. The magnitude, duration, frequency, and reversibility of any net effects was also described to better characterize the net effects.

The net effects of each alternative were ranked as follows for each environmental component:

- Most Preferred
- 2nd Most Preferred
- 3rd Most Preferred
- 4th Most Preferred
- Least Preferred

The Preferred Alternative overall is the Alternative that is most preferred for most criteria and is identified based on reasoned trade-offs between the alternatives. These trade-offs are discussed in both the summary tables and the text as appropriate. No indicators were given greater weight or significance than others.

The evaluation of Alternative Methods is presented in the following sections.

7.4 Impacts to the Atmosphere

7.4.1 Air Quality

Current Conditions and Indicators of Effect

Under the current conditions, landfill operations and equipment emit dust and products of combustion (i.e., vehicle exhaust) while the landfill materials are a source of

particulate matter and contaminants typically found in landfill gas. Current emissions from all of these sources are within provincial limits.

With the landfill expansion there is some potential for emissions to increase. The following indicators were used to assess any potential changes in air quality experienced by residents of Water St. S., the closest receptors, due to the landfill expansion:

- Indictor 1: Changes in air quality due to construction/closure activities
- Indicator 2: Changes in air quality due to landfill operations

Effects

An assessment of air quality effects was completed in the Emission Summary and Dispersion Modelling Report provided in Volume III, Appendix A for all Alternatives except Alternative 3A which is assessed in Appendix D. Findings are summarized in Table 7-4 and the following discussion:

Indicator 1: Changes in air quality due to construction/closure activities:

There is no construction associated with the Do Nothing Alternative. However, should this Alternative be selected, the landfill would be closed at the end of the current ECA which expires in September 2022. Some closure-related activities are similar to landfill construction and would involve the use of construction equipment and machinery. This equipment will emit vehicle exhaust. The quantities of these emissions are relatively minimal and for a short period of time when compared to the ongoing traffic on Water St. S. and regular landfill operations. Some dust emissions can be expected. Dust will be suppressed with water, as required to reduce effects.

For all other Alternatives, construction and closure activities will be required over the lifespan of the landfill. Construction will occur over different time periods depending on the Alternative selected and it will occur while the landfill site is operating. However, construction for all Alternatives is expected to take approximately the same amount of time, using the same type of construction equipment and materials. Therefore, there are no significant differences between dust or construction vehicle emissions during construction or closure for Alternatives 2, 3, 3A and 5.

There are no specific regulated limits on emissions from construction activities. However, for all Alternatives, emissions are expected to be relatively minor and within the range typically expected during construction projects.

Overall, changes in air quality due to construction and closure activities are minor. There is a slightly less effects associated with the Do Nothing Alternative because there is no construction phase and only a closure phase.

Indicator 2: Changes in air quality due to landfill operations:

During landfill operations, all Alternatives are expected to emit products of combustion, and particulate matter from vehicles as well as various contaminants known to be found in landfill gas. An Air Dispersion Model was used to predict current conditions and air quality effects to be expected from Alternatives 2, 3 and 5. The results were compared to the "Air Contaminants Benchmarks List: Standards, Guidelines and Screening Levels for Assessing Point of Impingement Concentrations of Air Contaminants", (MECP, 2018). The model showed that for all Alternatives, based on site emissions, the predicted concentrations of contaminants in the air are expected to be below the provincially accepted levels. There were no significant differences in the quantity or type of emissions between Alternatives 2, 3 or 5 or the Do Nothing Alternative and no significant changes from current conditions. With the Do Nothing Alternative, emissions are expected over a shorter timeframe as the landfill will close in the near future. Some emission of landfill gas will continue after closure but at a lower level than during operations.

Alternative 3A was not modeled. However, emissions from Alternative 3A are expected to be similar or better than emissions produced by Alternative 3. The model considers the effect at the property line and anywhere off property. As a result, the maximum ground level concentration can be at one location for one scenario and a different location for another scenario. The footprint of the landfill in Alternative 3A is the same distance to the western property line as Alternative 3. The model also considers the final landfill height. The maximum concentration of air contaminants occurs at ground level. With increasing height, there is greater dispersion and, therefore, lower concentrations of contaminants in the air. Alternative 3A will have a final landfill height that is higher than Alternative 3. Therefore, relative to Alternative 3, Alternative 3A can be expected to have slightly lower concentrations of air contaminants. For the purposes of this evaluation, the differences are expected to be minimal and are considered negligible.

Overall, only very minor changes in air quality due to landfill operations are expected, primarily related to the differences in height and footprint of each Alternative. None of the Alternatives are significantly different and all emissions are predicted to be below provincial limits. The Do Nothing Alternative has slightly fewer effects because landfilling will cease in the near future and, therefore landfill gas creation and emissions will begin to decrease and will continue to decrease over time.

Additional Mitigation

Standard operating procedures are sufficient to maintain LFG and other emissions at low levels for all Alternatives.

There are currently no requirements for St. Marys to monitor LFG emissions. However, should signs of significant LFG emission become apparent (e.g., significant odour may signify that higher-than-expected emissions are occurring), monitoring for LFG may become necessary. As a contingency measure to be addressed through Adaptive Management, an LFG monitoring program may be required. Subject to findings, additional measures, such as additional cover or LFG collection may be required. Adaptive Management measures will be developed in conjunction with MECP, as warranted.

Net Effects

The net effects of all Alternatives are similar as emissions are expected to be similar and within provincial limits. The Do Nothing Alternative is slightly preferred as there will be no construction-related air emissions and emissions from landfill operations will cease in the short term. All other Alternatives are considered to have equal minor net effects, meeting all provincial limits, as summarized in Table 7-4.

Table 7-4: Potential Effects to Air Quality

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: **Changes in air quality due to construction/closure activities**	There will be no construction effects. There will be some dust emission associated with closure activities expected to occur in the near future. This is expected to be minor and within levels typically expected for construction.	Dust may increase during construction and closure but will be suppressed with water. Any dust emissions are expected to be minor and within levels typically expected for construction.	Dust may increase during construction and closure but will be suppressed with water. Any dust emissions are expected to be minor and within levels typically expected for construction.	Dust may increase during construction and closure but will be suppressed with water. Any dust emissions are expected to be minor and within levels typically expected for construction.	Dust may increase during construction and closure but will be suppressed with water. Any dust emissions are expected to be minor and within levels typically expected for construction.
Indicator 2: **Changes in air quality due to landfill operations**	Air quality contaminant levels at the landfill boundary will be within provincial limits. Emissions will decrease when the landfill closes at the end of the current ECA.	Air quality contaminant levels at the landfill boundary will be within provincial limits.	Air quality contaminant levels at the landfill boundary will be within provincial limits.	Air quality contaminant levels at the landfill boundary will be within provincial limits.	Air quality contaminant levels at the landfill boundary will be within provincial limits.
Additional Mitigation	Should signs of significant LFG emission become apparent (e.g., significant odour may signify that higher-than-expected emissions are occurring), monitoring for LFG may become necessary. As a contingency measure to be addressed through Adaptive Management, an LFG monitoring program may be required. Subject to findings, additional measures, such as additional cover or LFG collection may be required.				
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No change to existing effects anticipated: **M**: Minor. All air emissions are within provincial guidelines. **F**: Contaminants will be emitted in a low level in the short-term during closure and then reducing over time post-closure. **D**: Emissions are expected through the construction, operation and closure phases of the landfill. **R**: Air quality effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All air emissions are within provincial guidelines. **F**: Contaminants will be emitted in a low level on an ongoing basis. **D**: Emissions are expected through the construction, operation and closure phases of the landfill. **R**: Air quality effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All air emissions are within provincial guidelines. **F**: Contaminants will be emitted in a low level on an ongoing basis. **D**: Emissions are expected through the construction, operation and closure phases of the landfill. **R**: Air quality effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All air emissions are within provincial guidelines **F**: Contaminants will be emitted in a low level on an ongoing basis. **D**: Emissions are expected through the construction, operation and closure phases of the landfill. **R**: Air quality effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All air emissions are within provincial guidelines. **F**: Contaminants will be emitted in a low level on an ongoing basis. **D**: Emissions are expected through the construction, operation and closure phases of the landfill. **R**: Air quality effects are reversible but only after landfill closure.
Evaluation	**Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**

7.4.2 Odours

Current Conditions and Indicators of Effect

Odours were modeled using the same air dispersion model used in the evaluation of air quality. The differences between Alternatives have been assessed based on the number of sensitive receptors (i.e., residences) likely to experience odour concerns and the frequency of those concerns. At sensitive receptors, the impact of 6 Odour Units (OU) appears to match the level of odour at which complaints tend to be received. Under current conditions, approximately ten receptors may experience 6 OU up to 0.7% of the time.

Modeling was conducted to identify any changes in odour using the following indicators:

- Indicator 1: the number of receptors impacted by odour; and,
- Indicator 2: the frequency at which odour impacts can be expected.

Effects

An assessment of odour effects was completed in the in the Emission Summary and Dispersion Modelling Report provided in Volume III, Appendix A for all Alternatives except Alternative 3A which is assessed in Appendix D. A summary is provided in Table 7-6 and in the following discussion.

Indicator 1: the number of receptors impacted by odour and Indicator 2: the frequency at which odour impacts can be expected:

Both indicators predicting the number of receptors affected and the frequency at which they will be affected were modeled simultaneously. 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, a such, the effects assessment focuses on the operational period only.

There is no specific provincially-regulated limit for odour. Ideally, odour should be below 1OU. However, at the St. Marys landfill the impact of 6 OU appears to match the level of odour at which complaints tend to be received, based on the complaints record.

During operations, for each of the Alternatives the effects are similar to current conditions, with only minor differences, as shown in Table 7-5. Alternative 3A was not modelled but is expected to have similar effects to Alternative 3 as its height and footprint are relatively similar.

Table 7-5: Predicted Odour Impacts

	Existing			Alternative Method 2			Alternative Method 3			Alternative Method 5		
Receptors	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**	**< 1 OU (%)**	**1 to 6 OU (%)**	**> 6 OU (%)**
1	97.62%	2.38%		98.86%	1.14%		98.69%	1.31%		98.21%	1.79%	
2	97.52%	2.48%		98.81%	1.19%		98.58%	1.42%		98.14%	1.86%	
3	96.96%	2.57%	0.47%	98.45%	1.53%	0.02%	97.93%	2.07%		97.33%	2.67%	
4	96.98%	2.50%	0.52%	98.45%	1.49%	0.07%	97.88%	2.12%		97.13%	2.82%	0.05%
5	97.19%	2.28%	0.53%	98.43%	1.41%	0.16%	97.77%	2.01%	0.23%	96.83%	3.00%	0.17%
6	97.32%	2.23%	0.45%	98.32%	1.46%	0.22%	97.56%	2.08%	0.36%	96.52%	3.18%	0.30%
7	97.83%	2.13%	0.04%	97.72%	1.86%	0.42%	96.28%	2.93%	0.78%	97.04%	2.24%	0.72%
8	97.86%	2.13%	0.01%	97.72%	1.85%	0.43%	96.38%	3.08%	0.54%	97.44%	1.92%	0.64%
9	98.03%	1.97%		97.68%	1.93%	0.39%	96.53%	3.04%	0.43%	97.70%	1.77%	0.54%
10	98.14%	1.86%		97.66%	1.95%	0.39%	96.69%	2.94%	0.37%	97.83%	1.75%	0.42%
11	98.23%	1.77%		97.65%	2.02%	0.33%	96.90%	2.85%	0.26%	97.91%	1.78%	0.32%
12	98.58%	1.42%		97.78%	2.14%	0.08%	97.79%	2.14%	0.07%	98.16%	1.81%	0.03%
13	98.65%	1.35%		97.87%	2.07%	0.06%	97.92%	2.04%	0.04%	98.25%	1.74%	0.01%
14	96.68%	2.75%	0.58%	98.39%	1.60%	0.02%	97.82%	2.18%		97.31%	2.69%	
15	96.71%	2.59%	0.70%	98.33%	1.60%	0.07%	97.76%	2.24%		97.04%	2.90%	0.06%
16	96.89%	2.43%	0.69%	98.32%	1.52%	0.16%	97.65%	2.17%	0.18%	96.78%	2.99%	0.22%
17	97.10%	2.33%	0.58%	98.24%	1.53%	0.24%	97.44%	2.12%	0.44%	96.29%	3.36%	0.35%
18	98.56%	1.44%		97.67%	2.22%	0.11%	97.72%	2.18%	0.10%	98.13%	1.81%	0.06%
19	98.65%	1.35%		97.80%	2.11%	0.09%	97.88%	2.05%	0.07%	98.24%	1.74%	0.02%
20	98.66%	1.34%		99.23%	0.77%		99.16%	0.84%		98.89%	1.11%	
21	98.52%	1.48%		99.19%	0.81%		99.11%	0.89%		98.77%	1.23%	
22	97.35%	2.65%		98.75%	1.25%		98.61%	1.39%		98.04%	1.96%	
23	98.61%	1.39%		99.19%	0.81%		99.11%	0.89%		98.82%	1.18%	
24	98.51%	1.49%		99.17%	0.83%		99.06%	0.94%		98.75%	1.25%	
25	97.34%	2.66%		98.71%	1.29%		98.52%	1.48%		97.93%	2.07%	
Maximum:			0.70%			0.43%			0.78%			0.72%

- Under the Do Nothing Alternative, odour effects will remain at their current level and will then decrease when the landfill is closed. Currently, 10 of twenty-four receptor locations monitored experienced over 6 OU, up to 0.7% of the time. Of these, six could experience it between 0.5% and 0.78% of the time. The remainder of the receptors will experience odour less than 0.5% of the time.
- Under Alternative 2, 17 residences may experience more than 6 OU up to 0.43% of the time, similar to existing conditions.
- Under Alternative 3, thirteen residences may experience more than 6 OU up to 0.78 % of the time. Of these, two could experience it between 0.5% and 0.78% of the time. The remainder of the receptors will experience odour less than 0.5% of the time. This is a slight increase over existing conditions.
- Alternative 3A is similar to Alternative 3 because all of the odour sources are in the same location; therefore, it was not modeled. It can be assumed that Alternative 3A will have the same effect as Alternative 3.
- Under Alternative Method 5, fifteen residences may experience more than 6 OU up to 0.72% of the time. Of these, three could experience it between 0.5% and 0.72% of the time. The remainder of the receptors will experience odour less than 0.5% of the time. This is a slight increase over existing conditions.

The differences between the Alternatives are minor and relate to the footprint of the landfill for each Alternative. Alternatives with a larger footprint have a greater surface area over which odour can be emitted. The Do Nothing Alternative has the smallest footprint and will be closed in the near future, therefore odour effects are expected to be minimal. Alternatives 2 and 5, with larger footprints will have greater odour effects. Alternatives 3 and 3A, with moderately sized footprints will have moderate odour effects.

Additional Mitigation

No specific mitigation is required, beyond standard operating procedures, described in Table 7-2. However, at the request of MECP, odour will be re-modelled during detailed design. A commitment to update the modelling is included in Table 11-1, Summary of EA Commitments.

Net Effects

Net effects are expected to be minimal for all Alternatives. Do Nothing is preferred as the landfill will close in the near future and odour will be significantly reduced. Differences between the remaining Alternatives are minor. However, Alternatives 3 and 3A are predicted to be slightly preferred over other Alternatives as thirteen receptors may experience minor odour effects over seventeen receptors in Alternative 2 and fifteen receptors in Alternative 5.

Effects are summarized in Table 7-6.

Table 7-6: Potential Effects due to Odour

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment [55]	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Number of Receptors Potentially Impacted by Odour	10 receptors may experience odour over 6 OU. This impact is expected to be reduced when the landfill closes.	17 receptors may experience odour over 6 OU.	13 receptors may experience odour over 6 OU.	13 receptors may experience odour over 6 OU.	15 receptors may experience odour over 6 OU.
Indicator 2: Frequency of odour impacts	Each of the 10 receptors will experience odour less than 0.7% of the time. Of these, 4 will be less than 0.5%. This impact is expected to be reduced when the landfill closes.	Each of the 8 receptors will experience odour less than 0.5% of the time.	11 of the receptors will experience odour less than 0.5% of the time. 2 of the receptors will experience odour less than 0.8% of the time.	11 of the receptors will experience odour less than 0.5% of the time. 2 of the receptors will experience odour less than 0.8% of the time.	12 of the receptors will experience odour less than 0.5% of the time. 3 of the receptors will experience odour less than 0.8% of the time.
Additional Mitigation	No additional mitigation is required, beyond standard operating procedures, described in Table 7-2.	Odour will be re-modelled during detailed design. Any additional mitigation, monitoring and contingency measures identified as a result of re-modelling will be implemented.			

[55] Effects were not modelled for this Alternative but can be assumed to be similar to Alternative 3 as all odour sources are in the same location.

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment [55]	Alternative 5: Vertical Expansion plus a New Footprint
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	Net improvement when landfill closes. **M**: Minor – Effect is expected to be low and in-line with existing conditions. **F**: Infrequent – Odour effects are expected very infrequently. **D**: Short-Term – Odour effects will be experienced only in the short-term and will be reduced when the landfill closes in September 2022. **R**: Reversible – Odour effects are reversible once the landfill has closed.	Moderate net effects anticipated. **M**: Moderate – Effect is expected to be low and only slightly higher than existing conditions. A slightly larger number of receptors will be affected over all other Alternatives. **F**: Infrequent – Odour effects are expected very 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.	Minor net effects anticipated. **M**: Minor – Effect is expected to be low and only slightly higher than existing conditions. **F**: Infrequent – Odour effects are expected infrequently but potentially more often than other Alternatives at two receptors. **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.	Minor net effects anticipated. **M**: Minor – Effect is expected to be low and only slightly higher than existing conditions. **F**: Infrequent – Odour effects are expected infrequently but potentially more often than other Alternatives at two receptors. **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.	Minor-Moderate net effects. **M**: Minor-Moderate – Effect is expected to be low and only slightly higher than existing conditions. More receptors will be affected than Alternatives 3 and 3A but fewer than Alternative 2. **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	**Most Preferred**	**4th Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**3rd Most Preferred**

7.4.3 Noise

Current Conditions and Indicators of Effect

Under current conditions, residences along Water St. S. (called receptors 56 in noise modeling) experience some noise from the on-going operations at the landfill. Modeling demonstrates that the closest residents experience up to 51 dBA as a result of the existing landfill operations. The maximum noise from the traffic on Water St. S. is 60 dBA.

All Alternatives are expected to generate some noise during the construction, operational and closure phases of the landfill expansion, with the exception of the Do Nothing Alternative which does not include a construction phase. The Do Nothing Alternative does include a short operational period until the end of the current ECA and a final closure phase.

During the construction phase of Alternatives 2, 3, 3A and 5, noise will be generated from construction activities in combination with the continued landfilling that will occur in existing portions of the landfill.

During the operational phase of the landfill expansion for all Alternatives, current standard operating procedures are not expected to change. No changes are expected in the size of the open landfill face, the number of waste collection trucks visiting the site each day and the number and type of equipment operating at the site to deposit and cover the waste. Nonetheless, there may be minor differences in the noise levels experienced at receptors, depending on the expanded landfill design and its location relative to the receptors on Water St. S.

All Alternatives will have a closure period. Noise during closure of the landfill is expected to be similar to that experienced during construction except that all operations will have ceased. It is expected that the noise generated due to closure-related activities will be similar for all Alternatives. Because closure is required, and will generate similar noise levels, regardless of the Alternative selected, noise generated during the closure period has not been used as an indicator (i.e., such an indicator would not reveal any distinction between any of the Alternatives)

In summary, to assess any potential changes in noise levels experienced by residents of Water St. S. as a result of the landfill expansion, each Alternative was reviewed to identify effects associated with:

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[56] A receptor is a modelled point on a residential property near the house. Because of spacing, some houses are indicated by more than 1 receptor.

- Indicator 1: Noise levels at receptors as a result of construction [57];
- Indicator 2: Number of receptors experiencing noise above provincial limit during landfill operations; and,
- Indicator 3: Number of receptors experiencing a change in noise level relative to current conditions during landfill operations.

Effects

An assessment of noise effects was completed in the in the Noise Impact Assessment provided in Volume III, Appendix B for all Alternatives except Alternative 3A which is detailed in Appendix D. A summary is provided in Table 7-7 and in the following discussion.

Indicator 1: Noise levels at receptors as a result of construction:

With the Do Nothing Alternative, there will be no construction-related noise. However, there will be noise associated with operations until the site's closure in September 2022, at which time there will be some noise associated with closure activities.

Construction is likely to be the noisiest period. Construction noise is not regulated and therefore was only estimated for the purposes of this study. It was assumed that 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. Construction noise was predicted to be 67 dBA at the nearest receptor 58. This is well below the typical value used in construction noise control plans of 80 dBA. This noise level is greater than the maximum predicted noise level from existing landfill operations (50 dBA) or the maximum noise from the traffic (50 to 60 dBA). 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. Construction noise is expected to be similar for all Alternatives as construction is likely to take approximately the same amount of time and use the same type of equipment.

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[57] **Noise will be generated from construction activities in combination with the continued landfilling that will occur in existing portions of the landfill. Values derived for this indicator include the combined noise of construction and operations.**

[58] This value includes consideration for existing noise from ongoing landfill operations.

Indicator 2: Number of receptors experiencing noise above provincial limit during landfill operations:

For the Do Nothing Alternative and Alternative 3, all receptors are expected to experience no more than 50 dBA during landfill operations. Alternative 3A was not modelled but is assumed to be similar to Alternative 3 as its height and distance from receptors is similar. For Alternatives 3 and 5, receptors will experience no more than 51 dBA. The difference between 50 and 51 dBA is indistinguishable to the human ear. The provincially set limit for noise for ongoing activities, such as landfill operations, is 55 dBA. Therefore, for all Alternatives, the amount of noise generated and experienced by sensitive receptors is below the provincial limit.

Indicator 3: Number of receptors experiencing a change in noise level relative to current conditions during landfill operations:

With the Do Nothing Alternative, none of the receptors will experience any change in noise level over existing conditions. However, the remaining operational period is short, coming to an end when the current ECA expires in September 2022. Therefore, noise related to landfill operations will only be experienced by nearby residents for a short period of time.

With Alternatives 2, 3, 3A and 5, the noise experienced at some receptors will decrease while at other receptors it may increase. The differences in sound level [59] are summarized as follows:

Alternative 2:

- One receptor will experience a very significant reduction (-11 dBA) in noise level.
- One receptor will experience a significant reduction (-10 dBA) in noise level.
- One receptor will experience a significant increase (+5 dBA) in noise level.
- One receptor will experience a significant increase (+7 dBA) in noise level.

Alternative 3:

- One receptor will experience a significant reduction (-10 dBA) in noise level.
- One receptor will experience a significant reduction (-9 dBA) in noise level.

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[59] Differences in sound level are described in accordance with the MOEE/GO Transit Noise and Vibration Protocol (December 1994), as follows:
0-2.99 dB= Insignificant
3.0-4.99 dB= Noticeable
5.0-9.99 dB= Significant
10+ dB= Very Significant

- One receptor will experience a significant increase (+6 dBA) in noise levels.
- One receptor will experience a noticeable increase (+4 dBA) in noise levels.
- Two receptors will experience a noticeable increase (+3 dBA) in noise level.

Alternative 3A:

- Assumed to be the same as Alternative 3.

Alternative 5:

- One receptor will experience a very significant reduction (-11 dBA) in noise level.
- One receptor will experience a significant (-9 dBA) reduction in noise level.
- Two receptors will experience a significant increase (both +6 dBA) in noise level.
- One receptor will experience a significant increase (+7 dBA) in noise level.
- Three receptors will experience a noticeable increase (all +3 dBA) in noise level.

The various increases or decreases in noise level associated with Alternatives 2, 3, 3A and 5 are similar and within the same general range, meaning there are no significant differences between these Alternatives. The differences in noise levels primarily relate to the height of each Alternative and the location of the working face relative to the closest receptors. The maximum noise impact at any receptor for all Alternatives is 51 dBA which is noticeably below the provincial limit.

Additional Mitigation

No specific mitigation is required, beyond standard operating procedures, described in Table 7-2.

Net Effects

The net effects of all Alternatives are expected to be within provincial limits. The Do Nothing Alternative is slightly preferred as there will be no construction noise and noise from landfill operations will cease in the short term. All other Alternatives are considered to have equal minor net effects, meeting all provincial limits, as summarized in Table 7-7.

Table 7-7: Potential Effects to Noise

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment [60]	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Noise levels at receptors as a result of construction/ closure activities	There will be no construction noise. There will be some noise associated with closure activities expected to occur in the near future.	Construction and closure-related noise will be higher than current operational noise but within levels typically expected for construction.	Construction and closure-related noise will be higher than current operational noise but within typical expected levels for construction.	Construction and closure-related noise will be higher than current operational noise but within typical expected levels for construction.	Construction and closure-related noise will be higher than current operational noise but within typical expected levels for construction.
Indicator 2: Number of receptors experiencing noise above provincial limit during landfill operations	0 residences will experience sound levels above the provincial limit of 55 dBA during the operational phase of the landfill. Maximum noise impact at any receptor is 50 dBA which is significantly below the provincial limit.	0 residences will experience sound levels above the provincial limit of 55 dBA during the operational phase of the landfill. Maximum noise impact at any receptor is 51 dBA which is noticeably below the provincial limit.	0 residences will experience sound levels above the provincial limit of 55 dBA during the operational phase of the landfill. Maximum noise impact at any receptor is 50 dBA which is significantly below the provincial limit.	0 residences will experience sound levels above the provincial limit of 55 dBA during the operational phase of the landfill. Maximum noise impact at any receptor is 50 dBA which is significantly below the provincial limit.	0 residences will experience sound levels above the provincial limit of 55 dBA during the operational phase of the landfill. Maximum noise impact at any receptor is 51 dBA which is noticeably below the provincial limit.
Indicator 3: Number of receptors experiencing a change in noise level during landfill operations	No change in noise levels will be experienced at any receptor.	Two receptors will experience a Significant (-10 dBA) or Very Significant (-11 dBA) reduction in noise levels. Two receptors will experience a Significant (+5 and +7 dBA) increase in noise levels over existing conditions. Regardless of these changes, the maximum noise impact at any receptor is 51 dBA which is noticeably below the provincial limit.	Two receptors will experience a Significant (-10 and -9 dBA) reduction in noise levels. Three receptors will experience a Noticeable (+3, +3 and +4 dBA) increase in noise levels. One receptor will experience a Significant (+6 dBA) increase in noise levels over existing conditions. Regardless of these changes, the maximum noise impact at any receptor is 51 dBA which is	Two receptors will experience a Significant (-10 and -9 dBA) reduction in noise levels. Three receptors will experience a Noticeable (+3, +3 and +4 dBA) increase in noise levels. One receptor will experience a Significant (+6 dBA) increase in noise levels over existing conditions. Regardless of these changes, the maximum noise impact at any receptor is 51 dBA which	Two receptors will experience a Significant (-9 dBA) or Very Significant (-11 dBA) reduction in noise levels. Three receptors will experience a Noticeable (both +3 dBA) increase in noise levels. Two receptors will experience a Significant (both +6 dBA) increase in noise levels over existing conditions. Regardless of these changes, the maximum noise impact at

[60] Not modelled but assumed to be the same as Alternative 3 as its height and distance from receptors is similar.

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment [60]	Alternative 5: Vertical Expansion plus a New Footprint
			noticeably below the provincial limit.	is noticeably below the provincial limit.	any receptor is 51 dBA which is noticeably below the provincial limit.
Additional Mitigation	No additional mitigation is required.				
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated	Minor net effects anticipated: **M**: Minor. All noise is within provincial guidelines at all receptors. However, small increases or decreases may be experienced at a small number of receptors. **F**: Noise will be ongoing during operational hours. **D**: Noise is expected through the construction, operation and closure phases of the landfill. **R**: Noise effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All noise is within provincial guidelines at all receptors. However, small increases or decreases may be experienced at a small number of receptors. **F**: Noise will be ongoing during operational hours. **D**: Noise is expected through the construction, operation and closure phases of the landfill. **R**: Noise effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All noise is within provincial guidelines at all receptors. However, small increases or decreases may be experienced at a small number of receptors. **F**: Noise will be ongoing during operational hours. **D**: Noise is expected through the construction, operation and closure phases of the landfill. **R**: Noise effects are reversible but only after landfill closure.	Minor net effects anticipated: **M**: Minor. All noise is within provincial guidelines at all receptors. However, small increases or decreases may be experienced at a small number of receptors. **F**: Noise will be ongoing during operational hours. **D**: Noise is expected through the construction, operation and closure phases of the landfill. **R**: Noise effects are reversible but only after landfill closure.
Evaluation	**Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**

7.5 Impacts to Hydrogeology

Current Conditions and Indicators of Effect

Under baseline conditions, the effects to groundwater from existing operations are minimal. There is little indication of groundwater effects at the site. This is due to the combination of the low permeable till and the LCS. The LCS collects leachate at the bottom of the landfill and directs it into the Town's sanitary sewer system and then further to the wastewater treatment plant (WWTP). 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 (i.e., leachate collecting and building up into the waste pile).

Each of the expansion Alternatives includes a new or expanded LCS. As with any LCS, there is some potential for the system to fail or to be breached, allowing leachate to be transmitted through the till to the bedrock aquifer, causing groundwater contamination beyond the site. The risk of contamination varies depending on soil characteristics below the landfill, the landfill design and characteristics, including the quantity and chemical concentration (i.e., strength) of the leachate generated. Landfill height and footprint are also risk factors. There is also some potential for the landfill to alter shallow groundwater flow direction.

To assess any potential effects on hydrogeology because of the landfill expansion, each Alternative was reviewed to determine if it would result in any changes to groundwater quality or flow using the following indicators:

- Indicator 1: Risk of increasing leachate generation and strength
- Indicator 2: Risk of impacting groundwater quality
- Indicator 3: Risk of altering groundwater flow

Effects

An analysis of effects was completed in the Hydrogeology Study provided in Vol III, Appendix C for all Alternatives except Alternative 3A the analysis for which is detail in Appendix D. A summary is provided in Table 7-8 and in the following discussion:

Indicator 1: Risk of increasing leachate generation and strength:

Leachate is generated as precipitation falls on the landfill and flows through the waste. Landfills with a greater footprint tend to generate more leachate as there is more interaction between water and waste over a larger area. Based on that:

- With the Do Nothing Alternative, landfilling will continue under current conditions and no additional quantity of leachate will be generated beyond existing amounts. Leachate generation will be reduced over time once landfilling ceases.
- Alternative 2, with the largest footprint (150,000 m^2), is likely to generate more leachate than under current conditions and the most leachate of all the Alternatives.
- Alternative 5, with the second largest footprint (141,000 m^2), is likely to generate less leachate than Alternative 2 but more than other Alternatives.
- Alternatives 3 and 3A, with moderately sized footprints (116,000 m^2 and 117,000 m^2 respectively), are likely to generate less leachate than Alternatives 2 and 5 but more than Doing Nothing.

Placing new waste over existing waste could change the strength of the leachate. Under the Do Nothing Alternative, landfilling will continue under existing conditions and no change to leachate strength is expected. Over time, once the landfill is closed, leachate strength will decrease.

Under the remaining Alternatives, the following changes may occur:

- Alternative 2: New waste will not be placed above the existing landfill. Therefore, interactions with other contaminants or existing waste are not expected and leachate strength is expected to be similar to current conditions.
- Alternative 3: New waste will be placed above the existing landfill which has the potential to increase the proportion of contaminants within the leachate (i.e., strengthen its contaminant concentration).
- Alternative 3A: New waste will be placed above the existing landfill which has the potential to increase the proportion of contaminants within the leachate (i.e., strengthen its contaminant concentration).
- Alternative 5: New waste will be placed above the existing landfill which has the potential to increase the proportion of contaminants within the leachate (i.e., strengthen its contaminant make-up). In a very unlikely circumstance, leachate from the CKD pile, could push its way up and breach the LCS from below and mix with the landfill leachate. This could theoretically, change the leachate chemistry in the LCS. It is unclear whether the WWTP could effectively treat this altered leachate.

Indicator 2: Risk of impacting groundwater quality:

In addition to the risks associated with the leachate characteristics, there are aspects of a landfill design that can increase the risk of a breach in the LCS. A breach of the LCS could occur in two ways. First, a seep could be created in the side slope of the waste pile, allowing leachate to escape to the surface and flow across the landfill surface to be collected by the landfill's stormwater management system, bypassing proper treatment

controls. Second, leachate could be forced downward and break through the landfill's liner, moving directly into groundwater below.

Both types of situations are unlikely and can be identified quickly through regular landfill monitoring. However, there are several aspects of the landfill's design which make either type of breach slightly more likely to occur, resulting in an increased risk of contaminating groundwater.

Increasing the height of the waste pile can increase the height of the leachate mounding within the waste. Mounding occurs when leachate builds up inside the waste pile rather than draining through the LCS. The current LCS was put in place to control leachate mounding in the existing phases. If the height of the waste above it is increased, it may result in increased leachate generation which could overload the system and create mounding. Mounding can, in turn, cause breakouts on the side slopes or downward pressure and movement of leachate through the liner.

There are seams of varying sand and silt composition (also known as inter-till meltwater deposits) across the landfill site. These deposits are more permeable than the clay till which is present across the site and which acts, in tandem with the LCS, to prevent leachate from moving through the groundwater to areas beyond the site. A meltwater deposit is present below the existing landfill. If the liner is breached, leachate could make its way into this deposit where it can flow more freely through the subsurface. A back-up system was installed below the existing landfill footprint to address this concern. A collector pipe takes groundwater present in the meltwater deposits to the landfill's stormwater management system. The groundwater collected in this secondary system is monitored twice annually at Manhole B. Routine water level monitoring demonstrates that the meltwater deposit near the landfill is often dry, indicating that the LCS is working. Increasing the amount of leachate in the system could change that.

Meltwater deposits are also present in other locations across the landfill site, including areas between the existing watercourse and CKD pile. The various components of the landfill expansion have the potential to intersect one of these deposits and create a conduit for leachate movement into the groundwater. This includes the relocated/realigned watercourse. In Alternatives 2 and 3 the watercourse will be relocated close to the CKD pile. If the new watercourse intersects a meltwater deposit seam, it could create a conduit for CKD-derived leachate [61] to enter the groundwater system.

[61] Recent groundwater monitoring indicates that some leachate created by the CKD pile is migrating through the groundwater but no effects to the watercourse have been observed.

In Alternative 5, waste will be placed above a portion of the CKD pile. Placing waste above the CKD pile could compress the CKD and cause a CKD leachate seep.

Given the various risks noted in the preceding discussion, the following effects to groundwater quality could occur:

- Do Nothing: No change from current conditions are expected. Currently the landfill does not exhibit significant concerns associated with mounding and rare seepage issues are addressed immediately. The meltwater till below the landfill includes a back-up solution to address seepage through the liner, should it occur.
- Alternative 2: No new waste will be placed above the existing landfill. Therefore, there is no additional risk for seepage in the existing landfill footprint. The expansion footprint has potential to come into contact with a meltwater deposit creating a pathway for any escaped leachate to enter and contaminate surrounding groundwater. The relocated watercourse also has potential to create a conduit for CKD leachate to enter a meltwater deposit and move through the groundwater.
- Alternative 3: New waste will be placed above the existing landfill area, increasing the overall height of the waste. This increases the risk for seepage from the side slopes or downward leachate movement into the meltwater deposit under the existing landfill area. The expansion footprint has potential to intersect a meltwater deposit creating a pathway for any escaped leachate to enter and contaminate surrounding groundwater. The relocated watercourse also has potential to create a conduit for CKD leachate to enter a meltwater deposit and move through the groundwater.
- Alternative 3A: New waste will be placed above the existing landfill area, increasing the overall height of the waste. The overall height will be higher than in Alternative 3. This increases the risk for seepage from the side slopes or downward leachate movement into the sand seam under the existing landfill area. The expansion footprint has potential to intersect a meltwater deposit creating a pathway for any escaped leachate to enter and contaminate surrounding groundwater. The realigned watercourse will bring a small section of the watercourse closer to the CKD pile but not as close as Alternatives 2 and 3. Alternative 3A is therefore less likely to create a conduit for CKD leachate to enter a meltwater deposit and move through the groundwater.
- Alternative 5: New waste will be placed above the existing landfill area, increasing the overall height of the waste. This Alternative is the highest above the existing waste. This results in the greatest risk for seepage from the side slopes or downward leachate movement into the sand seam under the existing landfill area. A portion of the new landfill footprint will be placed above the CKD pile, creating risk of CKD seepage.

Indicator 3: Risk of altering groundwater flow:

Currently, shallow groundwater (i.e., groundwater that is closest to the surface) flows towards the watercourse from both north and south of the watercourse. The direction of this flow could be altered by changing the topography and drainage around the watercourse. The following changes to groundwater flow could occur:

- Do Nothing: There will be no changes to the watercourse or the topography surrounding the watercourse and therefore no change to shallow groundwater flow.
- Alternative 2: The watercourse will be relocated north of the CKD pile and the existing watercourse will be filled with landfilled facilities and waste, thus changing to overall topography in the area. Shallow groundwater now flowing towards the watercourse may shift direction as the watercourse area is filled. Its altered flow path is unknown.
- Alternative 3: The watercourse will be relocated north of the CKD pile and the existing watercourse will be filled with landfilled facilities and waste, thus changing to overall topography in the area. Shallow groundwater now flowing towards the watercourse may shift direction as the watercourse area is filled. Its altered flow path is unknown.
- Alternative 3A: A short section of the watercourse will be realigned and the topography around the watercourse will change slightly. Changes to shallow groundwater flow will be imperceptible.
- Alternative 5: There will be no changes to the watercourse or the topography immediately surrounding the watercourse and therefore no change to shallow groundwater flow.

Additional Mitigation

No additional mitigation is required for the Do Nothing Alternative.

With Alternatives 2 and 3, the watercourse will be relocated close to the CKD pile. Measures to separate the watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 3A, interactions between CKD and the watercourse are not expected. However, if, as a result of the Annual Monitoring Program, effects from CKD are observed in the realigned watercourse, measures to separate the watercourse from the CKD will be required. This may include a barrier and interceptor pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 5, the design of the LCS will need to be more robust than with other Alternatives to limit the potential for mixing of landfill and CKD leachates and avoid creating CKD leachate seeps.

For all Alternatives, an Annual Monitoring Program and Adaptive Management Plan will be used to identify if unanticipated effects are occurring and to proposed measures to resolve the unanticipated effects. Adaptive Management Plans and their triggers are described in Section 11.3.

Net Effects

After mitigation, the risks to groundwater associated with each Alternative are relatively low.

Do Nothing is preferred as the landfill will soon close and leachate generation will slowly decrease. No new risk of contact between the landfill and groundwater will be created.

The risk associated with Alternative 3A is relatively minor and can be reduced significantly with appropriate design elements.

Alternatives 2 and 3 have a slightly increased risk over Alternative 3A due to the relocation of the watercourse which may create a conduit for CKD leachate to enter a meltwater deposit and move through the groundwater. Although this risk can be lowered with an appropriate design, some risk still persists.

Alternative 5 will have the greatest risk of groundwater contamination due to its large footprint and potential groundwater interactions between the landfill and CKD waste, should a breach of the LCS occur.

Effects are summarized in Table 7-8.

Table 7-8: Groundwater Effects Assessment

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Risk of Increasing Leachate Generation and Strength	• Existing landfill to close at end of current ECA. • No new leachate generation after closure and no interaction with CKD pile. Therefore, leachate strength will decrease over time.	• Largest footprint (150,000 m^2) will generate the most leachate. • No interaction with existing landfill. Therefore, there is no risk of increased leachate strength over existing conditions.	• Moderate increase in footprint (116,000 m^2) will generate moderate increase in leachate. • New waste to be placed above existing landfill, potentially increasing leachate strength.	• Moderate increase in footprint (117,000 m^2) will generate moderate increase in leachate. • New waste to be placed above existing landfill, potentially increasing leachate strength.	• Second largest footprint (141,000 m^2) will generate significant increase in leachate. • New waste to be placed above existing landfill, potentially increasing leachate strength.
Indicator 2: Risk of impacting groundwater	• No change to risk of leachate mounding and related seepage.	• Similar height to existing therefore no change to risk of leachate mounding or leachate seeps. • Largest footprint therefore broadest area for leachate to interact with groundwater. • Moderate risk of landfill and CKD leachate migrating through a meltwater deposit.	• Increased height over existing landfill area and therefore increased risk of leachate mounding or leachate seeps. • Moderate increase in footprint, therefore, moderately sized area for leachate to interact with groundwater. • Moderate risk of landfill and CKD leachate migrating through a meltwater deposit.	• Increased height over existing landfill area and therefore increased risk of leachate mounding or leachate seeps. • Moderate increase in footprint, therefore, moderately sized area for leachate to interact with groundwater. • Moderate risk of landfill leachate migrating through a meltwater deposit.	• Increased height over existing landfill area and therefore increased risk of leachate mounding or leachate seeps. • Second largest footprint, therefore second largest area for leachate to interact with groundwater. • High risk of landfill and CKD leachate migrating through a meltwater deposit.
Indicator 3: Risk of altering groundwater flow	• No potential for shift of groundwater flow	• High potential for shift of shallow groundwater flow due to the relocation of the watercourse. Groundwater now flowing towards the watercourse may shift direction as the watercourse area is filled.	• High potential for shift of shallow groundwater flow due to the relocation of the watercourse. Groundwater now flowing towards the watercourse may shift direction as the watercourse area is filled.	• Low potential for shift of groundwater flow due to the watercourse re-alignment. The small alignment may cause a minor shift in groundwater flow.	• Very low potential for shift of groundwater flow. The watercourse location will not be altered. Minor changes in topography may result in minor changes to groundwater flow but they are likely to be imperceptible.
Additional Mitigation	• **None required.**	• Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	• Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	• **As a contingency only, if effects from CKD are observed in the realigned watercourse through the Annual Monitoring Program, measures to separate the watercourse from the CKD will be required.** This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	• The LCS in expansion area must be specifically designed to prevent CKD pile leachate from mixing with the waste leachate.

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects beyond existing conditions.	Moderate net effects anticipated: **M:** Moderately higher risk of effects due to large footprint and potential interactions with CKD pile. **D:** Groundwater effects would persist for the contaminating lifespan of the site controlled by the continued operation of the LCS. **F:** Leachate generation and risk of groundwater impact is continuous over life of landfill. **R:** Effects to groundwater are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Moderate net effects anticipated: **M:** Moderately higher risk of effects due to large footprint and potential interactions with CKD pile. **D:** Groundwater effects would persist for the contaminating lifespan of the site controlled by the continued operation of the LCS. **F:** Leachate generation and risk of groundwater impact is continuous over life of landfill. **R:** Effects to groundwater are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Minor net effects anticipated: **M:** Minor increase in risk of effects after mitigation. **D:** Groundwater effects would persist for the contaminating lifespan of the site controlled by the continued operation of the LCS. **F:** Leachate generation and risk of groundwater impact is continuous over life of landfill. **R:** Effects to groundwater are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Significant net effects anticipated: **M:** Highest risk of effects due to interactions with CKD pile and relatively large waste footprint and quantity of leachate generated. **D:** Groundwater effects would persist for the contaminating lifespan of the site controlled by the continued operation of the LCS. **F:** Leachate generation and risk of groundwater impact is continuous over life of landfill. **R:** Effects to groundwater are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.
Evaluation	**Most Preferred**	**3rd Most Preferred**	**3rd Most Preferred**	**2nd Most Preferred**	**Least Preferred**

7.6 Impacts to Surface Water

7.6.1 Surface Water Quality

Current Conditions and Indicators of Effect

Under baseline conditions, the effects to surface water quality from existing operations are minimal. Surface water quality sampling results 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 surface water quality. Sampling stations both upstream and downstream of the waste have recorded concentrations above the Provincial Water Quality Objectives, particularly for iron and phosphorus.

There is some potential that the expanded landfill could affect surface water quality and cause impairment beyond existing conditions.

To assess potential changes to surface water quality resulting from landfill expansion, each Alternative was reviewed to identify the risk of contamination using the following indicators:

- Indicator 1: Risk of contaminated runoff reaching surface water
- Indicator 2: Risk of leachate from seeps reaching surface water
- Indicator 3: Risk of leachate from CKD pile reaching surface water

Indigenous communities identified a concern with potential water quality effects in the Thames River and therefore a fourth indicator was added, as follows:

- Indicator 4: Risk of on-site surface water quality impacting Thames River

Effects

The potential sources of, and risks to, surface water contamination were addressed in the Hydrogeology Study provided in Vol III, Appendix C for all Alternatives except Alternative 3A the analysis for which is detail in Appendix D. A summary of potential effects is provided in Table 7-9 and in the following discussion:

Indicator 1: Risk of contaminated runoff reaching surface water:

With all Alternatives, the landfill will be designed to direct precipitation or runoff that comes into contact with waste into the LCS. Should any contaminated runoff escape the LCS, it will be directed to the site's stormwater management facilities and ponds, which are regularly tested for contamination.

With Alternatives 2, 3 and 3A, SWM basins A and B will be removed and relocated. There is some risk that contaminated water from the SWM basins could be released into the watercourse and subsequently to the Thames River downstream. These SWM basins will be maintained in their current configuration for Alternative 5 and the Do Nothing Alternative. As such, no effects are expected for those Alternatives.

Indicator 2: Risk of leachate from seeps reaching surface water:

Increasing the height of the waste pile can increase the height of the leachate mounding within the waste. Mounding occurs when leachate builds up inside the waste pile rather than draining downward through the LCS. The current LCS was installed to control the mounding in the existing phases. If the height of the waste above the LCS is increased, it may increase leachate generation which could overload the system and create mounding. Mounding can, in turn, cause breakouts on the side slopes or downward pressure and movement of leachate through the liner.

Therefore, the following effects to surface water quality could occur:

- Do Nothing: No change from current conditions is expected. The landfill does not currently exhibit significant concerns associated with mounding and rare seepage issues are addressed immediately.
- Alternative 2: No new waste will be placed above the existing landfill. Therefore, there is no additional risk for seepage in the existing landfill footprint. The height of the new footprint is lower than the existing landfill and therefore there is no additional risk.
- Alternative 3: New waste will be placed above the existing landfill area, increasing the overall height of the waste. This increases the risk for seepage from the side slopes. Seepage could then flow into the stormwater management system and into the watercourse.
- Alternative 3A: New waste will be placed above the existing landfill area, increasing the overall height of the waste. The overall height will be higher than in Alternative 3. This increases the risk for seepage from the side slopes. Seepage could then flow into the stormwater management system and into the watercourse.
- Alternative 5: New waste will be placed above the existing landfill area, increasing the overall height of the waste. This Alternative has the highest overall height above the existing waste. This results in the greatest risk for seepage from the side slopes. Seepage could then flow into the stormwater management system and into the watercourse.

Indicator 3: Risk of leachate from CKD pile reaching surface water:

With the Do Nothing Alternative, there will be no interaction between the landfill, watercourse and CKD pile and therefore no increased risks from CKD beyond existing conditions.

Discontinuous meltwater deposits are present across the landfill site, including areas between the existing watercourse and CKD pile. The various components of the landfill expansion have the potential to intersect one of these deposits and create a conduit for leachate movement. This includes the relocated/realigned watercourse. In Alternatives 2 and 3 the watercourse will be relocated close to the CKD pile. The new watercourse will intersect a meltwater deposit seam. This could create a conduit for CKD-derived leachate to enter the relocated watercourse. In addition, cutting a new channel near the toe of the CKD pile could induce contaminated shallow groundwater flow from the CKD pile into the channel.

There is a lower risk of CKD effects reaching the watercourse with Alternative 3A as the watercourse realignment is minor and farther from the CKD pile compared to Alternatives 2 and 3.

With Alternative 5, there will be no change to the watercourse. However, a portion of the new landfill footprint will be placed above the CKD pile. The increased pressure on the CKD from the landfill above could create seeps, expelling CKD-related leachate to the surface where it will drain to surface water features.

Indicator 4: Risk of on-site surface water quality impacting Thames River:

Surface water from the site eventually drains to the Thames River. Existing landfill operations show no measurable impact on water quality exiting the landfill property, and therefore no impact on water quality in the Thames River. With the Do Nothing Alternative, the risk to the Thames River will not be changed over existing conditions.

The risk of contamination is higher in Alternatives 2, 3 and 5 than in Alternative 3A. This is because there is a higher chance of interactions with the CKD material as a result of the watercourse relocation in Alternatives 2 and 3 and a higher chance of CKD material interactions as a result of the landfilling above the CKD pile in Alternative 5.

With Alternative 3A, the watercourse realignment is minor and farther from the CKD pile compared to Alternatives 2 and 3.

Additional Mitigation

No additional mitigation is required for the Do Nothing Alternative.

With Alternatives 2 and 3, the watercourse will be relocated close to the CKD pile. Measures to separate the watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 3A, interactions between CKD and the watercourse are not expected. However, if annual monitoring indicates there are effects to water quality from CKD, measures to separate the watercourse from the CKD will be required. This may include a barrier and interceptor pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 5, the design of the LCS will need to be more robust than with other Alternatives to limit the potential for mixing of landfill and CKD leachates and avoid creating CKD leachate seeps.

For all Alternatives, an Annual Monitoring Program and Adaptive Management Plan will be used to identify if unanticipated effects are occurring and to proposed measures to resolve the unanticipated effects. Adaptive Management Plans and their triggers are described in Section 11.3.

Net Effects

With the Do Nothing Alternative, no net effects are expected. Alternative 3A represents a low to moderate risk of effects to surface water and Alternatives 2, 3 and 5 are high risk due to their potential interactions with the CKD pile. All other potential effects can be adequately mitigated.

A high-level summary of the potential net effects to surface water quality is provided in Table 7-9.

Table 7-9: Potential Effects to Surface Water Quality

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Risk of contaminated runoff reaching surface water	Negligible risk of runoff or precipitation contacting waste once landfill is closed.	Low risk of runoff or precipitation contacting waste and exiting footprint to reach surface water. SWM basins A and B will be removed and relocated. During removal there is a risk that contaminated water from the SWM basins could be released into the watercourse and subsequently to the Thames River downstream.	Low risk of runoff or precipitation contacting waste and exiting footprint to reach surface water. SWM basins A and B will be removed and relocated. During removal there is a risk that contaminated water from the SWM basins could be released into the watercourse and subsequently to the Thames River downstream.	Low risk of runoff or precipitation contacting waste and exiting footprint to reach surface water. SWM basins A and B will be removed and relocated. During removal there is a risk that contaminated water from the SWM basins could be released into the watercourse and subsequently to the Thames River downstream.	Low risk of runoff or precipitation contacting waste and exiting footprint to surface water.
Indicator 2: Risk of leachate from seeps reaching surface water	No increase in risk of leachate seeps reaching surface water beyond existing conditions.	Similar height to existing therefore no change to risk of leachate mounding and seeping out of waste slopes to surface and then to surface water features.	Increased height over existing landfill area and therefore increased risk of leachate mounding and seeping out of waste slopes to surface and then to surface water features.	Increased height over existing landfill area and therefore increased risk of leachate mounding and seeping out of waste slopes to surface and then to surface water features.	Increased height over existing landfill area and therefore increased risk of leachate mounding and seeping out of waste slopes to surface and then to surface water features.
Indicator 3: Risk of leachate from CKD pile reaching surface water	No increased risk of CKD pile effects on surface water beyond existing conditions.	High risk due to proximity of relocated watercourse to CKD pile and uncertainties associated with potential to disturb CKD waste, creating potential pathways for leachate migration.	High risk due to proximity of relocated watercourse to CKD pile and uncertainties associated with potential to disturb CKD waste, creating potential pathways for leachate migration.	Low to moderate risk due to proximity of relatively short watercourse realignment closer to CKD pile and low potential to disturb CKD waste.	High risk for surface water effects due to high risk of creating CKD leachate seeps when placing waste above CKD pile.
Indicator 4: Risk of on-site surface water quality impacting Thames River	Existing landfill operations show no measurable impact on water quality exiting the landfill property, and therefore no impact on water quality in the Thames River	Surface water from the site eventually drains to the Thames River. This option represents a high risk to on-site surface water quality relative to the other Alternatives and therefore a high risk to the Thames River downstream.	Surface water from the site eventually drains to the Thames River. This option represents a high risk to on-site surface water quality relative to the other Alternatives and therefore a high risk to the Thames River downstream.	Surface water from the site eventually drains to the Thames River. This option represents a low to moderate risk to on-site surface water quality relative to the other Alternatives and therefore a low to moderate risk to the Thames River downstream.	Surface water from the site eventually drains to the Thames River. This option represents a high risk to on-site surface water quality relative to the other Alternatives and therefore a high risk to the Thames River downstream.

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Additional Mitigation	**None required.**	Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	As a contingency only, if effects from CKD are observed in the realigned watercourse through the Annual Monitoring Program, measures to separate the watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	The LCS in expansion area must be specifically designed to prevent CKD pile leachate from mixing with the waste leachate.
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated.	High risk of net effect anticipated: **M:** High risk of effect due to potential watercourse/CKD pile interactions. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	High risk of net effect anticipated: **M:** High risk of effect due to potential watercourse/CKD pile interactions. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Low risk of net effect anticipated: **M:** Low risk of effect with mitigation and monitoring **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	High risk of net effect anticipated: **M:** High risk of effect due to waste height and potential seepage from CKD pile. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.
Evaluation	**Most Preferred**	**Least Preferred**	**Least Preferred**	**2nd Most Preferred**	**Least Preferred**

7.6.2 Surface Water Quantity

Current Conditions and Indicators of Effect

Surface water flow in the On-site Study Area and Study Area Vicinity has been altered significantly by past and on-going industrial activities. The watercourse through the existing landfill and the upstream SMC lands has been straightened and shifted as a result of past SMC operations. The current flow path appears to have been in place for several decades.

Upstream of the landfill, several stretches of the watercourse and its upstream tributaries are managed municipal drains, known as the Sgariglia Drain and Richardson Drain. Through the landfill property, the watercourse is channelized and straightened. Through the landfill, there are steep berms along the northern bank of the watercourse. Near Water St. S., portions of the channel bed contain rip-rap and angular stone. After alterations over many decades as a result of quarrying and landfilling activities, the watercourse does not exhibit a natural geometry. Water flows into the landfill from the east via a 600mm diameter culvert and exists at the northwestern landfill boundary via a 1500mm diameter culvert.

There are various stormwater management features on the landfill property, including permitter ditches and stormwater ponds, to control run-off. Surface water from the landfill is ultimately discharged to the watercourse, which outlets to the Thames River.

This section will consider potential changes to surface water flow pathways and quantities by examining each Alternative based on the following indicator:

- Indicator 1: Changes to surface water flow.

Effects

Changes to surface water flow are summarized in Table 7-10 and in the discussion below.

Indicator 1: Changes to surface water flow:

With the Do Nothing Alternative there will be no change to surface water flow relative to current conditions.

With Alternatives 2 and 3, the watercourse (approximately 790m) will be relocated north of the CKD pile. It will be designed to mimic the existing watercourse and make use of natural channel design principles, where appropriate. Its entrance and exit to and from the landfill site will remain the same.

With Alternative 3A, a short section (approximately 230m) of the watercourse will be realigned to the northeast. The realignment will occur in the central portion of the landfill property. Similar to Alternatives 2 and 3, the watercourse will mimic the existing watercourse and make use of natural channel design principles. It will continue to enter and exit the landfill via the existing culverts at the east and west property lines, respectfully.

No changes to the watercourse are proposed with Alternative 5.

Each of the Alternatives may result in minor changes to topography which could increase runoff and decrease infiltration but these effects will be addressed through stormwater management controls included in each landfill design to ensure that flows leaving the landfill property are similar to existing conditions. This may involve changes to the sizing and location of stormwater management ponds and ditches. In all cases (apart from the Do Nothing Alternative) there will be alterations to how, and where, water flows through the landfill property. However, there will be no changes to up- or downstream water quantity or flow. Therefore, there will be no overall effects to surface water quantity as a result of any of the Alternatives.

Additional Mitigation

For the Do Nothing Alternative and Alternative 5, no additional mitigation is required beyond the stormwater management controls that will be part of the design of all landfill Alternatives.

The realigned/relocated watercourse will be monitored for two years post-construction. Any additional mitigation identified as a result of the monitoring will be implemented. This may include additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA.

Net Effects

There will be no net effects to surface water quantity as a result of any of the Alternatives. A summary of the potential effects to surface water quantity is provided in Table 7-10.

Table 7-10 Potential Effects to Surface Water Quantity

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Changes to Surface Water Flow	• Existing surface water flow patterns in the On-Site Study Area and beyond are not expected to change.	• Watercourse relocation will alter the flow path for ~790 m through the landfill property. • Quantity and location of surface water flow entering and leaving the On-Site Study Area will not change.	• Watercourse relocation will alter the flow path for ~790 m through the landfill property. • Quantity and location of surface water flow entering and leaving the On-Site Study Area will not change.	• Watercourse relocation will alter the flow path for ~230 m through the landfill property. • Quantity and location of surface water flow entering and leaving the On-Site Study Area will not change.	• Quantity and location of surface water flow entering and leaving the On-Site Study Area will not change.
Additional Mitigation	• No additional mitigation required.	• Post-construction monitoring of the relocated watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as: – additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA.	• Post-construction monitoring of the relocated watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as: – additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA.	• Post-construction monitoring of the realigned watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as: – additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA.	• No additional mitigation required.
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	• No net effects anticipated.	• No net effects anticipated.	• No net effects anticipated.	• No net effects anticipated.	• No net effects anticipated.
Evaluation	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**

7.7 Impacts to Ecology

7.7.1 Terrestrial Ecology

Current Conditions and Indicators of Effect

Under current conditions the On-Site Study Area is highly disturbed and provides relatively few ecological features and functions. The Natural Heritage Assessment provided in Vol III, Appendix D, indicated that the following features are present, or may be present, in the On-Site Study Area:

- Significant Wildlife Habitats, including:
  - Habitat for Monarch Butterfly, a species designated as Special Concern;
  - Habitat for terrestrial crayfish;
  - Turtle Wintering Area
- Habitat of Endangered and Threatened Species:
  - Eastern Meadowlark, a species designated as Threatened.

Bank Swallows, a Threatened species, unsuccessfully attempted to nest in a soil stockpile in the composting area of the landfill in 2015. There is some potential that nesting could be attempted again in the future.

In addition, a variety of wildlife was observed, including turtles, amphibians, snakes and birds. These were observed in small numbers and many of these are likely to have been migrants, passing through the area. Some may be opportunists, making use of available features even where those features do not provide ideal habitat conditions or habitat that meets the characteristics for “provincial significance”.

Additional natural features are present in the Study Area Vicinity, primarily along the Thames River. Potential effects to these features are assessed under Aquatic Ecology, in Section 7.7.2.

To assess any potential changes to terrestrial ecology as a result of the landfill expansion, each Alternative was reviewed against the mapping of ecological features to determine if any effects to these features would result using the following indicators:

- Indicator 1: Impacts to Significant Wildlife Habitats;
- Indicator 2: Impacts to Habitat of Endangered and Threatened Species; and,
- Indicator 3: Impacts to Other Wildlife.

Effects

An assessment of ecological effects was completed in the Natural Heritage Assessment provided in Volume III, Appendix D for all Alternatives except Alternative 3A the analysis for which is detailed in Volume I Appendix D. Findings are summarized in Table 7-11 and the following discussion:

Indicator 1: Impacts to Significant Wildlife Habitats:

With respect to Significant Wildlife Habitats, the following effects are expected:

Monarch Butterfly:

- Existing habitat is marginal with a small number of milkweed and other wildflowers present in the existing grassy areas. Landfilling and capping of cells occurs sequentially such that when one area is filled, it is capped and restored when a new area is opened. Restored areas will be planted with native grasses and wildflowers. The actual open face of the landfill is not expected to increase in size as the landfill expands. Therefore, there will be no net loss of Monarch habitat over existing conditions for Alternatives 2, 3, 3A and 5 over the 40-year operating lifespan of the landfill. With respect to the Do Nothing Alternative, closure will occur sooner and operational portions of the site will be restored earlier than in the other Alternatives.

Habitat for Terrestrial Crayfish:

This habitat is located to the northwest of the CKD pile. Potential effects are as follows:

- The habitat will not be affected by the Do Nothing Alternative.
- The relocation of the watercourse in Alternatives 2 and 3 will occur adjacent to the habitat; however, with appropriate erosion and sediment control and fencing of the work area, effects can be avoided.
- The habitat will not be affected by Alternative 3A.
- The habitat will be entirely lost as a result of Alternative 5.

Turtle Overwintering Area:

A potential turtle overwintering area was identified in the plunge pool of the upstream culvert along the property boundary between the landfill and SMC. This pool will be altered as a result of the watercourse relocation that would occur in Alternatives 2 and 3. No changes to this habitat will occur as a result of Doing Nothing or Alternative 3A and 5.

Indicator 2: Impacts to Habitats of Endangered and Threatened Species:

No effects are expected with the Do Nothing Alternative.

The grassland areas north of the current landfill operations provide habitat for Eastern Meadowlark. This coincides with the habitat for the Monarch butterfly. With Alternatives 2, 3, 3A and 5, this habitat will be removed in sections overtime and replaced when landfill cells are closed. Under the Endangered Species Act, this temporary removal of habitat is considered to have an impact and will require adherence to the provisions of the Act. For Alternatives 2, 3, 3A and 5, compensation for the loss of Eastern Meadowlark will be provided through creation of habitat elsewhere in accordance with the ESA Regulations, or through a species conservation charge paid to the Species at Risk Conservation Trust (effective April 29, 2022). With this compensation, there will be no overall effects.

With all Alternatives, there is potential that landfill construction and operations could create temporary habitats which may attract Bank Swallows which will subsequently be disturbed or destroyed. This will primarily be avoided by following the Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario (MNRF, 2017), as noted in Table 7-2. Thus, the potential to create habitat conditions and subsequently destroy nests is very low.

Indicator 3: Impacts to Other Wildlife:

There will be no effects to wildlife beyond existing conditions as a result of the Do Nothing Alternative as there will be no further clearing of habitats and no construction associated with this option.

Birds may nest in the trees and other vegetation present in the On-site Study Area. Nests can be affected during construction if this vegetation is removed or disturbed. Similarly, bats may also be affected if they are actively roosting in trees when vegetation is cleared. The timing windows for tree clearing and contingencies listed in Table 7-2 will minimize effects. Some minor and highly disturbed areas used by opportunistic species will be lost.

A small number of amphibians and turtles were observed in the watercourse and SWM basins A and B. Potential effects to these species are as follows:

- In Alternatives 2, 3 and 3A, the watercourse (or a portion of it) will be relocated or realigned and SWM basins A and B will be removed and constructed elsewhere on the stie. During removal of features, some individuals may be harmed or disturbed.
- In Alternative 5, the watercourse and SWM basins A and B will be maintained in their current for and position without disturbance. As such, there will be no effects to wildlife using these features.

Beyond the watercourse and SWM basis, snakes and other wildlife may be encountered elsewhere on the landfill property during construction. Individuals may inadvertently wander into work zones; however, standard erosion and sediment control (ESC) fencing around work zones (a standard measure to be incorporated into the design, as listed in Table 7-2) will likely prevent this.

Additional Mitigation

No additional mitigation is required for the Do Nothing Alternative.

The terrestrial crayfish and turtle overwintering area that is expected to be lost as a result of Alternative 5 and Alternatives 2 and 3, respectively, cannot be easily restored or re-created elsewhere. Therefore, no additional mitigation is available to further minimize effects. A wildlife salvage of the plunge pool should occur prior to its removal.

For Alternatives 2, 3 and 3A, a wildlife salvage should occur prior to or during dewatering of the watercourse and SWM basins A and B as part of their relocation. A Wildlife Collectors Permit from the NDMNRF should be obtained prior to this work. Wildlife found within these features should be allowed to move from the habitat on their own or collected and transported to another suitable location in the vicinity.

For Alternatives 2, 3, 3A and 5, the site should be surveyed for Bank Swallow habitat prior to any site alteration and SAROntario@ontario.ca should be contacted for guidance under the *Endangered Species Act 2007* if Bank Swallow is found to be nesting on site. Should Bank Swallow be found nesting on-site, a 50 m buffer will be applied around the active nest.

Net Effects

No net effects are expected with the Do Nothing Alternative and Alternative 3A.

There will be a net loss of terrestrial crayfish habitat as a result of Alternative 5. There will also be a net loss of turtle overwintering habitat as a result of Alternatives 2 and 3. The magnitude, frequency, duration and reversibility of these effects is summarized in Table 7-11.

Table 7-11: Potential Effects to Terrestrial Ecology

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Impact to Significant Wildlife Habitat	No effects to Monarch butterfly habitat, terrestrial crayfish habitat or turtle overwintering areas.	No effects to Monarch butterfly habitat, terrestrial crayfish habitat. Potential turtle overwintering area at the plunge pool at the upstream culvert will be removed as a result of the watercourse location.	No effects to Monarch butterfly habitat, terrestrial crayfish habitat. Potential turtle overwintering area at the plunge pool at the upstream culvert will be removed as a result of the watercourse location.	No effects to Monarch butterfly habitat, terrestrial crayfish habitat or turtle overwintering areas.	No effects to Monarch butterfly habitat or turtle overwintering habitat. Terrestrial crayfish habitat will be removed.
Indicator 2: Impact to Habitat of Endangered and Threatened Species	No effects to habitats for Eastern Meadowlark. There is limited potential that landfill operations could create temporary habitats which may attract Bank Swallows which will subsequently be disturbed or destroyed.	With compensation, as required under the Endangered Species Act, there will be no overall impact to Eastern Meadowlark habitat. There is limited potential that landfill construction and operations could create temporary habitats which may attract Bank Swallows which will subsequently be disturbed or destroyed.	With compensation, as required under the Endangered Species Act, there will be no overall impact to Eastern Meadowlark habitat. There is limited potential that landfill construction and operations could create temporary habitats which may attract Bank Swallows which will subsequently be disturbed or destroyed.	With compensation, as required under the Endangered Species Act, there will be no overall impact to Eastern Meadowlark habitat. There is limited potential that landfill construction and operations could create temporary habitats which may attract Bank Swallows which will subsequently be disturbed or destroyed.	With compensation, as required under the Endangered Species Act, there will be no overall impact to Eastern Meadowlark habitat. There is limited potential that landfill construction and operations could create temporary habitats which may attract Bank Swallows which will subsequently be disturbed or destroyed.
Indictor 3: Impact to Other Wildlife	No effects to other wildlife.	Any amphibians and turtles present in the watercourse or SWM basins may be affected during construction and relocation of these features.	Any amphibians and turtles present in the watercourse or SWM basins may be affected during construction and relocation of these features.	Any amphibians and turtles present in the watercourse or SWM basins may be affected during construction and relocation of these features.	No effects to amphibians and turtles as the watercourse and stormwater basins will not be altered.
Additional Mitigation	No additional mitigation required.	Conduct a wildlife salvage of the plunge pool at the upstream culvert prior to its removal and watercourse and SWM basins during dewatering. Survey site for Bank Swallow habitat prior to any site alteration	Conduct a wildlife salvage of the plunge pool at the upstream culvert prior to its removal and watercourse and SWM basins during dewatering. Survey site for Bank Swallow habitat prior to any site alteration	Conduct a wildlife salvage of the watercourse and SWM basins during dewatering. Survey site for Bank Swallow habitat prior to any site alteration and contact SAROntario@ontario.ca for	Survey site for Bank Swallow habitat prior to any site alteration and contact SAROntario@ontario.ca for guidance under the *Endangered Species Act 2007* if Bank Swallow is found to be nesting on site. Should Bank Swallow be found nesting on-

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
		and contact SAROntario@ontario.ca for guidance under the *Endangered Species Act 2007* if Bank Swallow is found to be nesting on site. Should Bank Swallow be found nesting on-site, apply a 50 m buffer around the active nest.	and contact SAROntario@ontario.ca for guidance under the *Endangered Species Act 2007* if Bank Swallow is found to be nesting on site. Should Bank Swallow be found nesting on-site, apply a 50 m buffer around the active nest.	guidance under the *Endangered Species Act 2007* if Bank Swallow is found to be nesting on site. Should Bank Swallow be found nesting on-site, apply a 50 m buffer around the active nest.	site, apply a 50 m buffer around the active nest.
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated.	Moderate net effects anticipated. **M**: Moderate. Loss of plunge pool that may provide turtle overwintering habitat. **F**: One-time loss of habitat. **D**: Habitat loss is a long-term effect. **R**: Removal of overwintering habitat is irreversible.	Moderate net effects anticipated. **M**: Moderate. Loss of plunge pool that may provide turtle overwintering habitat. **F**: One-time loss of habitat. **D**: Habitat loss is a long-term effect. **R**: Removal of overwintering habitat is irreversible.	No net effects anticipated.	Moderate net effects anticipated. **M**: Moderate. Loss of a small number of terrestrial crayfish burrows. **F**: One-time loss of crayfish habitat. **D**: Crayfish habitat loss is a long-term effect. **R**: Removal of terrestrial crayfish habitat is irreversible.
Evaluation	**Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**Most Preferred**	**2nd Most Preferred**

7.7.2 Aquatic Ecology

Current Conditions and Indicators of Effect

The watercourse flowing through the landfill site does not provide direct fish habitat. The perched culvert at Water St. S. prevents fish from traveling from the Thames River upstream into the watercourse. No fish were collected during fish surveys. Nonetheless, the watercourse does contribute to downstream fish habitat. The watercourse outlets to the Thames River, which provides a variety of habitats for fish and other aquatic species. The Thames River is known to provide habitat for the Spiny Softshell Turtle, a species at risk identified as Threatened in Ontario.

To assess any potential changes to aquatic ecology as a result of the landfill expansion, each Alternative was reviewed to determine if it would result in any effects using the following indicators:

- Indicator 1: Effects to Aquatic Habitat
- Indicator 2: Effects to Aquatic Species at Risk

Effects

An assessment of aquatic ecological effects was completed in the in the Natural Heritage Assessment provided in Volume III, Appendix D for all Alternatives except Alternative 3A the analysis for which is detail in Volume I Appendix D. Findings are summarized in Table 7-12 and the following discussion:

Indicator 1: Effects to Aquatic Habitat:

Aquatic habitat could be affected by impairment to water quality and due to physical changes to the watercourse.

Impairment to Water Quality:

Effects to water quality were discussed in Section 7.6.1. In summary, there will be no changes in water quality from the Do Nothing Alternative. Alternatives 2, 3 and 5 have a high risk of water quality impairment due to the potential for interactions with the CKD pile. Alternative 3A is less risky as the watercourse realignment is farther from the CKD pile than in Alternatives 2 and 3 and doesn't have the risk of CKD seepage associated with Alternative 5.

Physical Changes to the Watercourse:

Aquatic habitat will be affected where the watercourse will be relocated or realigned to allow for the expansion. The relocation of the watercourse (~790m) is required for

Alternatives 2 and 3. Relocating the watercourse has the potential to harm aquatic species and disturb existing habitat during the relocation process. However, the relocation 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, in accordance with natural channel design principles. All new and remaining riparian areas will be naturalized with trees, shrub and grass plantings to improve riparian habitat and stabilize stream banks. In summary, there is potential for negative effects during relocation; however, in the long-term there may be improvements to aquatic habitat once the new channel is stable and functioning.

Alternative 3A requires the realignment of ~230 m of the watercourse which has the potential to disrupt aquatic species and habitat conditions, albeit over a shorter span than in Alternatives 2 and 3. The realigned channel will mimic the existing channel and incorporate natural channel design principles, where appropriate. Additional improvements to the remaining sections of the watercourse through the landfill property will be made, including the addition of channel substrates, installation of habitat features and bank stabilization, where required. All new and remaining riparian areas will be naturalized with trees, shrub and grass plantings. As such, there is potential for negative effects during the realignment; however, in the long-term there may be improvements to aquatic habitat once the new channel and habitat features are stable and functioning.

Alternative 5 has no requirements for in-water work and the watercourse will remain in its current position. Riparian areas will be naturalized with trees, shrub and grass plantings. Therefore, the effects associated with relocating or realigning the watercourse will be avoided with this Alternative but the potential to improve habitat is relatively limited.

With the Do Nothing Alternative, there will be no change from existing conditions and no impact or benefit to aquatic habitat.

Indicator 2: Impacts to Aquatic Species at Risk

There are no aquatic species at risk in the watercourse on the landfill property. However, there are aquatic species at risk in the Thames River. The Thames River will not be directly affected; however, contaminants or sediments from the watercourse could move downstream and impact the Thames River and the aquatics species inhabiting it.

Additional Mitigation

No additional mitigation is required for the Do Nothing Alternative.

With Alternative 5:

- The design of the LCS will need to be more robust than with other Alternatives to limit the potential for mixing of landfill and CKD leachates and avoid creating CKD leachate seeps.

With Alternatives 2 and 3:

- The relocated watercourse will be designed using natural channel design principles which will result in improved habitat conditions.
- All new riparian areas will be naturalized with tree, shrub and grass plantings to improve riparian habitat and stabilize stream banks.
- No in-water work will occur during June and July.
- Any wildlife within affected portions of the existing channel will be salvaged and relocated.
- Post-construction monitoring of the relocated watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as:
  - Additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA.
- The watercourse will be relocated close to the CKD pile. Measures to separate the watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 3A:

- The realigned watercourse will be designed using natural channel design principles which will result in improved habitat conditions.
- All new and remaining riparian areas will be naturalized with tree, shrub and grass plantings to improve riparian habitat and stabilize stream banks.
- No in-water work will occur during June and July.
- Any wildlife within affected portions of the existing channel will be salvaged and relocated.
- Post-construction monitoring of the realigned watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as:
  - Additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA.
- Interactions between CKD and the watercourse are not expected. However, if, as a result of the Annual Monitoring Program, effects from CKD are observed in the realigned watercourse, measures to separate the watercourse from the CKD will be

required. This may include a barrier and interceptor pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

For all Alternatives, an Annual Monitoring Program and Adaptive Management Plan will be part of the landfill's standard operating procedures, described in Table 7-2. Adaptive Management Plans and their triggers are described in Section 11.3.

Net Effects

Effects resulting from the relocation or realignment of the watercourse are low if standard construction and erosion and sediment control measures are utilized in conjunction with the additional mitigation noted above.

The most significant net effects relate to the increased risk of water quality effects in the watercourse and downstream in the Thames River. These effects were previously summarized in Section 7.6.1. Based on that the Do Nothing Alternative is most preferred, followed by Alternative 3A. Alternatives 2, 3 and 5 have similar high risk to water quality and are equally least preferred.

Table 7-12: Potential Effects to Aquatic Ecology

Evaluation Factors	Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Impact to Aquatic Habitat	No net effects anticipated beyond existing conditions.	High risk of water quality effects due to potential watercourse/CKD pile interactions. Habitat will be physically altered during watercourse relocation.	High risk of water quality effects due to potential watercourse/CKD pile interactions. Habitat will be physically altered during watercourse relocation.	Low-moderate risk of water quality effects due to potential watercourse/CKD pile interactions. Habitat will be physically altered during watercourse realignment.	High risk of water quality effects due to potential CKD pile seepage. There will be no physical alteration to fish habitat.
Indicator 2: Impacts to Aquatic Species at Risk	No net effects anticipated beyond existing conditions.	High risk of water quality effects due to potential watercourse/CKD pile interactions which could affect downstream habitats.	High risk of water quality effects due to potential watercourse/CKD pile interactions which could affect downstream habitats.	Low-moderate risk of water quality effects due to potential watercourse/CKD pile interactions which could affect downstream habitats.	High risk of water quality effects due to potential watercourse/CKD pile interactions which could affect downstream habitats.

Evaluation Factors	Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Additional Mitigation	None required.	• The relocated watercourse will be designed using natural channel design principles which will result in improved habitat conditions. • All new riparian areas will be naturalized with tree, shrub and grass plantings to improve riparian habitat and stabilize stream banks. • No in-water work will occur during June and July. • Any wildlife within affected portions of the existing channel will be salvaged and relocated. • Post-construction monitoring of the relocated watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as: – Additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA. • Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	• The relocated watercourse will be designed using natural channel design principles which will result in improved habitat conditions. • All new riparian areas will be naturalized with tree, shrub and grass plantings to improve riparian habitat and stabilize stream banks. • No in-water work will occur during June and July. • Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS. • Any wildlife within affected portions of the existing channel will be salvaged and relocated. • Post-construction monitoring of the relocated watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as: – Additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA. • Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	• The realigned watercourse will be designed using natural channel design principles which will result in improved habitat conditions. • All new and remaining riparian areas will be naturalized with tree, shrub and grass plantings to improve riparian habitat and stabilize stream banks. • No in-water work will occur during June and July. • Any wildlife within affected portions of the existing channel will be salvaged and relocated. • Post-construction monitoring of the realigned watercourse will be carried out. Any additional mitigation identified at that stage will be implemented, such as: – Additional bank protection measures, bank and riparian plantings, new substrates etc. as required, in consultation with UTRCA. • As a contingency only, if effects from CKD are observed in the realigned watercourse through the Annual Monitoring Program, measures to separate the watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	• The LCS in expansion area must be specifically designed to prevent CKD pile leachate from mixing with the waste leachate.

Evaluation Factors	Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Net Effects M = Magnitude D = Duration F = Frequency R = Reversibility	No net effects anticipated.	Minor net effects due to watercourse relocation. High risk of net effects due to water quality impairment. **M:** Low risk of effect due to watercourse relocation with mitigation and monitoring/High risk of water quality effect due to potential watercourse/CKD pile interactions. **D:** Habitat alterations will occur only once during watercourse relocation/Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Habitat alterations will occur only once during watercourse realignment/Risk of surface water impact is continuous over life of landfill. **R:** Watercourse relocation is not reversible but will result in improved habitat/ Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Minor net effects due to watercourse relocation. High risk of net effects due to water quality impairment. **M:** Low risk of effect due to watercourse relocation with mitigation and monitoring/High risk of water quality effect due to potential watercourse/CKD pile interactions. **D:** Habitat alterations will occur only once during watercourse relocation/Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Habitat alterations will occur only once during watercourse realignment/Risk of surface water impact is continuous over life of landfill. **R:** Watercourse relocation is not reversible but will result in improved habitat/ Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Minor net effects due to watercourse relocation. Low risk of net effects due to water quality impairment. **M:** Low risk of effect due to watercourse realignment with mitigation and monitoring/Low risk of water quality effect due to distance between watercourse and CKD pile. **D:** Habitat alterations will occur only once during watercourse realignment/Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Habitat alterations will occur only once during watercourse realignment/Risk of surface water impact is continuous over life of landfill. **R:** Watercourse realignment is not reversible but will result in improved habitat/ Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	High risk of net effects due to water quality impairment. **M:** High risk of effect due to waste height and potential seepage from CKD pile. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.
Evaluation	**Most Preferred**	**Least Preferred**	**Least Preferred**	**2nd Most Preferred**	**Least Preferred**

7.8 Impacts to Cultural Heritage Resources

7.8.1 Built Heritage and Cultural Heritage Landscapes

Current Conditions and Indicators of Effect

There are no Built Heritage Resources or Cultural Heritage Landscapes (CHLs) in the On-Site Study Area. There is one Built Heritage Resource present in the Study Area Vicinity. This is a residence located at 481 Water St. S., approximately 925m to the north of the landfill property. SMC is located between this residence and the landfill. Thus, the landfill is not the predominant view from the residence.

There are 11 CHLs located within the Study Area Vicinity. Of these, two are directly adjacent to the landfill. These include:

- The St. Marys Cement Plant Industrial Complex CHL, which is located directly to the east.
- The farmscape located at 1025 Water St. S., which is directly adjacent to the landfill to the west.

The remaining CHLs are located primarily to the west and south of the landfill. Under current conditions, there is a visual block of coniferous trees around the west and south sides of the landfill and around the property at 1025 Water St. S. As such, the landfill is not the predominant view from most of the CHLs. The landfill is visible from the St. Marys Cement Plant Industrial Complex CHL but this feature is itself an industrial site and highly disturbed landscape.

To assess any potential changes from current conditions as a result of the landfill expansion, each Alternative was reviewed relative to the following indicator:

- Indicator 1: Impacts to the Built Heritage Resources or Cultural Heritage Landscapes.

Effects

A preliminary analysis of effects was completed in the Cultural Heritage Resources Assessment (CHRA) provided in Vol III, Appendix E for all Alternatives except Alternative 3A the analysis for which is detail in Volume I Appendix D.

Indicator 1: Impacts to the Built Heritage Resources or Cultural Heritage Landscapes:

Based on the preliminary analysis, none of the Alternatives will result in any direct effects to the heritage residence on Water St. S. due to its distance from the landfill expansion area.

There does not appear to be a visual connection between the property and any of the Alternatives that would indirectly affect the heritage residence. However, this will be confirmed in an updated CHRA to be prepared during the detailed design phase of the project.

Similarly, there will be no direct effects to any CHLs, according to the CHRA as the viewscape is not expected to change significantly with any of the Alternatives. The trees along the southern boundary of the landfill property will need to be removed for Alternative 3A. These trees will remain in place with all remaining Alternatives. The effect of this removal on the landscape is very minimal as these trees only provide a visual block from the agricultural field to the south. They are not integral to blocking the view from Water St. S. It is noted that overall, the trees are on the slope of the former quarry and therefore provide a relatively low and minimally effective visual blockage. Indirect effects to CHLs are not expected but will be confirmed in an updated CHRA to be prepared during the detailed design phase of the project.

Additional Mitigation

No mitigation or further study is required under the Do Nothing option. For all other Alternatives, during detailed design, a CHRA will be updated to further assess effects and identify additional mitigation measures with all cultural heritage resources. Mitigation will be developed as follows:

- Construction activities and staging should be suitably planned and undertaken to avoid effects to identified cultural heritage resources.
- Once the detailed design of the proposed work are available, the CHRA will be updated with a confirmation of effects 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 will 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 will be contacted in order to confirm the effects of the proposed work on potential heritage resources.

Net Effects

With the additional study and measures noted above, no net effects are anticipated for any of the Alternatives. This will be confirmed through the updated CHRA to be completed during detailed design.

A summary of the potential effects to the Cultural Heritage Resources is provided in Table 7-13.

Table 7-13: Potential Effects to the Built Heritage Resources and Cultural Heritage Landscapes

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Impacts to Bult Heritage Resources or Cultural Heritage Landscapes	One BHR is located approximately 925m from the landfill site. 11 CHLs are located within 1km of the landfill site. No BHRs or CHLs are located within the On-site Study Area. No effects are expected beyond existing conditions.	One BHR is located approximately 925m from the landfill site. 11 CHLs are located within 1km of the landfill site. No BHRs or CHLs are located within the On-site Study Area. No effects are anticipated, given the distance between the resource and landfill and the existing landscape disturbance in between. Further study will be carried out during the detailed design phase to confirm.	One BHR is located approximately 925m from the landfill site. 11 CHLs are located within 1km of the landfill site. No BHRs or CHLs are located within the On-site Study Area. No effects are anticipated, given the distance between the resource and landfill and the existing landscape disturbance in between. Further study will be carried out during the detailed design phase to confirm.	One BHR is located approximately 925m from the landfill site. 11 CHLs are located within 1km of the landfill site. No BHRs or CHLs are located within the On-site Study Area. No effects are anticipated, given the distance between the resource and landfill and the existing landscape disturbance in between. Further study will be carried out during the detailed design phase to confirm.	One BHR is located approximately 925m from the landfill site. 11 CHLs are located within 1km of the landfill site. No BHRs or CHLs are located within the On-site Study Area. No effects are anticipated, given the distance between the resource and landfill and the existing landscape disturbance in between. Further study will be carried out during the detailed design phase to confirm.
Additional Mitigation	No additional mitigation is required.	• Construction activities and staging should be suitably planned and undertaken to avoid effects to identified cultural heritage resources. • Once a detailed design of the proposed work is available, the CHRA will be updated with a confirmation of effects 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 effects of the proposed work on potential heritage resources.			
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects	No net effects anticipated	No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**

7.8.2 Archaeological Resources

Current Conditions and Indicators of Effect

The landfill was opened in 1984 on a 16.2 ha parcel of land leased from SMC. Prior to its use as a landfill site, SMC mined the site for clays to use in 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.

Given this past disturbance, the On-Site Study Area offers no archaeological potential and no archaeological resources have previously been discovered on the property.

There are no previously registered archaeological sites are located within the Study Area Vicinity but there is some potential that unknown sites exist.

To assess any potential changes from current conditions as a result of the landfill expansion, each Alternative was reviewed relative to the following indicator:

- Indicator 1: Impacts to the Archaeological Resources.

Effects

A Stage 1 Archaeological Assessment was completed and is included in Volume III - Appendix F for all Alternatives except Alternative 3A which is assessed in Appendix D. A summary is provided in Table 7-14 and in the following discussion:

Indicator 1: impacts to the Archaeological Resources:

The Stage 1 Archaeological Assessment concluded that the entire On-Site Study Area has been documented to not retain archaeological potential and that these lands do not require further archaeological assessment. There is a small portion of SMC land beyond the On-Site Study Area that is required for the watercourse relocation in Alternatives 2 and 3. This small area was not part of the Archaeological Assessment and would require further study. Previous disturbance in this area means that site is unlikely to retain archaeological potential. In the unlikely chance that archaeological resources were identified in this area, further study through the various stages of the archaeological assessment process would be carried out to clear the area. Therefore, none of the Alternatives will result in any impact.

Furthermore, there will be no disturbance to the ground in the Study Area Vicinity, thus there will no effect on any potential archaeological resources beyond the landfill property itself.

Additional Mitigation

No additional mitigation is required for the Do Nothing Alternative. Additional study is required for Alternatives 2 and 3 as the watercourse relocation extends beyond the current On-Site Study Area.

For Alternatives 3A and 5, should the proposed work extend the current study area, then further Stage 1 Archaeological Assessment (and further assessments, if recommended) will be conducted by a licensed archaeologist as early as possible during detailed design and prior to ground disturbing activities.

Net Effects

No net effects to archaeological resources are anticipated with any of the Alternatives. A summary of the net effects to the archaeological resources is provided in Table 7-14.

Table 7-14: Potential Effects to Archaeological Resources

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: **Impacts to archaeological resources.**	The On-Site Study Area offers no archaeological potential, given its past and current disturbances. No effects anticipated.	The On-Site Study Area offers no archaeological potential, given its past and current disturbances. No effects anticipated.	The On-Site Study Area offers no archaeological potential, given its past and current disturbances. No effects anticipated.	The On-Site Study Area offers no archaeological potential, given its past and current disturbances. No effects anticipated.	The On-Site Study Area offers no archaeological potential, given its past and current disturbances. No effects anticipated.
Additional Mitigation	No additional mitigation required.	Additional review required in area of watercourse relocation. Previous disturbance in this area means that site is unlikely to retain archaeological potential.	Additional review required in area of watercourse relocation. Previous disturbance in this area means that site is unlikely to retain archaeological potential.	Should the proposed work extend the current study area, then further Stage 1 Archaeological Assessment (and further assessments, if recommended) will be conducted by a licensed archaeologist as early as possible during detailed design and prior to ground disturbing activities	Should the proposed work extend the current study area, then further Stage 1 Archaeological Assessment (and further assessments, if recommended) will be conducted by a licensed archaeologist as early as possible during detailed design and prior to ground disturbing activities
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated	No net effects anticipated	No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**

7.9 Impacts to Traffic

Current Conditions and Indicators of Effect

Under current conditions, there is one entrance to the landfill on the east side of Water St. S. A Traffic Impact Study, provided in Vol III, Appendix H, confirmed that there are no existing traffic concerns associated with the entrance or major access routes to the landfill.

To assess any potential changes from current conditions as a result of the landfill expansion, the following indicator was used:

- Indicator 1: Impacts to traffic on Water St. S.

Effects

A Traffic Impact Study, provided in Vol III, Appendix H was completed and is included in Volume III, Appendix H for all Alternatives except Alternative 3A which is assessed in Appendix D. A summary is provided in Table 7-15 and in the following discussion:

Indicator 1: Impacts to traffic on Water St. S:

None of the Alternatives is expected to increase the amount of waste generated or transported to the landfill, with the exception of small increases anticipated as the Town's population grows. All Alternatives will continue to be accessed through the existing entrance off Water St. S. The Traffic Impact Study (Volume III, Appendix H) determined that the intersection at Water St. S and the landfill entrance is sufficient to meet traffic demands through 2059 and beyond. No capacity improvements are needed to Water St. S. and no changes are required to the landfill entrance. Therefore, no effects on traffic are expected from any of the Alternatives.

Additional Mitigation

No additional mitigation is required.

Net Effects

No net effects are expected. A summary of the potential traffic effects is provided in Table 7-15.

Table 7-15: Potential Effects to Local Transportation

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: **Impacts to traffic on Water St. S.**	There are no current traffic concerns at the landfill entrance off Water St. S. No changes are expected with this Alternative. Therefore, no effects on traffic are expected.	The intersection at Water St. S. and the landfill entrance is sufficient to meet traffic demands through 2059 and beyond. No capacity improvements are needed to Water St. S. or the entrance intersection. Therefore, no effects on traffic are expected.	The intersection at Water St. S. and the landfill entrance is sufficient to meet traffic demands through 2059 and beyond. No capacity improvements are needed to Water St. S. or the entrance intersection. Therefore, no effects on traffic are expected.	The intersection at Water St. S. and the landfill entrance is sufficient to meet traffic demands through 2059 and beyond. No capacity improvements are needed to Water St. S. or the entrance intersection. Therefore, no effects on traffic are expected.	The intersection at Water St. S. and the landfill entrance is sufficient to meet traffic demands through 2059 and beyond. No capacity improvements are needed to Water St. S. or the entrance intersection. Therefore, no effects on traffic are expected.
Additional Mitigation	No additional mitigation required.				
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated	No net effects anticipated	No net effects anticipated	No net effects anticipated	No net effects anticipated
Evaluation	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**

7.10 Impacts to Land Use

7.10.1 Sensitive Land Use

Current Conditions and Indicators of Effect

Aggregate extraction associated with SMC occurs to the north, northeast and west of the landfill. 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 west side of Water St.S. and on the east side of Water St. S., immediately adjacent to the landfill.

Sensitive land uses are those which may experience negative effects as a result of incompatible adjacent land uses. The residential and agricultural land uses to the west of the landfill site and agricultural lands to the south are identified as sensitive land uses. The existing waste footprint is setback from Water St. S. by approximately 75m and from the landfill's southern property boundary by approximately 25m.

For this part of the evaluation, the following indicator was considered:

- Indicator 1: Presence of sensitive lands within the study areas.

Effects

A Socio-economic Impact Assessment was completed and is included in Volume III - Appendix G for all Alternatives except Alternative 3A which is assessed in Appendix D. The presence of sensitive land uses are described in that report. A summary is provided in Table 7-16 and in the following discussion:

Indicator 1: Presence of sensitive lands within the study areas:

There are no sensitive land uses in the On-Site Study Area. The existing landfill and vacant, former extraction lands are the only uses currently present.

There are sixteen residences within 120 m of the landfill and an additional 28 residences within the 1 km Study Area Vicinity. There are farmlands directly to the south of the landfill.

With the Do Nothing Alternative, the landfill will be no closer to any of these sensitive land uses than it is today. When the landfill closes at the end of the current ECA, many of the effects to sensitive land uses will diminish; however, some land use restrictions will remain in place throughout the post-closure period.

Alternative 2 does not include any landfilling above the existing waste footprint. The new footprint will be located farther from sensitive land uses than the current landfill. All new waste will be placed at least 100m from the landfill property boundaries.

Alternatives 3 and 5 include landfilling above the existing waste piles. The existing setback s of 75m from Water St. S. and 25m from the southern property boundary will be maintained. The new waste footprint associated with these Alternatives will be at least 100m from all property boundaries.

Alternative 3A will also include landfilling above the existing waste footprint, maintain the existing setbacks in that area. The new footprint will be at least 100m from Water St. S.; however, that setback will be reduced to 30m along the southern property boundary. Alternative 3A includes a more compressed footprint relative to Alternative 3 to accommodate sufficient capacity with only minimal channel realignment. As a result, the setback from the southern boundary is narrower to accommodate a new perimeter road and fencing.

For Alternative 3A, the trees along the southern boundary of the landfill property will need to be removed. This is not required for any other Alternative. These trees will remain in place with all remaining Alternatives. The effect of this removal on the landscape is very minimal as these trees only provide a visual block from the agricultural field to the south. They are not integral to blocking the view from Water St. S. It is noted that overall, the trees are on the slope of the former quarry and therefore provide a relatively low and minimally effective visual blockage.

No landfilling will occur any closer to sensitive land uses than under current conditions. Therefore, there will be no negative effects.

Additional Mitigation

A new treeline will be planted along the southern property boundary for Alternative 3A.

Additional mitigation related to effects to sensitive land uses is provided under Social Impacts in Section 1.1.1.

Net Effects

No net effects are expected.

Table 7-16: Sensitive Land Uses

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: **Presence of sensitive lands within the study areas.**	No sensitive land uses are present within the On-site Study Area. Sensitive residential and agricultural land uses are present within Study Area Vicinity. No effects to sensitive land uses are predicted. Landfilling will occur no closer to sensitive land uses than existing waste footprint. Landfilling will cease in near future.	No sensitive land uses are present within the On-site Study Area. Sensitive residential and agricultural land uses are present within Study Area Vicinity. No effects to sensitive land uses are predicted. All new landfilling will occur farther from sensitive land uses than it currently does.	No sensitive land uses are present within the On-site Study Area. Sensitive residential and agricultural land uses are present within Study Area Vicinity. No effects to sensitive land uses are predicted. Landfilling will not occur any closer to sensitive land uses than occurs during existing operations, therefore, there is no change to effects experienced as a result of landfill expansion.	No sensitive land uses are present within the On-site Study Area. Sensitive residential and agricultural land uses are present within Study Area Vicinity. No effects to sensitive land uses are predicted. Landfilling will not occur any closer to sensitive land uses than occurs during existing operations, therefore, there is no change to effects experienced as a result of landfill expansion. Trees between landfill and farmland to the south will be removed.	No sensitive land uses are present within the On-site Study Area. Sensitive residential and agricultural land uses are present within Study Area Vicinity. No effects to sensitive land uses are predicted. Landfilling will not occur any closer to sensitive land uses than occurs during existing operations, therefore, there is no change to effects experienced as a result of landfill expansion.
Additional Mitigation	No additional mitigation is required.	No additional mitigation is required.	No additional mitigation is required.	A new treeline will be planted along the southern property boundary.	No additional mitigation is required.
Net Effect M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated.	No net effects anticipated.	No net effects anticipated.	No net effects anticipated.	No net effects anticipated.
Evaluation	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**	**Most Preferred**

7.10.2 Aggregate Resources

Current Conditions and Indicators of Effect

Aggregate extraction is a significant industry in St. Marys. Extraction occurred historically on the landfill property when owned by SMC. SMC 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 On-Site Study Area is now unencumbered by the aggregate extraction license.

In the Study Area Vicinity, industrial-scale aggregate extraction and processing occurs to the west and north of the landfill. Under current conditions, the landfill and adjacent SMC operations coexist with minimal effects.

To assess any potential changes from current conditions as a result of the landfill expansion, each Alternative was reviewed to determine if it would result in any effects to adjacent aggregate extraction and processing operations.

Effects

Under the Do Nothing Alternative, no changes to existing conditions are expected and there will be no negative effect on aggregate extraction or processing on neighbouring properties.

Alternatives 2 and 3 require relocation of the watercourse north of the CKD pile. A portion of the watercourse will need to be placed on SMC lands which are subject to an active Aggregate License. This portion of lands may need to be acquired by the Town or placed in an easement. The license would also need to be amended to remove the area required for the watercourse. Although the area is relatively small, there is some potential that this could impact future extraction of processing operations at SMC.

With Alternatives 3A and 5, no work is required on SMC lands. The landfill is expected to operate in a similar manner as it does under current conditions. Therefore, no effects are expected to the quantity of aggregate material available or to processing operations.

Additional Mitigation

No additional mitigation is required for Alternatives 3A, 5 or Do Nothing. There is no additional mitigation that can be applied to minimize the effects of the watercourse relocation on SMC as a result of Alternatives 2 and 3.

Net Effects

No additional mitigation is required for Alternatives 3A, 5 or Do Nothing. There is a potential net effect to aggregate extraction and processing at SMC as a result of Alternatives 2 and 3. The magnitude, frequency, duration and reversibility of these effects is summarized in Table 7-17.

Table 7-17: Potential Effects to Aggregate Extraction and Processing

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: **Impacts to aggregate extraction and processing**	There are no current effects to aggregate extraction or processing. No changes are expected with this Alternative. Therefore, no effects to extractive land uses are expected.	Relocation of the watercourse will require an amendment to the active aggregate licence at SMC and will require property acquisition of easement. Future extraction and processing operations may be affected.	Relocation of the watercourse will require an amendment to the active aggregate licence at SMC and will require property acquisition of easement. Future extraction and processing operations may be affected.	No work is required on SMC lands and no change to landfill operations are planned that would indirectly affect extractive land uses or processing operations.	No work is required on SMC lands and no change to landfill operations are planned that would indirectly affect extractive land uses or processing operations.
Additional Mitigation	No additional mitigation required.	No additional mitigation available.	No additional mitigation available	No additional mitigation required.	No additional mitigation required.
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated	Minor net effects anticipated: **M**: Minor. Area required is expected to be less than 1 ha. **F**: One-time loss of licenced land from SMC. **D**: Ability to extract or process aggregates on the small piece of is a long-term effect. **R**: Once the watercourse is relocated, lands could not be returned to SMC for future extraction purposes.	Minor net effects anticipated: **M**: Minor. Area required is expected to be less than 1 ha. **F**: One-time loss of licenced land from SMC. **D**: Ability to extract or process aggregates on the small piece of is a long-term effect. **R**: Once the watercourse is relocated, lands could not be returned to SMC for future extraction purposes.	No net effects anticipated	No net effects anticipated
Evaluation	**Most Preferred**	**2nd Most Preferred**	**2nd Most Preferred**	**Most Preferred**	**Most Preferred**

7.11 Impacts to Socio-economic Conditions

7.11.1 Financial Factors

Current Conditions and Indicators of Effect

Under current conditions, the Town is responsible for covering the costs of operating and decommissioning the existing landfill. To assess these differences and the overall cost of each Alternative, the following are considered:

- Indicator 1: Capital Costs;
- Indicator 2: Operational and Maintenance Costs.

Effects

Indicator 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 of the new expansion capacity, such as building roads, excavating the landfill base (preparing the engineered liner) and building the LCS. The capital costs also include the cost for decommissioning the site and placing final closure cover. The following describes the expected capital costs:

- Do Nothing: This Alternative is expected to have the lowest capital cost as there is no new construction and only site closure is required.
- Alternative 2: This Alternative has the greatest new footprint, meaning that the new LCS, perimeter roads, perimeter ditching and new SWM basins are all larger than with any other Alternative. The watercourse will also be relocated for this Alternative, adding an additional cost. A portion of the relocated watercourse will be on SMC lands, requiring negotiated property acquisition or easement, further increasing the cost. No changes to scale, scale house or public drop-off area are required with this Alternative, resulting in some cost savings. Closure of the site will also be more expensive than with other Alternatives because of the larger footprint. Overall, this Alternative has the second highest capital cost.
- Alternative 3: This Alternative has a moderately sized new footprint. This means that the new LCS, perimeter roads, perimeter ditching and new SWM basins are all larger than existing conditions but smaller than Alternatives 2 and 5. The watercourse will also be relocated for this Alternative, adding an additional cost. A portion of the relocated watercourse will be on SMC lands, requiring negotiated property acquisition or easement, further increasing the cost. The scale, scale house and public drop-off area will need to be relocated with this Alternative, resulting in additional costs. Closure of the site will also be more expensive than with the Do

Nothing Alternative but less costly than Alternatives 2 and 5 because of its moderately-sized footprint. Overall, this Alternative has the third lowest capital cost.

- Alternative 3A: This Alternative has a similar footprint to Alternative 3. This means that the new LCS, perimeter roads, perimeter ditching and new SWM basins are all similar to Alternative 3 (i.e., larger than existing conditions but smaller than Alternatives 2 and 5). The watercourse only requires realignment for this Alternative, which is less work, and therefore lower cost than the relocation in Alternatives 2 and 3. No work is required on SMC lands and therefore there will be no costs associated with property acquisition or easement. There are additional earthworks required on the south and north sides of the waste footprint to prepare for the internal perimeter ditch, perimeter road and the external ditch. The scale, scale house and public drop-off area will need to be relocated with this Alternative, resulting in additional costs. Closure of the site will also be the same as Alternative 3 (i.e., more expensive than with the Do Nothing Alternative but less costly than Alternatives 2 and 5) because of its moderately-sized footprint. Overall, this Alternative has the second lowest capital cost.
- Alternative 5: This Alternative has the second largest new footprint, meaning that the new LCS, perimeter roads, perimeter ditching and new SWM basins will be larger than in Alternatives 3 and 3A but smaller than in Alternative 2. This Alternative requires an entirely new, separate LCS, rather than just expansion of the existing system, as is required with the other Alternatives. The LCS will need a more robust design than other Alternatives. 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 above the CKD pile. Stability issues may further increase capital costs. This Alternative does not require any alterations to the watercourse or acquisition or easement on SMC lands. However, a bridge over the watercourse will be required. The scale, scale house and public drop-off area will need to be relocated with this Alternative, resulting in additional costs. Closure of the site will also be relatively expensive because of its large footprint. Overall, this Alternative has the highest capital cost.

Indicator 2: Operational and Maintenance Costs:

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 Town currently spends approximately $425,000 annually on operation and maintenance of the landfill.

Following closure 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 LCS.
- 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.

For most operational items during the site's lifespan or following closure, there is essentially no difference between the Alternatives. For example, staffing and equipment requirements are expected to be the same between Alternatives as the same amount of waste will require disposal each year regardless of the Alternative 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 such as:

- Quantity of leachate requiring disposal: a smaller waste footprint generates less leachate than a larger footprint.
- Maintenance requirements: the length of ditches and the LCS 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.

Based on the information above, the following **is expected with respect to operational and maintenance costs:**

- Do Nothing: This Alternative is expected to have the lowest operational cost as its footprint is smallest and its remaining operational period is very short.
- Alternative 2: This Alternative has the largest 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 other Alternatives. This Alternative is expected to have the highest operational and maintenance cost.
- Alternative 3 and 3A: These Alternatives have a moderately sized new footprint and a moderate amount of new LCS and stormwater facilities to maintain. A moderate quantity of leachate will be generated, and therefore, needed to be treated. Both Alternatives will have similar, moderate operational and maintenance costs.
- Alternative 5: This Alternative has the second largest footprint. Compared to Alternatives 3 and 3A, there is more leachate requiring disposal. Maintenance associated with the leachate and stormwater systems will be higher than for Alternatives 3 and 3A as well. Alternative 5 is expected to have slightly lower operational costs than Alternative 2.

There is no mitigation or net effects associated with the costs of the landfill. Costs are summarized in Table 7-18.

Table 7-18 Summary of Financial Factors

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Capital Costs **Present Value Cost**	Lowest cost as no construction is required. Not estimated	Second highest cost due to large footprint and watercourse relocation. $7,662,000	Third lowest cost due to small footprint and watercourse relocation. $7,958,000	Second lowest cost due to small footprint and short watercourse realignment. $6,989,000	Highest cost due to large footprint, separate, new LCS and additional measures to separate waste from CKD. $8,426,000
Indicator 2: Operational and Maintenance Costs **Annual Cost**	Lowest cost due to short operating period remaining. Not estimated	Highest cost due to largest footprint. A large amount of leachate will be generated and therefore a large amount of leachate will need to be treated. Infrastructure (LCS, SWM facilities etc.) are larger in size than all other Alternatives and therefore will have the highest costs to maintain. $532,000	Second lowest cost due to moderately sized footprint. A moderate amount of leachate will be generated and therefore a moderate amount of leachate will need to be treated. Infrastructure (LCS, SWM facilities etc.) are moderate in length and therefore will have moderate costs to maintain. $525,000	Second lowest cost due to moderately sized footprint. A moderate amount of leachate will be generated and therefore a moderate amount of leachate will need to be treated. Infrastructure (LCS, SWM facilities etc.) are moderate in length and therefore will have moderate costs to maintain. $522,000	Second highest cost due to large footprint. A large amount of leachate will be generated and therefore a large amount of leachate will need to be treated. Infrastructure (LCS, SWM facilities etc.) is larger in size than Alternatives 3 and 3A but small er than Alternative 2 and, therefore, will have a high cost to maintain. $535,000
Additional Mitigation	No Additional Mitigation.				
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	Lowest capital and operational cost.	Second highest capital cost and highest operational cost.	Third lowest capital cost and second lowest operational cost.	Second lowest capital cost and second lowest operational cost.	Highest capital cost and second highest operational cost.
Evaluation	**Most Preferred**	**3rd Most Preferred**	**3rd Most Preferred**	**2nd Most Preferred**	**4th Most Preferred**

Note 1 – Cost estimates provided in Appendix D, Section 3.8

7.11.2 Social Impacts

Current Conditions and Indicators of Effect

There are no sensitive land uses in the On-Site Study Area. Sixteen residences are located on the east side of Water St. S., immediately adjacent to the landfill. Nuisance effects associated with landfill operations have the potential to affect these neighbours. Nuisance effects generally refer to noise, odour, visual impact, litter, dust and vermin, among other factors which can affect the quality of life and the ability to enjoy one's property.

As such, to assess any potential changes from current conditions as a result of the landfill expansion, each Alternative was reviewed using the following indicator:

- Indicator 1: Potential impacts to enjoyment of life and private property associated with the residences along Water St. S.

Effects

Indicator 1: Potential impacts to enjoyment of life and private property associated with the residences along Water St. S:

With the Do Nothing Alternative, the landfill will close in September 2022 when its current ECA expires. Nuisance effects associated with noise, odour, litter, dust and other related effects would decrease upon landfill closure.

With Alternatives 2, 3, 3A and 5 landfilling will continue. The landfill is expected to continue to operate and accept the same volume of waste as it currently does. Therefore, a small number of odour, noise, and dust issues may infrequently affect neighbouring residents within acceptable provincially-set limits and similar to existing conditions.

Changes to air quality, odour and noise were described in Sections 7.4.1, 7.4.2 and 7.4.3, respectively. All predicted changes to air quality, odour and noise are within provincial limits.

With regard to air quality, the effects of all Alternatives are expected to be within provincial limits. The Do Nothing Alternative is slightly preferred as there will be no construction-related air emissions and emissions from landfill operations will cease in the short term and emissions will be reduced relative to current conditions. All other Alternatives are considered to have equal minor net effects, meeting all provincial limits

With regard to odour, effects are also expected to be minimal for all Alternatives. Do Nothing is preferred as the landfill will close in the near future and odour will be

significantly reduced. Differences between the remaining Alternatives are minor. However, Alternatives 3 and 3A are predicted to be slightly preferred over other Alternatives as thirteen receptors may experience minor odour effects over seventeen receptors in Alternative 2 and fifteen receptors in Alternative 5.

With regard to noise, the net effects of all Alternatives are expected to be within provincial limits. The Do Nothing Alternative is slightly preferred as there will be no construction noise and noise from landfill operations will cease in the short term. All other Alternatives are considered to have equal minor net effects, meeting all provincial limits.

With all Alternatives, the spread of blowing litter and presence of vermin can also affect the ability of local residents to enjoy a high quality of life and enjoy their property. Effects associated with litter and vermin are currently very minor. Few complaints of nuisance effects have been received by neighbours in recent years. As operations are intended to continue in a similar manner and therefore the frequency or severity of these types of effects is not expected to change over current conditions.

The current visual barrier, comprised of a thick treeline, will be maintained along the western and southern property boundaries for all Alternatives, with the exception of Alternative 3A. With this Alternative, landfill infrastructure, including perimeter roads and fencing, must be placed closer to the southern property boundary than they currently are. The line of trees on the southern boundary will therefore need to be removed. The effect of this removal on the landscape is very minimal as these trees only provide a visual block from the agricultural field to the south. They are not integral to blocking the view from Water St. S. It is noted that overall, the trees are on the slope of the former quarry and therefore provide a relatively low and minimally effective visual blockage.

Additional Mitigation

A new treeline will be planted along the southern property boundary for Alternative 3A.

Odour will be re-modeled during detailed design for Alternatives 2, 3, 3A and 5. Any additional mitigation identified at that stage will be implemented.

Remaining nuisance effects can be addressed with the standard operating procedures listed in Table 7-2.

Net Effects

Net effects are expected to be minimal for all Alternatives. Do Nothing is preferred as the landfill will close in the near future and odour, noise, blowing litter and other nuisance effects will be reduced.

From an odour perspective, Alternatives 3 and 3A are predicted to be slightly preferred over other Alternatives as thirteen receptors may experience minor odour effects over seventeen receptors in Alternative 2 and fifteen receptors in Alternative 5.

There will also be a very minor net effect from Alternative 3A as a result of the need to remove the existing trees along the southern property line. The net effect is minor as the current row of trees does not provide a significant visual block from most vantage points. The view from the agricultural field to the south may be slightly affected. New trees will be planted; however, a net effect will be experienced over a short time period until the new treeline matures.

Table 7-19: Potential Effects to Social Conditions

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment [62]	Alternative 5: Vertical Expansion plus a New Footprint
Indicator 1: Potential impacts to enjoyment of life and private property associated with the residences along Water St. S.	Air quality, odour noise, litter, vermin and visual effects will be minor and will improve over time when the landfill closes.	Air quality, odour, noise, litter, vermin and visual effects will be minor and not significantly changed from current conditions. Odour may be experienced infrequently at a higher number of receptors than under current conditions.	Air quality, noise, litter, vermin and visual effects will be minor and not significantly changed from current conditions. Odour may be experienced infrequently at a slightly higher number of receptors than under current conditions.	Air quality, noise, litter and vermin-related effects will be minor and not significantly changed from current conditions. Odour may be experienced infrequently at a slightly higher number of receptors than under current conditions. Very minor changes to the view from the south are expected as the existing line of trees along the southern boundary is removed (These trees are currently in a low-lying area and don't provide a significant visual block).	Air quality, noise, litter, vermin and visual effects will be minor and not significantly changed from current conditions. Odour may be experienced infrequently at a higher number of receptors than under current conditions.
Additional Mitigation	No mitigation required.	Odour will be re-modeled during detailed design. Any additional mitigation identified at that stage will be implemented.	Odour will be re-modeled during detailed design. Any additional mitigation identified at that stage will be implemented.	Odour will be re-modeled during detailed design. Any additional mitigation identified at that stage will be implemented. A new treeline and visual buffer will be planted along the southern property boundary.	Odour will be re-modeled during detailed design. Any additional mitigation identified at that stage will be implemented.

[62] Effects were not modelled for this Alternative but can be assumed to be similar to Alternative 3 as they both have approximately the same footprint.

Evaluation Factors	Do Nothing Alternative	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment [62]	Alternative 5: Vertical Expansion plus a New Footprint
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	Netimprovement when landfill closes. **M**: Minor – Effect is expected to be low and in-line with existing conditions. **F**: Infrequent – Odour effects are expected very infrequently. **D**: Short-Term – Odour effects will be experienced only in the short-term and will be reduced when the landfill closes in September 2022. **R**: Reversible – Odour effects are reversible once the landfill has closed.	Moderate net effects anticipated: **M**: Moderate – Effect is expected to be low and only slightly higher than existing conditions. A slightly larger number of receptors will be affected over all other Alternatives. **F**: Infrequent – Odour effects are expected very 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.	Minor net effects anticipated: **M**: Minor – Effect is expected to be low and only slightly higher than existing conditions. **F**: Infrequent – Odour effects are expected infrequently but potentially more often than other Alternatives at two receptors. **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.	Minor-Moderate net effects anticipated: **M**: Minor – Effect is expected to be low and only slightly higher than existing conditions. Visual effect is negligible as only the view from the south will be affected and the current treeline is topographically low-lying. **F**: Infrequent – Odour effects are expected infrequently but potentially more often than other Alternatives at two receptors. Existing visual break will be removed once. **D**: Long-Term – Odour effects will be experienced over the life of the landfill. The visual impact will be experienced short-term until the new trees have matured. **R**: Reversible – Odour effects are reversible once the landfill has closed. Changes to the view are reversible with a newly planted visual break.	Minor-Moderate net effects anticipated: **M**: Minor-Moderate – Effect is expected to be low and only slightly higher than existing conditions. More receptors will be affected than Alternatives 3 and 3A but fewer than Alternative 2. **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	**Most Preferred**	**4th Most Preferred**	**2nd Most Preferred**	**3rd Most Preferred**	**3rd Most Preferred**

7.12 Impacts to Indigenous Communities

7.12.1 Cultural and Environmental Features

Current Conditions and Indicators of Effect

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. However, this list may not be exhaustive.'

Under current conditions, lands within the On-Site Study Area which may have historically been used by Indigenous communities have been subject to aggregate extraction and landfilling for nearly a century, removing any potential for traditional use. Regardless of the Alternative selected, including the Do Nothing Alternative, there will be no opportunity to return lands to a condition under which they could be used for traditional uses in the short-term.

The Thames River is located west of the landfill within the Study Area Vicinity. The river was historically significant and continues to be an important for hunting, fishing, gathering of traditional and medicinal plants and source of drinking water for several Indigenous communities. Several Indigenous communities identified potential effects to the Thames River as a concern.

To assess any potential changes from current conditions as a result of the landfill expansion, each Alternative was reviewed to determine if it would result in any effects to the Thames River.

Effects

There is potential for the Thames River to be affected, as described in Section 7.6.1 (Surface Water) and 7.7.2 (Aquatic Ecology).

In summary, surface water from the site eventually drains to the Thames River. Existing landfill operations show no measurable impact on water quality exiting the landfill property, and therefore no impact on water quality in the Thames River. With the Do Nothing Alternative, the risk to the Thames River will not be changed over existing conditions.

The risk of contamination is higher in Alternatives 2, 3 and 5 than in Alternative 3A. This is because there is a higher chance of interactions with the CKD material as a result of the watercourse relocation in Alternatives 2 and 3 and a higher chance of CKD material interactions as a result of the landfilling above the CKD pile in Alternative 5.

With Alternative 3A, the watercourse realignment is minor and farther from the CKD pile compared to Alternatives 2 and 3.

In addition, there are aquatic species at risk in the Thames River. The Thames River will not be directly affected; however, contaminants or sediments from the watercourse could move downstream and impact the Thames River and the aquatics species inhabiting it.

Additional Mitigation

No additional mitigation is required for the Do Nothing Alternative.

With Alternatives 2 and 3, the watercourse will be relocated close to the CKD pile. Measures to separate the watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 3A, interactions between CKD and the watercourse are not expected. However, if annual monitoring indicates there are effects to water quality from CKD, measures to separate the watercourse from the CKD will be required. This may include a barrier and interceptor pipe to trap CKD and direct it to the LCS, similar to the pipe in the meltwater deposit below the existing landfill.

With Alternative 5, the design of the LCS will need to be more robust than with other Alternatives to limit the potential for mixing of landfill and CKD leachates and avoid creating CKD leachate seeps.

For all Alternatives, an Annual Monitoring Program and Adaptive Management Plan will be used to identify if unanticipated effects are occurring and to proposed measures to

resolve the unanticipated effects. Adaptive Management Plans and their triggers are described in Section 11.3.

Net Effects

With the Do Nothing Alternative, no net effects are expected. Alternative 3A represents a low to moderate risk of effects to surface water and Alternatives 2, 3 and 5 are high risk due to their potential interactions with the CKD pile. All other potential effects can be adequately mitigated.

A summary of net effects is provided in Table 7-20.

Table 7-20: Cultural and Environmental Features

Evaluation Factors	Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Impacts to culturally or environmentally significant features	Existing landfill operations show no measurable impact on water quality exiting the landfill property, and therefore no impact on water quality in the Thames River or aquatic habitats within it.	Surface water from the site eventually drains to the Thames River. This option represents a high risk to on-site surface water features relative to the other Alternatives and therefore a high risk to the Thames River and aquatic habitats within it.	Surface water from the site eventually drains to the Thames River. This option represents a high risk to on-site surface water features relative to the other Alternatives and therefore a high risk to the Thames River and aquatic habitats within it.	Surface water from the site eventually drains to the Thames River. This option represents a low to moderate risk to on-site surface water features relative to the other Alternatives and therefore a low to moderate risk to the Thames River and aquatic habitats within it.	Surface water from the site eventually drains to the Thames River. This option represents a high risk to on-site surface water features relative to the other Alternatives and therefore a high risk to the Thames River and aquatic habitats within it.
Additional Mitigation	None required.	Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	Measures to separate the relocated watercourse from the CKD will be required. This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	**As a contingency only, if effects from CKD are observed in the realigned watercourse through the Annual Monitoring Program, measures to separate the watercourse from the CKD will be required.** This may include a barrier and collector pipe to trap CKD leachate and direct it to the LCS.	The LCS in expansion area must be specifically designed to prevent CKD pile leachate from mixing with the waste leachate.

Evaluation Factors	Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Net Effects M= Magnitude D= Duration F= Frequency R= Reversibility	No net effects anticipated.	High risk of net effect anticipated: **M:** High risk of effect due to potential watercourse/CKD pile interactions. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	High risk of net effect anticipated: **M:** High risk of effect due to potential watercourse/CKD pile interactions. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	Low risk of net effect anticipated: **M:** Low risk of effect with mitigation and monitoring **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.	High risk of net effect anticipated: **M:** High risk of effect due to waste height and potential seepage from CKD pile. **D:** Surface water effects would gradually change during construction/operation and decline through the contaminating lifespan. **F:** Risk of surface water impact is continuous over life of landfill. **R:** Effects to surface water are reversible in the long-term as leachate strength and quantity diminish when the landfill closes or when any leakages are resolved.
Evaluation	**Most Preferred**	**Least Preferred**	**Least Preferred**	**2nd Most Preferred**	**Least Preferred**

7.13 Summary of Net Effects

The evaluation of net effects for all environmental components are summarized in Table 7-21. In summary:

- Doing Nothing does not address the Town's waste management needs and obligations and is not a feasible solution to the Problem Statement.
- Alternative 3A is Most Preferred or 2nd Most Preferred for the greatest number of criteria.
- Alternative 3 is 2nd Most Preferred. It is similar to Alternative 3A but has additional effects associated with the watercourse relocation. In particular, the water quality in the watercourse may be affected by its proximity to the CKD pile.
- Alternative 5 is 3rd Most Preferred. Although the watercourse will remain as is, the entirely new footprint is costly and requires a significant amount of new infrastructure. Risks to ground and surface water quality are high due to potential interactions with the CKD pile.
- Alternative 2 is 4th Most Preferred as it has the largest footprint and therefore the greatest quantity of new infrastructure and highest cost. It has effects associated with the watercourse relocation. In particular, the water quality in the watercourse may be affected by its proximity to the CKD pile.

Table 7-21: Summary of Net Effects

Criteria	Do Nothing	Alternative 2: Horizontal Expansion of the Existing Landfill	Alternative 3: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Location	Alternative 3A: A Combination of Vertical and Horizontal Expansion with Watercourse Re-Alignment	Alternative 5: Vertical Expansion plus a New Footprint
Natural Environment					
Air Quality	Most Preferred	2nd Most Preferred	2nd Most Preferred	2nd Most Preferred	2nd Most Preferred
Odour	Most Preferred	4th Most Preferred	2nd Most Preferred	2nd Most Preferred	3rd Most Preferred
Noise	Most Preferred	2nd Most Preferred	2nd Most Preferred	2nd Most Preferred	2nd Most Preferred
Groundwater	Most Preferred	3rd Most Preferred	3rd Most Preferred	2nd Most Preferred	Least Preferred
Surface Water Quality	Most Preferred	Least Preferred	Least Preferred	2nd Most Preferred	Least Preferred
Surface Water Quantity	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Terrestrial Ecology	Most Preferred	2nd Most preferred	2nd Most preferred	Most Preferred	2nd Most preferred
Aquatic Ecology	Most Preferred	Least Preferred	Least Preferred	2nd Most Preferred	Least Preferred
Cultural Environment					
Built Heritage Resources and Cultural Heritage Landscapes	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Archaeological Resources	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Impacts to Traffic					
Traffic	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Impacts to Land Use					
Sensitive Land Uses	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Aggregate Resources	Most Preferred	2nd Most Preferred	2nd Most Preferred	Most Preferred	Most Preferred
Impacts to Socio-economic Conditions					
Financial Factors	Most Preferred	3rd Most Preferred	3rd Most Preferred	2nd Most Preferred	4th Most Preferred
Social Impacts	Most Preferred	4th Most Preferred	2nd Most Preferred	3rd Most Preferred	3rd Most Preferred
Impacts to Indigenous Communities					
Cultural and Environmental Features	Most Preferred	Least Preferred	Least Preferred	2nd Most Preferred	Least Preferred
Overall Preference	**Does not address Problem Statement**	**4th Most Preferred**	**2nd Most Preferred**	**Most Preferred**	**3rd Most Preferred**

7.14 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 7-22.

Table 7-22: 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. Effects and mitigation are addressed in Section 7.5 and Section 9.0.
Concerned with site Odours	Neighbouring residents identified intermittent issues with landfill odour effects 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 effects.	Mitigation measures were provided to minimize odour, including the use of Best Management Practices and daily cover. Odour will be re-evaluated and modelled based on detailed design plans during preparation of the ECA application as noted in Section 11.1.
Concerned with Traffic Speeds on	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).	A Traffic Impact Study was completed. As a result of modeling, it was determined that current and future

Comment	Study Team Response	Where Addressed in EA
County Road 123.	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.	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 Water St. S. or the landfill entrance due to present or future conditions.

7.15 Preferred Undertaking

Based on the evaluation presented in Table 7-21 and review of input from the public, it was determined that Alternative 3A, expanding the St. Marys Landfill both vertically and horizontally with a watercourse realignment, is preferred.