December 2022 / Rev February 2023

Volume 1

Environmental Assessment of the Township of North Dundas Waste Management Plan

GOLDER
MEMBER OF WSP

TOWNSHIP OF
North Dundas

13.0 Impact Assessment of The Preferred Undertaking

13.1 Atmosphere

13.1.1 Air Quality

The effects of the proposed landfill expansion on air quality were identified through comparing the existing landfill and the proposed expansion, using the following three steps:

- Calculating representative emissions rates for each of the significant sources (detailed in Volume 2 Appendix B-2). The results are summarized in Sections 13.1.1.2 ad 13.1.1.3.
- Carrying out atmospheric dispersion modelling to predict off-Site concentrations of the indicator compounds (detailed in Volume 2 Appendix B-3). The results of the modelling are provided in Section 13.1.1.4.
- Comparison of predicted concentrations to existing conditions and the Applicable Guidelines (Section 9.1.1.5).

13.1.1.1 Emission Estimation

The method used for calculating and quantifying air emissions resulting from the existing and proposed landfill involved the following steps:

- **Identifying emissions sources:** Emission sources were identified based on information provided by the Township of North Dundas.
- **Calculating emission rates:** Air emission rates were calculated using MECP typically accepted methods, such as published emission factors, and were based on design activity data provided by the engineering team. Emission rates were conservatively calculated to estimate the release rates into the atmosphere.

The emission estimation methods followed accepted MECP practices including, where applicable, guidance in the Ontario MECP document *Procedure for Preparing an Emission Summary and Dispersion Modelling Report Version 4.1* (MECP, 2018b).

In calculating these emissions, all potential sources of emission at the proposed landfill expansion were considered; however, only sources with emissions rates that are expected to be either negligible or infrequent were not considered (e.g., household hazardous waste drop off). Details of the specific emissions calculation methods and resulting emissions are provided in Volume 2 Appendix B-2.

13.1.1.2 Identification of Emission Sources

Table 13-1 outlines the activities (i.e., sources of emissions) that have been assessed as part of the air quality assessment for both the existing landfill and the proposed landfill expansion. For sources that were identified and not included in the assessment, the rationale has also been presented.

The on-site sources of air emissions for the existing and the proposed landfill expansion include the following:

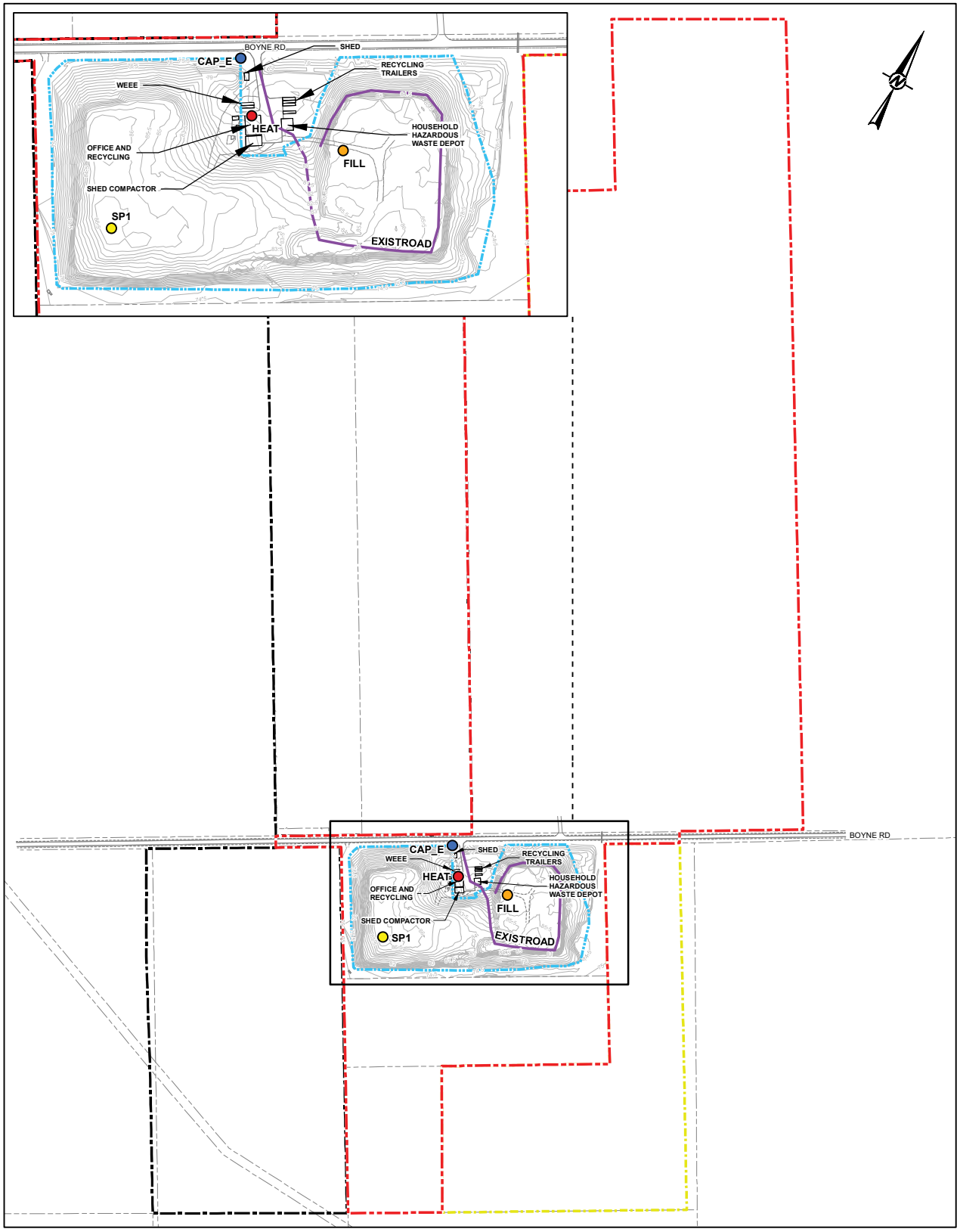
- Landfill gas generated from waste decomposition
- Traffic, loading and unloading
- On-site vehicle emissions
- Landfill waste receipt activities
- Landfill daily and final cover activities

Emissions during existing operations and after expansion are expected to be greater than during the post-operation phase (i.e., closure) because the level of on-site activities will be greater during the operational phase; therefore, the air emissions and associated effects during the operational phase represent the greatest potential impacts. The locations of the relevant sources under the existing and expansion scenarios are illustrated on Figures 13-1 and 13-2, respectively.

For LFG emissions, LFG generation from the Boyne Road landfill was estimated using LandGEM v.3.03 (US EPA, 2020). The LandGEM modelling software was developed by the United States Environmental Protection Agency. The predicted maximum LFG generation rate estimation for the expanded landfill was 136 standard cubic feet per minute (scfm) or 231.2 m^3/hr. This maximum generation is predicted to occur in 2049, one year after the planned closure date of the landfill. Predicted LFG generation declines each year after 2049 and by the year 2080 the predicted LFG generation rate falls to 39.4 scfm (67.0 m^3/hr). A summary of the LandGEM modelling inputs and predicted annual LFG generation rates are presented in Volume 2 Appendix B-4.

Table 13-1: Boyne Road Landfill Emission Sources

General Location	Source	Significant (Yes or No)?	Modelled (Yes or No)?	Rationale
Landfill Cap	Landfill gas emissions released passively through the landfill cap	Yes	Yes	—
Landfill Working Area	Fugitive dust and vehicle exhaust emissions from material handling activities at the working face	Yes	Yes	—
Paved and unpaved roads	Vehicle exhaust and fugitive road dust from travel on on-site roads	Yes	Yes	—
Storage piles	Wind erosion from on-site storage piles	Yes	Yes	—
Administration Building	Combustion emissions from comfort heating equipment at the administration buildings	Yes	Yes	—



LEGEND

EMISSION SOURCES

- COMFORT HEATING
- EXISTING LANDFILL CAP
- LANDFILL OPERATIONS
- STORAGE PILES
- EXISTING ROAD
- EXISTING LANDFILL FILL AREA
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- TOWNSHIP OWNED PROPERTY
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED FROM 2008 TO 2020

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

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CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
SITE LAYOUT AND EMISSION SOURCE LOCATION: EXISTING

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	13-1

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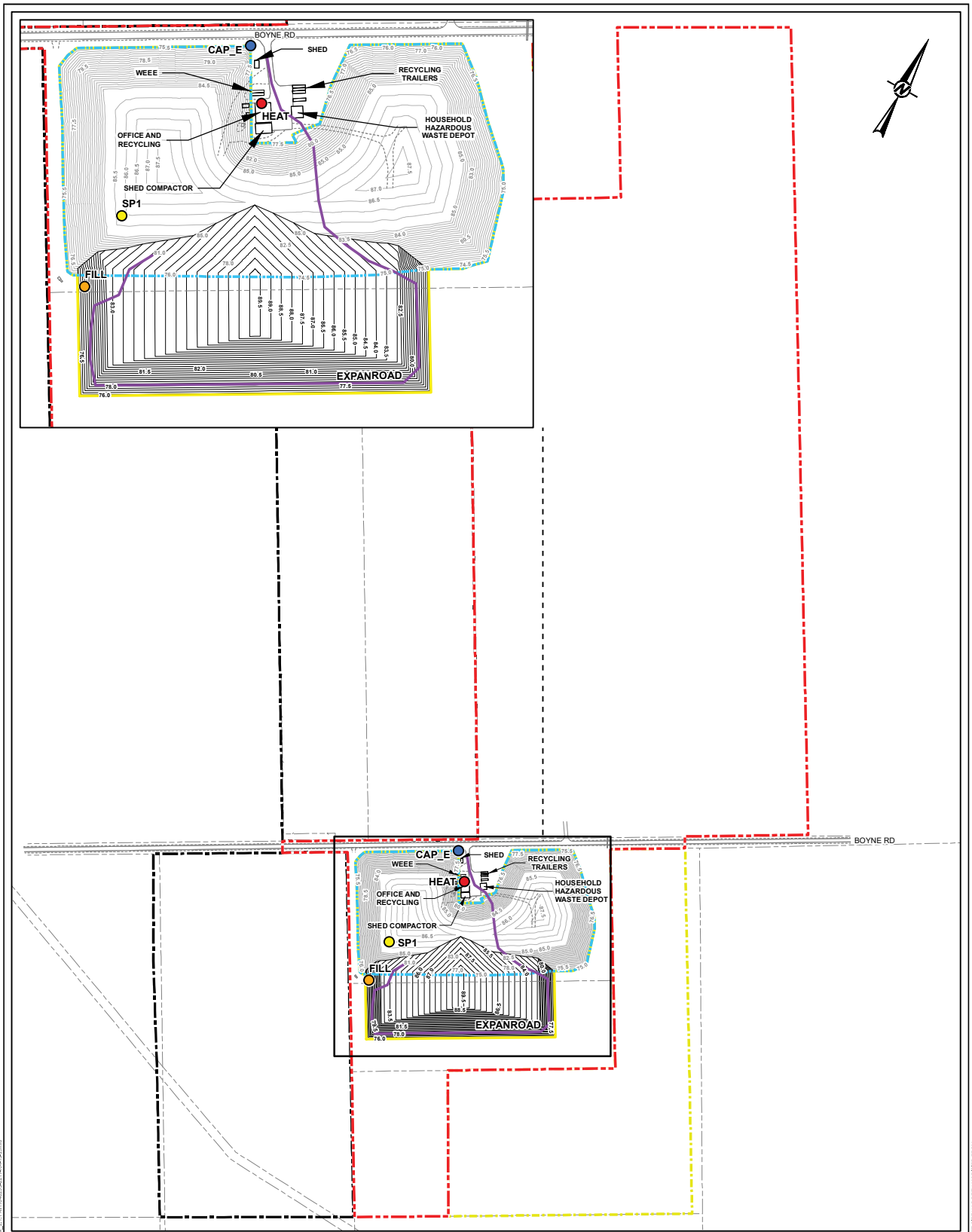

LEGEND

EMISSION SOURCES

- COMFORT HEATING
- EXISTING LANDFILL CAP
- LANDFILL OPERATIONS
- STORAGE PILES
- EXPANSION ROAD

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY

- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED FROM 2008 TO 2020
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-05-27
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
SITE LAYOUT AND EMISSION SOURCE LOCATION: EXPANSION

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**13-2**

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13.1.1.3 Emission Summary

Table 13-2 below summarizes the estimated emission rates for each indicator compound from the existing operations as identified in the previous sections, and the estimated emission rates for the expansion of the Landfill. Further details and the breakdown of emissions by source are provided in Volume 2 Appendix B-2.

Table 13-2: Summary of Emissions from Existing and Expansion Landfill Operations

Compound	Units	Existing Landfill Emission Rate	Proposed Landfill Expansion Emission Rate
SPM	g/s	2.832	6.472
PM_{10}	g/s	0.744	1.727
$PM_{2.5}$	g/s	0.113	0.212
NO_X	g/s	0.191	0.209
SO_2	g/s	0.0001	0.0001
CO	g/s	0.197	0.228
H_2S	g/s	0.002	0.003
C_2H_3Cl	g/s	0.001	0.001
Odour	OU/s	663.658	821.802

13.1.1.4 Dispersion Modelling

Atmospheric dispersion models were used to predict ground-level concentrations of indicator compounds. The models incorporate the emission rates for each scenario and local atmospheric conditions and terrain.

The AERMOD-PRIME (AERMOD) dispersion model (Version 19191) was used to predict ground-level concentrations for the indicator compounds. The AERMOD modelling system was developed by the United States Environmental Protection Agency (U.S. EPA) and has been adopted in Ontario as the regulatory model recommended by the MECP.

The AERMOD system consists of the dispersion model itself and two pre-processors; the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following approved dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v.19191)
- AERMAP surface pre-processor (v.18081)

AERMET was not required since MECP provided a 5-year site-specific pre-processed meteorological dataset (2013-2017).

Results were predicted at the sensitive receptors, identified on Figure 9-1.

Additional details regarding the dispersion modelling inputs and source characterization are provided in Volume 2 Appendix B-3.

13.1.1.5 Effects Prediction

To determine potential effects of the proposed landfill expansion on air quality and odour, the predicted concentrations of indicator compounds were compared to the applicable guidelines identified in Section 9.1.1.5.

Background air quality conditions (i.e., the concentrations without any landfill activities) are also presented in Table 13-3, which are added to the predicted concentrations from the existing landfill to provide the cumulative concentration for each indicator compound.

Maximum predicted concentrations for the existing and expansion scenarios at the sensitive receptors are presented in Table 13-3 and Table 13-4. The location at which the maximum concentration occurs is also identified.

The maximum cumulative concentrations of all indicator compounds are below the relevant guidelines for all indicator compounds. As such, the predicted compound concentrations associated with the expansion are predicted to meet the relevant air quality criteria.

All predicted maximum concentrations for all compounds occurred at the closest residence west of the Boyne Road Landfill along Boyne Road, identified by a star icon on Figure 9-1.

Table 13-3: Maximum Predicted Concentrations at the Sensitive Receptors for the Existing Landfill

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Background Conditions[(1)] (µg/m³)	Maximum Predicted Concentration – Existing Landfill (µg/m³)	Cumulative Effect - Existing Landfill (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	38.58	43.92	82.50	68.7%
	Annual	60	21.50	1.29	22.79	38.0%
PM_{10}	24-hour	50	21.44	11.86	33.30	66.6%
$PM_{2.5}$	24-hour	27	11.58	1.90	13.48	49.9%
	Annual	8.8	6.45	0.05	6.50	73.9%
NO_2	1-hour	400/ 79	9.40	37.18	46.58	11.6/59%
	24-hour	200	8.91	3.31	12.22	6.1%
	Annual	32	4.93	0.09	5.02	22.3%
SO_2	10-min	180	4.32	0.03	4.35	2.4%
	1-hour	100	2.62	0.02	2.64	2.6%
	24-hour	150	3.06	0.002	3.06	2.0%
	Annual	10	1.12	0.0001	1.12	11.2%
CO	1-hour	15,000	343.57	38.13	381.70	2.5%
	8-hour	6,000	343.57	9.44	353.01	5.9%
H_2S	10-min	13	0.84	0.77	1.61	12.4%
	24-hour	7	0.21	0.14	0.350	5.0%
C_2H_3Cl	24-hour	1	0.0038	0.05	0.056	5.6%
	Annual	0.2	0.0015	0.003	0.00	2.2%
Odour[(2)]	10-min	1	—	0.216	0.22	Below 1 OU/m^3

Notes:

[(1)] Background conditions as described in Section 9.1.1.6.

[(2)] Values for odour are in OU/m^3 and presented at the 99.5 percentile.

"—" indicates that there is no data available for existing conditions.

Table 13-4: Maximum Predicted Concentrations at the Sensitive Receptors for Proposed Expansion Landfill

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Background Conditions[(1)] (µg/m³)	Maximum Predicted Concentration - Proposed Landfill Expansion (µg/m³)[(3)]	Cumulative Effect - Proposed Landfill Expansion (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	38.58	78.66	117.24	97.7%
	Annual	60	21.50	3.16	24.66	41.1%
PM_{10}	24-hour	50	21.44	21.03	42.47	84.9%
$PM_{2.5}$	24-hour	27	11.58	2.76	14.34	53.1%
	Annual	8.8	6.45	0.11	6.56	74.6%
NO_2	1-hour	400/ 79	9.40	41.79	51.19	12.8%/64.8%
	24-hour	200	8.91	3.54	12.45	6.2%
	Annual	32	4.93	0.12	5.05	22.4%
SO_2	10-min	180	4.32	0.04	4.36	2.4%
	1-hour	100	2.62	0.02	2.64	2.6%
	24-hour	150	3.06	0.002	3.06	2.0%
	Annual	10	1.12	0.0001	1.12	11.2%
CO	1-hour	15,000	343.57	43.48	387.05	2.6%
	8-hour	6,000	343.57	10.87	354.44	5.9%
H_2S	10-min	13	0.84	0.77	1.61	12.4%
	24-hour	7	0.21	0.18	0.39	5.6%
C_2H_3Cl	24-hour	1	0.0038	0.067	0.07	7.1%
	Annual	0.2	0.0015	0.004	0.01	2.6%
Odour[(2)]	10-min	1	—	0.20	0.20	Below 1 OU/m^3

Notes:

[(1)] Background conditions as described in Section 9.1.1.6.

[(2)] Values for odour are in OU/m^3 and presented at the 99.5 percentile.

"—" indicates that there is no data available for existing conditions.

13.1.1.6 Compliance with Ontario Regulation 419/05

In addition to the assessment of the effects of the proposed landfill expansion on ambient air quality and odour, consideration was given to an evaluation of compliance by determining whether an ECA for air and noise under Section 9 of the *Environmental Protection Act* (Ontario, 1990d) could be obtained based on whether the facility is in compliance for those sources regulated under *O. Reg.* 419/05. At the landfill, this would include landfill gases and materials handling emissions only. All mobile equipment is exempt from compliance requirements under *O. Reg.* 419/05. In addition, assessment of compliance with

O. Reg. 419/05 would not include any consideration of the background air quality. Table 13-5 below summarizes the estimated emission rates for each indicator compound from the proposed landfill expansion operations as identified in the previous sections suitable for assessment against *O. Reg.* 419/05. More details and the emissions per source are provided in Volume 2 Appendix B-2.

A modelling grid that satisfies s. 14 *O. Reg.* 419/05 assessment was used in modelling the indicator compounds. Emissions from vehicle tailpipes, bulldozing and road dust were not considered in *O. Reg*. 419/05 assessment as they can be excluded from modelling as per *O. Reg.* 524/98 and the Emissions Summary Dispersion Modelling Procedure Document.

Table 13-5: Summary of O. Reg. 419/05 Emission Rates

Compound	Units	Emission Rates from *O. Reg.* 419/05 Sources
SPM	g/s	0.400
NO_X	g/s	0.001
CO	g/s	0.010
H_2S	g/s	0.003
C_2H_3Cl	g/s	0.001
Odour	OU/s	821.802

Maximum concentrations at the property boundary and the gridded receptors as per section 14 of *O. Reg.* 419/05 are presented in Table 13-6 and were predicted with the AERMOD dispersion model (as described in Section 13.1.1.4).

Table 13-6: Predicted Air Quality Compliance with O. Reg. 419/05

Indicator	Averaging Period	Air Quality Criteria (µg/m³)	Maximum Predicted Point of Effect Concentration (µg/m³)	Percentage of Air Quality Criteria (%)
SPM	24-hour	120	57.11	47.6%
NO_X	1-hour	400	4.03	1.0%
NO_X	24-hour	200	1.42	<1%
CO	½-hour	6000	2.36	<1%
H_2S	10-min	13	1.02	7.8%
H_2S	24-hour	7	0.28	4.0%
C_2H_3Cl	24-hour	1	0.10	10.3%
Odour (1)	10-min	1	0.22	Below 1 OU/m^3

Notes: (1) Values for odour are in OU/m^3 and presented at the 99.5 percentile.

The assessment indicates that the proposed landfill expansion is expected to operate in compliance with Schedule 3 of *O. Reg.* 419/05.

13.1.1.7 Air Mitigation Measures

In determining the air emissions associated with the proposed landfill expansion works and activities, consideration was given to those mitigation measures that were considered to be integrated into the design and implementation of the works and activities. These mitigation measures, which are considered to be typical and consistent with best practices, were incorporated into the emission estimates presented in Section 13.1.1.3, and therefore were incorporated in the effects predictions presented in Section 13.1.1.5. The in-design mitigation measures that were included in the air quality and odour assessment are summarized in Table 13-7.

Table 13-7: Summary of In-Design Mitigation Incorporated into the Air Quality and Odour Assessment

Mitigation Measure	Mitigation Specifics	Works and Activities Affected	Compound Affected by Mitigation Measure	Landfill Phase where Mitigation is being Considered
On-site road ways Vehicle Speed	Restrict vehicle speed to 40 km per hour or less.	• Vehicle movements	• SPM • PM_{10} • $PM_{2.5}$	• Construction • Operation
Maintenance of on-Site vehicles and equipment	On-Site vehicles and equipment engines will meet Tier 3 emission standards and be maintained in good working order	• On-site Vehicles	• NO_2 • CO • SO_2 • SPM • PM_{10} • $PM_{2.5}$	• Construction • Operation
Minimize idling of vehicles on-Site	Minimize idling of vehicles on-site	• On-site vehicles	• NO_2 • CO • SO_2 • SPM • PM_{10} • $PM_{2.5}$	• Construction • Operation
Minimize working face/daily cover	Site will operate with approx. 200 m^2 maximum working face, daily cover of waste is required	• Landfill	• H_2S • C_2H_3Cl • Odour	• Operation
Capping of Landfill	Landfill will be capped progressively as cells are completed	• Landfill	• H_2S • C_2H_3Cl • Odour	• Operation • Post-closure

13.1.1.8 Consideration of Climate Change

The potential effects of climate change on infrastructure associated with the proposed landfill expansion have been included in this report to qualitatively assess potential climate change effects.

The activities associated with the landfill expansion that will produce GHGs include the following:

- Landfill gas
- On-site transportation fuel combustion emissions
- Stationary combustion emissions from propane used for comfort heating in the buildings
- Land clearing as part of the expansion

The GHG emission estimates, where applicable, have followed quantification guidelines for both provincial and federal reporting:

- Federal reporting under Section 46 of the *Canadian Environmental Protection Act*, (CEPA), SC 1999: Greenhouse Gas Emissions Reporting Program (GHGRP).
- Provincial reporting under Ontario's Greenhouse Gas Emissions: Quantification, Reporting, and Verification Regulation, *O. Reg.* 390/18.

13.1.1.8.1 Boyne Road Landfill Greenhouse Gas Emissions

Table 13-8 presents the sources of emissions from the Boyne Road Landfill, the GHGs emitted, and the corresponding methodology used to estimate emissions.

GHG emissions from on-site transportation and stationary combustion have been estimated using emission factors from Tables 2-2 and 2-6 of Canada's ECCC Document "2020 Canada's Greenhouse Gas Quantification Requirements" dated December 2020 (GHGRP Guidance Document) (ECCC, 2020b). Fuel consumption for the on-Site transportation equipment was estimated using methods in the document titled *Exhaust and Crankcase Emission Factors for Non-road Compression-Ignition Engines in MOVES*' (US EPA, 2018). Stationary combustion emissions from propane used for comfort heating were estimated. There is no prescribed method in the 2020 GHGRP Guidance Document for estimating fugitive methane emitted through the landfill cap and therefore GHG emissions from these sources were estimated using engineering calculations. Fugitive methane that is oxidized in the atmosphere once emitted through the cap has not been taken into consideration for this assessment; however, it is commonly assumed that approximately 10% of the methane from landfill gas oxidizes.

The methods used to estimate GHG emissions from each source are summarized in Table 13-8 below.

Table 13-8: GHG Emissions Sources and Methods

Source Category	Emission Sources	Emissions Methodology	GHG
Stationary Combustion	• Propane	• 2020 GHGRP Guidance Document s.2.A.1 Equation 2-2 • 2020 GHGRP Guidance Document s.2.B Equation 2-13	• Carbon Dioxide (CO_2) • Methane (CH_4) • Nitrous Oxide (N_20)
On-site Transportation	• Diesel • Gasoline	• 2020 GHGRP Guidance Document s.2.A.1 Equation 2-2 • Crankcase Document (Fuel Consumption) • 2020 GHGRP Guidance Document s.2.B Equation 2-13	• CO_2 • CH_4 • N_20
Waste (Landfill Gas)	• Fugitive LFG	• Not prescribed in 2020 GHGRP Guidance Document • Engineering Estimate – Carbon Dioxide/Methane composition of LFG and the amount of LFG lost fugitively	• CO_2 • CH_4
Land Clearing	• Loss of CO_2 storage (sink) • Cleared trees and vegetation	• IPCC 2006 Vol 4, Chapter 4 and 2019 Refinement Document	• CO_2

Table 13-9 and Table 13-10 summarize the estimated annual GHG emission rates in tonnes per year for each activity at the existing landfill and the proposed expanded landfill, respectively.

Table 13-9: Summary of Estimated GHG Annual Emissions from the Existing (2021) Boyne Road Landfill

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr][1]
Landfill Gas	1380	501	0	13,897
Mobile Combustion Emissions (road and non-road vehicles)	1564	0.051	0.132	1605
Comfort Heating	22	0.0004	0.002	23

Notes:
1. CO_2e equals carbon dioxide equivalence, which is the summation of multiplying the emissions of CO_2, CH_4, N_2O by their respective global warming potential of 1, 25, and 298, respectively (IPCC, 2012).

The existing annual emissions were estimated to represent the 2021 year.

Table 13-10: Summary of Estimated GHG Annual Emissions from the Proposed Expansion of the Boyne Road Landfill in Year 2049

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr][1]
Landfill	1831	664	0	18,438
Mobile Combustion Emissions (road and non-road vehicles)	1566	0.055	0.13	1607
Comfort Heating	22	0.0004	0.002	23
Land Clearing[2]	117	—	—	121

Notes:
1. CO_2e equals carbon dioxide equivalence, which is the summation of multiplying the emissions of CO_2, CH_4, N_2O by their respective global warming potential of 1, 25, and 298, respectively (IPCC, 2012).
2. Emissions represent the combination of the loss of CO_2 storage and the one-time land clearing emissions averaged over the life of the proposed landfill expansion (estimated at 25 years).

The peak annual GHG emissions were predicted to occur in 2049.

13.1.1.8.2 Reportable Greenhouse Gas Emissions

The tables below summarize the reportable GHG emissions under the GHGRP and *O. Reg.* 390/18. Table 13-11 and Table 13-12 present the annual GHG emission rates in tonnes per year for each activity at the Boyne Road Landfill for the existing landfill and the proposed expanded landfill, respectively. Carbon dioxide from the combustion of biomass is excluded from GHGRP per Schedule 3 s.2(b) of the Notice with respect to reporting of greenhouse gases for 2019 and it is not included in the Reporting Amount per s.6(2) of *O. Reg.* 390/18. Carbon dioxide from the decomposition of biomass is excluded from GHGRP per Schedule 3 s.2(c) of the Notice with respect to reporting of greenhouse gases for 2019 and from *O. Reg.* 390/18 per ON.191 of the MECP Guideline for QRV of GHG Emissions, Feb 2020.

Table 13-11: Summary of Reportable Annual GHG Emissions from the Existing (2021) Landfill

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr]
Landfill	—[1]	501	0	12,517
Mobile Combustion Emissions (road and non-road vehicles)	1,564	0.051	0.132	1,605
Comfort Heating	22	0.0004	0.002	23

Notes:

[1] CO_2 from decomposition of biomass is excluded from GHGRP per Schedule 3 s.2(c) of the Notice with respect to reporting of greenhouse gases for 2020 and from the MECP per ON.191 of the MECP Guideline for QRV of GHG Emissions, Feb 2020.

The existing annual emissions were estimated to represent the 2021 year.

Table 13-12: Summary of Reportable Annual GHG Emissions from the Proposed Expansion of the Boyne Road Landfill in Year 2049

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr]
Landfill	—[1]	664	0	16,607
Mobile Combustion Emissions (road and non-road vehicles)	1,566	0.055	0.13	1,607
Comfort Heating	22	0.0004	0.002	23

Notes:
[1] CO_2 from decomposition of biomass is excluded from GHGRP per Schedule 3 s.2(c) of the Notice with respect to reporting of greenhouse gases for 2020 and from the MECP per ON.191 of the MECP Guideline for QRV of GHG Emissions, Feb 2020.

The peak annual GHG emissions were predicted to occur in 2049.

13.1.1.8.3 Comparison to Provincial and Canadian Totals

Table 13-13 presents a comparison of the Boyne Road Landfill site's existing and proposed expansion GHG emissions to the provincial and Canadian totals. As indicated, the increase in emissions from the existing landfill to the proposed expansion would have a negligible contribution of less than 0.003% to the Ontario emissions and less than 0.0006% to the Canadian emissions; therefore, the proposed landfill expansion will have a negligible effect on climate change.

Table 13-13: Comparison of GHG Emissions from the Boyne Road Landfill Expansion to Ontario and Canadian Emission Totals

Ontario GHG Emissions (2019)		**163,200**	**163,200**
Canada-wide GHG Emissions (2019)		**730,000**	**730,000**
Source	**Existing Emissions [kt/year CO_2e]**	**Expansion Emissions [kt/year CO_2e]**	**Increase in Emissions [kt/year CO_2e]**
Landfill Expansion GHG Emissions	15.64	20.18	4.54
Comparison to Ontario Total	0.01%	0.01%	0.003%
Comparison to Canada-wide Total	0.002%	0.003%	0.0006%

13.1.1.9 Conclusion

This section evaluated the potential effects of the proposed landfill expansion on air quality and odour. The conclusions of the assessment are highlighted below. Emissions estimates and dispersion modelling were carried out to predict concentrations of the indicator compounds from all emission sources. Anticipated measurable air emissions were identified and evaluated to determine effects. The residual effects were evaluated and it is concluded that they do not result in adverse effects in terms of air quality or odour, as they are all below the relevant guidelines, and do necessitate the inclusion of a landfill gas collection system.

An assessment to demonstrate that the proposed landfill expansion can achieve compliance with *O. Reg.* 419/05 was also completed. Air modelling guidance for the Province of Ontario was followed where appropriate. This assessment demonstrates that the proposed landfill expansion can be expected to operate in compliance with s. 20 of *O. Reg.* 419/05.

13.1.2 Noise

This section presents the noise component impact assessment for the EA Study of the proposed expansion. In particular, this section describes and summarizes a noise assessment that considers the existing conditions and potential effects of the landfill expansion on the outdoor acoustic environment. Specifically, environmental effects relevant to human noise receptors are assessed in accordance with the applicable MECP guidance documents. This work has been conducted in accordance with the requirements set out in the work plan developed with MECP feedback and provided in Section 8.

13.1.2.1 Methodology

The following methodology was carried out to assess the potential impacts due to the proposed landfill expansion:

- Determination of future noise levels with the Boyne Road Landfill proposed expansion
- Determination of potential noise impact due to the Boyne Road Landfill proposed expansion
- Assessment of noise mitigation, if required

The methodology used for the noise assessment was based on the Landfill Guidelines (MECP 1998) and NPC-300 (MECP 2013).

A desktop assessment was completed to assess the potential impacts due to the proposed landfill expansion. Based on information provided by the Township, noise levels from the following activities were assessed to determine potential impacts due to the Boyne Road Landfill:

- Landfilling operations, which occur between 8:00 a.m. to 4:00 p.m.
- Landfill ancillary equipment, which operate for up to 24 hours per day
- Landfill traffic along off-site Haul Routes

The Boyne Road Landfill does not use pest control devices and there are no plans to use them in the future; therefore, no assessment of pest control devices was carried out.

The following sections outline the modelling completed to establish Boyne Road Landfill noise levels.

13.1.2.1.1 Noise Prediction Modelling

Noise prediction methodology for the haul route analysis is described in Section 9.1.2.3.1.

Noise predictions of the landfill operations and ancillary equipment noise sources were carried out using the Computer Aided Noise Attenuation (CadnaA) noise modelling software to support the assessment of potential Boyne Road Landfill noise impacts within the Site-vicinity Study Area. The CadnaA noise modelling software (version 2021 MR 2), developed by DataKustik GmbH, is widely accepted for evaluating environmental noise. Numerous algorithms are made available for use within CadnaA but, for the purposes of the EA, the model algorithm International Organization for Standardization (ISO) 9613 Acoustics: Attenuation of Sound during Propagation Outdoors (ISO 1993 and 1996) was considered.

The ISO 9613 prediction method is conservative as it assumes that all PORs are always downwind from the noise source or that a moderate ground-based temperature inversion exists. In addition, ground cover and physical barriers, either natural (terrain-based) or constructed and atmospheric absorption are included as they relate specifically to the proposed landfill expansion. Noise sources for the landfill operations and ancillary equipment were characterized by entering the sound power and/or sound pressure octave band spectrum associated with each source. Other parameters including frequency of use, hours of operation, and enclosure attenuation ratings also define the nature of sound emissions.

A summary of CadnaA model input parameters is presented in Table 13-14.

Table 13-14: CadnaA Model Input Parameters

Parameter	Model Setting	Notes
Software	CadnaA Version 2021 MR 2	CadnaA is a widely used environmental noise monitoring software package developed by DataKustik GmbH
Standards	ISO 9613-2	All sources and attenuation effects were treated as required by this standard
Ground effect	G = 0.5	
Temperature/ humidity	10°C / 70% relative humidity	
Other meteorological conditions	**Wind**: 1 to 5 m/s; all receivers downwind from all sources; or	Consistent with standard ISO 9613-2

Parameter	Model Setting	Notes
	Temperature Inversion: Moderate temperature inversion	
Receptor height	1.5 m (outdoor PORs, POW one-storey homes) 4.5 m (vacant lots, POW two-storey homes)	Conservatively assumed all POW locations are a two-storey home.
Terrain	Contour lines (75 to 80 masl)	Terrain has been accounted for in the model within the Site-vicinity Study Area.

Source operations, locations and elevations were selected such that the predicted Site-vicinity Study Area noise levels were expected to result in the worst-case noise predictions at all representative PORs.

13.1.2.2 Noise Emissions

Noise emissions from the existing landfill, both from the landfill operations and ancillary equipment, were used as inputs for the noise prediction model to assess the potential proposed landfill expansion noise impacts in the Site-vicinity Study Area at identified representative PORs.

13.1.2.2.1 Landfill Operations Noise Emissions

The assessment considered the noise emissions associated with the Boyne Road Landfill proposed expansion. The noise emissions for the landfilling operations for both the existing landfill and proposed expansion are the same other than an increase in on-site truck traffic. It was assumed the same noise sources are required for site preparation, normal operations and cell cover. Table 13-15 provides a summary of the overall sound power data and expected quantity for each noise source considered in the assessment of landfilling operations. Noise emissions (i.e., sound power levels) were established using the project information and Golder's database of similar noise sources. When assessing compliance with MECP sound level limits it was conservatively assumed that when a piece of equipment was operating, it would operate continuously for any one-hour period.

Table 13-15: Landfilling Operations Noise Sources Summary

Source	Quantity	Overall Sound Power Level (dBA)
Landfilling Compactor	1	108
Loader	1	105
Township Waste/Recycling Truck [1]	5	105
Roll-Off Truck [1]	4	105

Notes:

[1] Quantity expected to arrive to the landfill during the maximum worst case predictable hour

13.1.2.2.2 Ancillary Equipment Noise Emissions

The existing landfill includes a recycling compactor, exhaust fans and a heating, ventilation and air conditioning (HVAC) unit on the Office building. The use of the recycling compactor is variable due to changes to the recycling program on-site, but it has been included in the assessment of ancillary equipment noise emissions. Table 13-16 provides a summary of the overall sound power data for each noise source considered in the assessment of ancillary equipment for the Boyne Road Landfill proposed expansion. Noise emissions (i.e., sound power levels) were established using the project information and Golder's database of similar noise sources. When assessing compliance with MECP sound level limits it was conservatively assumed that when a piece of equipment was operating, it would operate continuously for any one-hour period.

Table 13-16: Ancillary Facilities Noise Sources Summary

Source	Quantity	Overall Sound Power Level (dBA)
Recycling Compactor	1	89
Exhaust Fan	2	90
HVAC	1	81

13.1.2.3 Potential Noise Effects

The following presents the noise prediction results of landfilling operations, ancillary equipment, and traffic along the off-site Haul Routes.

13.1.2.3.1 Landfilling Operations

Table 13-17 provides a summary of the predictable worst-case hour predicted noise levels for the landfill operation scenario described in Section 13.1.2.1. Noise levels were predicted at the identified representative PORs in the Site-vicinity Study Area.

Noise predictions were carried out for the landfill operations, which are expected to occur during the daytime only and therefore are compared to the Landfill Guidelines daytime sound level limit of 55 dBA.

Table 13-17: Daytime Landfilling Operations Predictable Worst Case Hour Noise Predictions

Receptor	Normal Operations Noise Level (dBA)	Landfill Guidelines Daytime Sound Level Limit (dBA)
R01	39	55
R02	40	55
R03	31	55
R04	37	55
R05	39	55
R06	33	55
R07	38	55
R08	36	55

The results presented in Table 13-17 indicates that the Boyne Road Landfill is expected to meet the Landfill Guidelines sound level limits at all representative PORs.

13.1.2.3.2 Ancillary Equipment

Table 13-18 provides a summary of the predictable worst-case hour predicted noise levels associated with ancillary equipment. As it is assumed the equipment will operate continuously for 24 hours per day, the predicted noise levels from the ancillary equipment are compared to the nighttime NPC-300 stationary source sound level limits as the nighttime limits are most stringent.

Table 13-18: Ancillary Equipment Predictable Worst Case Hour Noise Predictions

Receptor	Ancillary Equipment Noise Level (dBA)	NPC-300 Nighttime Stationary Source Sound Level Limit (dBA)	Meets NPC-300 Sound Level Limit?
R01	< 30	40	Yes
R02	< 30	40	Yes
R03	< 30	40	Yes
R04	< 30	40	Yes
R05	< 30	40	Yes
R06	< 30	40	Yes
R07	< 30	40	Yes
R08	< 30	40	Yes

As shown in Table 13-18, the ancillary equipment is expected to operate below the NPC-300 sound level limits at the representative PORs.

13.1.2.3.3 Off-Site Haul Route

As discussed in Section 9.1.2.2, the Landfill Guidelines outline the protocol for evaluating the noise impact due to off-site haul road vehicles. Following the methodology presented in Section 9.1.2.3.1, predicted noise levels due to the 2023 background traffic (without the traffic associated with the Boyne Road Landfill) were compared to the expected noise levels in 2023 with the Boyne Road Landfill during the predictable worst case hour (i.e., the hour when impacts are predicted to be the greatest). The road traffic modelling indicated the predictable worst-case hour was from 2:00 p.m. to 3:00 p.m. Table 13-19 summarizes the expected change in noise levels due to the Boyne Road Landfill at representative PORs along the Haul Routes as well as the associated qualitative rankings (as summarized in Table 9-4 in Section 9.1.2.2). Results are shown for all representative PORs in Table 9-3 that are located within 500 m of the Haul Routes.

Table 13-19: Predicted Worst-Case One Hour Change in Noise Levels along Haul Routes

Receptor	2023 Traffic Worst Case One-Hour Noise Level[1] – Without Landfill (dBA)	2023 Traffic Worst Case One-Hour Noise Level – With Landfill (dBA)	Change in Noise Level (dB)	Qualitative Rating[2]
R01	56	59	3	Insignificant
R04	52	53	1	Insignificant
R09	60	61	1	Insignificant
R10	58	62	4	Noticeable
R11	53	54	1	Insignificant
R12	54	55	1	Insignificant

Notes:

1 Hour with worst case predicted noise impact due to the Boyne Road Landfill is 2:00 p.m. to 3:00 p.m.

2 See Table 9-4 for details of qualitative ranking system

The results in Table 13-19 indicate that during the proposed landfill expansion predictable worst-case hour, the change in noise levels ranges from insignificant to noticeable. General industry practice typically does not require action to be carried out unless a significant rating is predicted. Note that if the Boyne Road Landfill proposed expansion worst case hour noise levels were compared to existing worst case hour noise levels with the existing Boyne Road Landfill traffic included, more representative of current conditions, changes in noise level would be insignificant.

13.1.2.4 Best Management Practices

The following best management practices have been considered in design to help minimize potential noise effects due to the Boyne Road Landfill proposed expansion and are recommended to be implemented:

- Limit landfill activities to the hours described in Section 13.1.2.1 to reduce the potential effect of noise on nearby PORs.
- All mobile equipment properly maintained according to manufacturers' recommendations and be in accordance with the noise emissions specified in Section 13.1.2.2 and MECP NPC-115 – Construction Equipment.
- When possible, maintain an acceptable setback distance from the identified PORs.
- Maintain on-site roadways to minimize vehicles travelling over ruts.
- Address noise concerns if they arise through a compliant resolution mechanism whereby persons can contact the landfill if there are perceived noise issues.
- Design on-site access roads to minimize reversing, which is expected to minimize use of backup warning devices where possible.
- Operate vehicles and equipment such that impulsive noise is minimized (i.e., truck tailgate closing), where possible.
- Where reasonable and practical, turn off vehicles and equipment when not in use, unless weather and/or safety conditions dictate the need for them to remain idling and in a safe operating condition.

13.2 Geology and Hydrogeology

A series of analytical contaminant transport calculations were conducted based on a conceptual model of groundwater flow and contaminant transport at the site to calibrate to current conditions and assess expected future compliance with MECP Reasonable Use Guideline B-7. The calculations were completed using GoldSim, a flexible, non-specific modelling code, designed to provide the user with an understanding of the factors that control the performance of an engineered or natural system (as defined by a user-specified mathematical model) and to predict the future behaviour of the defined system. With respect to addressing the landfill expansion groundwater quality, GoldSim was used to simulate the passage of contaminants in the landfill leachate from the source area (i.e., the active and expanded landfill area) through the downstream groundwater flow systems to the downgradient boundary of the CAZ. GoldSim is fully documented in the Main Users Guide (GTG, 2010a) and the Contaminant Transport Module Users Guide (GTG, 2010b). These calculations were completed for both current conditions at the Site, and expected conditions under the proposed expansion option.

This impact assessment describes the background information and provides a summary of the conceptual hydrogeological model in Section 13.2.1, and the analytical screening

calculation set-up, calibration to current conditions, adaptation for predictive simulations, and assumptions in Section 13.2.2. The calculation results and a summary discussion are provided in Section 13.2.3.

13.2.1 Conceptual Model Background Information

The general hydrogeological conditions of the Site are documented in Section 9.2 of this EASR.

13.2.1.1 Geology

Based on the landfill expansion area subsurface conditions encountered during borehole drilling programs completed at the site, overburden in the area consists of discontinuous topsoil/peat (between 0 and 2 m in thickness), underlain by discontinuous silt/clay (between 0 and 2.9 metres in thickness), underlain by silty sand/sandy silt till (between 0.9 and 6.0 metres in thickness). Bedrock, consisting of limestone (interbedded with shale), has been encountered at between 1.4 and 9.0 mbgs.

13.2.1.2 Groundwater Flow Directions

Based on existing groundwater elevations and groundwater flow directions as described in Section 9.2.2.2.1 of the EASR, the model considered two groundwater pathways from the disposal area, one towards the south and one towards the north. One-dimensional contaminant transport pathways were represented assuming that the flow path is linear between points in the model represented by existing monitoring locations.

13.2.1.3 Hydraulic Conductivity, Hydraulic Gradients, and Groundwater Velocity

Estimates of horizontal hydraulic conductivity of overburden materials in the area of the Site and Site-vicinity Study Areas, as determined based on the results of slug tests and grain size distribution analysis completed as part of previously completed studies, are presented in Section 9.2.2.2.3 of the EASR.

13.2.1.4 Groundwater Quality and Leachate Indicators

Monitoring wells MW13 and BR07-26 (to the east of the Site Study Area) have been established as representative of background water quality in the overburden and the bedrock, respectively. Monitoring well MW06-22 and the replacement well MW06-22R are screened in the silty sand unit immediately below the waste mound and have been used as indicators of leachate strength at the existing landfill. Based on a comparison of background groundwater quality, leachate quality and mobility of the leachate parameters, leachate indicator parameters for the existing landfill are: alkalinity, aluminum, ammonia, barium, BOD, boron, chloride, cobalt, conductivity, DOC, hardness, iron, manganese, phenols, potassium, sodium, and TDS. Use of chloride as a leachate indicator parameter is complicated due to the additional sources of chloride such as road salting activities along Boyne Road and the snow storage facility on the north side of Boyne Road to the northeast of the landfill footprint. Based on the relatively low concentrations of chloride observed at the background monitoring locations, chloride remains a useful leachate indicator parameter for monitoring locations upgradient (south) of Boyne Road and the snow storage facility.

Conservative and mobile leachate indicators were considered for the contaminant transport calculations. Of those available, chloride and boron were considered most appropriate as they are present in low concentrations in background groundwater in both the overburden and the bedrock, and generally show decreasing concentration trends in the downgradient direction. A summary of the observed concentrations of boron and chloride are shown in Table 13-20 for groundwater monitoring wells included in the areas of consideration for the north and south groundwater flow pathways.

Table 13-20: Existing Chloride and Boron Concentrations in Groundwater

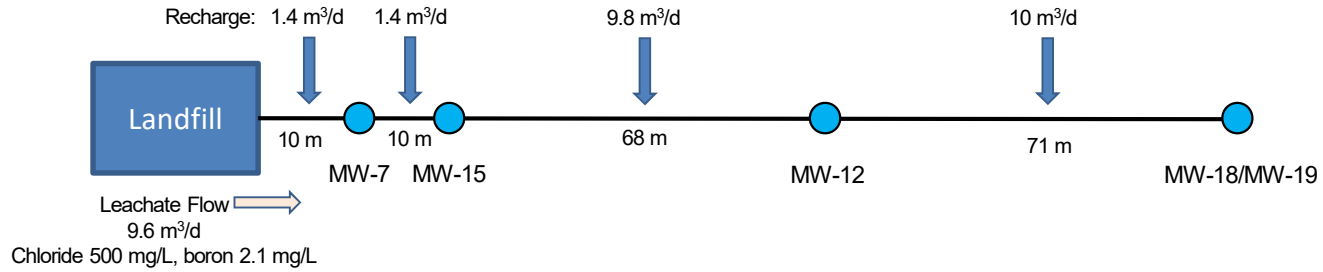
	Distance from landfill area	Chloride Observed Concentration (mg/L)	Chloride Observed Concentration (mg/L)	Chloride Observed Concentration (mg/L)	Boron Observed Concentration (mg/L)	Boron Observed Concentration (mg/L)	Boron Observed Concentration (mg/L)
Location	**(m)**	**Maximum**	**Minimum**	**Average**	**Maximum**	**Minimum**	**Average**
Source							
MW06-22R	0	521	170	367	2.5	2	2.1
North							
MW10	101	343	44	266	0.73	0.53	0.62
MW16	205	484	180	283	1.20	0.54	0.81
MW07-25	325	130	3	75.2	0.60	0.21	0.43
South							
MW7	11	510	390	456	1.1	0.7	0.89
MW15	16	670	140	356	1.10	0.1	0.77
MW12	94	390	40	175	0.84	0.23	0.50
MW18	165	430	74	201	0.95	0.35	0.63
MW19	172	460	36	207	1.4	0.05	0.61

13.2.2 Analytical Calculations

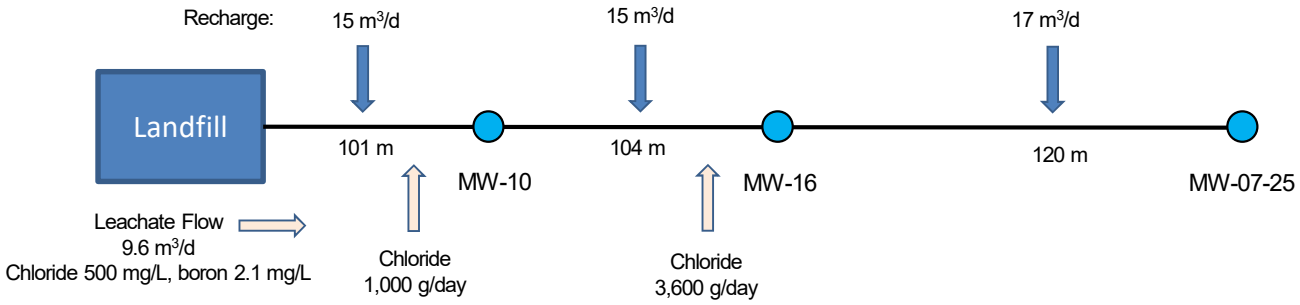
13.2.2.1 Assumptions

One-dimensional contaminant transport calculations were completed to provide an assessment of contaminant transport based on the available data for the existing landfill. The model setup for the calibration and predictive simulations is illustrated on Figure 13-3.

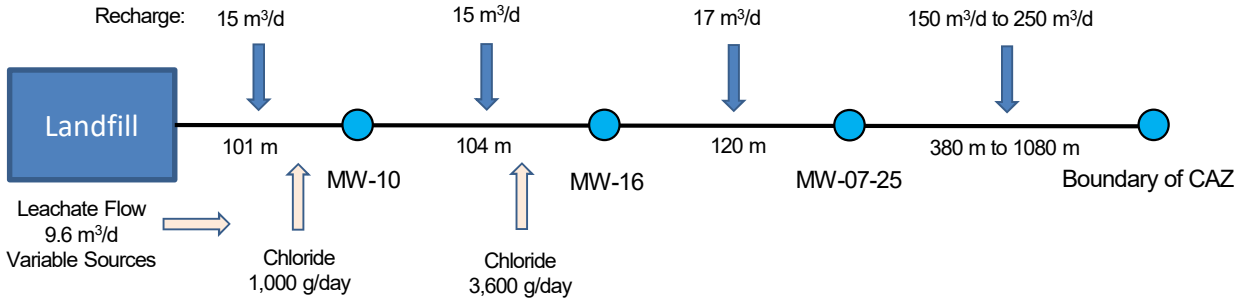
South Pathway - Calibration



North Pathway - Calibration



North Pathway - Predictive



Note:

1) Time-variable source terms for the predictive simulation were calculated using POLLUTE (refer to the memo text)

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INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-31
PREPARED	NB
DESIGN	NB
REVIEW	TE
APPROVED	TE

TITLE

SOLUTE TRANSPORT CALCULATION SCHEMATIC

PROJECT No.	PHASE	Rev.	FIGURE
1648553		**0**	**13-3**

The following assumptions were made for the calculations:

- One-dimensional contaminant transport pathways were represented. This representation assumes that the flow path is linear between points.
- The leachate plume in the overburden is assumed to be more extensive than the plume in the bedrock. For the purposes of the calculations, leachate source concentrations were applied to overburden only. It is acknowledged that some portion of the plume may extend into bedrock. The vertical spreading of the plume to the bedrock would result in lower concentrations in the bedrock relative to what is represented in the one-dimensional calculations. As such, it is assumed that if regulatory compliance is met in the overburden, compliance would also be met in the bedrock at the same distance from the disposal area.
- The overburden pathway thickness in the model was specified as the average saturated overburden thickness from available data (4.4 m). The analytical solute transport simulations were completed using the geometric mean hydraulic conductivity of 3.0 x 10-4 cm/s for the overburden.
- The calibration is considered at steady-state (long term) conditions; data for calibration was limited to points within 200 m to the north and south of the fill area.
- For current conditions, a leachate chloride concentration of 500 mg/L was applied based on approximate maximum concentrations of chloride in leachate-impacted groundwater at MW-06-22R. For the expansion, a chloride concentration of 1,500 mg/L was applied (as per O. Reg. 232/98 (MECP, 2012)). For the closure period, a chloride source depletion curve was generated using POLLUTEv7 (Rowe and Booker, 2005).
- The leachate source term for boron under current conditions was set at 2.1 mg/L based on approximate average boron concentrations in leachate-impacted groundwater from MW06-22R. For the expansion, a boron concentration of 5 mg/L was applied based on historical data from landfills in Eastern Ontario of similar size to the proposed expansion. For the expansion, in the post-closure period, a boron source depletion curve was generated using POLLUTEv7 (Rowe and Booker, 2005).
- The contaminant depletion within the source, as accounted for in the POLLUTE model, is due to wash-out by moisture infiltration/percolation through the waste mass for the contaminants of interest. Output files for each of the POLLUTE source concentration models are provided in Volume 2 Appendix D-3.
- Advection of chloride and boron was assumed to be conservative in the assessment (i.e., retardation and decay rates of chloride or boron in the downgradient flow path, which would decrease the concentrations in groundwater, were assumed to be zero).

- To account for the potential impacts on groundwater quality due to the Township-owned snow storage facility to the northeast of the disposal area, additional loading of chloride (associated with snow melt) was applied to the flow path adjacent to the snow storage facility. Between the landfill area and MW-10, a loading rate of 1,000 grams/day (g/d) of chloride was applied; between MW-10 and MW-16, a loading rate of 3,600 g/day was applied.

- As the transport calculations are one-dimensional, any transverse dispersion or spreading of the plume is not explicitly accounted for. To account for these processes, along with potential recharge of unimpacted water downgradient, the calculations were calibrated by "mixing" additional volumes of groundwater, at background concentrations, between the landfill source area and the CAZ. These volumes were estimated based on the model calibration to existing groundwater parameter concentrations.

- The expansion of the landfill is not expected to affect existing groundwater flow directions or gradients.

- Considering that the groundwater flow systems are similar in the northward and southward directions, predictive calculations were carried out to the north only. Results for the northern flow path apply to the south of the proposed landfill expansion.

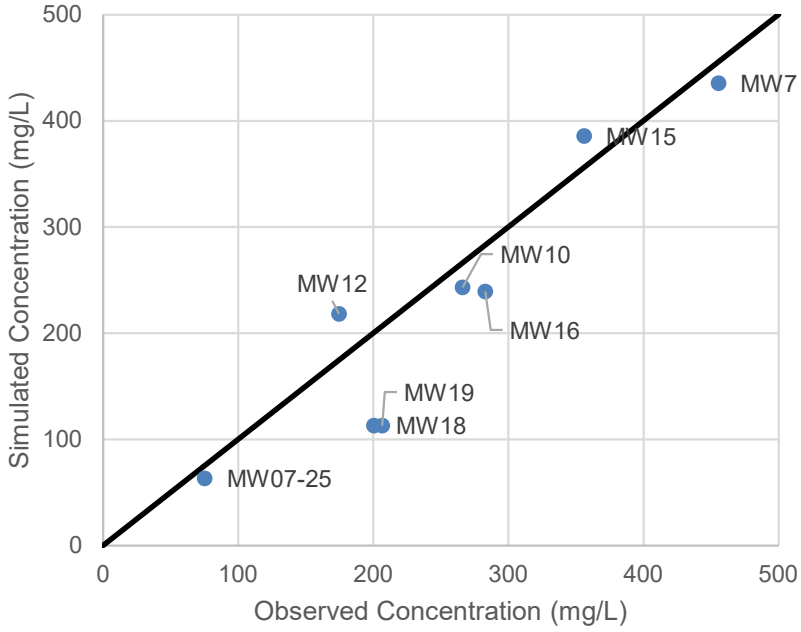
13.2.3 Results

13.2.3.1 Calibration to Current Conditions

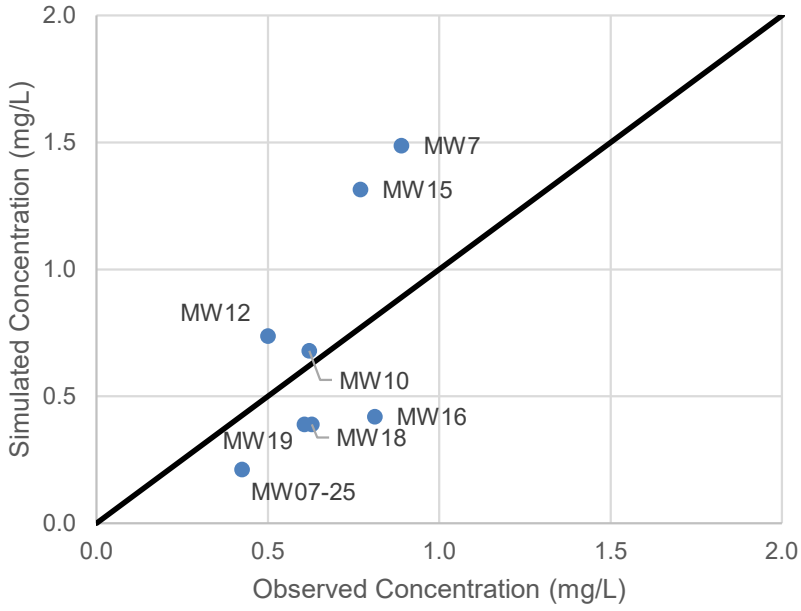
As described above, screening calculations were calibrated to existing conditions by adding recharge volumes of water (at background groundwater concentrations) to the northward and southward downgradient flow paths until calculated steady-state concentrations were similar to the average concentrations from observed data at each monitoring location in the groundwater flow paths. For the northern flow path, an additional chloride load was added between the landfill and MW10 and between MW10 and MW16 to account for the effects of the snow storage facility on groundwater quality. As shown on Figure 13-3, mixing volumes equivalent to 150 mm per year were added to each portion of the flow path. For the northern flow path, an additional chloride load of 1,000 g/d was added between the landfill and MW10, and 3,600 g/d was added between MW10 and MW16. Calibration results are shown on Figure 13-4.

For both the southward and northward pathways, the simulated steady state groundwater concentrations of chloride and boron provided an acceptable match to the observed concentrations. For chloride, the simulated values were generally consistent with the observed values, with no indication of spatial bias in the residual error (i.e., simulated minus observed values) for the northward or southward pathways. At the furthest downgradient location along the southward pathway (i.e., MW18/MW19), the simulated chloride concentration was lower than the measured value by a factor of approximately 2. For boron, the average observed concentrations decrease with distance from the landfill in both the northward and southward directions, which was well represented in the model.

CHLORIDE



BORON



Note:

1) Observed concentrations represent average measurements for the period of record at each individual monitoring well.

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TOWNSHIP OF NORTH DUNDAS

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INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-31
PREPARED	NB
DESIGN	NB
REVIEW	TE
APPROVED	TE

TITLE

CALIBRATION

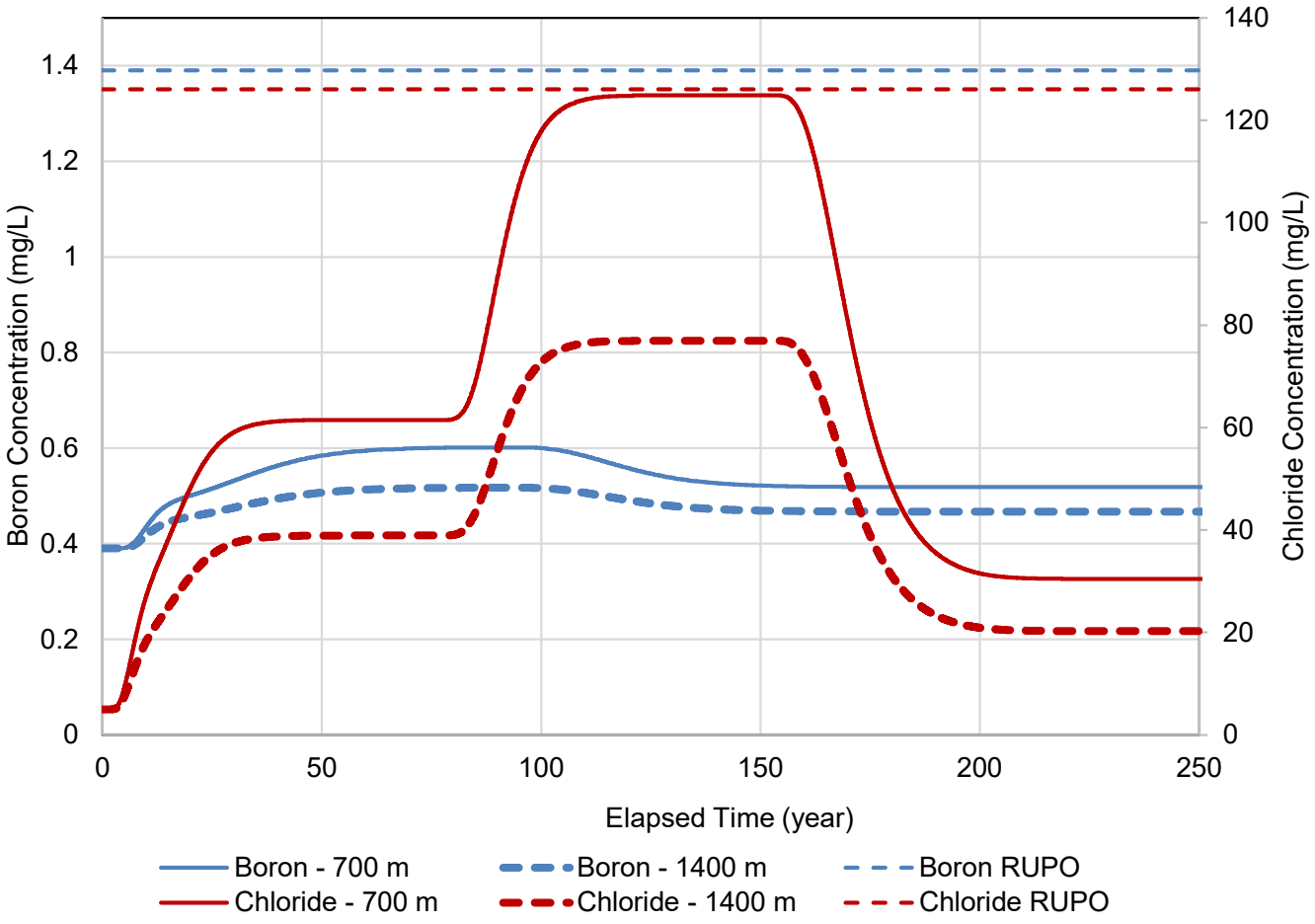
PROJECT No.	PHASE	Rev.	FIGURE
1648553		**A**	**13-4**

13.2.3.2 Predictive Calculations

Predictive calculations were used to determine the peak chloride and boron concentrations at various distances downgradient from the fill area. Results were compared to the 2020 calculated Reasonable Use Performance objectives (RUPO) for chloride and boron for the landfill (as described under Guideline B-7 (MOE, 1994)). Results of the predictive simulations are provided in Figure 13-5. As shown, chloride concentrations are simulated to be closer to the RUPO as compared to boron. The predictive results indicate that chloride concentrations are likely to meet the RUPO for overburden groundwater beyond 700 m downgradient of the fill area. The current landfill site property and/or CAZ lands currently available to the Township for leachate-impacted groundwater plume attenuation consist of the following: 1) a 1,200 m distance from the north side of the disposal area on the north side of Boundary Road as part of the landfill site property and CAZ easement; and 2) a 313 m distance from the edge of the proposed landfill expansion southward to the property and/or CAZ boundary. As such, to achieve compliance with the RUPO in future, it will be necessary for the Township in future to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area. The approximate extent of CAZ required in the southward direction is illustrated on Figure 13-5A; it is note that this additional CAZ land is not needed immediately, and the timing such that the landfill site remains in compliance with the Reasonable Use Guideline will be dependent on the ongoing groundwater monitoring program results.

13.2.3.3 Discussion

The analysis presented above was completed to provide an estimate of landfill contaminant concentrations in groundwater at the downgradient boundaries of the landfill property or CAZ for both current conditions and the proposed landfill expansion. Based on this analysis, chloride and boron concentrations are expected to meet RUPO at 700 m downgradient from the fill area (for the northward and southward groundwater flow pathways) for the proposed landfill expansion. As such, to achieve compliance with the RUPO in future, it will be necessary for the Township in future to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area.



Note:

1) Elapsed time zero corresponds to the beginning of landfilling operations.

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CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-01-31
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DESIGN	NB
REVIEW	TE
APPROVED	TE

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SOLUTE TRANSPORT CALCULATION RESULTS

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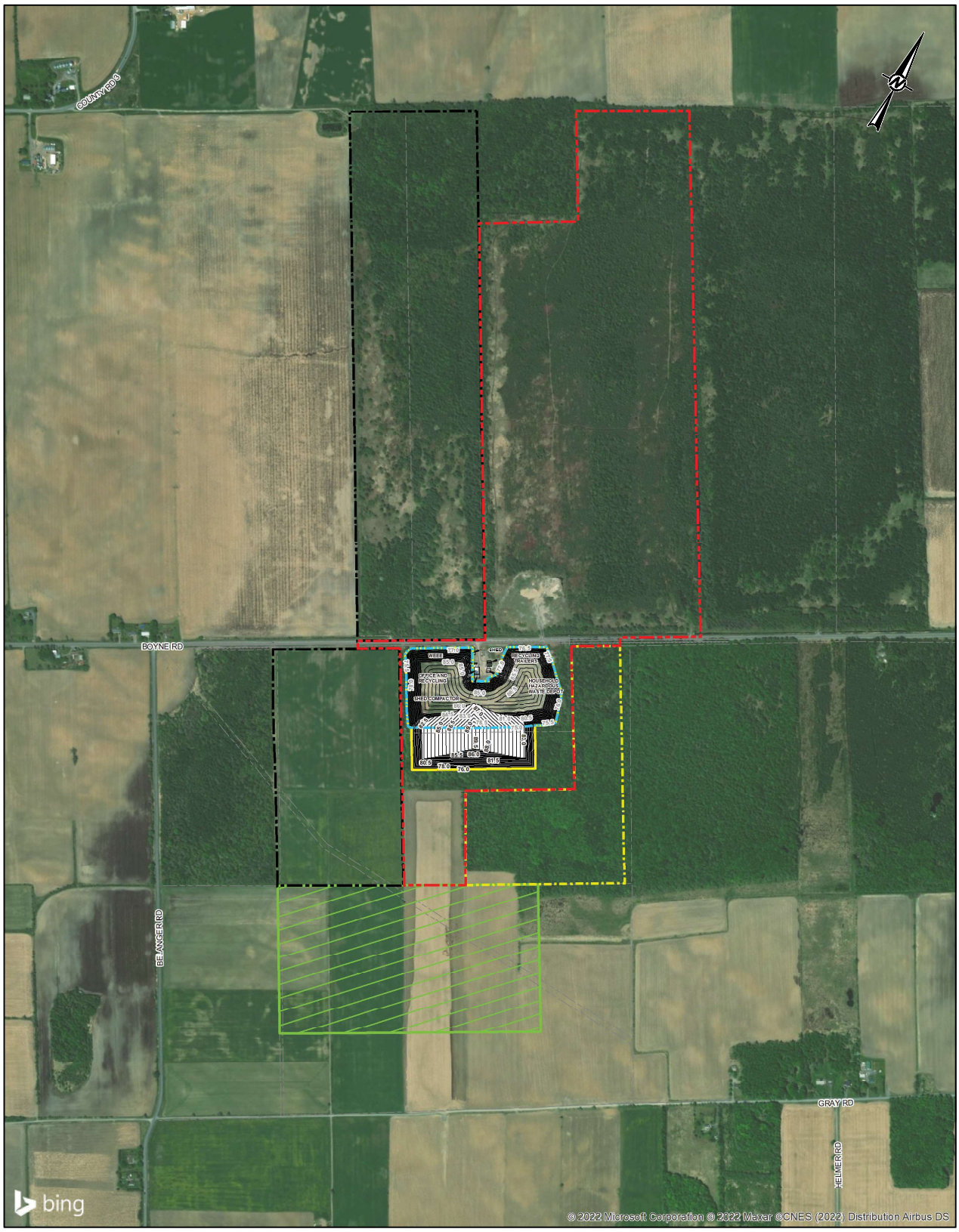


LEGEND

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINATION ATTENUATION ZONE
- APPROXIMATE BOUNDARY OF ADDITIONAL CAZ FOR FUTURE RUPO COMPLIANCE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, AND DECEMBER 2017 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.

0 100 200 300 400 500

1:10,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-02-09
PREPARED	JEM
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
PROPOSED ADDITIONAL CONTAMINANT ATTENUATION ZONE FOR EXPANDED LANDFILL

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**13-5A**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: X:\Active\Shared_All\Township_of_North_Dundas\BoyneRoadLandfill\69_PRO\A1648253MG_PRO\PPlots_2.0_Task_2.2\A1648253-2.2.0-CA-13A.mxd

13.2.4 Source Water Protection

The proposed Boyne Road Landfill expansion is within the existing WHPA-D of the Chesterville wellfield with a vulnerability score of 4. Also, the current Source Protection Plan (SNC and RRC, 2016a) for the Chesterville wellfield indicates that the provincial policies concerning waste only apply to WHPAs A and B and portions of WHPA-C for which the vulnerability score is 8 or higher. Waste sites are not prohibited within WHPA-D. Additionally, the groundwater flow direction of leachate impacted groundwater is not indicated to be traveling eastward (as discussed in Section 9.2.2.2.1) towards the Chesterville Wells. The proposed expansion is on the south side of the existing waste disposal area, so further from what is shown as the central portion of mapped WHPA-D. A portion of the CAZ for the existing landfill is located on the north side of Boyne Road within WHPA-D; as described in Section 13.2.2 and 13.2.3, this same portion of the CAZ is also proposed to serve the same function for the expanded landfill.

An assessment of the definition of the current WHPA's was provided in Section 9.2.2.3, which concluded that the majority of the recharge to the Maple Ridge Esker is much more local than identified in the Source Protection mapping and occurs on the mapped esker itself. The potential for an actual connection between the groundwater in the area of the Boyne Road landfill and recharge to Chesterville wells No. 5 and 6 (to which the source water protection requirements currently apply) is unlikely to be as reflected by the capture zones of the WHPA.

The proposed Boyne Road Landfill expansion is not interpreted to have an impact on the Winchester, Chesterville, or nearby residential wells due to its location within the geological setting, the local hydrogeology and its remote location from residents.

13.2.5 Contaminating Lifespan

Using the source concentration output files from POLLUTE (Volume 2 Appendix D-3), the contaminating lifespan of the proposed expanded landfill can be determined using the parameter chloride and the RUPO. It is anticipated that chloride concentrations in the leachate beneath the landfill expansion will be below the RUPO at approximately year 2070 or 22 years post closure. This is a relatively short amount of time but not unexpected for a natural attenuation landfill with a permeable soil cover.

13.3 Surface Water

This section provides the assessment of impacts on surface water quality and quantity for the proposed expansion of the Boyne Road Landfill as described in Section 12 of this EASR. This assessment was conducted in accordance with the requirements set out in the work plan provided in Section 8.

13.3.1 Stormwater Management System Design

As described in Section 11.2.3, there is currently no quality or quantity control system for stormwater management in place for the existing landfill except for the existing perimeter ditch that collects and conveys runoff to the Volks Municipal Drain ditch along the north side of Boyne Road. For the expansion, it is proposed that a wetland type stormwater facility will be constructed at the northeast corner area of the landfill site on the south side of Boyne Road and outlet at the same location as the existing perimeter ditch. This wetland will be sized based on the following MECP criteria:

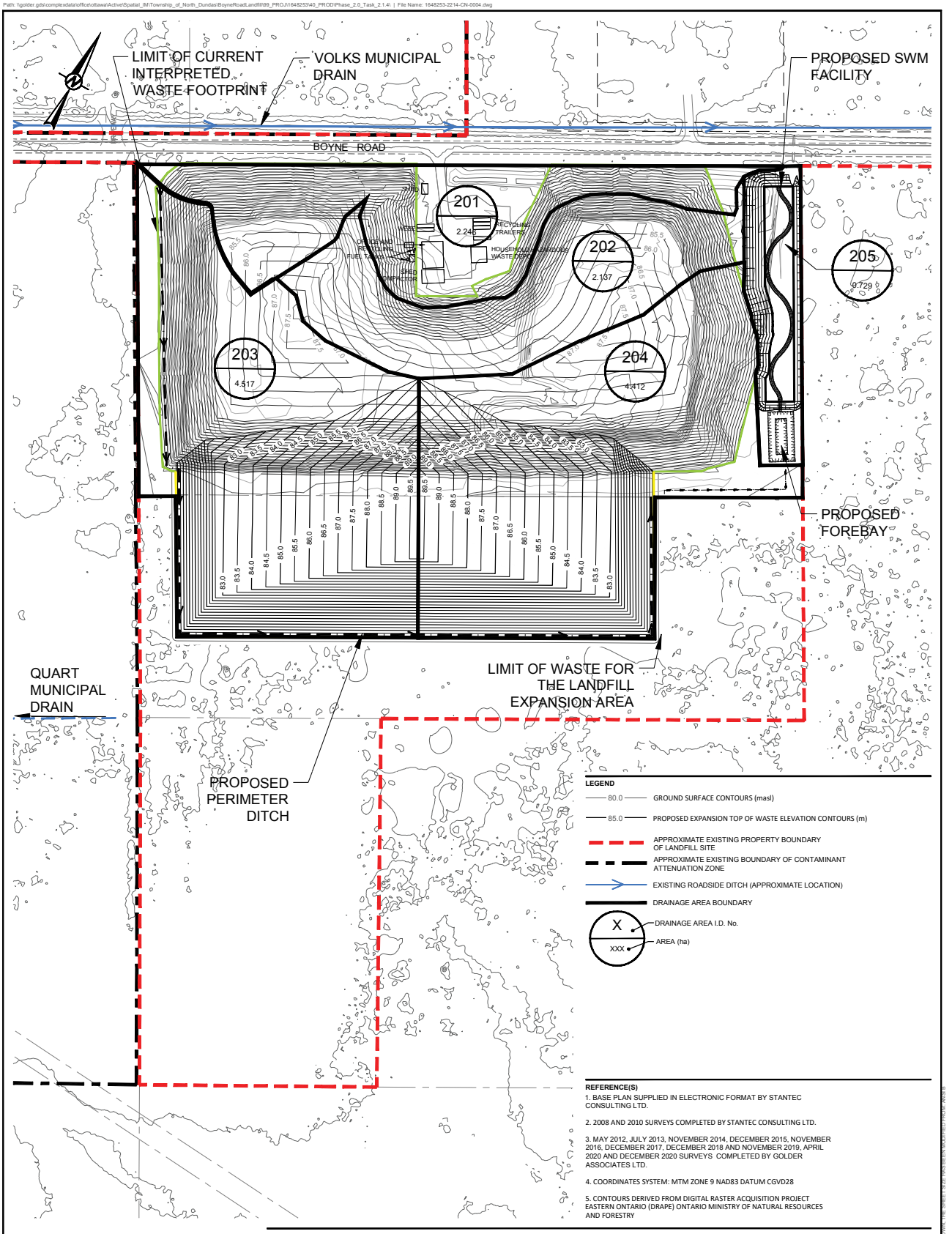
Enhanced (80%) long-term TSS removal to provide the “highest level” of quality control of stormwater.

Water quality storage requirements will be determined based on Table 3.2 of the Ontario Stormwater Management Planning and Design Manual (MECP, 2003).

- Match post-expansion outlet flows to corresponding pre-expansion flows for the 1:5 year through the 1:100 year return period design storm.
- Surface drainage from potentially contaminated areas, i.e., originating from active landfilling areas, will be contained locally within berms and will discharge into the waste. Surface drainage from non-contaminated areas such as road areas and areas with interim or final landfill cover will be conveyed to the SWM pond via the internal drainage ditches.
- Ditches will be sized to convey the 1:100 year return period design storm and culverts sized to convey a 1:25 year return period design storm as per *O. Reg.* 232/98.
- A 20% increase of intensity values will be applied to the 1:100 year return period design storm to “stress test” the proposed SWMS and evaluate potential climate change effects.

Runoff scenarios for the proposed expansion under the range of storm events were assessed with U.S. Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) for the 1:2, 1:5, 1:25, 1:50 and 1:100 year return period design storm provided in the City of Ottawa Sewer Design Manual (City of Ottawa, 2012) with a Soils Conservation Service (SCS) Type II 24-hour design storm to determine storage requirements and a 4-hour Chicago distribution to size conveyance ditches and culverts. Intensity duration frequency (IDF) curves were obtained from the City of Ottawa Sewer Manual, which are derived from the Ottawa Macdonald-Cartier International Airport Environment Canada Station. Pre-expansion and post-expansion conditions used a Curve Number of 74 based on open space with good condition grass cover >75% and hydrologic soil group C with an antecedent moisture condition of AMC II. The pre-expansion drainage areas are smaller, based on the smaller footprint of the existing landfill. The proposed SWMS for the proposed expansion is shown on Figure 13-7. To achieve the design objectives and criteria described above, the proposed SWM pond is described below.

The following Tables 13-21 and 13-22 provides a summary of model inputs used in SWMM.



REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

0 50 100
1:2,500 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ZS/ABD	MHK	DVK

CLIENT
TOWNSHIP OF NORTH DUNDAS

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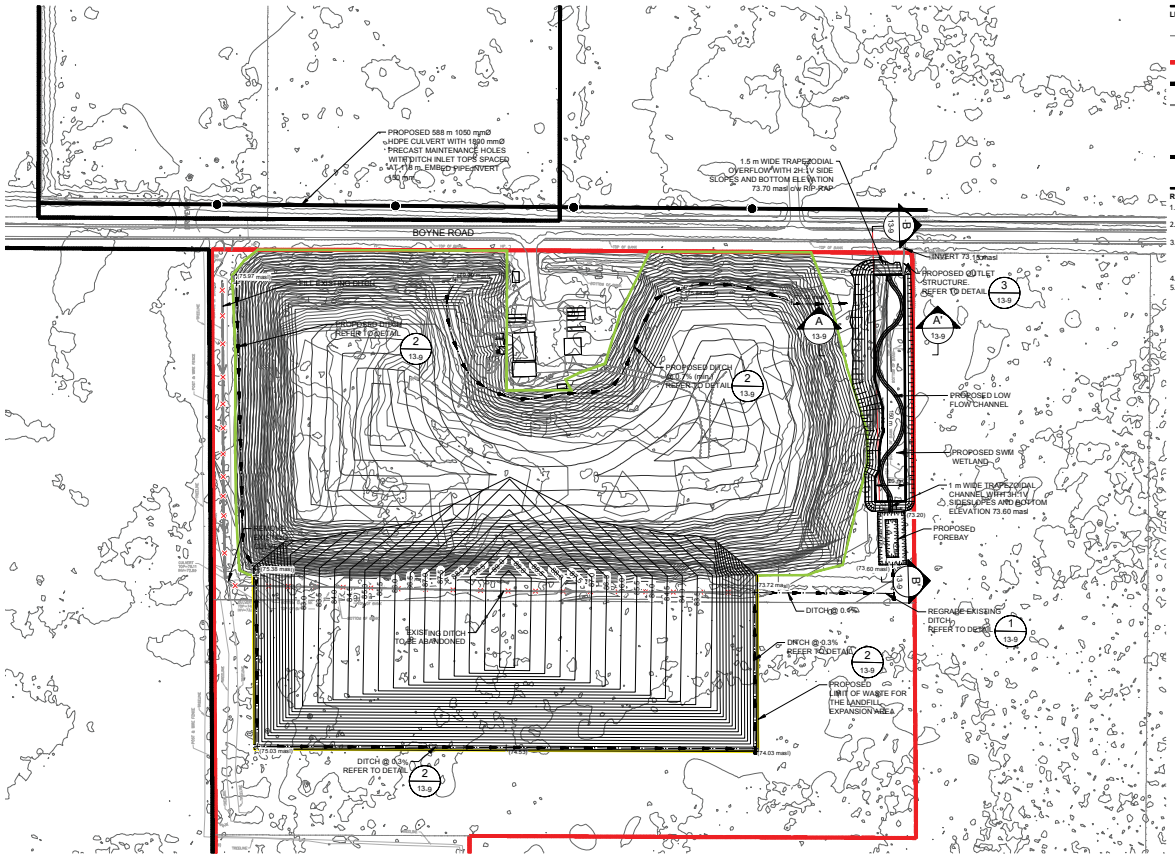
PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
PROPOSED EXPANSION POST-CLOSURE AREA DRAINAGE PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	13-6



LEGEND

- GROUND SURFACE CONTOURS (masl), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, AND 2014
- APPROXIMATE EXISTING PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE EXISTING BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- APPROXIMATE LOCATION OF EXISTING PERIMETER DITCH AND INFERRED FLOW DIRECTION
- EXISTING GRADE (FROM STANTEC) (masl)
- (73.20)+ PROPOSED DITCH GRADE ELEVATION (masl)
- PROPOSED CULVERT
- PROPOSED DITCH INLET MAINTENANCE HOLE

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28
5. CONTOURS DERIVED FROM DIGITAL RASTER ACQUISITION PROJECT EASTERN ONTARIO (DRAPE) ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ABD	DVK	DVK

CLIENT
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PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
PROPOSED EXPANSION - PROPOSED STORMWATER MANAGEMENT DESIGN CONCEPT PLAN

PROJECT NO.	PHASE/TASK	REV.	of	FIGURE
1648253	2.0/2.2.0	0		13-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

Table 13-21: Model Inputs – Subcatchments

Subcatchment	Area (ha)	Width (m)	Slope (%)	% Impervious	Mannings N Impervious	Mannings N Pervious	Depression Storage Impervious (mm)	Depression Storage Pervious (mm)	Curve Number	Drying Time (days)
Existing Conditions										
101	4.90	363.0	7.2	6	0.015	0.25	1	5	74.96	7
102	6.92	875.9	11.4	0	0.015	0.25	1	5	74	7
Proposed Conditions										
201	2.14	319.9	6.7	0	0.015	0.25	1	5	74	7
202	4.52	354.3	10.6	0	0.015	0.25	1	5	74	7
203	4.41	331.0	10.1	0	0.015	0.25	1	5	74	7
204	0.73	50.0	2.0	50	0.015	0.25	1	5	74	7
205	2.14	319.9	6.7	0	0.015	0.25	1	5	86	7

Table 13-22: Model Inputs – Pond Geometry/Storage

Elevation (masl)	Depth (m)	Area (m^2)	Extended Detention Volume (m^3)
72.9	0	2,780	0
73.0	0.1	2,910	0
73.1	0.2	3,047	0
73.2	0.3 (Normal Water Level)	3,185	0
73.3	0.4	3,324	326
73.4	0.5	3,465	666
73.5	0.6	3,607	1,021
73.6	0.7	4,018	1,391
73.7	0.8	4,187	1,887
73.8	0.9	4,359	2,321
73.9	1.0	4,532	2,773
74.0	1.1	4,708	3,243
74.1	1.2	4,886	3,699
74.2	1.3	5,067	4,171
74.3	1.4	5,250	4,658

13.3.2 Quality Control

A wetland stormwater management pond is proposed to be located in the northeast corner of the Site adjacent to the landfill.

The proposed extended detention wetland pond outlet structure provides a 33-hour draw-down time for runoff produced by a 25 mm rainfall event with a 4-hour duration modified Chicago distribution. The time period included in the draw-down noted has been limited to the period when flow through the pond orifice in the model is greater than or equal to 0.2 L/s. The pond hydrograph is provided in Volume 2 Appendix E-3. The proposed outlet structure includes a 75 mm diameter orifice at elevation 73.20 masl. The outlet pipe from the wetland to the outlet structure is designed as a submerged reverse sloped pipe to promote separation/floating of oils (if any), providing potential for spilled material to be recovered prior to an off-site release occurring. The proposed outlet structure for the pond has a sluice gate to allow emergency closure to assist in spill / leachate containment activities, if needed. A 1.0 m wide trapezoidal outlet with 2 horizontal to 1 vertical side slopes and a bottom elevation of 73.70 masl is proposed to provide discharge control for larger storm events, including the 1:5 year through 1:100 year return period and climate change storm event, which were confirmed to flow without flooding to the existing ditch and culvert.

Table 3.2 of the MECP Manual (MECP, 2003) provides storage volume design requirements based on specific site imperviousness levels to achieve required TSS removal objectives. Table 3.2 indicates that the minimum storage volume should be based on 80.0 m3/ha, for 80% TSS removal at an impervious level of 35%. The site has a drainage area of 14.041 ha

post-expansion, of which 2.246 will continue to be conveyed directly to the existing Boyne Road municipal ditch. For the remaining drainage area of 11.795 ha, this results in a minimum total required pond volume of 957 m^3, with 40 m^3/ha required as extended detention. Therefore, 478 m^3, at minimum, is required for both the permanent pool and extended detention. A permanent pool volume of 895 m^3 is provided in the proposed wetland pond at the normal water level depth of 0.3 m, which exceeds the required permanent pool volume. An additional 168 m^3 of extended detention storage is provided for the 25 mm design storm 4-hour duration with a modified Chicago storm distribution and 1,238 m^3 for the 1:2 year return period 24-hour duration SCS Type II distribution storm using a minimum sized orifice of 75 mm.

Table 13-23 provides the design values for the wetland pond and compares these values to the minimum or preferred criteria as per Table 4.7 of the MECP Manual.

Table 13-23: Proposed Wetland Pond – MECP Design Criteria

Design Element	Design Value	Comparison to MECP Criteria
Drainage Area	14.78 ha	Meets preferred criteria (> 10 ha)
Treatment Volume	Permanent Pool – 895 m^3 Active Storage (for 25mm event) – 168 m^3 Active Storage (for 1:2 year event) – 1,238 m^3	Permanent Pool Meets Minimum Criteria. Active Storage does not meet minimum criteria, but the combined storage volume exceeds the minimum criteria – a minimum sized orifice was used.
Active Storage Detention Time	33 hours	Meets Preferred Criteria (>24 hrs)
Forebay	0.3 m permanent pool and 1 m total depth. Less than 20% of permanent pool area.	Meets criteria: minimum depth 1 m and less than 20% of permanent pool area.
Length-to-Width Ratio	Overall – 7.5:1	Exceeds Minimum Criteria (3:1)
Permanent Pool Depth	Permanent pool depth 300 mm	Meets Criteria (depth 150 mm – 300 mm)
Active Storage Depth	The 1:10 year return period design storm is 0.56 m above the permanent pool	Meets Minimum Criteria (<1.0 m for up to 1:10 year return period design storm)
Side Slopes	4H:1V	Does not meet Minimum Criteria of 5H:1V for 3 m above and below permanent pool due to space limitations. However, this is acceptable since the landfill site has controlled access.
Inlet	Ditch	N/A

Design Element	Design Value	Comparison to MECP Criteria
Outlet	450 mm diameter outlet pipe at 1.0% slope 75 mm orifice for quality control outlet 1.0 m wide trapezoidal weir for quantity control outlet	Meets Minimum Criteria
Maintenance Access	No maintenance drawdown pipe provided. Access for backhoes or dredging equipment provided.	Meets Minimum Criteria
Buffer	Not provided	Does not meet Minimum Criteria of 7.5 m above maximum water quality/erosion control water level due to space constraints. However, this is a landfill site with restricted access.

The following calculations summarize the design requirements of the forebay as per Section 4.6.2 of the MECP Manual:

Minimum Forebay Settling Length

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Where: Dist = forebay length (m)

r = length-to-width ratio

Q_p = peak flow rate from the pond during design quality event (25 mm storm event) (m^3/s)

V_s = settling velocity (m/s)

$$Dist = \sqrt{\frac{(2.75)(0.002)}{0.003}}$$

$$Dist = 4.3\ m$$

Minimum Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

Where: Dist = length of dispersion (m)
Q = inlet pipe capacity (10 year storm event) (m^3/s)
d = depth of permanent pool in the forebay (m)
V_f = desired velocity in the forebay (m/s)

$$Dist = \frac{8(0.285)}{(0.2)(0.5)}$$

$$Dist = 22.8\ m$$

The proposed forebay length is 25.0 metres and is therefore greater than the required lengths for settling and dispersion.

Minimum Forebay Bottom Width

$$Width = \frac{Dist}{8}$$

Where: Dist = greater value of minimum forebay length or length of dispersion (m)
Width = minimum forebay bottom width (m)

$$Width = \frac{22.8}{8}$$

Width = 2.9 m

The proposed bottom width is 8.0 metres (average) and is therefore greater than the required width.

13.3.3 Quantity Control

A comparison of pre-expansion to the proposed post-expansion site discharge rates is provided in Table 13-24 for the 25 mm and 1:2 year through the 1:100 year return period design storm events. The pond storage and peak flow rates were assessed using the 24-hour duration SCS Type II distribution which resulted in the largest storage requirements and resulting peak flows while the 25 mm design storm used a 4-hour modified Chicago storm distribution. In addition, a 20% increase has been applied to the 1:100 year return period IDF values to stress test potential impacts of climate change. Details of the model input and outputs are provided in Volume 2 Appendix E-2.

Table 13-24: Pre-Expansion and Post Expansion Storage and Peak Flows

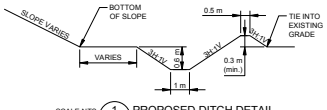
Return Period	Pre-Expansion Peak Flow (L/s)	Post-Expansion Uncontrolled Peak Flow (L/s)	Post-Expansion Controlled Peak Flow (L/s)	Storage Volume (m3)	Depth above Perm. Pool (m)	Elevation (masl)
25mm 4-hr	46	105	49	97	0.03	73.23
2-yr	155	237	88	1,186	0.35	73.55
5-yr	452	587	176	1,917	0.53	73.73
10-yr	703	873	241	2,051	0.56	73.76
25-yr	1050	1,275	323	2,245	0.60	73.80
50-yr	1341	1,613	388	2,452	0.65	73.85
100-yr	1644	1,972	454	2,671	0.70	73.90
100-yr + 20%	2309	2,757	672	3,170	0.81	74.01

The post-expansion controlled discharge from the site are reduced from current conditions for all modelled storm events except for the 25mm event. For the 25mm event, the peak post-development flows are expected to be approximately 6% larger than the current conditions. A minimum sized 75 mm orifice is proposed to control discharge from the pond from the 25 mm and 1:2 year return period design storm.

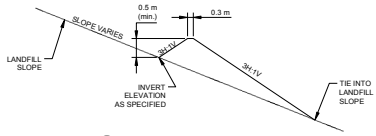
13.3.4 Surface Water Conveyance

During the continuing operations phase of the expanded landfill and post-closure, it is proposed that stormwater from the landfill will be collected by existing and proposed grass-lined ditches and will be directed to a stormwater management wetland located at the northeast corner of the landfill. The stormwater wetland will be located within an existing partially filled, partially low area adjacent to the landfill. The depth of the excavation will be limited to the existing grades of the existing perimeter ditch in the area, to limit the possibility of interception of groundwater potentially impacted by leachate. The stormwater run-off from the wetland will discharge via an existing 900 mm culvert into the roadside ditch on the north side of Boyne Road. The culvert has been confirmed to convey the 1:25 year return period storm event with a 3-hour duration and modified Chicago distribution.

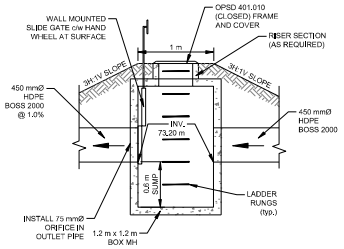
The on-site ditches have been designed to convey the peak runoff rate from the 1:100 year storm event. A 3-hour modified Chicago distribution design storm was used to assess the surface water runoff from the contributing drainage areas for each ditch. The drainage areas for each ditch are shown on Figure 13-6. The detailed calculations for the ditch sizing are in Table 13-25 and in Appendix E-5. Refer to Figure 13-8 for details.



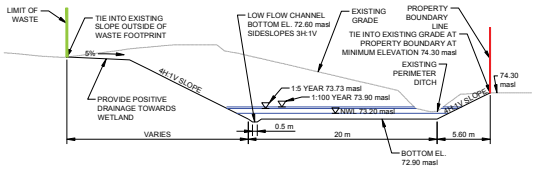
SCALE NTS 1 13-8 PROPOSED DITCH DETAIL



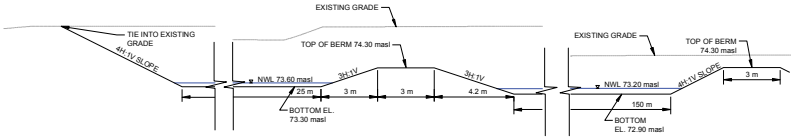
SCALE NTS 2 13-8 PROPOSED DITCH DETAIL ON SIDESLOPE



SCALE NTS 3 13-8 PROPOSED OUTLET STRUCTURE DETAILS



SCALE NTS A-A' 13-8 SECTION



SCALE NTS B-B 13-8 SECTION

0 50 100
1:1,250 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2022-01-11	ISSUED FOR CLIENT REVIEW	MHK	ABD	DVK	DVK

CLIENT
TOWNSHIP OF NORTH DUNDAS

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PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
PROPOSED EXPANSION - STORMWATER MANAGEMENT DESIGN DETAILS

PROJECT NO.	PHASE/TASK	REV.	of	FIGURE
1648253	2.0/2.2.0	0		13-8

Table 13-25: Ditch Sizing

	Area 203 Ditch	Area 203 / 204 Ditch	Area 202 Ditch
DRAINAGE AREA			
A (ha)	4.517	8.929	2.137
Q 100yr (model) (m^3/s)	0.2500	0.4800	0.1500
Manning's Roughness Coefficient n	0.035	0.035	0.035
DITCH CHARACTERISTICS			
Slope S (mm)	0.003	0.003	0.003
Bottom Width (m)	0.00	1.00	0.00
Side Slope X:1	3	3	3
From Manning's Equation $(Q)n/(\sqrt{S})$	0.160	0.531	0.096
CHECK			
Depth of Flow (m)	0.401	0.488	0.332
From Manning's Equation $A^{5/3}/P^{2/3}$	0.160	0.532	0.096
Cross-Sectional Area (m^2)	0.482	1.202	0.331
Actual Velocity (m/s)	0.52	0.40	0.45

There is an existing drainage feature, labelled Reach #2 in Figure 9-10 and described in Section 9.4.2, which is located in the southern portion of the proposed expansion. The field to the south of the landfill is owned by the Township and is currently tile drained. The existing tile drainage piping will be removed as required for the expansion and drainage will be directed to the existing natural wetland area.

As described previously, the flow in the open section of the Volks Municipal Drain north of the landfill site is proposed to be conveyed via a new culvert. The culvert proposed is a 1050 mm diameter high density polyethylene culvert with a length of approximately 588 m. The culvert sizing will be confirmed with the Township Drainage Superintendent. It is anticipated that a shallow ditch will still exist above the top of the culvert to provide drainage and snow storage for the adjacent section of road. Four ditch inlet catchbasins/maintenance holes are proposed along the length to limit each individual section of pipe to around 118 m. Seepage collars around the piping will be installed periodically along the length of the culvert to reduce the potential groundwater flow within the pipe bedding.

13.4 Biology

This section provides the assessment of impacts on the biology (aquatic and terrestrial) aspects of the environment associated with the proposed landfill expansion as described in Section 12 of this EA study report. This assessment was conducted in accordance with the requirements set out in the work plan provided in Section 8.

Figure 13-9 shows the proposed expansion in relation to natural heritage features and existing infrastructure.

The following impact assessment considers the potential direct and indirect impacts of the proposed expansion on the aquatic and terrestrial ecosystems within the Site and Site-vicinity Study Area for the construction, operations and closure stages of the landfill expansion.

Potential direct impacts to natural heritage features and functions are those that result in an immediate loss of the feature or function as a consequence of the landfill expansion. This may include the removal of a vegetation community or habitat within the area of expansion or ancillary facilities and related works or work areas. Potential indirect impacts are those whereby the landfill expansion cause impacts to an adjacent or downstream feature or function through the alteration of the site.

When considering and assessing the potential environmental impacts of a project on natural heritage features and functions, the first approach is to avoid potential impacts through layout and design of the project. Where impacts cannot be avoided, then mitigation of those impacts should be implemented to reduce the severity of those impacts. If mitigation measures are not possible or sufficient to mitigate potential impacts, then compensation for the loss of features and/or functions may be required.

LEGEND

- SUITABLE MATERNITY ROOST TREES FOR LITTLE BROWN MYOTIS
- FISH HABITAT - PERMANENT
- FISH HABITAT - INTERMITTENT
- ROADWAY
- RELOCATED DITCH/PROPOSED PERMIETER DITCH
- OPEN DRAINAGE DITCH TO BE REPLACED WITH A CULVERT
- UNEVALUATED WETLAND
- EVALUATED NON-PSW WETLAND
- SIGNIFICANT WILDLIFE HABITAT - WOOD THRUSH AND EASTERN WOOD-PEWEE
- SIGNIFICANT WOODLAND
- SIGNIFICANT WILDLIFE HABITAT - INTERIOR FOREST
- APPROXIMATE PROPOSED AREA FOR STORMWATER MANAGEMENT FACILITY
- LIMIT OF CURRENT INTERPRETED WASTE FOOTPRINT
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- SITE STUDY AREA
- 120 m STUDY AREA
- AREA OF DISTURBANCE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES. © QUEENS PRINTER 2014
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 40 80 160
1:4,000 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
BIOLOGY IMPACT OF PREFERRED EXPANSION ALTERNATIVE

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-02-04
DESIGNED	----
PREPARED	JEM
REVIEWED	YJM
APPROVED	PLE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**13-9**

20cm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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13.4.1 Construction Stage

13.4.1.1 Aquatic Ecosystems

Components of the proposed landfill expansion near and within surface water features on site are summarized below. The landfill expansion activities that could potentially affect aquatic features are currently high-level and may change through detailed landfill expansion design.

The proposed landfill expansion includes the removal of an area of evaluated and unevaluated wetland and relocation and / or re-grading of the existing perimeter ditch (Reaches 1, 3, 4 in Section 9.4), as well as removal of part of the small tile-drain outlet feature (Reach 2 in Section 9.4). For the most part, the reaches of the perimeter ditch are considered as supporting fish habitat in that they contribute flows and beneficial materials. However, there is low likelihood the perimeter ditch directly supports fish due to its ephemeral nature. New perimeter ditches will be constructed along the new perimeter of the landfill following expansion to convey surface water runoff from the landfill area and groundwater seepage from the adjacent wetlands. A new SWMP will be constructed at the existing Reach 4 confluence with Volks Municipal Drain and will be designed so that it provides enhanced (80%) TSS removal and controls peak flows off-site.

The proposed landfill expansion also includes activities to modify Volks Municipal Drain to reduce potential contamination from leachate-impacted groundwater in periods of elevated groundwater levels, as well as reduce contaminated surface runoff from Boyne Road into the drain to protect fish habitat and surface water quality in the drain. The proposed modification is enclosing Volks Municipal Drain in an approximately 588 m long pipe along the north side of Boyne Road to isolate and convey surface water past the landfill site from upstream (west) to downstream (east); refer to Figure 12-2).

13.4.1.1.1 Potential Direct Impacts

Based on the aquatic habitat observed in the perimeter ditch and Volks Municipal Drain (Section 9.4), the preliminary conceptual landfill expansion activities described above were assessed at a high-level to determine potential impacts and measures to avoid or mitigate impact to observed fish habitat from the proposed landfill expansion activities in accordance with the *Fisheries Act* (Canada, 1985). Potential residual effects of the expansion (i.e., those that cannot be fully mitigated) that could result in the death of fish or the harmful alteration, disruption, or destruction of fish habitat (HADD) will need to proceed through the DFO review process, and a DFO *Fisheries Act* Authorization for the landfill expansion may be required. The DFO permit application will include a comprehensive impact assessment that will incorporate the landfill expansion detailed design.

In the following assessment, the DFO Pathways of Effects (PoE) will be used to describe potential impacts of the proposed expansion activities on aquatic ecosystems in detail. Most of these effects can be eliminated and/or minimized by using appropriate mitigation measures and best practices. The PoE, applicable mitigation measures, and assessment of residual effects to fish and fish habitat during the construction stage are discussed below and summarized in Table 13-26.

Potential direct PoE resulting from activities carried out during the construction stage include:

- Fish habitat loss and alteration
- Fish passage and fish access to habitats
- Mortality of fish/eggs/ova
- Displacement or stranding of fish or incubating eggs
- Incidental entrainment and impingement of resident species

Most of these potential effects, including mortality of fish/eggs/ova, fish displacement, and incidental entrainment/impingement can be eliminated and fish habitat loss and alteration can be minimized using appropriate mitigation measures and best practices.

The proposed expansion of the landfill will result in the removal of the wetland areas and relocation of the perimeter ditch. A SWMP will be built at the downstream end of the new perimeter ditch in the vicinity of Reach 4 before the confluence with Volks Municipal Drain. These proposed works will alter flow regimes, prevent fish access and remove supporting fish habitat in the perimeter ditch. Approximately 1,622 m (10,011 m^2) of supporting fish habitat in the perimeter ditch will be altered/lost. However, the habitat in the ditch is seasonal and of marginal quality, and new ditches will be created around the expanded landfill. The habitat created through reinstating the perimeter ditches is approximately 1,414 m, with approximately 170 m being part of the SWMP. The aquatic habitat in the new ditches will not directly connect to the Volks Drain but instead flow into the SWMP that discharges to the Volks Drain.

The SWMP will act to receive runoff from the new perimeter ditch, allow sediment to settle out in the pond and slowly release to the drain to minimize runoff with elevated TSS from entering Volks Municipal Drain. The construction of the SWMP at the reinstated perimeter ditch will eliminate fish access to habitats in the new perimeter ditch. Due to very low water flow in the existing perimeter ditch, it was determined that direct fish usage of most of the ditch was unlikely, but there is some potential that fish could inhabitant waters within Reach 4 near the confluence of Volks Municipal Drain when spring water is high enough. So, the creation of a SWMP at the confluence of Reach 4 and the Drain eliminates the potential for fish to directly inhabit this area during seasonal high flow. However, the resulting improvements in water quality from the SWMP into Volks Municipal Drain, a fish bearing watercourse, will outweigh the loss of access to the seasonal, low quality habitat within the perimeter ditch.

The proposed modifications (Option 1 and 2) to Volks Municipal Drain are proposed to improve water quality by preventing potentially leachate-impacted groundwater seepage from entering the drain. This project work will result in impacts to fish habitat. The 588 m long pipe (which will be referred to as Option 1) would eliminate fish passage and fish access to upstream habitats, including access to the perimeter ditch. The potential effects of Option 1 include permanent changes to fish habitat, flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain as the length of the culvert is impassable for fish (Di Rocco and Gervais, 2021), and flow velocity during high-flow periods is expected to

increase following construction. In addition, Option 1 is expected to result in the permanent loss of approximately 588 m of fish habitat in the watercourse as fish cannot pass the long culvert and the existing channel will be enclosed within the culvert. As an alternative, maintaining the watercourse as an open ditch with installation of a low permeability liner system in the base and sides of the ditch, incorporating a liner such as a geomembrane or geosynthetic clay liner (which will be referred to as Option 2) would reduce the likelihood of potentially leachate-impacted groundwater seepage entering the watercourse and also maintain fish passage and access to upstream habitats. The potential effects of Option 2 include alteration of fish habitat, temporary changes to fish passage and flows during construction. Option 2 will result in the alteration of fish habitat structure through the placement of the geomembrane along the drain channel bed. However, once the liner system is in place, natural substrates are expected to establish over the liner system and support aquatic macrophyte re-growth. The existing bed and bank elevations would be maintained as well. Therefore, the potential effects on fish habitat and structure in the drain are anticipated to be short-term and not expected to interrupt key life processes for fish. Overall, the effects of these modification options should be weighed with the quality of the fish habitat that is in the existing Volks Municipal Drain. This reach of the drain (Class F) experiences intermittent flow and lacks depth and connection to upstream and downstream habitats except for in high flow periods. The habitat in the affected reach of Volks Municipal Drain is not critical to support specialized fish life history processes (e.g., spawning). In addition, modifications will be designed to reduce the risk of contamination entering the watercourse, protecting surface water quality and thereby improving downstream fish habitat and reduce the likelihood of harm to fish over time.

13.4.1.1.2 Potential Indirect Impacts

Potential indirect PoE resulting from activities carried out during the construction stage include:

- Changes in water quality including a change in:
  - Contaminant concentrations
  - Water temperature
  - Nutrient concentrations
  - Dissolved oxygen concentrations
- Change in base flow
- Changes in sediment concentrations
- Change in food supply
- Change in habitat structure and cover

Potential effects can be minimized or eliminated using appropriate mitigation measures and best practices, and development and implementation of an Erosion and Sediment Control Plan and Spill Contingency Plan (Table 13-26).

There will be an increase in peak flow in the new perimeter ditch compared to current conditions and an increase in total volume of runoff leaving the Site, resulting in a residual change to flow and water quality (e.g., dissolved oxygen, TSS). The SWMP will be implemented to control peak flows off-site to pre-expansion conditions and achieve 80% TSS removal. Therefore, there is only the potential for increased flow in the perimeter ditch during storm events. These potential changes to flow are considered to be minor.

Excavation and grading during the proposed modifications (Option 1 or 2) to Volks Municipal Drain have the potential to increase sediment concentrations, alter flows and water temperature, and alter fish habitat and structure. No residual effects from these stressors are anticipated if mitigation measures are implemented and properly maintained and construction activities are conducted according to best management practices. Indirect effects resulting from the use of construction equipment can be mitigated (Table 13-26).

The intent of the modifications to Volks Municipal Drain is to protect it from seepage of potentially leachate-impacted groundwater, thereby improving fish habitat and preventing harm to fish over time. Minor residual effects to fish habitat structure, cover, food supply and nutrient concentrations are expected due to removal of aquatic vegetation in the Volks Municipal Drain. However, aquatic vegetation currently inhibits fish passage in the watercourse and it is expected to naturally regenerate if Option 2 is selected.

There are no residual indirect effects to fish and fish habitat expected, resulting from the temporary diversion system during construction in Volks Municipal Drain if mitigation measures are properly implemented and maintained. Both modifications options are expected to improve and protect water quality in Volks Municipal Drain and hydrologically connected watercourses following construction, outweighing residual effects to fish and fish habitat.

Table 13-26: Aquatics Effects Assessment During the Construction Stage, Boyne Road Landfill Expansion

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
Perimeter Ditch (Reaches 1, 2, 3, 4); Volks Municipal Drain	Fish Passage Issues	• Removal and re-establishment of the perimeter ditch alters supporting fish habitat and changes flow regime. • Construction of the stormwater management pond in Reach 4 of the perimeter ditch will reduce or eliminate fish access to habitats upstream permanently. • Modification to Volks Municipal Drain (Option 1) will permanently alter flows and restrict fish access to upstream habitats. • The temporary diversion of flow in Volks Municipal Drain during construction (of either Option 1 or 2) will obstruct fish movement temporarily.	• Fish passage in Volks Municipal Drain is currently inhibited by abundant aquatic vegetation and low water levels in summer/fall low flow periods. • Option 2 includes incorporating streambed elevations that approximately mirror existing elevations, maintaining existing flows and fish passage. • Modifications to Volks Municipal Drain may improve fish passage by removing barriers to fish (aquatic vegetation). • Temporary flow management will be the responsibility of the contractor but will be maintained via a temporary flow management system to maintain flow during construction (i.e., dam and pump). • Temporary flow control structures will be installed upstream of the work area in Volks Municipal Drain.	Permanent change to flow, fish passage, and fish access to habitats is anticipated due to infilling the perimeter ditch. The perimeter ditch is supporting fish habitat, contributing flows downstream, but unlikely to directly support fish use. The habitat in the ditch is seasonal and of marginal quality, and new ditches will be reinstated around the expanded landfill. Anticipated residual effects to fish passage issues upstream of the SWMP in the perimeter ditch are minor as the improvements in Volks Municipal Drain water quality resulting from the SWMP are expected to outweigh the loss of

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• Accumulated sediment from the isolated area will be removed before the isolation barrier. • Cofferdams, if needed, will consist of clean material and adequately sized to withstand high-flow events and prevent sedimentation of the watercourse. • Fish will be removed from the isolated work area • Water pumps will be screened to prevent accidental entrainment of fish. • Prior to dewatering, any fish stranded within the dewatering area will be rescued and immediately released as specified in a license to collect fish. • All pumped water will be discharged to a sediment filtration bag/straw bales within a well vegetated riparian area, which will allow water to infiltrate before re-entering the drain downstream of the work area.	access to the seasonal, low quality habitat within the perimeter ditch. In general, the reinstated upstream reaches of the perimeter ditch and upstream Volks Municipal Drain are seasonally wetted and low in habitat quality, providing limited ecological functions. Option 1 is expected to result in permanent changes to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain. The length of the culvert is impassable for fish. No permanent effect to fish passage at Volks Municipal Drain is expected as a result of Option 2 modifications.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
				The temporary obstruction of fish passage due to temporary flow structures in Volks Municipal Drain is of short duration and is not anticipated to interrupt key life processes of fish, if applicable mitigation measures are carried out.
Perimeter Ditch (Reaches 1, 2, 3, 4); Volks Municipal Drain	Change in Timing, Duration, and Frequency of Flow	• Temporary dewatering to accommodate infilling of perimeter ditches and modification to Volks Municipal Drain can displace fish and impact fish access to habitats. • Flow changes can impact water temperature, contaminant concentrations, sediment concentrations, nutrient concentrations, and habitat structure and cover in the watercourses.	• In-water work will avoid wet and rainy periods and sensitive periods for fish. • The temporary diversion of flow in Volks Municipal Drain will be limited in duration. • Accumulated sediment from the Volks Municipal Drain isolated area will be removed before the isolation barrier. • Cofferdams will be clean and adequately sized to withstand high-flow events and prevent sedimentation of the watercourse.	Permanent change to flow and fish access to habitats is anticipated due to infilling the perimeter ditch. The habitat in the ditch is seasonal and of marginal quality, and new ditches will be reinstated around the expanded landfill, which are expected to provide similar flows and fish habitat compared to the existing ditch.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
		• increased flows and runoff volume in the reinstated perimeter ditch compared to current conditions are expected to alter flow regime and water quality in the perimeter ditch and Volks Municipal Drain	• Option 2 is expected to result in flows similar to existing flows in Volks Municipal Drain • fish stranded within dewatering areas will be rescued immediately and released as specified in a license to collect fish	Option 1 is expected to result in permanent changes to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain. The length of the culvert is impassable for fish and flow is expected to increase through the culvert in high-flow periods. No residual effects to fish passage at Volks Municipal Drain is expected as a result of Option 2 modifications. There are no residual effects to fish habitat as a result of the temporary dewatering and obstruction of flow in Volks Municipal Drain if applicable mitigation measures are carried out.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
				Minor residual changes to base flow and water quality (e.g., dissolved oxygen, TSS) in the reinstated perimeter ditch and Volks Municipal Ditch are expected; however, the SWMP will be implemented to control peak flows off-site to pre-expansion conditions and achieve 80% TSS removal.
Perimeter Ditch (Reaches 1, 2, 3, 4); Volks Municipal Drain	Placement of materials in the water	• The placement of fill in perimeter ditch permanently removes an area of fish habitat in the drainage feature. • enclosing Volks Municipal Drain will remove an area of fish habitat in the watercourse as fish cannot pass the long culvert (Option 1).	• Option 2 minimizes the intensity and extent of in-water work relative to Option 1. • The water quality in Volks Municipal Drain will be protected in the long term following modification Option 1 or 2, improving fish habitat over time. • Natural fine substrates will likely attenuate over the pipe material (Option 1) or liner system (Option 2), mimicking existing substrates.	Permanent loss of 1,622 m of fish habitat is anticipated due to infilling the perimeter ditch. New ditches will be reinstated around the expanded landfill, creating approximately 1,414 m of potential fish habitat, with approximately 170 m part of the SWMP. However, fish access to

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
		• The placement of the liner system (Option 2) along the length of Volks Municipal Drain will permanently change fish habitat structure. • Volks Municipal Drain modifications have the potential to change sediment and nutrient concentrations in the watercourse. • A temporary flow diversion system (i.e., cofferdams) will be installed in Volks Municipal Drain to isolate the work area prior to construction.	• All in-water work will avoid wet and rainy periods will sensitive life stages for fish. • In-water work will be carried out in isolation of flowing water using isolation techniques in Volks Municipal Drain and perimeter ditch (if wetted at the time of construction). • The temporary flow diversion system will use clean materials, adequately sized to withstand high-flow events and prevent sedimentation of the watercourse. • Fish located within the dewatering area will be rescued immediately and released as specified in a license to collect fish. • After construction, the cofferdams will be removed and the upstream dam will be gradually removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle prior to removing the upstream dam.	the reinstated ditches may not be possible due to the SWMP. Permanent changes to Volks Municipal Drain are expected following modifications (Options 1 or 2). However, water quality will be protected following construction. The Option 2 liner system is expected to support aquatic revegetation growth, the existing bed and bank elevations will be approximately maintained, natural substrates are expected to attenuate over the liner system. Option 1 is expected to result in the loss of approximately 588 m of fish habitat in the watercourse as fish cannot pass the long culvert. However, the fish habitat in the

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• Accumulated sediment from the isolated area will be removed before the isolation barrier.	existing watercourse is intermittent and does not support specialized life history functions for fish (e.g., spawning). The temporary change in fish habitat in Volks Municipal Drain due to cofferdam placement is minor and is not anticipated to interrupt key life processes of fish.
Volks Municipal Drain	Excavation and Grading	Excavation and grading can result in: • Bank instability and soil exposure leading to increased erosion potential, resulting in sediment concentration changes and thus changes in aquatic habitat in the watercourse.	• The contractor will develop an Erosion and Sediment Control (ESC) Plan and Spill Contingency Plan for the landfill expansion. • ESC measures will be installed upstream of the work area and along the banks in Volks Municipal Drain. • ESC measures will be regularly inspected to isolate the work area to prevent sediment from entering the watercourse.	Option 1: Residual effects to fish habitat structure and cover are anticipated due to modification to the watercourse bed and banks that will not be reinstated to pre-construction conditions. However, water quality will be protected following construction.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
		• Slope changes can alter drainage patterns and lead to increase erosion potential and sedimentation of the watercourse. • Excavation can alter base flows and change water temperature.	• Disturbed areas will be stabilized and reinstated, including minimizing changes to existing drainage patterns, implementing bioengineering and rock reinforcement, if required (Option 2; Option 1 to the extent possible). • Machinery will be operated on land with appropriate erosion control measures as needed (swamp mats) to eliminate disturbance to watercourse bed and banks. • Exposed soils will be stabilized and revegetated and drainage will be directed away from steep slopes where required.	Option 2: No residual effects are anticipated to the fish and fish habitat in Volks Municipal Drain if mitigation measures are properly implemented and maintained.
Volks Municipal Drain	Use of Construction Equipment	• Potential to create bank instability and soil exposure leading to changes in sediment concentrations. • Potential for equipment leaks and spills changing contaminant concentrations. • Potential for fish and fish egg mortality caused by machinery.	• Work will implement ESC measures described in the Erosion and Sediment Control Plan and Spill Contingency Plan. • In-water work will be carried out during low water levels and will avoid wet and rainy periods.	No residual effects to the fish and fish habitat in Volks Municipal Drain are anticipated if mitigation measures are properly implemented and maintained.

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			• In-water work will be conducted from 29 June to 14 March (no in-water work from 15 March to 28 June) to avoid sensitive periods for fish spawning. • Machinery will be operated on land with appropriate erosion control measures as needed (swamp mats) to reduce disturbance to watercourse banks. • All equipment will be clean and maintained so that no fluids or contaminants are leaked and no invasive weeds or pests are transferred to the watercourse as per the Clean Equipment Protocol for Industry. • Sediment and erosion control measures will be installed upstream and along the banks of Volks Municipal Drain and regularly inspected to isolate the work area to prevent sediment from entering the watercourse. • A spill prevention and response plan to be developed by the contractor to minimize the risk of accidental spills	

Surface Water Feature	Pathway of Effect(s)	Stressor (Potential Impact)	Mitigation Measures	Residual Effects
			or releases will be kept on site at all times. • All stockpiled materials, including but not limited to excavated overburden and topsoil, excess materials, construction debris and containers shall be stored and stabilized in a manner that prevents them from entering the watercourse. All construction materials will be removed and properly disposed of from site following construction.	
Volks Municipal Drain	Removal of Aquatic Vegetation	Removal of aquatic vegetation to accommodate modifications to Volks Municipal Drain can result in: • Changes in water temperature and dissolved oxygen. • Changes in food supply and nutrient concentrations available to fish. • Changes characteristics of fish habitat and cover.	• The removal of aquatic vegetation is limited to the footprint of the watercourse adjacent to the Site (approximately 588 m in length). • Aquatic vegetation is expected to naturally regenerate following construction (Option 2 only).	Minor, short-term residual effects to fish habitat structure, cover, food supply and nutrient concentrations are expected due to removal of aquatic vegetation in the Volks Municipal Drain.

Source: DFO Pathways of Effects (2018).

Potential residual effects to flow, fish passage, and fish access to habitats are anticipated due to infilling the perimeter ditch, and there will be a permanent loss of approximately 1,622 m of fish habitat. However, the habitat in the ditch is seasonal and of marginal quality. New ditches will be reinstated around the expanded landfill; however, fish may not be able to access the ditches upstream of the SWMP. Minor residual changes to flow and water quality (e.g., dissolved oxygen, TSS) in the reinstated perimeter ditch and Volks Municipal Ditch are expected; however, the SWMP will be implemented to control peak flows off-site to pre-expansion conditions and achieve 80% TSS removal. Residual effects to fish passage issues upstream of the SWMP in perimeter ditch are minor as the improvements in Volks Municipal Drain water quality resulting from the SWMP are expected to outweigh the loss of access to the seasonal, low quality habitat within the perimeter ditch.

Potential residual effects to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain are anticipated due to enclosing the Drain in a culvert as part of modification Option 1. The length of the culvert is impassable for fish preventing fish access to upstream reaches of the Drain, removing fish access to the perimeter ditch, and increasing flows through the culvert in high-flow periods relative to existing conditions. Option 1 is expected to result in the loss of approximately 588 m of fish habitat in the watercourse (within the long culvert), and permanent changes to fish structure and cover are expected as the bed and banks will not be restored to pre-construction conditions. However, the fish habitat in the existing watercourse is intermittent and does not support specialized life history functions for fish (e.g., spawning).

Potential residual effects to flow and fish access to habitats upstream of the landfill expansion in Volks Municipal Drain are anticipated due to installation of a liner system as part of modification Option 2; however, modification Option 2 is expected to have less of an impact to fish and fish habitat compared to modification Option 1. Potential residual effects are expected to be minor following application of mitigation measures, as the proposed liner system is expected to support aquatic revegetation growth, the existing bed and bank elevations will be maintained, and natural substrates are expected to attenuate over the channel, maintaining natural conditions as much as possible.

The temporary change in fish habitat in Volks Municipal Drain due to cofferdam placement is minor and is not anticipated to interrupt key life processes of fish. The temporary obstruction of fish passage due to temporary flow structures in Volks Municipal Drain is of short duration and is not anticipated to interrupt key life processes of fish, if applicable mitigation measures are carried out.

13.4.1.2 Terrestrial Ecosystems

13.4.1.2.1 Potential Direct Impacts

The proposed expansion will result in disturbance of 9.3 ha of naturally occurring vegetation (i.e., outside of the current interpreted waste footprint shown on Figure 13-9), which includes the proposed limit of waste for the proposed expansion, the relocated perimeter ditches, the SWMP, and an assumed offset of approximately 30 m to allow for construction access (offset does not extend off-site to the west or north). The disturbance area values discussed below (e.g., significant woodlands, wetlands, etc.) are overlapping features in many cases, and all occur within the total 9.3 ha of anticipated disturbance. While the proposed expansion avoids some areas of natural heritage features and functions, some direct impacts are anticipated. These impacts are based on the occurrence of:

- Habitat for endangered or threatened species (little brown myotis)
- Significant woodland
- Evaluated non-PSW (Melvin Swamp) and unevaluated wetlands
- Significant wildlife habitat - species of conservation concern (wood thrush and eastern wood-pewee)
- Significant wildlife habitat – interior forest

The proposed expansion will result in the loss of three trees that were identified as potential maternity roost habitat for little brown myotis, which is designated endangered under the ESA. In addition, 5.2 ha of the contiguous ELC ecosite associated with the potential roost trees, and foraging habitat, will be removed. As this species and its habitat is protected under the ESA, an Information Gathering Form must be prepared and submitted to the MECP prior to any works being undertaken to initiate any required permitting under the ESA. Additional endangered and threatened species have the potential to be present in the Site-vicinity Area where areas of construction disturbance could occur. For this reason, barn swallow, bobolink, eastern meadowlark, American ginseng and butternut should be included on the Information Gathering Form submitted to the MECP to confirm that no permitting under the ESA related to those species is required. Additionally, American ginseng and butternut surveys will be completed in the Site-vicinity Area where construction disturbance is anticipated on the east site of the stormwater management pond.

The proposed expansion will result in the loss of 6.3 ha of the overall 54.5 ha significant woodland (11.5% decrease). Although forest cover in the planning area is low, the woodland loss does not represent a significant reduction of the size of the overall woodland, especially when the additional woodlands north of Boyne Road are considered. The proposed expansion will occur at the western edge of the forest and immediately south of the existing landfill, so no fragmentation or impacts to the core of the woodland patch will result. It is not expected that the proposed expansion will affect the function of the woodland for provision of wildlife habitat.

The proposed expansion will result in the loss of 7.2 ha of evaluated non-PSW and unevaluated wetlands. This represents approximately 8% of the approximately 85.4 ha of contiguous wetland on and off-site, south of Boyne Road. Additional wetlands are also present north of Boyne Road. Based on field observations, the wetlands did not support significant numbers of wetland-obligate species, such as amphibians. The proposed expansion is not expected to have a significant impact on the remaining portions of the wetlands or their functions.

The proposed expansion will result in the loss of 6.3 ha of significant wildlife habitat for wood thrush and eastern wood-pewee. Although forest cover in the planning area is low, the proposed expansion is not expected to reduce the ability of either species to continue to use the remaining 48.2 ha of forest adjacent to the proposed expansion for breeding.

The proposed expansion will result in the loss of 1.3 ha of the approximately 6.0 ha of significant wildlife habitat in the form of interior forest habitat. The proposed expansion will occur at the western edge of the forest and immediately south of the existing landfill, so no fragmentation or impacts to the core of the interior forest habitat will result. The proposed expansion will not significantly reduce the area of interior forest habitat available in the woodland, and the remaining portions will continue to provide this habitat type for area-sensitive species.

In addition to the features discussed above, the proposed expansion has the potential to cause direct mortality to wildlife during construction. To avoid contravention of the *Migratory Birds Convention Act*, clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31) to protect birds, their nests and young. If clearing must occur during this time, a nest survey must be performed by a qualified biologist within 24 hours prior to the proposed works. If a nest is located, it must be buffered and protected until it is no longer active. Other wildlife have the potential for direct mortality during construction, such as snakes and mammals. A Wildlife Encounter Protocol should be developed for use during construction, and all staff should be trained on the contents of the protocol. The protocol should include steps to take if wildlife are observed in the work area, if wildlife are injured, and contact information for appropriate individuals who can offer advice or assistance. Any specific mitigation measures identified by MECP for little brown myotis as a result of consultation, following submission of the Information Gathering Form, must also be implemented.

13.4.1.2.2 Potential Indirect Impacts

Potential indirect impacts of the construction phase include typical construction-related impacts. These potential indirect impacts are not considered significant and are mitigable with standard construction best management practices. These potential indirect impacts and the corresponding best management mitigation practices are as follows:

- Accidental spills or sedimentation in adjacent vegetation communities
  - Best Management Practices: Regular equipment maintenance to minimize the potential for fluid leaks/releases; Spill Prevention & Response Plan; Sediment & Erosion Control Plan to isolate work areas from adjacent vegetation communities

- Dust deposition on vegetation in adjacent vegetation communities
  - Best Management Practices: provide dust control measures as required (water spray is preferred)
- Noise related impacts to wildlife in adjacent habitats
  - Best Management Practices: maintenance of equipment, controls on equipment use including site speed limits
- Introduction of invasive plant species via construction equipment
  - Best Management Practices: clean equipment prior to mobilizing it to the site (per the Clean Equipment Protocol for Industry)

13.4.2 Operations Stage

13.4.2.1 Aquatic Ecosystems

13.4.2.1.1 Potential Direct Impacts

Once the proposed expansion is constructed, potential impacts related to the landfill during the Operations Stage on surface water features are expected to be limited to effects related to the use of site operations equipment (Table 13-27). These impacts can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage (Table 13-26), routine environmental monitoring for potential releases from the landfill and, if required, investigation and mitigation measures before adverse effects occur off-site.

Table 13-27: Summary of Potential Pathway of Effects and Measures to Protect Fish Habitat Related to the Landfill Expansion Operation Stage

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
Direct Impacts		
Habitat Loss and Alteration • Change in habitat structure and cover. • Change in food supply. • Change in access to habitat/migration.	• Minimize footprint associated with landfill expansion. • Minimize riparian and aquatic vegetation clearing and use proper clearing techniques. • Minimize duration of any in-water mitigation measures. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Complete any in-water works from 1 July to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods. • Minimize organic debris (e.g., woody debris) clearing and use proper clearing techniques. • Revegetate cleared areas using native species. • Remove all material or structures (e.g., isolation dams, silt curtains) placed in the watercourse and perimeter ditch. • If required for maintenance, construct in isolation and complete a fish rescue to remove and relocate fish from the isolated work area.	The relocation of the perimeter ditch and removal of watercourse (i.e., Reach 2) will result in approximately 1621 m (10,011 m^2) of "supporting" fish habitat loss based on current plans. However, this habitat is unlikely to be used directly by fish and the existing ditch contributes flows downstream to fish bearing waters. Flows downstream will be maintained and improved through a new ditch and SWMP.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
Potential mortality of fish/eggs/ova from equipment	• Minimize footprint associated with landfill expansion. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works. • Complete any in-water mitigation measures from 16 July to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods.	No negative residual effects anticipated if mitigation measures are properly applied and maintained.
Displacement or stranding of fish or incubating eggs	• Minimize footprint associated with landfill expansion. • Maintain 100% downstream flow during construction. • If required for maintenance, construct an isolation area and perform a fish rescue to remove and relocate all fish from the isolated work area. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works. • Complete any in-water mitigation measures from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods.	

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• If applicable, follow the DFO interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020e) to prevent entrainment or impingement of fish. • If applicable, ensure in-water activities do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of a fish. • If applicable, ensure the pumping system is sized to accommodate expected high flows/high water events during the construction period. Pumps should always be monitored, and back-up pumps should be readily available on-site in case of pump failure. • If applicable, protect pump discharge area(s) to prevent erosion and the release of suspended sediments and remove this material when the works have been completed.	
Incidental entrainment, impingements or mortality of resident species	• Minimize footprint associated with landfill expansion. • Maintain 100% downstream flow during construction. • If required for maintenance, construct an isolation area and perform a fish rescue to remove and relocate all fish from the isolated work area. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b). • Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works.	No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• Complete any in-water mitigation measures from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods. • If applicable, follow the DFO interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020e) to prevent entrainment or impingement of fish. • If applicable, ensure in-water activities do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of a fish. • If applicable, ensure the pumping system is sized to accommodate expected high flows/high water events during the construction period. Pumps should always be monitored, and back-up pumps should be readily available on-site in case of pump failure. • If applicable, protect pump discharge area(s) to prevent erosion and the release of suspended sediments and remove this material when the works have been completed.	
Direct mortality of fish	• Minimize footprint associated with landfill expansion. • Maintain 100% downstream flow during construction. • If required for maintenance, construct an isolation area and perform a fish rescue to remove and relocate all fish from the isolated work area. • Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b).	

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• Operate machinery from above the high watermark to minimize the disturbance of the bed, riparian area, and shoreline. • Minimize duration of in-water works. • Complete any in-water mitigation measures from 29 June to 14 March, which is outside the restricted activity timing window to avoid spawning and egg/larval development periods. • If applicable, follow the DFO interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020e) to prevent entrainment or impingement of fish. • If applicable, ensure in-water activities do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of a fish. • If applicable, ensure the pumping system is sized to accommodate expected high flows/high water events during the construction period. Pumps should always be monitored, and back-up pumps should be readily available on-site in case of pump failure. If applicable, protect pump discharge area(s) to prevent erosion and the release of suspended sediments and remove this material when the works have been completed.	

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
Indirect Impacts		
Change in water quality including a change in: • Contaminant concentrations. • Nutrient concentrations. • Water temperature. • Dissolved oxygen concentrations.	• Follow the mitigation measures outlined under the "change in sediment concentrations" stressor. • Develop and implement a site-specific Spill Management Plan and have all components of the Plan on-site at all times in event of a spill. • Maintain equipment in clean condition and free of fluid leaks, invasive species (per the Clean Equipment Protocol for Industry), or noxious weeds. • Wash, refuel, and service equipment away from watercourse and perimeter ditch (i.e., greater than 30 m). • Plan activities near water such that chemicals do not enter watercourse and perimeter ditch. • Ensure that material used in a watercourse has been handled and treated in a manner to prevent the release or leaching of substances into the water that may be deleterious to fish. • Minimize aquatic and terrestrial vegetation clearing and use proper clearing techniques. • Revegetate cleared terrestrial areas to minimize exposed soils and therefore erosion potential. • Revegetate cleared terrestrial areas with native species. • Remove all material or structures (e.g., isolation dams, silt curtains) placed in the waterbody. • Minimize organic debris (e.g., woody debris) clearing and use proper clearing techniques.	No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• If appliable, follow the DFO interim code of practice for routine maintenance and dredging (DFO, 2020b) and temporary cofferdams and diversion channels (DFO, 2020c).	
Change in base flow	• Minimize footprint associated with the landfill expansion. • Undertake all in-water activities in isolation of open or flowing water to maintain the natural flow of water. • Follow the DFO interim code of practice for culvert maintenance (DFO, 2020d) and temporary cofferdams and diversion channels (DFO, 2020c).	No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Change in sediment concentrations	• Apply DFO's Measures to Protect Fish and Fish Habitat (DFO, 2019b).
	• Obtain and work in compliance with regulatory permits and approvals.
	• Develop and implement a site-specific Erosion and Sediment Control Plan or equivalent that minimizes risk of sedimentation in the watercourse and perimeter ditch during all phases of the landfill expansion.
	• Install, monitor, and maintain effective erosion and sediment control measures (e.g., silt fence, cofferdam) before starting work to prevent sediment from entering the watercourse and perimeter ditch.
	• Temporary erosion control measures must be:
	  • Properly installed.
	  • Installed before or immediately after disturbance.
		No negative residual effects anticipated if mitigation measures are properly applied and maintained.

Stressor	Expected Mitigation Measures to Protect Fish and Fish Habitat	Residual Effect
	• Inspected and properly maintained (e.g., repaired, replaced, or supplemented with functional materials) throughout construction until permanent erosion control is established, or reclamation is complete. • Manage water flowing onto the site, as well as water being pumped/diverted from the site, such that sediment is filtered out prior to the water entering the watercourse and perimeter ditch. • Conduct in-water work during a period of low flow and avoid wet, windy, and rainy periods. • Minimize duration of in-water work. • Revegetate disturbed areas and exposed soils on shoreline banks. • Revegetate cleared areas to minimize exposed soils and, therefore, erosion potential. • Revegetate cleared areas with native species. • Undertake all instream activities in isolation of open or flowing water to avoid introducing sediment into the watercourse and perimeter ditch. • If appliable, follow the DFO interim code of practice for routine maintenance and dredging (DFO, 2020b) and temporary cofferdams and diversion channels (DFO, 2020c).	

Notes: DFO = Fisheries and Oceans Canada.

13.4.2.1.2 Potential Indirect Impacts

During the Operations Stage, potential indirect impacts to aquatic ecosystems are likely to be limited to the following:

- Site runoff, accidental spills, or sedimentation of fish habitat
- Dust and airborne waste deposition into fish habitat

Given the presence of the existing landfill, some of these potential impacts (i.e., site runoff, accidental spills, dust and airborne waste) are already present to some degree. These potential impacts will be mitigated by a site-specific Erosion and Sediment Control Plan and Spill Contingency Plan or equivalent, as well as maintaining regulated air quality parameters. Monitoring of groundwater and surface water quality and quantity will be carried out to meet relevant provincial permitting and approvals.

The proposed SWMP at the northeast corner area of the landfill site on the south side of Boyne Road will be designed so that it provides enhanced (80%) TSS removal and control peak flows off-site. The modifications to Volks Municipal Drain will be designed to prevent potential seepage of leachate-impacted groundwater into the surface water in the ditch. Therefore, with the addition of the SWMP and modifications to Volks Municipal Drain and implementation of appropriate mitigation measures (i.e., erosion and sediment control; Table 13-27), existing standard operational measures, and groundwater and surface water quality/quantity monitoring, potential indirect impacts to fish and fish habitat during the Operations Stage are considered minor.

13.4.2.2 Terrestrial Ecosystems

13.4.2.2.1 Potential Direct Impacts

Once the proposed expansion is constructed, impacts related to the Operations Stage of the landfill are expected to be limited to potential, occasional mortality of wildlife. These occurrences can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage, and compensation for the loss of habitat of endangered species (as described in Section 13.4.1.2.1).

13.4.2.2.2 Potential Indirect Impacts

During the Operations Stage of the proposed expansion, potential indirect impacts to terrestrial ecosystems are likely to be limited to the following types of impacts:

- Accidental spills or sedimentation in adjacent vegetation communities
- Dust and airborne waste deposition in natural habitats
- Noise related impacts on wildlife in adjacent habitats
- Introduction of invasive plant species via equipment or yard waste

Given the presence of the existing landfill, some of these impacts may be or already are present to some degree. The existing standard operational measures will continue to mitigate these potential impacts to the extent feasible, and the proposed buffer around the proposed limit of waste will provide a buffer to adjacent natural areas and the associated habitats they represent.

13.4.3 Closure and Post-closure Stage

13.4.3.1 Aquatic Ecosystems

13.4.3.1.1 Potential Direct Impacts

Activities associated with landfill closure include the addition of final cover soil, organic material capable of supporting vegetation growth (such as topsoil) and revegetation; as such, potential direct impacts to aquatic systems are anticipated to include:

- Planting terrestrial vegetation adjacent to a watercourse
- Using mechanical equipment for the addition of topsoil and plantings

The use of mechanical equipment near the watercourse, above the highwater mark, may cause accidental release of deleterious substances and sedimentation of fish habitat. These impacts can be avoided through the mitigation measures to protect fish and fish habitat outlined in Section 13.4.4.1.1 (Table 13-27).

Riparian planting and addition of topsoil may influence fish habitat through changes in water quality (i.e., temperature, dissolved oxygen, nutrient concentrations), habitat structure and cover, and food supply. The addition of riparian plantings of native vegetation are expected to improve fish habitat through increased cover for fish, water quality, and prevent sedimentation or runoff of deleterious substances into fish habitat.

13.4.3.1.2 Potential Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to effects from site runoff to the reinstated perimeter ditch (e.g., contamination, sedimentation). With the continued operation of the proposed SWMP, indirect impacts to fish habitat as a result of landfill closure are not anticipated.

13.4.3.2 Terrestrial Ecosystems

13.4.3.2.1 Potential Direct Impacts

Activities associated with landfill closure include the addition of final cover soil, organic material capable of supporting vegetation growth (such as topsoil) and plantings of native vegetation; as such, the landfill closure will result in some compensation for natural communities lost during construction and operations. No negative direct impacts are anticipated.

13.4.3.2.2 Potential Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to stormwater management on the landfill site, and possible importation of invasive species with the landfill cover seed mix, topsoil or via the equipment used to implement the capping. Care must be taken to ensure the materials imported to the landfill site for capping of the landfill are free of invasive species through careful preparation of the seed mix and sourcing of the topsoil, and making sure equipment is clean and free of invasive species. With these measures, indirect impacts as a result of landfill closure are not anticipated.

13.4.3.3 Construction Stage

13.4.3.3.1 Aquatic Ecosystems

The Pathways of Effects were used to identify and evaluate potential effects, and applicable mitigation measures were identified for the Landfill Expansion Construction Stage (Table 13-26). Residual effects, if any, are identified for activities that cannot be eliminated through implementation of mitigation measures to protect fish and fish habitat (DFO, 2019b), and DFO standards and interim codes of practice (e.g., DFO, 2020b,c).

Approvals Requirements for Potential Impacts to Fish and Fish Habitat

As the likelihood of the HADD of fish habitat cannot be avoided for the proposed expansion (based on current preliminary design options), the landfill expansion will likely require review by DFO through a Request for Review submission during the detailed design process. DFO will provide a determination regarding approvals requirements. If required, consultation with DFO will need to occur to determine if habitat compensation measures are required. These measures may include incorporating design elements or habitat features that further improve fish habitat (e.g., riparian plantings, instream features, varied substrates), creating additional fish habitat on/off-site, or a combination of these measures. If required, a DFO application for Authorization will include a comprehensive impact assessment that will incorporate the landfill expansion detailed design

13.4.3.3.2 Terrestrial Ecosystems

Mitigation of Direct Impacts to Species at Risk and Wildlife

Natural heritage features and habitat are most susceptible to being altered during the construction stage. Therefore, construction activities need to be mitigated and controlled to avoid significant adverse effects.

To avoid contravention of the *Migratory Birds Convention Act*, clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31) to protect birds, their nests and young. If clearing must occur during this time, a nest survey must be performed by a qualified biologist within 24 hours prior to the proposed works. If a nest is located, it must be buffered and protected until it is no longer active.

Based on the proposed expansion and its proximity to natural heritage features and significant species, the preparation and implementation of a Wildlife Encounter Protocol will be required. This protocol will outline the steps to take in the event of an encounter with wildlife, including SAR, during the construction stage, including steps to take if wildlife are injured. Detailed information and specific requirements related to wildlife and SAR encounters will be incorporated in the protocol including proper species identification, taxa- or species-specific handling methods, contact information if support is needed, and reporting of wildlife and SAR as required by provincial legislation.

Along with the Wildlife Encounter Protocol, further mitigation related to potential wildlife and SAR encounters during the construction stage will include the following items:

- Species Fact Sheets for SAR that may be encountered on-site during the construction stage will be posted on-site in the site office or trailer where it is visible to workers for review. These fact sheets will outline SAR identification and species-specific protocols in the event they are encountered.
- To ensure compliance with policy and the Wildlife Encounter Protocol, all persons entering the Site will receive staff training outlining the proper identification, handling methods, any associated reporting of wildlife and/or SAR encounters, and steps to take to ensure compliance with the in the event of wildlife and SAR encounters.

Wildlife exclusionary fencing around the landfill expansion area, or portions of the area should be considered at Detailed Design to mitigate wildlife encounters on site during construction.

In addition, typical construction mitigation measures such as erosion and sediment control, work area delineation, noise reduction, dust suppression, etc. must be implemented. All heavy machinery should be carefully cleaned prior to entering the work area to reduce the potential for spread of invasive species to the Site.

Compensation for Potential Impacts to SAR and Wildlife

As habitat for SAR bats (little brown myotis) cannot be avoided within the proposed expansion, a permit under the ESA (*O. Reg.* 242/08) will be required, and conditions of such a permit will likely include compensation measures. Consultation with the MECP will be required to determine appropriate compensation measures. These measures may include planting additional forest habitat nearby, providing alternative roost structures (e.g., bat boxes), funding research studies, or a combination of these measures.

No compensation for the loss of other features, such as interior forest habitat and wetlands, is warranted as the remaining natural areas will continue to function as wildlife habitat.

13.4.3.4 Operations Stage

During the Operations Stage, standard mitigation measures for erosion and sediment control, accidental spills, dust suppression, reduction of airborne waste, timing of operations and maintenance of the SWMS and facilities will be required.

As heavy machinery activity will continue throughout the operations phase, implementation of the Wildlife Encounter Protocol developed for the Construction Stage should continue. Equipment for containing spills should be available on-site. The following should be implemented: provide spill response kits in fuel and hazardous materials storage and handling facilities at temporary work areas, in on-site work areas and/or in vehicles and equipment, and train personnel in spill response practices and procedures; contain and clean up spills and leaks as soon as possible following incidents; maintain equipment in clean condition and free of fluid leaks, invasive species, or noxious weeds; and wash, refuel, and service equipment away from the watercourse and perimeter ditch (i.e., greater than 30 m).

Mitigations during the Operations Stage associated with SAR, if any, will be contained in the conditions of the permit issued under the ESA (*O. Reg.* 242/08). Best management practices and environmental approval conditions, permits, authorizations, or plans issued for the landfill expansion would be followed.

13.4.3.5 Closure and Post-Closure Stage

The Closure and Post-closure stage of the landfill is self-mitigating, as the site will be vegetated as landfilling is completed in the proposed expansion. Plantings should include native, non-invasive species that are known to occur within the region. The riparian edges should be revegetated using the same species that were removed to the extent possible. As well, revegetate disturbed areas and install appropriate erosion control measures over exposed soils on banks. Care must be taken to ensure the materials imported to the Site are free of invasive species through careful preparation of the seed mix and sourcing of the topsoil, and making sure equipment is clean and free of invasive species.

Mitigation during the Closure and Post-closure Stage associated with SAR, if any, will be contained in the conditions of the permit issued under the ESA (*O. Reg.* 242/08).

13.5 Land Use Planning

This section provides the assessment of impacts from the proposed expansion of the Boyne Road Landfill on land use.

The preferred expansion for the landfill site is primarily a horizontal expansion to the south of the existing landfill and a vertical expansion above the southern portion of the approved top of landfill contours. The expansion will add an additional 3.8 ha to the landfill footprint, as well as 16.21 ha of Township-owned property to the east and southeast of the overall landfill property. These Township-owned lands are not currently zoned for landfill use and will remain zoned as Rural.

The following data sources were utilized for this assessment:

- Provincial Policy Statement, 2020
- United Counties of Stormont, Dundas, and Glengarry Official Plan (2018)
- Township of Winchester Zoning By-law No. 12-93

- MECP Guideline D-4, Land Use On or Near Landfills and Dumps
- MECP Guideline D-6, Compatibility between Industrial Facilities
- Digital sources to supplement the characterization of existing conditions.

13.5.1 Policy Overview

Following is an overview of the policy and guidelines described above that were used to discern the existing Site Area and Site-vicinity Study Area characteristics in terms of land use composition.

13.5.1.1 Provincial Policy Statement, 2020

The PPS defines *waste management systems* as sites and facilities designed to accommodate solid waste from one or more municipalities and may include recycling facilities, transfer stations, processing and disposal sites.

Given the nature and scale of the expansion and the surrounding land use context, the following policies contained with Section 1.0 of the PPS have specific relevance to the landfill expansion:

Policy 1.1.1 states that healthy, liveable and safe communities are sustained by:

a) promoting efficient development and land use patterns which sustain the financial well-being of the Province and municipalities over the long term;

c) avoiding development and land use patterns which may cause environmental or public health and safety concerns.

Opinion regarding PPS2020:

The landfill expansion will help to promote an efficient land use pattern to help sustain the financial well-being of the Province and Township over the long term. In this regard, the landfill expansion is expected to increase the available capacity of the landfill to the year 2048, which will allow the Township to continue to use these lands as designated for waste to be disposed of locally.

The lands for the expansion are Class O (Organic) soils. These are not considered as being lands that would normally be considered for protection as Prime Agricultural Lands nor included within a Prime Agricultural Area for long-term protection for agriculture.

The landfill expansion is to take place within the existing landfill property, avoiding the need to use additional undeveloped lands. According to the OP schedule, the existing landfill is designated as Rural by the Official Plan and is surrounded by Agricultural and Rural land uses. It is not anticipated that the expansion of the landfill will have any direct negative effects on these existing land uses. The designation of the landfill site on the Official Plan uses symbology, an “A” to show the area as a landfill use. This symbology denotates usage, not spatial usage, and as such does not define the size of

the landfill site. Therefore, no Official Plan Amendment is required as there are no spatial limitations to change.

Based upon analysis of the existing context, there does not appear to be any existing development that would be adversely affected in terms of PPS2020 policy.

13.5.1.2 United Counties of Stormont, Dundas, and Glengarry Official Plan

The County Official Plan directs development for the next 20 years in the municipality. The Plan designates the Landfill Site within the Rural Zone, and as having an Active Landfill. The intent of this designation is to promote agricultural land uses and a limited amount of residential development so residential development will not impede existing agriculture and non-agriculture uses. The landfill is also considered as an appropriate rural land use.

There are also policies that require study for any development that is proposed within proximity of the landfill (see below).

Permitted uses within this designation include:

- agricultural uses, forestry and conservation, and natural resource management
- residential uses of existing lots of record and new lots created by severance as provided for by this Plan
- Animal boarding, breeding, and training facilities, including stables
- Bed and breakfast establishments
- Open space
- Cemeteries

Relevant sections of the OP to waste management systems, and the proposed expansion include:

3.5.2.2.9. Land use compatibility shall be considered in the design and development or redevelopment of residential areas. This includes establishing or respecting building setbacks, separation distances, and influence areas from incompatible land uses (e.g., sewage treatment facilities, waste management facilities, industrial uses, mineral extraction operations etc.). Such uses should be located to avoid existing and future residential areas.

4.3.5.5 Local Municipalities will use a 500 m radius, or such other distance recommended by the Ministry of the Environment, as a guideline for triggering the assessment of the impact(s) of waste management systems on surrounding lands. Development proposals near sensitive land uses within the influence study area must include, but are not limited to, landfill generated gases, ground and surface water contamination by leachate, odour, litter, vehicular traffic, dust, noise, vectors and vermin and visual impact (see Section 3.5.1.5). Development within 500 m of the lands zoned for waste disposal shall generally be discouraged unless supported by an appropriate study or studies which confirm that there will be no negative

impacts on the proposed development related to current uses/activities associated with the normal operation of the waste management system. Furthermore, the study(ies) shall confirm, to the satisfaction of the County, that the proposed development will not impact future expansions of the uses/activities associated with the existing waste management system.

Opinion regarding Official Plan Policy:

As previously mentioned, as the denotation of the landfill site on the Official Plan Schedule is a symbol, and does not designate spatial usage, an Official Plan Amendment will not be required to expand the landfill site.

According to the OP schedule, the existing landfill is surrounded by Agricultural and Rural land uses. Through the land use analysis, agricultural fields were identified surrounding the landfill site. It is considered that the expansion of the landfill, as described above, will not have any direct negative effects on these existing land uses.

13.5.1.3 Township of Winchester Zoning By-law No. 12-93

The current active Boyne Road Landfill site is zoned SRD under the Township of Winchester Zoning By-law No. 12-93. The balance of the Township owned lands are zoned as Rural. It is noted that the Township still uses the By-laws that existed at the time of amalgamation, hence the reference is still to the former municipality and not North Dundas.

Waste disposal site is defined as (Section 2.103) a site which is licensed or approved by the Ministry of the Environment and/or its agents where garbage, refuse, domestic or industrial waste is disposed of or dumped, excluding radioactive or toxic chemical wastes, and shall include a sludge disposal area.

Permitted uses within the SRD zone (Section 11.5) include:

- agricultural uses
- conservation use
- forestry use
- waste disposal site

The expansion is to take place within the existing lands designated by the Official Plan as a Waste Disposal Site. The separation distance between SRD uses and dwelling units must be 500 m as stated in the Official Plan, and as found in Section 3.19 of the Zoning By-law.

The lands to the south and east, designated for addition to the existing Landfill Site, are designated Rural. Permitted uses within the Rural designation include:

- accessory dwelling
- agricultural use
- apartment, accessory

- apiary
- conservation use
- farm produce outlet
- forestry use
- golf course
- group home
- market and nursery gardening
- riding stable
- rural home occupation
- riding stable
- rural home occupation
- single dwelling
- sod farming
- trail system
- wayside pit or wayside quarry

The zoning By-law, in Section 3.19, identifies the restrictions on uses within 500 m of the SRD Zone. This is the only tool used by most people when making choices on land purchases and requests for land development. Thus, while there is no requirement for a zoning change for the expansion, it is best practice to amend the zoning should the EA be approved to ensure transparency with the public.

Opinion regarding Zoning:

Waste disposal sites are not a permitted use within the Rural designation. However, the area proposed for the expansion is already owned by the Township and is simply being added to the designated part of the lands as an additional buffer to accommodate the landfill expansion and will not be used for waste management services. Therefore, a re-zoning of this property is not required to accommodate the proposed landfill expansion. However, it is recommended that once the EA has been approved confirming that this additional land is to be reserved as part of the landfill site property for buffer area, the Township rezone the lands to ensure that the 500 m study area is correctly identified when using the land use schedule to the Zoning By-law, as this is the only tool available to the general public in regard to potential development within the 500 m restricted zone around the landfill site.

13.5.1.4 MECP Guideline D-4, Land Use On or Near Landfills and Dumps

This guideline identifies restrictions and controls on land use in the vicinity of landfills and dumps to protect the health, safety, convenience and welfare of residents near such facilities. The direction provided in this document is a compliment to existing Ministry abatement programs for landfills and is a direct application of Guideline D-1, Land Use Compatibility.

Application of the D-4 Guideline extends to all proposals for land use on, or near, operating and non-operating landfills, that contain municipal solid waste, industrial solid waste and/or sewage sludges.

The guide states that no land use shall take place with 30 m of an active landfill site and that the landfill shall have a buffer of no less than 30 m. The typical buffer is between 30 and 100 m with a 500 m study area for anticipated impacts.

The addition of Township-owned lands as an additional buffer, while satisfying the 30 to 100 m buffer requirement, will require that the 500 m study area be adjusted to start from the new landfill site property line.

Opinion regarding D-4:

Based on the analysis, the landfill expansion is consistent with the D-4 Guideline.

13.5.1.5 MECP Guideline D-6, Compatibility between Industrial Facilities

The *MECP Guideline D-6 Compatibility between Industrial Facilities* defines category designations for industrial uses and provides recommended distances between these uses and sensitive land uses.

There are no anticipated impacts in relation to the D-6 Guideline as the County and Township define minimum buffers of 30 m between the landfill and adjacent land uses, and 500 m between the landfill and sensitive land uses.

Opinion regarding D-6:

The landfill expansion is consistent with the D-6 Guideline.

13.6 Agriculture

This section provides the assessment of impacts from the proposed expansion of the Boyne Road Landfill on agriculture and agricultural land use.

In the United Counties of Stormont, Dundas and Glengarry Official Plan, the majority of the Township of North Dundas is designated as Agricultural Resource Lands outside of the Urban Settlement Area. The County Official Plan defines Agricultural Resource Lands as lands predominated by prime agricultural lands and other large tracts of land characterized by viable farming activity.

In the Township of North Dundas, subject lands that are in the former Township of Winchester immediately surrounding the Boyne Road Landfill site are designated as Rural, where agricultural use is a permitted use. Lands on the perimeter of these Rural lands are designated Agricultural Zone.

Both the County OP and Township Zoning By-law require a minimum separation distance of 500 m between the lands zoned for waste disposal (SRD) and sensitive land uses, and no land use may take place within 30 m of the fill area.

The addition of the Township-owned lands will create a larger buffer on the east and south side of the landfill and no land use will be allowed on this property.

13.6.1 Soil

The Ministry of Agriculture, Food and Rural Affairs Agricultural Maps shows the Landfill Site within a Muck soil area. Muck soil, as defined in the Soil Survey of Dundas County (Ontario Agricultural College, 1952), is soil 0 to 450 mm deep of organic layer consisting of semi-decomposed vegetative material, usually neutral to alkaline on the surface. This soil is generally not suitable for agriculture and has traditionally not been included in an Agricultural designation, as it requires a great deal of work to prepare for crops and the rate of return is low.

The landfill expansion is to take place within this Muck soil area and it is not anticipated that the expansion will overtly affect neighbouring soils.

13.6.2 Agricultural Impact Assessment

An Agricultural Impact Assessment (AIA) is a study that evaluates the potential impacts of non-agricultural development on agricultural operations and the Agricultural System and recommends ways to avoid or, if avoidance is not possible, minimize and mitigate adverse impacts. This assessment of effects on agricultural land use, while not an AIA is an AIA-based summary of the potential effects from the proposed landfill expansion and has considered requirements described in the Draft Agricultural Impact Assessment Guidance Document (Ontario Ministry of Agriculture, Food and Rural Affairs, March 2018).

There are five active farming operations in proximity to the landfill site. The Township engages in regular discussions with the owners of these farms, and they are aware of the expansion and the expansion process.

It is expected that neighbouring agricultural operations will continue to implement normal farm practices. Based on the noise and odour assessments completed during this EA it is not anticipated that agricultural operations will complain about these potential nuisance effects. It is anticipated that any nuisance effects associated with the landfill expansion will be at worst occasional and of low magnitude. As identified in studies completed for the EA, elevated dust levels can pose a potential impact to nearby crops. Mitigation measures will be implemented to minimize the amount of airborne dust such as enforcing on-site speed limits and applying site fugitive dust best management practices, as necessary and appropriate (e.g., watering or applying dust suppressant to on-site road surfaces).

The expansion is not expected to cause issues with farm vehicles in the area. The volume of farm vehicles and observations during a September 2021 traffic counting period did not identify any major impacts at intersections or along the roadways due to the equipment.

No active agricultural operations will be affected with the proposed landfill expansion. Lands adjacent to the landfill site and used as agricultural fields will continue to be used for this purpose.

13.7 Cultural Heritage Resources

13.7.1 Archaeological Resources

In support of this EASR, a Stage 1 archaeological assessment was carried out in the Site Study Area (Volume 2 Appendix G-2) and submitted to MHSTCI.

Although the Site Study Area was identified as having archaeological potential within 100 m of Boyne Road, this archaeological potential has been impacted by the existing Boyne Road Landfill. The landfill has resulted in disturbance below grade in the northern half of the Site Study Area and significant landscape alteration as seen by the presence of large berms around its boundaries. A previous Stage 1 archaeological assessment conducted by CARF (1992) that covers a portion of the present Stage 1 Site Study Area along Boyne Road also indicated that this area had low potential for archaeological resources.

The southern portion of the Site Study Area is not associated with any features indicating archaeological potential and is thus considered to have low potential for archaeological resources. The drainage ditches located within the Site Study Area reflect 20th century alterations to the landscape and background research shows they do not correspond to any historical water sources located within 300 m. As such, the Site Study Area does not meet the requirements for further archaeological assessment based on the MHSTCI Standards and Guidelines for Consultant Archaeologists (MHSTCI, 2011) and no further archaeological assessments are recommended for the Stage 1 Site Study Area.

The Stage 1 archaeological assessment resulted in the following recommendations:

1. No further archaeological assessments are required for the Site Study Area as shown on Figure 8-1.
2. Should archaeological resources be identified during the landfill expansion in the areas identified as having low archaeological potential on Figure 8-1, a licensed archaeologist should be contacted and additional archaeological assessment may be required.
3. Should landscape disturbance extend beyond the present Stage 1 Site Study Area, additional archaeological assessment may be required.

13.7.2 Cultural Heritage Landscapes and Cultural Heritage Resources

The Counties' *Official Plan* identifies the study area as an active landfill site within a Rural District and across from Crown Land located on part of Lot 8, Concession 7. The Counties' Land Use Schedules B1 and B2 indicate that the Site-vicinity Study Area is surrounded by wood lots, organic soils and non-significant wetlands but no identified built heritage resources or cultural heritage landscapes.

While review of 19th and 20th century mapping suggest there are structures 40 or more years old and potential built heritage resources within the EA-defined Wider Study Area, none are located within or crossed by the designation of 500 m from the Site Study Area. There is also no evidence that any part of the Site-vicinity Study Area is considered to be a cultural heritage landscape.

13.8 Socio-economic

The socio-economic environment is evaluated in a number of different ways and looks at both direct and indirect effects and the level of change that may result to the baseline environment described in Section 9.8.

Direct effects – These are effects to the socio-economic environment that occur as a direct result of a change to a socio-economic feature such as population change, employment effects or visual effects.

Indirect effects – these are effects to the socio-economic environment that occur indirectly as a result of landfill expansion related changes on other aspects of the environment (e.g., increased noise, dust or odour creating nuisance effects).

This assessment was completed in collaboration with data collection and analyses undertaken by other disciplines (including noise and air quality). These data and analyses were used to determine the effects (both beneficial and adverse) associated with the measurable changes in the socio-economic environment resulting from the proposed landfill expansion and identify mitigation measures that are technically and economically feasible to prevent, reduce or otherwise ameliorate the adverse environmental effects.

13.8.1 Local Economy

The following indicators were evaluated to assess effects to the local economy:

- Expected effect on local employment
- Expected effects on local businesses and commercial activity
- Expected effects on municipal finances

13.8.1.1 Potential Effects

The following criteria were used to evaluate potential effects on the local economy:

- Employment opportunities during landfill expansion construction and operation
- Potential effects to local commercial businesses in the Site-area (excludes agriculture)
- Capital costs associated with construction and operation

The local economy can be affected through the potential for the creation of new employment opportunities at the site. Effects to local businesses could occur through increased usage of services during construction or effects on operations that may change patronage. Increased capital costs associated with construction and operation may affect municipal finances,

e.g., maintenance, equipment replacement, etc. These are evaluated using relevant figures and information provided by the Township of North Dundas and findings from applicable discipline studies.

13.8.1.2 Evaluation of Effects on the Local Economy

The proposed landfill expansion is not expected to create any new jobs in the community, the existing landfill workforce is deemed sufficient. The annual operating cost are expected to remain the same at approximately $55,000. No significant changes to local traffic around the landfill as a result of the landfill expansion are predicted. Other businesses (excluding farms) in the Site-vicinity Study Area are not anticipated to be affected negatively or positively as a result of the landfill expansion.

Revenue to the landfill is expected to remain generally the same with mild increases related to inflation and the modest population increase forecast.

13.8.2 Residents and Community

The following factors were evaluated to assess effects to the local economy:

- Displacement of residents
- Expected interference with use and enjoyment of residential properties (nuisance effects)

13.8.2.1 Potential Effects

The following criteria were used to evaluate potential effects on residents and communities in the Site-vicinity Study Area.

- Proximity to nearby residences
- Biophysical and social interactions with nearby residential and community receptors (i.e., noise, dust, odour, and nuisance wildlife/pests)

The effect of landfill operations on the local population and on the use and enjoyment of residences are typical public concerns. The proximity of the expanded landfill to residences may cause out-migration of local residents or discourage new residents from moving in. The extent to which local residents can use and enjoy their properties and outdoor spaces can be affected by landfill-related activity that results in, for example, litter, noise, odour, dust and/or vermin or change the visual aspect in an objectionable way. These are evaluated using findings from the respective studies for these components of the environment, as well as qualitative findings from engagement and professional judgement.

13.8.2.2 Evaluation of Effects on Local Residences and Community Features

The physical landfill expansion does not require any displacement of residences. There are no properties with existing homes within the 500 m Site-vicinity Study Area. There are no community features (church, school, etc.) within the 500 m Site-vicinity Study Area. To date, the Township has never received a complaint from neighbours about the operation of the landfill related to noise, traffic, dust, odours or visual. Current noise, dust and odour sources

within the Site-vicinity Study Area will primarily be agricultural and traffic as well as potential noise, dust and odour from the existing site.

Air quality studies identified anticipated measurable air emissions and evaluated them to determine effects. The residual effects were evaluated and concluded that they do not result in adverse effects in terms of air quality, dust or odour for the neighbouring existing residences as they meet appropriate provincial regulatory limits. As such, interference with use and enjoyment of property and other outdoor spaces from air quality, dust or odour are not expected. Best practice measures will control air quality, dust and odour levels such that they do not exceed acceptable levels.

Potential noise impacts were evaluated using existing information and predictive modelling. Ancillary equipment and emergency equipment are expected to operate below provincial sound level limits. The change in traffic noise levels between the existing landfill and the landfill expansion is insignificant to noticeable using the provincial scale to quantify this change; this is considered an acceptable change. On-site noise from the landfill expansion itself is predicted to operate below provincial sound level limits.

Concerns relating to traffic may include changes to access/egress to the site for trucks, increased truck traffic and noise from vehicles during construction and operations. No changes to access and egress are anticipated from the expanded site. As noted above, the anticipated increase in traffic as a result of increasing population is not forecast to cause any issues with traffic movement along the haul routes. Applicable by-laws will be adhered to for truck traffic and operational hours, and good housekeeping practices will be maintained such that noise and emissions are not above acceptable levels.

Vermin such as rats and gulls are concerns associated with landfill sites. No complaints regarding vermin have been noted and continued good site maintenance practices (e.g., application of daily cover, litter control program) will continue.

13.8.2.3 Mitigation

Adherence to applicable municipal and provincial guidelines and best management practices (BMP) for effects such as litter, noise, dust or odour will assist in reducing potential effects to local residents. Examples include:

- In design air (odour and dust) mitigation
- Noise Best Management Practices
- Best practice measures and good housekeeping practices such as vehicle and equipment maintenance, use of mufflers, minimal idling, etc.
- Prepare Complaints Response Protocol

13.8.3 Visual

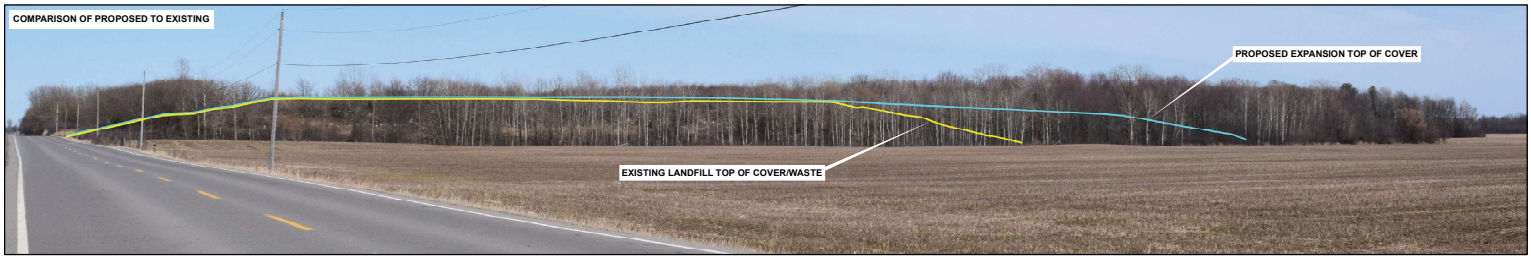
13.8.3.1 Proposed Development Character

The proposed expansion to somewhat higher than the currently approved top of waste contours is limited to the southern half of the current footprint. For the horizontal expansion area, trees and vegetation will be removed to prepare for the expansion. A row of trees and bushes along the western and southern boundaries will remain in place and grow over time to further screen the view from potential off-site receptors. Piles of soil will be levelled off and blended into the top of cover that will be planted with native grass species.

Visual receptors with visibility of the proposed expansion will mostly see the side slopes with 4H:1V, 25 % or flatter and will see less of the top area slopes that are not flatter than 20H:1V (5 %) as they slope from the property boundary of the landfill site (Figure 9-32) towards the proposed top of cover peak.

Portions of the existing landfill have already reached the approved top of cover or waste along the northern area and a portion of the western area as shown in the ‘comparison of proposed to existing’ lines in Figures 13-10 to 13-13. The existing landfill top of cover will tie into the expansion area top of cover and rise to a maximum peak elevation of 90.5 masl.

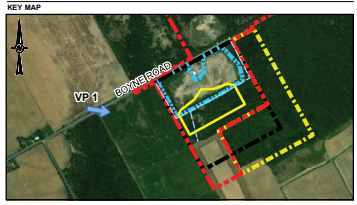
During operations, the landfill will continue to make use of the existing infrastructure, including buildings on site and the entrance, exit and haul route.



LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

KEY MAP



SCALE 1:20,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

CAMERA COORDINATES (MTM NAD 83): 397028.6 E 4996463.9 N
CAMERA ELEVATION (CGVD28): 77.2 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 346 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: YES
DATE AND TIME PHOTOGRAPH WAS TAKEN: APRIL 7, 2020, 3:16 PM
APPROXIMATE DIRECTION: 113 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 51.9 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

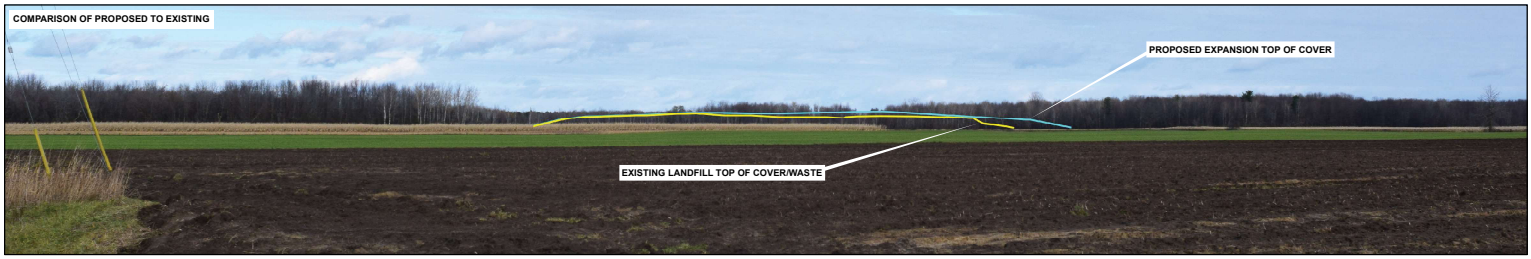
PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 1 - BOYNE ROAD
PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-10-12
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	PLE

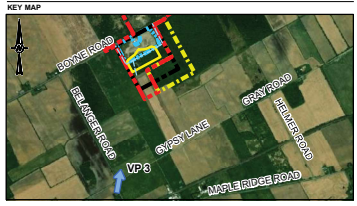
PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	13-10



LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

KEY MAP



SCALE 1:40,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

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CAMERA ELEVATION (CGVD28): 77.6 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 995 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: YES
DATE AND TIME PHOTOGRAPH WAS TAKEN: NOV 6, 2019, 11:30 AM
APPROXIMATE DIRECTION: 22.5 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 51.9 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
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3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

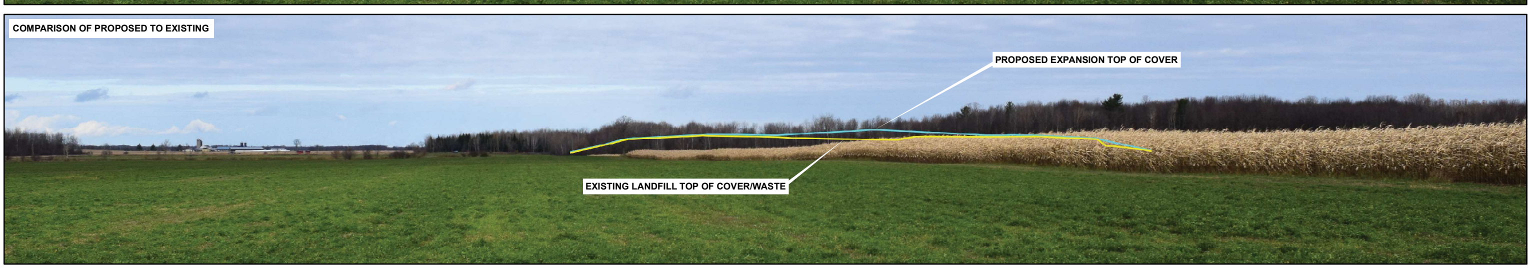
PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 3 - BELANGER ROAD AT GYPSY LANE PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-10-12
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	PLE

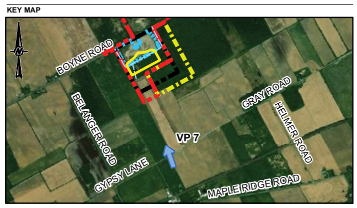
PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	13-11



LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

KEY MAP



SCALE 1:40,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

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CAMERA ELEVATION (CGVD28): 79.9 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 744 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: YES
DATE AND TIME PHOTOGRAPH WAS TAKEN: NOV 6, 2019, 10:37 AM
APPROXIMATE DIRECTION: 336.5 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 51.9 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 7 - GYPSY LANE (SNOWMOBILE TRAIL)
PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-10-12
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	PLE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**13-12**

EXISTING CONDITIONS

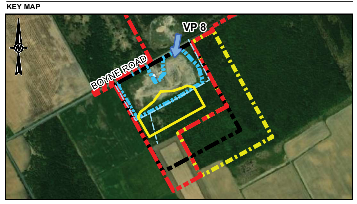
PROPOSED EXPANSION

COMPARISON OF PROPOSED TO EXISTING

LEGEND

- VIEWPOINT LOCATION AND DIRECTION
- INTERMITTENT WATERCOURSE
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- SITE STUDY AREA
- EXISTING LANDFILL FILL AREA
- TOWNSHIP OWNED PROPERTY

KEY MAP



SCALE 1:20,000

PHOTOGRAPH VIEWPOINT TECHNICAL DATA

CAMERA COORDINATES (MTM NAD 83): 397656.5 E 4996814.3 N
CAMERA ELEVATION (CGVD28): 77.1 m
APPROXIMATE DISTANCE TO PROPOSED EXPANSION: 219 m
VISIBILITY OF PROPOSED EXPANSION IN SIMULATION: NO
DATE AND TIME PHOTOGRAPH WAS TAKEN: NOV 6, 2019, 9:10 AM
APPROXIMATE DIRECTION: 190 DEGREES T.N.
FOCAL LENGTH: 24 mm
APPROXIMATE HORIZONTAL FIELD OF VIEW : 95 DEGREES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
2. SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
VIEWPOINT 8 - BOYNE ROAD AT ENTRANCE TO SNOW STORAGE FACILITY
PROPOSED EXPANSION PHOTOGRAPHIC SIMULATION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-10-12
DESIGNED	PJM
PREPARED	JEM
REVIEWED	PAS
APPROVED	PLE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	**13-13**

13.8.3.2 Landscape Modelling

A computer generated 3D landscape model was developed in a geographic information system (GIS) with a 2 m resolution digital elevation model, available land cover information to account for potential vegetation screening, and 3D modelling of the proposed expansion design. The 3D model was used to conduct visibility analysis and determine potential key representative public locations for viewing the landfill site within a 1 km site-vicinity study area[2] (9-32). This model also allowed for the rendering of simulated images of the proposed expansion from key viewpoints. These simulated images were combined with field survey photographs to produce photo-composite images to portray the relative scale and extent of the proposed expansion within the existing viewing conditions and to support the assessment of potential visible effects.

13.8.3.3 Visual Assessment

The qualitative visual assessment was established by desktop studies to identify and describe the physical elements of the landscape within the site-vicinity study area. Landscape character evaluation is a process of gathering the landscape into distinct patterns of physical elements that distinguish areas from one another. The description of landscape character focuses on the nature of these elements and their combination to express visual aesthetic assets, including scenic quality. The assessment methodology used in this study is based on components of the Guidelines for Landscape and Visual Impact Assessment (IEMA, 2013) and the USDI Visual Resource Management System (USDI, 1986), as well as professional judgment and experience from conducting previous visual impact assessments. An assessment and characterization of potential visual effects of the proposed expansion was conducted using the following elements of visual change to existing viewing conditions from representative key viewpoints.

- **Visibility of the proposed expansion** - the visible extent of the proposed expansion area and vertical/horizontal limits within the available field of view.
- **Visual contrast of the proposed expansion** - the visual character of the visible proposed expansion and the level of visual contrast between the proposed expansion components and the existing landscape.

Visibility was assessed based on the results of the desktop visibility analysis and the prominence of the visible portion of the proposed expansion. Visually referencing the photo-composite simulations and qualitative analysis of the proposed expansion visual character was used to determine the contrast created between the expansion and the existing viewing conditions. The degree of contrast was determined based on the following definitions:

- **None** - The element is not visible or perceived
- **Weak** - The element contrast can be seen but does not attract attention

[2] 1 km represents a foreground viewing distances that which provides for a discernible level of visual detail to be perceived (USDI BLM, 1986a).

- **Moderate** - The element contrast begins to attract attention and begins to dominate the characteristic landscape
- **Strong** - The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

13.8.3.4 Assessment Results

A total of nine viewpoints (Figure 9-32) were identified during the visibility analysis and baseline field photo reconnaissance. Viewpoints 4, 5 and 6 are outside the one km visual study area and the proposed expansion is not discernible with any level of visual detail from these locations. Viewpoint 9 has no visibility due to the wood lots southeast of the proposed expansion screening the view. Viewpoint 2 at the main gate on Boyne Road is mostly blocked by buildings and trees on-site and only offers a very brief glimpse to motorists passing by. Four key viewpoint locations were identified to conduct visual simulations and an effects assessment based on the visibility analysis and baseline field visits as described in Table 13-28.

Table 13-28: Key Viewpoints

Key Viewpoints	Description	Coordinates	Viewing Direction
Viewpoint 1	Boyne Road	397028.6 m E, 4996463.9 m N	East (113°)
Viewpoint 3	Belanger Road at Gypsy Lane	397359.1 m E, 4995179.4 m N	North (22.5°)
Viewpoint 7	Gypsy Lane (snowmobile trail)	397904.2 m E, 4995476.1 m N	North (336.5 °)
Viewpoint 8	Boyne Road at entrance to snow storage facility	397656.5 m E, 4996814.3 m N	South (190°)

Notes: Coordinates are in NAD 83 MTM Zone 17 projection; 0 = degrees

Viewpoints 1, 3, 7 and 8 were selected to produce simulations of the proposed expansion that represent the visual character and assess the overall level of contrast with the existing viewing conditions. The simulations for viewpoints 1, 3, 7 and 8 are displayed in Figures 13-10 to 13-13. Each simulation is accompanied by the following assessments of the visual contrast and related rationale for determining the level of visual effect.

Viewpoint 1 - Boyne Road, Proposed Expansion Photographic Simulation (refer to Figure 13-10)

Receptors: motorists and pedestrians travelling along Boyne Road.

Visibility: partial visibility of the proposed expansion through trees and vegetation, minimal scale of the proposed expansion within the available field of view.

Visual Contrast: the predominantly horizontally-oriented landscape is maintained with the addition of the linear expansion that is partially visible through the existing treeline. The view of the existing horizon will slightly change and become more disconnected with the removal of

trees within the expansion area. The natural brown and yellow hues of the native vegetation growing on the proposed expansion are similar to the surrounding agricultural fields, grass, shrubs and trees in the study area. The colour and texture of the proposed expansion reduce the contrast within the setting and integrate effectively within the landscape. The expansion creates an overall degree of contrast that is **weak** and will not attract attention.

Visual Effect: partial alteration to the existing landscape based on the introduction of an earth form feature (the landfill expansion) with a low level of discernable visual detail due to vegetation screening. The **weak** level of contrast does not change the overall rural landscape character of the Study area.

Viewpoint 3 - Belanger Road at Gypsy Lane, Proposed Expansion Photographic Simulation (refer to Figure 13-11)

Receptors: motorists and pedestrians travelling along Belanger Road. Recreational users or pedestrians travelling along Gypsy Lane.

Visibility: partial visibility of the proposed expansion through trees and vegetation, minimal scale of the proposed expansion within the available field of view.

Visual Contrast: the predominantly horizontally-oriented landscape is maintained with the addition of the linear expansion that is partially visible through the existing treeline. The view of the existing horizon will slightly change and become more disconnected with the removal of trees within the expansion area. The natural brown and yellow hues of the native vegetation growing on the proposed expansion are similar to the surrounding agricultural fields, grass, shrubs and trees in the study area. The colour and texture of the proposed expansion reduce the contrast within the setting and integrate effectively within the landscape. The expansion creates an overall degree of contrast that is **weak** and will not attract attention.

Visual Effect: partial alteration to the existing landscape based on the introduction of an earth form feature (the landfill expansion) with a low level of discernable visual detail due to vegetation screening. The **weak** level of contrast does not change the overall rural landscape character of the Study area.

Viewpoint 7 - Gypsy Lane (Snowmobile Trail), Proposed Expansion Photographic Simulation, (refer to Figure 13-12)

Receptors: Recreational users or pedestrians travelling along Gypsy Lane.

Visibility: partial visibility of the proposed expansion through trees and vegetation, minimal scale of the proposed expansion within the available field of view. An intermittent watercourse that flows through the trees and vegetation will provide an opening through which the proposed expansion may be more visible.

Visual Contrast: the predominantly horizontally-oriented landscape is maintained with the addition of the linear expansion that is partially visible through the existing treeline. The view of the existing horizon will slightly change and become more disconnected with the removal of trees within the expansion area. The natural brown and yellow hues of the native vegetation growing on the proposed expansion are similar to the surrounding agricultural fields, grass, shrubs and trees in the study area. The colour and texture of the proposed expansion reduce the contrast within the setting and integrate effectively within the landscape. The expansion creates an overall degree of contrast that is **weak** and will not attract attention.

Visual Effect: partial alteration to the existing landscape based on the introduction of an earth form feature (the landfill expansion) with a low level of discernable visual detail due to vegetation screening. The **weak** level of contrast does not change the overall rural landscape character of the Study area.

Viewpoint 8 - Boyne Road at Entrance to Snow Storage Facility, Proposed Expansion Photographic Simulation (refer to Figure 13-13)

Receptors: motorists and pedestrians travelling along Boyne Road.

Visibility: no visibility of the proposed expansion from this viewpoint.

Visual Contrast: no visible contrast.

Visual Effect: no visual effect.

13.8.3.5 Summary and Recommendations

To further mitigate visibility and reduce contrast with the surrounding landscape, it is recommended that additional trees be planted within the tree line between the proposed expansion and the southwestern property boundaries.

Considering the partial visibility and **weak** degree of contrast with the surrounding landscape, along with the minimal scale of the proposed expansion within the available field of view, the overall visual effect of the proposed expansion can be seen but does not attract attention and would not alter the prevailing rural character of the landscape setting.

13.9 Transportation

The existing traffic related to landfill site operations was described in Section 9.9. The traffic impact study evaluated the operation of the Access/Boyne, St. Lawrence/Main and County Road (CR) 7/Boyne intersections, and examined the lane configuration and left turn lane warrants. The analysis was conducted for the traffic using the 2021 traffic counts, and the expected 2048 traffic, which represents the end of the 25 year planning period for the landfill expansion. The time period selected for the analysis was the weekday peak a.m. and p.m. hours, which are expected to be the peak traffic periods for both the landfill facility and the background traffic.

13.9.1 Traffic Analysis

13.9.1.1 Trip Generation

The site generated trips were calculated for two scenarios, to determine the most representative a.m. and p.m. peak hour trips for use in the study.

The landfill facility will continue to be open weekdays from 8:00 a.m. to 4:00 p.m., and on Saturdays from 8:00 a.m. to 12:00 p.m. May through November and only one Saturday a month from 8:00 a.m. to 12:00 p.m. November through May. The facility will continue to receive waste and recyclable materials, as well as brush and wood. Trips will originate mainly from the two main municipalities of Winchester to the west along Boyne Road, and Chesterville to the east along Boyne Road then south along CR 7. The site will have the one access point onto Boyne Road.

13.9.1.1.1 Scenario 1 - Average Trips

The first scenario utilized the number of monthly trips to/from the facility, averaged the trips to hourly trips, and then applied a peaking factor (PF) which converted the average hour trips to peak hour trips by applying a conservative PF of 2.0. Traffic counts have determined a PF of 1.5 as being typical in converting average hour traffic to peak hour traffic. The trips were then increased by 5.5 percent, which is the expected increase in landfill traffic over the 25 year planning period.

Traffic counts of vehicles entering and exiting the landfill facility were obtained from the Township on a vehicles per month basis. The average counts were taken for two time periods, with the traffic analysis using the greater number of trips which occurred between April 1st and October 31st:

April 1st to October 31st -	460 vehicles/month	35% Heavy vehicle
November 1st to March 31st -	285 vehicles/month	42% Heavy vehicle

For the April 1st to October 31st time period and a 5½ day week (44 hr):

Average vehicle trips per hour
460 veh per month / (44 hr per week x 4 weeks per month) = 2.61 or 3 veh/hr

Peak vehicle trips per hour
3 veh/hr x 2.0 peaking factor x 1.055 (landfill expansion) = 6.33 or 7 veh/hr

	Entering	Exiting	Total
AM/PM Peak Hour Vehicle Trips	7	7	14

13.9.1.1.2 Scenario 2 – Site Trips Determined from Traffic Counts

The second scenario used the existing site trip counts entering and exiting the facility, which were taken on September 9, 2021 between 8:00 a.m. and 10:00 a.m. and between 2:00 p.m. and 4:00 p.m. Observations and counts showed that peak periods occurred when the landfill facility just opened and trucks were leaving and waste was dropped off from the previous day, and when waste was dropped off at the end of the work day.

September 9, 2021 traffic count - 2 hour peak a.m. and p.m. time period

	Entering		Exiting	
	EB right	WB left	NB left	NB right
2 hr a.m. Vehicle Trips	8	1	6	2
2 hr p.m. Vehicle Trips	14	5	15	3

The trips from the 2 hour a.m. and p.m. time period were increased by 5.5 percent at each approach, which is the expected increase in traffic due to the landfill expansion over the 25 year planning period to the year 2048. The 2 hour trip period was then averaged to get a peak a.m. and pm. hour, and a peaking factor (PF) of 2.0 was applied.

The traffic counts would form the base for the calculation of the expected trips during the April 1st to October 31st time period. The expected 2048 trips were calculated using the above adjustment factors with the peak a.m. and p.m. hour trips shown below.

	Entering	Exiting	Total
a.m. Peak Hour Vehicle Trips	11	10	21
p.m. Peak Hour Vehicle Trips	21	20	41

13.9.2 Trip Distribution

The traffic impact assessment study has utilized the trips for Scenario 2, which were calculated from the counts as discussed in Section 9.9.1. The higher number of trips would reflect the trip pattern of waste being dropped off at the facility at the beginning and end of the workday.

The distribution of expected site generated trips entering and exiting the landfill facility was determined from the examination of the peak a.m. and p.m. hour traffic movements along Boyne Road past the site, and at the St. Lawrence/Main and CR 7/Boyne intersections. Site generated trips were distributed onto the adjacent roads in the proportions shown on Figure 13-14.

Figure 13-15 shows the expected weekday peak a.m. and p.m. hour site generated trips for the proposed expansion using the expected trips calculated from the existing traffic counts (Scenario 2).

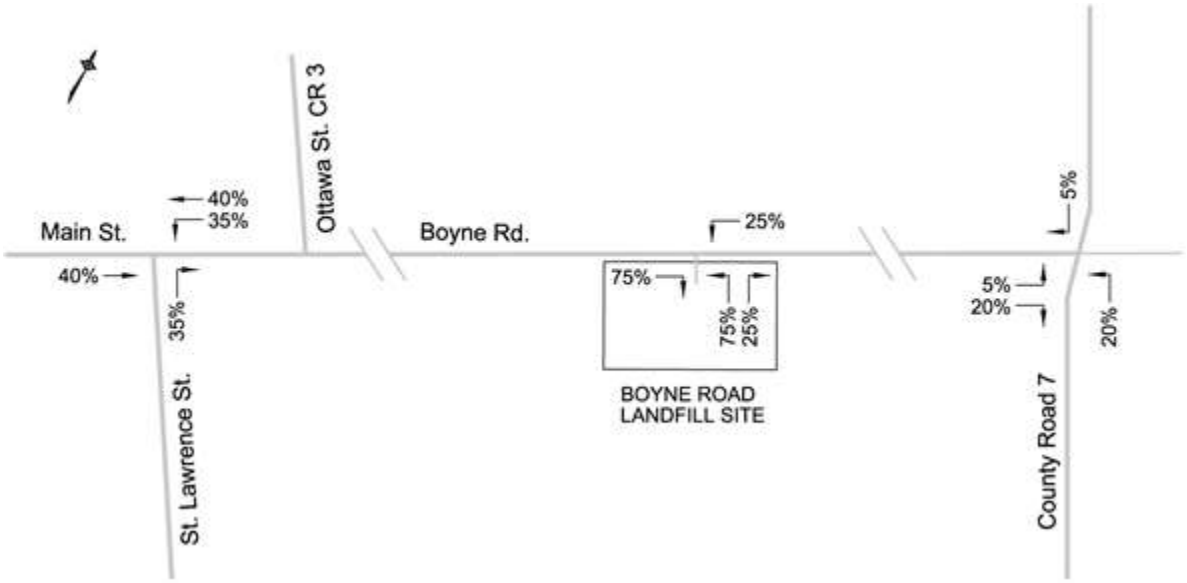


Figure 13-14: Trip Distribution on the Road Network

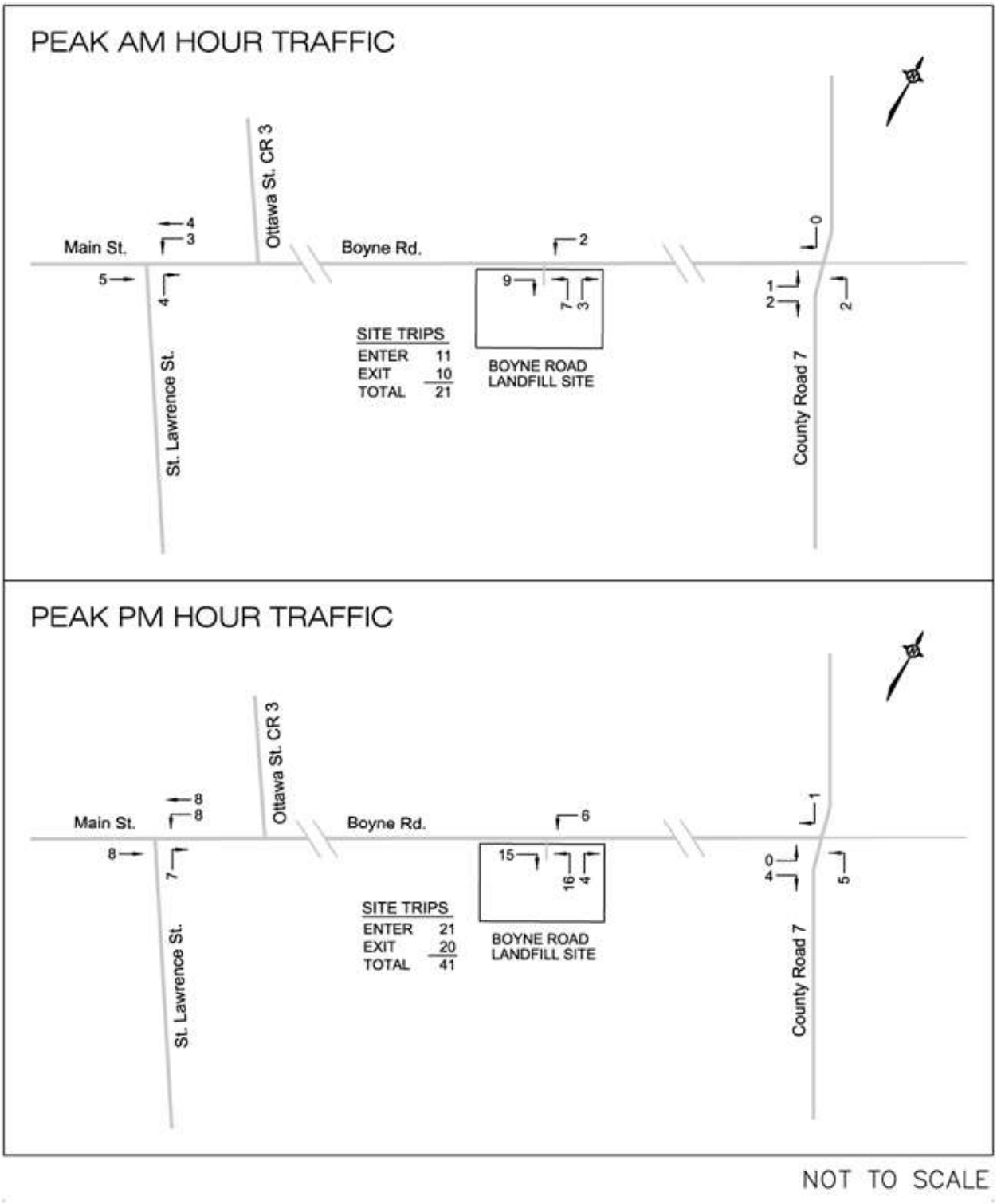


Figure 13-15: Peak AM and PM Site Generated Trips

13.9.3 Traffic Impact Assessment

The following sections provide the assessment of impacts of traffic associated with the proposed landfill expansion.

13.9.3.1 2048 Background and Total Traffic Volumes

The 2048 background traffic would consist of the future traffic, which would include future development, but would not include the expected trips from the landfill facility. The 2021 traffic counts taken at the Access/Boyne, St. Lawrence/Main and CR 7/Boyne intersections were projected to the year 2048, which represents the horizon year of the 25 year planning period.

The future background traffic was determined by applying the following two factors, which would increase the September 2021 traffic counts to the peak a.m. and p.m. hour pre-COVID-19 traffic (normalize to typical peak hour traffic), and the traffic resulting from future development in the Township (2048 background traffic). Trips to/from the landfill facility were not adjusted for COVID-19 as it was assumed that there would be little change in household or construction waste due to home improvements or contractors. The following are the two factors:

13.9.3.1.1 Typical Peak Hour Traffic (pre-COVID-19)

The September 2021 traffic counts would need to be increased to account for the decreased traffic due to the COVID-19 outbreak, which resulted from both the temporary job loss of some of the work force and allowing some workers to work remotely from home. To convert the 2021 counts to the expected pre-COVID-19 traffic volumes, a conversion factor was applied to the counts. Traffic counts were obtained from the United Counties of Prescott and Russell, which were taken along Russell Road 1.5 km east of the Drouin/Russell intersection. The location is approximately 2.5 km east of the east city limit of the City of Ottawa and would be influenced by federal government employees working remotely. The July 2018 peak hour counts were compared to the September 2020 counts at the east approach to the Drouin/Russell intersection. The counts showed that the 2020 counts were 11 percent lower during the peak a.m. hour and 15 percent lower during the peak p.m. hour. The counts are shown below:

Count Date	AM	PM
July 2018	491	524
September 2020	441	457
	-11%	**-15%**

The study has therefore assumed a 15 percent COVID-19 adjustment factor, which was applied to the 2021 through traffic along Boyne Road to increase traffic at the site access, and at all approaches to the St. Lawrence/Main and CR 7/Boyne intersections, which converted the 2021 counts to pre-COVID-19 traffic volumes.

13.9.3.1.2 Future 2048 Background Traffic

The second factor represents the increase in traffic due to future development unrelated to the landfill operations/expansion. The study has examined the growth in population determined from projections obtained from the Township's Municipal Department, which were completed as part of the Township's Official Plan. The projections have shown the population to increase from 12,107 in 2021 to 13,236 in 2036. This would translate to an annual average compounded increase of 0.596 percent. Considering the growth projections discussed above, the study has assumed an annual average compounded growth of 1.0 percent, which was applied to the 2021 pre-COVID-19 through traffic along Boyne Road at the site access, and at all approaches to the St. Lawrence/Main and CR 7/Boyne intersections. The growth rate translates to the factor below, which was applied to the typical traffic (pre-COVID-19).

1.0% Annual Increase

2021 → 2048 1.308

Figure 13-16 shows the expected 2048 peak a.m. and p.m. hour background traffic utilizing the COVID-19 and future background traffic projections discussed above.

The total traffic volumes are the addition of the 2048 background traffic (Figure 13-16) and the expected site generated trips (Figure 13-15). Figure 13-17 shows the 2048 total volume of traffic at the landfill facility access and the critical intersections within the Haul Route Study Area.

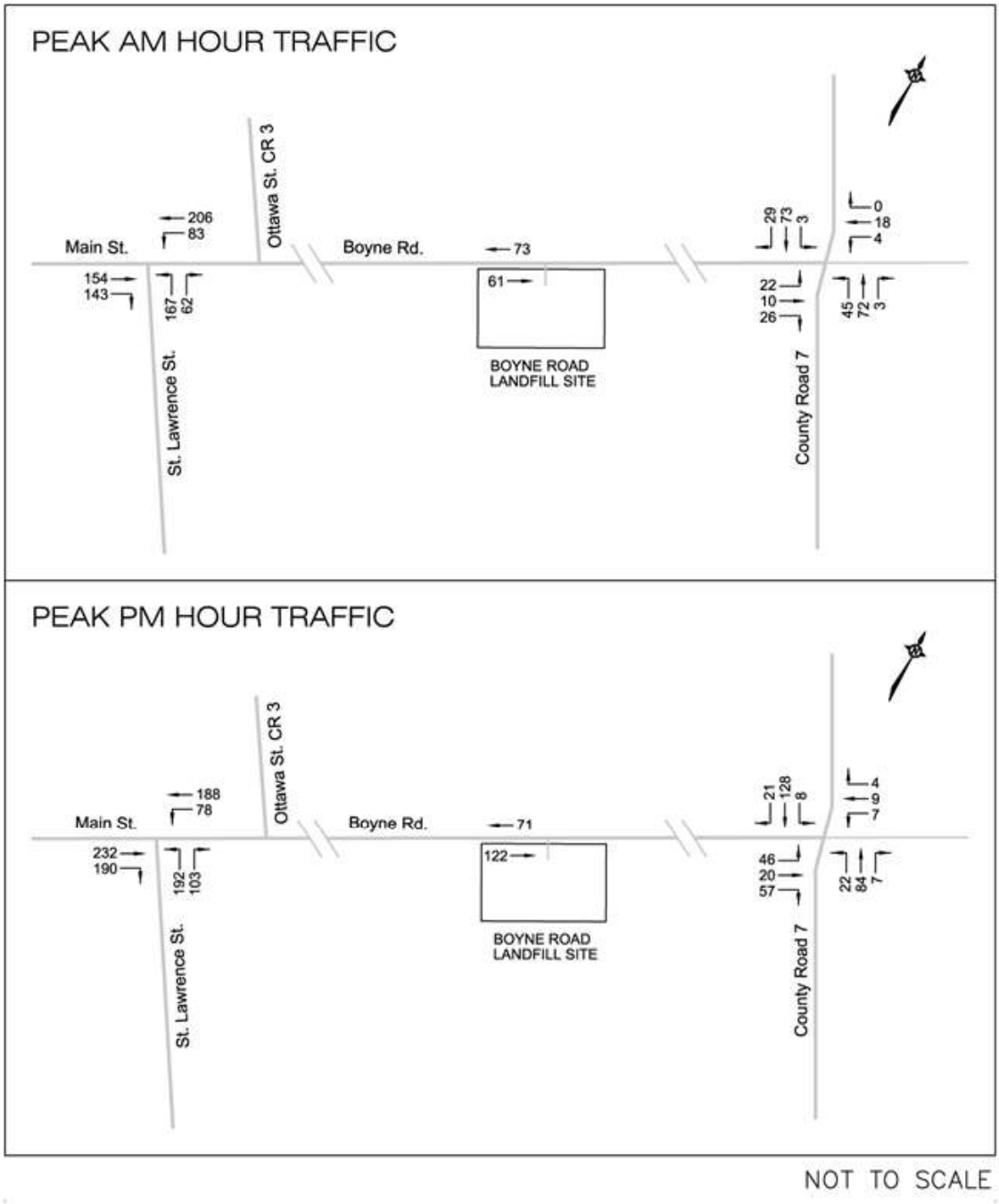


Figure 13-16: 2048 Peak AM and PM Hour Background Traffic

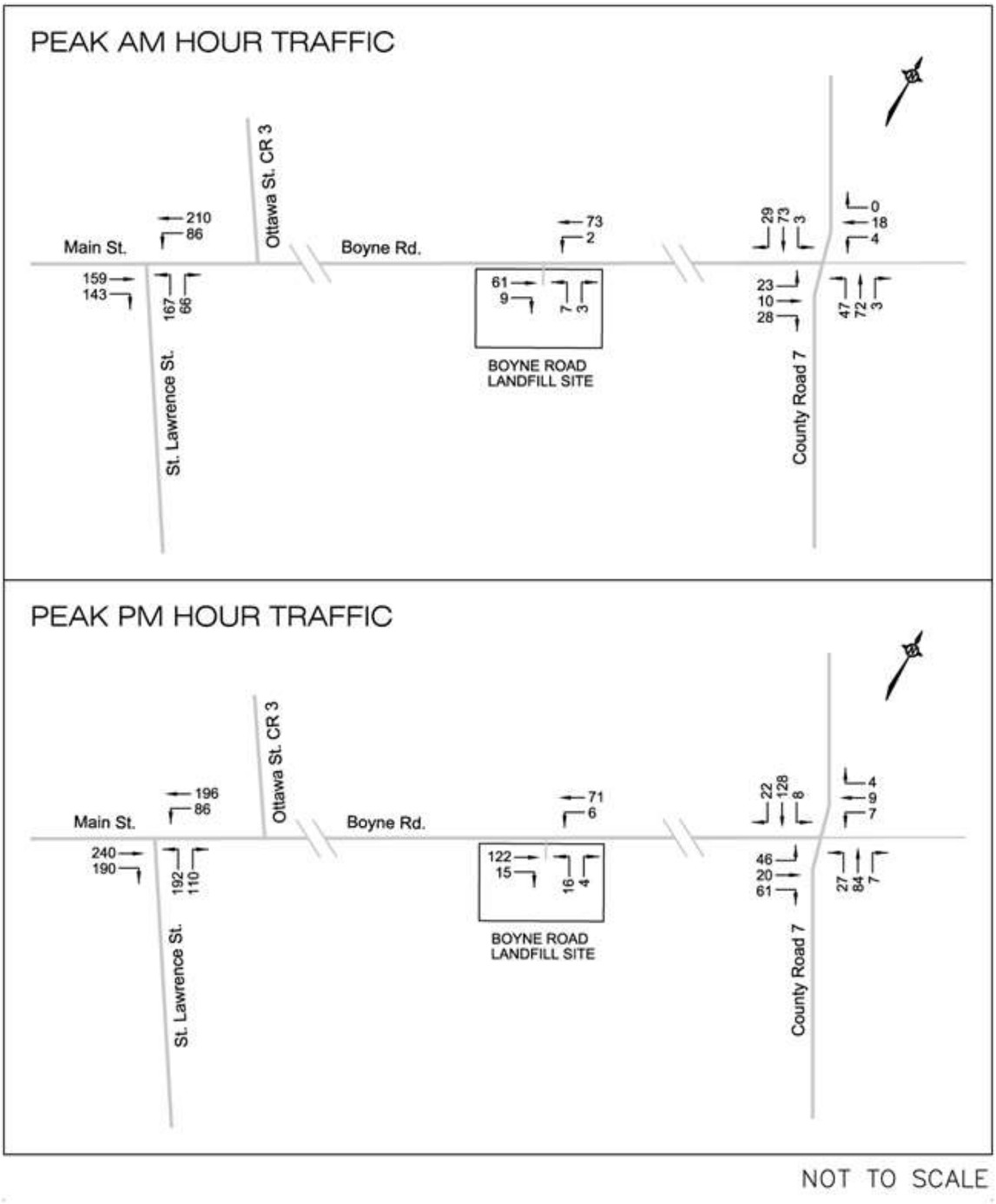


Figure 13-17: 2048 Peak AM and PM Hour Total Traffic

13.9.3.2 Intersection Performance Analysis

The traffic impact study examined the operation of the intersections of Access/Boyne, St. Lawrence/Main and CR 7/Boyne. The analysis periods were the peak a.m. and p.m. hour for the existing traffic counts, and 2048 projected traffic (which represents the horizon year of

the expanded landfill facility's planning period). The analysis used the *Highway Capacity Software, Version 7.9.5,* which utilizes the analysis procedure as documented in the Transportation Research Board publication, *Highway Capacity Manual (HCM) 2010 and HCM 6th Edition*.

For unsignalized intersections, the level of service of each lane movement and approach is determined as a function of the delay of vehicles at the approach. The following relates the level of service (LOS) of each lane movement with the expected control delay at the approach.

LEVEL OF SERVICE	CONTROL DELAY	
Level of Service A	0-10 sec./vehicle	Little or No Delay
Level of Service B	>10-15 sec./vehicle	Short Traffic Delays
Level of Service C	>15-25 sec./vehicle	Average Traffic Delays
Level of Service D	>25-35 sec./vehicle	Long Traffic Delays
Level of Service E	>35-50 sec./vehicle	Very Long Traffic Delays
Level of Service F	>50 sec./vehicle	Extreme Delays – Demand Exceeds Capacity

The expected length of queue at the critical lane movements for an unsignalized stop-controlled intersection was determined by the calculation of the 95th percentile queue at each lane approach. The 95th percentile queue length is the calculated 95th greatest queue length out of 100 occurrences at a movement during a 15-minute peak period. The 95th percentile queue length is a function of the capacity of a movement and the total expected traffic, with the calculated value determining the magnitude of the queue by representing the queue length as fractions of vehicles.

The results of the analysis are discussed in the following sections.

13.9.3.2.1 Access and Boyne Road Intersection

The site access to the Boyne Road Landfill facility is a single access point shared by the municipal waste management vehicles, contractors and private homeowners in the Township. The landfill facility will be operational from 8:00 a.m. to 4:00 p.m. weekdays, and 8:00 a.m. to 12:00 p.m. Saturdays from May through November. The traffic study has examined the operation of the site access and adjacent roads during the peak trip period of the facility when vehicles are entering/exiting at the beginning of the day and at the end of the day.

The existing configuration of the Access/Boyne intersection is a "T" intersection with Boyne Road forming the eastbound and westbound approaches and the site access the northbound approach. All approaches are a single lane with no exclusive turn lanes as discussed in Section 9.9.1 of this report. The northbound site exit approach would have an implied stop sign.

An operational analysis of the intersection was performed using the weekday 2021 traffic counts taken on September 9, 2021 and shown in Figure 9-39. The analysis determined that the westbound Boyne Road left/through movement and northbound left/right access movement both functioned at a Level of Service (LOS) "A" during the peak a.m. hour (8:30 to

9:30 a.m.) and during the peak p.m. hour (2:45 to 3:45 p.m.). The results are summarized in Table 13-29 with the summary sheets provided in Volume 2 Appendix H as Exhibit 4 for the 2021 peak a.m. hour and Exhibit 5 for the peak p.m. hour.

Table 13-29: Site Access and Boyne Road Intersection – LOS and Delay

	PEAK AM HOUR 2021 Count **2048** Total	**PEAK AM HOUR** 2021 Count **2048** Total	**PEAK PM HOUR** 2021 Count **2048** Total	**PEAK PM HOUR** 2021 Count **2048** Total
Intersection Approach	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
WB Left/Through – Boyne Road	A **A**	7.7 **7.7**	A **A**	7.8 **7.9**
NB Left/Right - Site Access	A **A**	9.3 **9.6**	A **B**	9.7 **10.3**

The expected 2048 traffic was determined as shown in Figure 13-17, which included the future site generated trips and background traffic along Boyne Road. A left turn lane warrant analysis was performed for the 2048 total peak AM and PM hour volume of traffic at the westbound Boyne Road approach. The analysis utilized the left turn lane warrant graphs from the Ministry of Transportation Ontario (MTO) publication, *Geometric Design Standards for Ontario Highways*. The analysis determined that the westbound Boyne Road approach did not trigger the warrant for an exclusive westbound left turn lane into the site. The 2048 traffic analysis will be conducted using the existing intersection geometry. The left turn lane warrant analysis is provided in Volume 2 Appendix H as Exhibit 6.

The operation analysis using the expected 2048 total traffic and the existing intersection geometry determined that all approaches functioned at a LOS “A” during the peak a.m. hour. During the peak p.m. hour, the westbound Boyne Road approach functioned at a LOS “A” and northbound site Access approach at a LOS “B”. Table 13-29 summarizes the operation of the intersection with the analysis sheets provided in Volume 2 Appendix H as Exhibit 7 for the peak a.m. hour and Exhibit 8 for the peak p.m. hour. The peak p.m. hour 95th percentile queue was determined to be 0.0 vehicles for the westbound Boyne Road approach and 0.1 vehicles for the northbound site access.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

13.9.3.2.2 Main Street and St. Lawrence Street Intersection

The St. Lawrence/Main intersection is an all-way stop-controlled intersection in the village core and is located 2.8 km west of the site. The intersection is a “T” intersection with St. Lawrence Street forming the northbound approach, and Main Street the eastbound and westbound approaches. Main Street is the extension of Boyne Road within the village limits. The peak hour traffic during the operational hours of the landfill facility occurred between 9:00 and 10:00 a.m., and 3:00 and 4:00 p.m.

The existing traffic counts were taken on September 14, 2021. The operational analysis determined that all approaches functioned at a LOS “A” during the peak AM hour. During the

peak p.m. hour, the eastbound and northbound approaches functioned at a LOS “B”, and westbound approach at a LOS “A”. The analysis work sheets are provided in Volume 2 Appendix H as Exhibit 9 for the peak a.m. hour and Exhibit 10 for the peak p.m. hour. The intersection operation is summarized in Table 13-30.

Table 13-30: Main Street and St. Lawrence Street Intersection – LOS and Delay

	PEAK AM HOUR 2021 Count (2048) Background **2048** Total	**PEAK AM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total
Intersection Approach	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
EB Through/Right – Main St.	A (B) **B**	9.0 (11.7) **12.0**	B (C) **C**	10.3 (17.4) **18.6**
WB Left/Through – Main St.	A (B) **B**	9.5 (12.5) **12.8**	A (B) **B**	9.9 (13.6) **14.4**
NB Left/Right - St. Lawrence St.	A (B) **B**	9.4 (11.9) **12.1**	B (B) **C**	10.3 (14.9) **15.5**

The 2048 background traffic is the expected volume of traffic derived from the traffic counts and increased using a COVID-19 adjustment factor and an annual average compounded growth factor. The background traffic analysis does not include existing or future trips generated by the landfill facility. The 2048 analysis determined that all approaches functioned at a LOS “B” during the peak a.m. hour. During the peak p.m. hour the westbound and northbound approaches functioned at a LOS “B”, and the eastbound approach at a LOS ”C”. Table 13-30 summarizes the operation of the intersection with the analysis sheets provided in Volume 2 Appendix H as Exhibit 11 and Exhibit 12.

Following the expansion of the site, all approaches functioned at a LOS “B” during the 2048 peak a.m. total traffic. During the peak p.m. hour the eastbound and northbound approaches functioned at a LOS “C” and westbound at a LOS “B”. The analysis sheets are provided as Exhibits 13 and 14, with Table 13-30 summarizing the operation of the intersection. The 95th percentile queue during the peak p.m. hour was determined to be 5.3 vehicles at the eastbound approach, 2.7 vehicles at the westbound approach, and 3.2 vehicles at the northbound approach.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

13.9.3.2.3 County Road 7 and Boyne Road (Connaught Road) Intersection

The intersection of CR 7/Boyne is located 6.6 km east of the site with CR 7 forming the northbound and southbound approaches, Boyne Road the eastbound approach, and Connaught Road the westbound approach. The intersection is a two-way stop-controlled intersection with stop signs installed at the Boyne Road and Connaught Road approaches. All approaches consist of a single lane with shared turning movements. Traffic counts taken

on September 14, 2021 determined that the peak a.m. hour occurred between 9:00 and 10:00 a.m., and peak p.m. hour between 2:45 and 3:45 p.m.

The existing 2021 traffic counts determined that the approaches to the intersection functioned at a LOS “A” or “B” during both the peak a.m. and p.m. hours. Table 13-31 summarizes the operation of the intersection with the analysis sheets provided in Volume 2 Appendix H as Exhibit 15 for the peak a.m. hour and Exhibit 16 for the peak p.m. hour.

Table 13-31: Boyne Rd and County Road 7 Intersection – LOS and Delay

	PEAK AM HOUR 2021 Count (2048) Background **2048** Total	**PEAK AM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total	**PEAK PM HOUR** 2021 Count (2048) Background **2048** Total
Intersection Approach	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
EB Left/Through/Right – Boyne Rd.	A (B) **B**	9.6 (10.3) **10.4**	B (B) **B**	10.1 (11.3) **11.4**
WB Left/Through/Right – Connaught	B (B) **B**	10.3 (11.3) **11.3**	B (B) **B**	10.1 (11.2) **11.3**
NB Left/Through/Right – CR 7	A (A) **A**	7.4 (7.6) **7.6**	A (A) **A**	7.5 (7.6) **7.6**
SB Left/Through/Right – CR 7	A (A) **A**	7.3 (7.4) **7.4**	A (A) **A**	7.4 (7.4) **7.4**

The operational analysis using the 2048 background traffic (excluding site trips) determined that the eastbound and westbound approaches functioned at a LOS “B” and northbound and southbound CR 7 approaches at a LOS “A” during both the peak AM and PM hours. The operational analysis worksheets are provided in Volume 2 Appendix H as Exhibits 17 and 18, respectively, with Table 13-31 summarizing the analysis.

The analysis of the total traffic at the year 2048 determined that the intersection would continue to operate at the same level of service as the 2048 background traffic, with the eastbound and westbound approaches functioning at a LOS “B” and northbound and southbound approaches at a LOS “A” during both the peak a.m. and p.m. hour. Table 13-31 summarizes the results with the analysis sheets provided in Volume 2 Appendix H as Exhibit 19 and Exhibit 20. The 95th percentile queue at the approaches for the 2048 peak PM hour traffic was 0.7 vehicles at the eastbound Boyne Road approach and 0.1 vehicles at the northbound CR 7 approach.

The intersection would operate at an acceptable level of service, resulting in no requirement for modifications triggered by the expansion of the landfill facility.

13.9.3.3 Agricultural Equipment on the Public Roads

A large portion of the Township of North Dundas contains agricultural land. Farm equipment constantly travels between fields and the main farming compound along public roads. The equipment is usually large and travels at a low speed. Traffic Counts taken in September 2021 during the two hour a.m. and two hour p.m. peak periods recorded the following farm vehicles and movements at the intersections:

	AM	PM
Access/Boyne	No vehicles	No vehicles
St. Lawrence/Main	1 EB Through (8:45-9:00)	1 NB Right (2:15-2:30) 1 EB Right (3:45-4:00)
CR 7/Boyne	1 SB Through (8:15-8:30) 2 SB Through (8:30-8:45) 1 EB Through (9:00-9:15)	1 SB Through (3:15-3:30)

The volume of farm vehicles and observations during the counting period did not identify any major impacts at intersections or along the roadways due to the equipment.

13.9.4 Summary of Traffic Assessment

The Traffic Impact Study examined the impact of the additional traffic generated by the proposed landfill expansion at the site access onto Boyne Road, and the St. Lawrence/Main and CR 7/Boyne intersections. The analysis considered the weekday peak a.m. and p.m. hours for the expected traffic at the year 2048. The following summarizes the findings of the study:

- The trip generation analysis determined that following the expansion of the Boyne Road Landfill site, the facility would generate 11 trips entering and 10 trips exiting the site during the weekday peak a.m. hour for a total of 21 vehicle trips, and 21 trips entering and 20 trips exiting during the peak p.m. hour for a total of 41 vehicle trips.

- The traffic analysis adjusted the 2021 traffic counts to the expected year 2021 pre-COVID-19 volume of traffic by utilizing a factor that was determined from the comparison of pre-COVID-19 and COVID-19 counts taken along a county road at the east limit of the City of Ottawa in the United Counties of Prescott and Russell. The examination of counts determined that the 2021 counts should be increased by 15 percent to represent pre-COVID-19 traffic volumes. The peak hour background traffic counts were further increased by an annual average compounded rate of 1.0 percent to the year 2048 to account for future development in the Township.

- The landfill site is currently operating with one access onto Boyne Road. The access is a single lane entering and one lane exiting the site. An analysis of the expected 2048 traffic determined that there would be no roadway modifications required to the site access and Boyne Road intersection due to the expansion of the landfill facility. The traffic analysis

further examined the St. Lawrence/Main intersection in the Village of Winchester, and CR 7/Boyne intersection located 6.6 km east of the landfill site. The expected site trips at both intersections would have a minor impact on the operation of the intersections with no modifications required.

13.10 Design and Operations

This section provides the assessment of impacts associated with the design and operations of the proposed expansion of the Boyne Road Landfill site as described in Section 12 of this EASR.

13.10.1 Landfill Expansion Development

The landfill expansion involves a limited vertical expansion on the south portion of the existing landfill and a new 3.8 ha horizontal expansion footprint area. The horizontal expansion area will have a constructed base consisting of a pad of imported permeable fill. It is proposed that the expansion area would be constructed and filled in three or four phases; final cover would be placed progressively as the landfilling in a phase is completed. It is anticipated that the development would proceed from east to west, since the proposed SWM pond is located along the east side of the site and this would allow drainage from the first phase of the landfill cover into the pond. A detailed phasing plan for the expansion will be prepared as part of the Development and Operations plan in support of the ECA amendment application.

It is also noted that the expansion is located south of the existing landfill and is of similar height to the existing landfill. As described in the visual impact assessment in Section 13.8.3, the combination of the existing landfill and forested areas will be quite effective at screening the view of the expansion operations from Boyne Road and other off-site vantage points.

13.10.2 Leachate Management

As described in Section 12.2, the proposed expansion will continue to reply on natural attenuation to control potential adverse effects on off-site groundwater quality. The results of the hydrogeological impact assessment in Section 13.2 are that the expanded landfill site requires some additional CAZ lands to the south to remain in compliance with the MECP Reasonable Use Guideline. It is noted that the Township is already in discussion with the landowners to secure a groundwater easement on this land. With the addition of more CAZ lands to the south, adverse impacts to off-site groundwater quality are not expected. In addition, the development and operation of the landfill do not involve lowering of the groundwater level or taking of groundwater; as such, no effects on off-site groundwater availability are expected.

In addition, the expansion design includes the replacement of the section of existing open ditch on the north side of Boyne Road opposite the landfill with a culvert or a lined ditch. This is intended to avoid the potential effects of leachate-impacted groundwater from discharging into the ditch and adversely affecting surface water quality. In addition, the proposed perimeter ditch around the expansion area and the proposed SWM pond will be elevated to minimize the potential for leachate-impacted groundwater from coming into contact with runoff from the landfill cover and non-landfill areas of the site. As such, adverse effects from landfill operations on surface water quality are not anticipated.

13.10.3 Landfill Gas

As described in Section 12.4, it is neither required by regulation nor proposed to install a landfill gas collection system at the Boyne Road Landfill site. The air quality assessment reported in Section 13.1 demonstrates that air emissions from the expanded landfill (air quality, odour, dust) are expected to comply with provincial requirements. Also, the estimated GHG generation from the expanded landfill is indicated to negligibly contribute to provincial GHG release.

As described in Section 12.4, off-site lateral migration of landfill gas through the subsurface is not expected. Rather, the landfill gas generated at the site is expected to vent to atmosphere through the landfill cover soils. It is also noted that there are no existing structures within 500 m of the landfill site other than the landfill building. As such, there is no potential for off-site lateral migration of landfill gas from the existing landfill or the expansion area to cause adverse effects.

13.10.4 Soil Requirements/Balance

As is the case for the existing landfill operations, there are no potential sources of earth borrow materials on the landfill site property for use in construction of the expansion or future site operations. The construction of the landfill expansion will require the importation of approximately 38,000 m^3 of permeable sandy soil for the landfill base; additional imported soil will be required for construction of the stormwater pond berms.

As is done for the current landfill operations, daily cover for the expansion waste will consist of imported soil materials as well some alternative daily cover materials. The daily cover materials will consist of a combination of surplus soils from construction projects within the Township as well as material from licensed pit sources. For the proposed expansion, if soil is used for all the daily cover, using a 4 waste : 1 daily cover ratio, an estimated 84,000 m^3 of soils would be required.

The proposed final landfill cover is proposed to consist of a general soil final cover meeting the requirements of *O.Reg.* 232/98. Again, imported soil (suitable soils that are surplus from construction projects and/or from licensed pits) and topsoil will be required. It is noted that the final cover is to be placed progressively as waste placement is completed in each phase of the expansion, so not all the final cover material will be required at one time.

13.10.5 Capital and Operational Costs

As described in Section 12.0 of this EASR, the proposed expansion involves the construction of new site infrastructure components as part of the expansion design. An estimate of capital costs for implementation of the expansion was prepared. It is considered appropriate to consider a contingency allowance to account for the final engineering design and potential variations in both construction materials and contractor costs over time. There will also be costs associated with the approvals process and engineering services during design and construction.

An estimate of possible costs for the main components of the capital costs (in 2021 dollars) can be broken down as follows, including what are considered appropriate contingencies and ranges above and below the estimate costs at this EA stage of planning and design:

- Clearing, excavation and fill placement to construct the expansion base pad: approximately $1,300,000 to $1,500,000.
- Construction of the SWM wetland facility and north side landfill ditching: approximately $171,500 to $365,000.
- Construction of the mitigation measure in the north side Boyne Road ditch (Volks Drain): approximately $615,000 to $950,000 for the culvert option, which is expected to be the more expensive option.

As described previously, these capital costs will be phased with progressive construction and filling of the expansion. Initially the clearing and base for the first expansion cell will be constructed, along with the stormwater management wetland and ditch on the north side of the existing landfill. The mitigation measures in the Volks Drain opposite the north side of the landfill could be constructed during the first few years of the expansion. As such, the capital costs associated with the expansion can be planned within the Township's annual capital expenditures budgeting process. The operating costs are expected to be comparable to the current operating costs. These cost components are not expected to adversely impact municipal finances.

13.10.6 Summary

In summary, there are no significant impacts expected as related to site design and operations.

13.11 Comparison to Do- Nothing

For the Township, the Do-Nothing alternative would be to allow the Boyne Road Landfill to reach its approved capacity and not pursue any other solution for residual waste management for the Township. The predicted effects of the preferred alternative were compared to the Do-Nothing scenario to better understand and appreciate the magnitude of any predicted effects of the proposed expansion design. Considering the natural, social, economic, cultural and technical components and indicators, a discussion of this comparison is provided in Table 13-32.

Not all effects of landfill expansion noted below in Table 13-32 were negative, a few were positive, and some effects were similar whether considering Do-Nothing or landfill expansion. However, when considering the identified preferred undertaking and the discussion in Table 13-32, it is shown that all negative effects are mitigatable to within regulatory limits, as landfill expansion is a well-known and well understood type of approach in terms of landfill development, operations and performance.

One of the Township's basic requirements as a municipality is to provide municipal services and infrastructure for its ratepayers including waste management. As such, the Do-Nothing Alterative would not be practical to implement. If the Township actually did nothing, individual residents would be responsible for finding their own solution to waste management such as hiring a private waste management company or disposing of waste on their own property. The comparison of the Do-Nothing alternative does not include the potential actual impacts of the Do-Nothing alternative.

Table 13-32: Comparison of Do-Nothing to the Preferred Undertaking

Component	Sub-component	Indicator(s)	Do-Nothing Versus Preferred Undertaking
Atmosphere	Air quality (including dust, odour, GHG)	Expected concentrations of air quality indicator compounds (selected regulated air contaminants to represent this type of project), including dust, at the property boundary and nearby sensitive receptors. Expected site-related odour at off-site sensitive receptors. Expected GHG emissions	Under Do-Nothing conditions, the landfill would close and air quality indicators, odour and GHG would reduce over time from current conditions as the site would not be operational. The site will still have the potential for air quality, odour and GHG impacts, just at lower thresholds. The proposed landfill expansion design would see continued air quality indicators, odour and GHG from the operational site at levels greater than Do-Nothing, but in compliance with regulatory limits. There is the possibility of air quality, odour and GHG impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
	Noise	Noise Levels at neighbouring noise sensitive existing receptors or vacant lots (with appropriate zoning that may accommodate the future construction of sensitive noise receptors).	The closure of the existing landfill under the Do-Nothing scenario would see noise from the site activities reduce to zero. There would still be noise in the area due to other activities, as well as the recycling activities. The landfill expansion proposed is predicted to have noise effects in compliance with regulatory limits.
Geology and Hydrogeology	Groundwater quality	Expected effect on groundwater quality at the landfill site property boundary and/or compliance boundaries.	The existing landfill, if closed in a Do-Nothing scenario, would continue to have impacts to groundwater quality at the property boundary for 100s of years, at concentrations below regulatory limits. The proposed expansion of the landfill will increase the potential impacts to groundwater quality at the property boundary beyond the Do-Nothing scenario, but with concentrations below regulatory limits. There is the possibility of groundwater quality impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Surface Water	Surface water quality	Expected effect on surface water quality in the drainage ditch along Boyne Road and within the Site-vicinity Study Area.	The closure of the existing landfill will still allow for potential leachate-impacted groundwater to discharge to the municipal drain along Boyne Road. With the proposed expansion of the landfill as designed, the possibility of impacts to the SWMS and other water bodies is very limited as a result of operational practices. Therefore, the proposed expansion of the landfill will decrease the potential impacts to surface water quality compared to Do-Nothing. There is the possibility of surface water quality impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
	Surface water quantity	Expected change in runoff to and peak flows in drainage features. Expected degree of off-site effects on surface water quantity within the Site-vicinity Study Area.	Surface water quantity peak flows are based on landfill final design parameters (e.g., slope steepness, length, etc.). Under the Do-Nothing scenario a pre-existing peak flow is anticipated for the closed landfill. The regulatory requirements for landfill expansion require the matching of peak flow by using stormwater management tools (e.g., ponds, orifices, etc.). As such, the peak flow in Do-Nothing and landfill expansion scenarios is the same. The only difference is the peak flow may be sustained for a longer duration with the landfill expansion in some drainage areas, and for a shorter duration in other areas, compared to the Do-Nothing scenario.

Component	Sub-component	Indicator(s)	Do-Nothing Versus Preferred Undertaking
Biology	Aquatic ecosystems	Expected change in surface water quality and/or quantity within the Site Study Area and the Site-vicinity Study Area. Expected impact on aquatic habitat and biota, including rare, threatened, or endangered species within the Site Study Area and the Site-vicinity Study Area.	As noted for surface water, there is no anticipated difference between the Do-Nothing scenario and the landfill expansion as related to surface water quality or peak flow on or off-site. As noted, under landfill expansion conditions there may be a longer or shorter duration of peak flow that could impact aquatic habit (although there are no rare, threatened or endangered species). The works associated with landfill expansion are expected to result in a loss of aquatic habitat, which may require compensation. Conversely, the proposed expansion will also result in improvement to some components of the aquatic habitat. There is the possibility of aquatic habitat impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
	Terrestrial ecosystems	Expected impact on terrestrial vegetation communities, wildlife habitat, and wildlife, including rare, threatened or endangered species within the Site and Site-vicinity Study Areas.	The closure of the landfill under the Do-Nothing scenario is not likely to affect habitat for SAR bats (little brown myotis). The landfill expansion will directly negatively impact the habitat of little brown myotis through the construction process. Compensation for habitat loss will be developed in consultation with the MECP for little brown myotis. There is the possibility of terrestrial habitat impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Land Use	Current and planned future land uses	Expected incompatibility with existing or known future land use.	The landfill expansion is consistent with the Provincial Policy Statement and conforms with the Official Plan. There is the possibility of land use policy issues if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Agriculture	Agriculture	Expected effect on agricultural land base and agricultural operations within the Site and Site-vicinity Study Areas.	The Do-Nothing scenario would see no change or effect regarding agricultural operations in the area. The landfill expansion design requires some land to the south of the existing landfill that will reduce some existing agricultural operations on Township-owned lands. There is the possibility of agricultural land loss if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Cultural Heritage Resources	Archaeology	Expected archaeological resources potentially affected on-site.	There is the possibility of archaeological resource disturbance/loss if unorganized waste disposal occurred as a result of the Do-Nothing condition. The landfill expansion lands required to the South will have no effect on expected archaeological resources.
	Built Heritage Resources	Expected impact on identified cultural heritage landscapes within the Site-vicinity Study Area.	The landfill expansion will not impact built heritage resources and neither will the Do-Nothing scenario.
	Cultural Heritage Landscapes	Expected impact on the heritage attributes of identified built heritage resources within the Site-vicinity Study Area.	The landfill expansion will not impact cultural heritage landscapes and neither will the Do-Nothing scenario.

Component	Sub-component	Indicator(s)	Do-Nothing Versus Preferred Undertaking
Socio-economic	Local Economic	Expected effect on local employment. Expected effects on local businesses and commercial activity. Expected effects on municipal finances.	The Do-Nothing scenario causes a negative effect with regard to local employment while the landfill expansion should have a positive effect on local employment during construction and continued operation. Neither the Do-Nothing nor the landfill expansion are expected to cause effects to local businesses or commercial activity. The Do-Nothing scenario will cost the Township less than expanding the site.
	Residents and Community	Displacement of residents. Expected interference with use and enjoyment of residential properties (nuisance effects).	Under Do-Nothing conditions there is no expected displacement of residents. As noted from other components (noise, air quality, visual and traffic), the expectation is that neither the landfill expansion nor the Do-Nothing scenario will interfere with the use and enjoyment of residential properties.
	Visual	Expected changes in landscape views from off-site.	The closure of the existing landfill under the Do-Nothing scenario will continue to have areas where the landfill is visible from off-site. With the proposed landfill expansion, it is expected that the landfill will have slightly greater visibility from off-site locations to the South, although mitigation could be effective. There is the possibility of visual impacts if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Design and Operations	Financial	Expected effect on traffic along haul routes.	The costs for the Do-Nothing scenario are not zero as on-going monitoring and maintenance will be required for decades post-closure of the existing landfill. To expand the landfill will incur some capital costs, although these will be relatively lower because a natural attenuation expansion design is proposed, and affordable for the Township as they are spread over time as the expansion is progressively developed. During operation of the landfill and post-closure, on-going monitoring will be required. There is the possibility of clean up costs if unorganized waste disposal occurred as a result of the Do-Nothing condition.
Transportation	Traffic	Estimated costs associated with implementation of expansion alternatives.	The proposed expansion is predicted to have no impact to traffic that will require the upgrade of any intersection over the life of the landfill. If the landfill were to close (Do-Nothing), this would also have no impact to traffic requiring upgrades to any intersections.

14.0 Climate Change Considerations

The document entitled “Considering Climate Change in the Environmental Assessment Process” (MECP, 2019) was used as a guide for incorporating measures in the landfill expansion design that reduce both the potential impact of climate change on the landfill (i.e., climate change adaptation) and its potential impact on climate change (i.e., climate change mitigation).

14.1 Potential Impacts of Climate Change on the Landfill Expansion

It is expected that the planned 25 year operational period of the landfill expansion, i.e., through 2048, will be too short to be significantly affected by impacts from climate change. However, during the post-closure period, longer term changes in precipitation and temperature could possibly affect the vegetative cover growth on the closed landfill and/or runoff of surface water from the landfill final cover and the performance of the components that comprise the SWMS. For example, an increase in precipitation and/or an increase in storm intensity or duration compared to historical design storms would increase the amount of runoff, potentially resulting in surface erosion of the vegetated landfill final cover surface and exceedance of the capacity of the SWMS.

As described in Sections 12.5 and 13.3, climate change adaptation was incorporated into the design of the landfill expansion as follows:

- The SWM pond has been designed to provide 80% total suspended solids removal (Enhanced level of treatment). In the event that larger storms result in an increased amount of surface erosion and a corresponding increased amount of suspended solids in the runoff, the pond will be better able to remove suspended solids and thereby reduce potential effects on the off-site downstream receiving municipal drainage ditch system.

- In addition to the design of the SWMS components, i.e., ditches and SWM pond, to accommodate the runoff associated with the storm events corresponding to the 1:5 and 1:100 year return period storm intensities and durations (as required by *O. Reg.* 232/98), to evaluate potential climate change effects the 1:100 year design storm intensity-duration-frequency values were increased by 20 percent to check/confirm that the stormwater runoff conveyance and storage systems could still be expected to manage the increased flows. This approach follows the climate change guidelines for stormwater management system design and assessment in the adjacent City of Ottawa. The evaluation indicates that under expansion conditions, the proposed stormwater management facilities are indicated to be capable of acceptably controlling discharge from the site, including consideration of increased precipitation associated with climate change as described above.

Landfill operations may also have to adapt to climate change effects. For example:

- Changing climate patterns may result in extremes of heat or cold for extended periods of time. This will require site operations staff working outdoors to use applicable operational procedures that are reviewed and periodically updated to reflect these changing conditions. Landfill vehicles and equipment will continue to have heaters and air conditioners to provide climate-controlled conditions for the operators.

- If there are stronger winds for extended periods of time that reduce the effectiveness of current methods to control litter, consideration can be given to the use of properly anchored litter control fences whose dimensions around the working area are sufficient to control litter. Additional resources to pick up litter from strong wind events, both on and off the site, may also be required.

The expanded landfill footprint will result in an increased area of landfill through which precipitation will infiltrate and generate leachate. A gradual increase in annual precipitation associated with climate change in future could result in a gradual increase in the annual infiltration through the landfill final cover and an increase in leachate generation. However, it is noted that not all the increase in precipitation would infiltrate, i.e., the runoff and evapotranspiration components of the site water balance would also increase. This would result in a larger volume of leachate entering the groundwater flow system to be naturally attenuated within the on-site buffers and Contaminant Attenuation Zone lands. The groundwater modelling results reported in Section 13.2 indicates that with the CAZ lands as proposed, the expanded landfill is expected to perform in accordance with the Reasonable Use Guideline. However, if ongoing monitoring indicates that the site is expected to not remain in compliance in terms of effects on off-site groundwater quality, whether due to increased precipitation or other reasons, then the mitigation measure would be to increase the size of the Contaminant Attenuation Zone in the required direction(s) and by the required dimensions.

In summary, the potential impacts from climate change related to precipitation have been considered in terms of design of the stormwater management system for the expanded landfill. Adjustments to landfill operations can be made, as required, in future to mitigate potential effects from climate change.

14.2 Impacts of the Landfill Expansion on Climate Change

The potential effects of the landfill expansion on climate change have been assessed to quantify potential climate change effects. Ways that the landfill expansion could reduce GHG emissions or remove GHGs from the atmosphere have also been considered. The detailed assessment of GHGs associated with the proposed expansion is provided in Section 13.1.1.8 and summarized below.

The two main ways that a landfill expansion could affect climate change are the generation of GHG that enters the atmosphere, and reduction of GHG sequestration by removal of forested areas.

The activities at the landfill expansion that will produce GHGs include the following:

- Landfill gas
- On-site transportation fuel combustion emissions
- Stationary combustion emissions from propane used for comfort heating in the buildings
- Land clearing as part of the expansion

The GHG emission estimates, where applicable, followed quantification guidelines for both provincial and federal reporting:

- Federal reporting under Section 46 of the *Canadian Environmental Protection Act*, (CEPA), SC 1999: Greenhouse Gas Emissions Reporting Program (GHGRP).
- Provincial reporting under Ontario's Greenhouse Gas Emissions: Quantification, Reporting, and Verification Regulation, Ontario Regulation 390/18 (*O. Reg.* 390/18).

GHG emissions from on-Site transportation and stationary combustion were estimated using emission factors from Tables 2-2 and 2-6 of Canada's ECCC Document "2020 Canada's Greenhouse Gas Quantification Requirements" dated December 2020 (GHGRP Guidance Document) (ECCC, 2020b). Fuel consumption for the on-Site transportation equipment was estimated using methods in the document titled Exhaust and Crankcase Emission Factors for Non-road Compression-Ignition Engines in MOVES' (US EPA, 2018). Stationary combustion emissions from propane used for comfort heating were estimated. There is no prescribed method in the 2020 GHGRP Guidance Document for estimating fugitive methane emitted through the landfill cap and therefore GHG emissions from these sources were estimated using engineering calculations. Fugitive methane that is oxidized in the atmosphere once emitted through the cap has not been taken into consideration for this assessment; however, it is commonly assumed that approximately 10% of the methane from landfill gas oxidizes.

Table 14-1 summarizes the estimated annual GHG emission rates in tonnes per year for each activity at the proposed expanded landfill.

Table 14-1: Summary of Estimated GHG Annual Emissions from the Proposed Expansion of the Boyne Road Landfill in Year 2049

Source	CO_2 Estimated Annual Emissions [tonnes/yr]	CH_4 Estimated Annual Emissions [tonnes/yr]	N_2O Estimated Annual Emissions [tonnes/yr]	CO_2e Annual Total [tonnes/yr][1]
Landfill	1831	664	0	18,438
Mobile Combustion Emissions (road and non-road vehicles)	1566	0.055	0.13	1607
Comfort Heating	22	0.000	0.002	23
Land Clearing[2]	117	—	—	121

Notes:

1. CO_2e equals carbon dioxide equivalence, which is the summation of multiplying the emissions of CO_2, CH_4, N_2O by their respective global warming potential of 1, 25, and 298, respectively (IPCC, 2012).
2. Emissions represent the combination of the loss of CO_2 storage and the one-time land clearing emissions averaged over the life of the proposed landfill expansion (estimated at 25 years).

The peak annual GHG emissions were predicted to occur in 2049.

Table 14-2 presents a comparison of the Boyne Road Landfill site's proposed expansion GHG emissions to the provincial and Canadian totals. As indicated, the increase in emissions from the existing landfill to the proposed expansion would have a negligible contribution of less than 0.003% to the Ontario emissions and less than 0.0006% to the Canadian emissions; therefore, the proposed landfill expansion will have a negligible effect on climate change.

Table 14-2: Comparison of GHG Emissions from the Boyne Road Landfill Expansion to Ontario and Canadian Emission Totals

Ontario GHG Emissions (2019)		**163,200**	**163,200**
Canada-wide GHG Emissions (2019)		**730,000**	**730,000**
Source	**Existing Emissions [kt/year CO_2e]**	**Expansion Emissions [kt/year CO_2e]**	**Increase in Emissions [kt/year CO_2e]**
Landfill Expansion GHG Emissions	15.64	20.18	4.54
Comparison to Ontario Total	0.01%	0.01%	0.003%
Comparison to Canada-wide Total	0.002%	0.003%	0.0006%

15.0 Cumulative Impact Assessment

15.1 Approach

In the approved ToR, the Township committed to undertake a cumulative impact assessment of the preferred alternative, which is expansion of the Boyne Road Landfill site as described in Section 12.0. The cumulative impact assessment combines the potential effects of the proposed landfill expansion in combination with past, present and reasonably foreseeable future activities, where possible, as briefly outlined in the Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario (MOECC, 2014). To carry out this assessment, a framework often used in federal EA processes was considered (Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, March 2018, Version 2 (Government of Canada (2012)), noting that the Canadian Environmental Assessment Act has been replaced by the Impact Assessment Act (2019). Cumulative effects guidance documents under the new act have not been prepared.

An assessment of cumulative effects provides a more complete understanding of what might happen to natural, social, economic, cultural and technical components beyond the influence of the proposed landfill expansion alone. This is useful for regulatory decision-makers and authorities as they review and plan future developments.

15.1.1 General

This analysis considers the residual, negative effects of the proposed Boyne Road Landfill expansion and the potential for these residual effects to interact with other projects or activities, which when combined may result in a greater and in particular adverse effect to a natural, social economic, cultural or technical component.

15.1.2 Assessment Methodology

The cumulative effects analysis involved a scoping phase and an analysis of effects phase. For the scoping phase, the components that had residual negative effects (after mitigation) from the proposed landfill expansion were identified. After this, other projects or activities in the area that may affect the same components were identified.

During the analysis of effects phase, the other projects or activities were evaluated to assess if their effects would overlap in timing or spatial extent with the effects of the proposed landfill expansion, accounting for and including the proposed landfill expansion mitigation measures. The nature and extent of the possible cumulative effects were then identified along with any possible mitigation and/or monitoring strategies.

15.2 Scope

15.2.1 Identified Components

Of the natural, social economic, cultural and technical components for which impact assessments associated with the proposed landfill expansion were carried out, the only identified components with potential residual negative off-site effects after proposed

mitigation measures are in effect were related to those components shown in Table 15-1 below.

Table 15-1 summarizes the predicted potential residual effects of the Boyne Road Landfill expansion on the selected components where the proposed mitigation measures may not be sufficient to completely eliminate any potential effects, even though the assessments indicate it is expected that site compliance with the regulatory standards and guidelines can be achieved in all regards.

Table 15-1: Summary of Landfill Expansion Potential Residual Effects

Component/ Sub-component	Potential Effects of Boyne Road Landfill Expansion	Location of Residual Effect from Boyne Road Landfill Expansion
Atmosphere*	Odour	Site, Site-vicinity
	Dust emissions	Site, Site-vicinity
	Air quality	Site, Site-vicinity
	Noise emissions	Site, Site-vicinity (including haul routes)
	GHG	Site, Site-vicinity (including haul routes)
Hydrogeology	Groundwater quality impacts	Site
Surface Water	Surface water quantity or quality impacts	Site-vicinity
Biology	Change in habitat as a result of alteration of flows (aquatic biological resources)	Site-vicinity
	Removal of vegetation and disruption to wildlife (terrestrial biological resources)	Site
Transportation	Traffic along the haul route	Site-vicinity (including haul route)
Socio-economic/Visual	Change in views of the expansion from the south	Site-vicinity

Notes:

* A quantitative cumulative impact assessment is a component of the air quality assessment described in Section 13.1.1 whereby the background air quality expected for the area obtained from a combination of background air quality for the region and the modelled air quality resulting from the emissions of currently approved sources at the existing Boyne Road Landfill site is added to the predicted impact from the landfill expansion. This is a different qualitative cumulative impact assessment from that following the framework often used in federal EA processes. These are different cumulative impact assessments.

15.2.2 Spatial Boundaries

All predicted negative, residual effects of the Boyne Road Landfill expansion are located on the Site and in the Site-vicinity (including along the haul route); therefore, this is the area for primary consideration in the cumulative impact assessment.

15.2.3 Temporal Boundaries

The residual effects of the Boyne Road Landfill expansion will arise primarily during the construction and operations phases.

15.2.4 Other Projects and Activities

The existing zoning and land use in the vicinity of the landfill was considered in determining the other projects and activities to include in this cumulative assessment. The lands in the Site-vicinity are zoned as rural and the current land uses consist of undeveloped lands and forested areas, with agricultural uses (crop lands) to the south. There are also individual residences, with the closest being approximately 700 m to the west.

There are no known new future planned land uses in the Site-vicinity.

As such, the only expected activity in the Site-vicinity whose effects could possibly overlap with those from the landfill expansion is farming operations

15.2.5 Potential Impacts Due to Other Projects and Activities

A residual effects interaction matrix shown in Table 15-2 was completed to identify potential overlaps in terms of types of effect between negative, residual effects of the Boyne Road Landfill expansion and potential residual effects of other projects and activities on each component.

Table 15-2: Interactions Matrix – Type of Effect

Component/ Sub-component[1]	Potential Effects of Boyne Road Landfill Expansion	Farming Operations
Atmosphere	Odour	yes
	Dust emissions	yes
	Air quality	yes
	Noise emissions	yes
	GHG	yes
Hydrogeology	Groundwater quality impacts	no
Surface Water	Surface water quantity or quality impacts	no
Biology	Change in habitat as a result of alteration of flows (aquatic biological resources)	no
	Removal of vegetation and disruption to wildlife (terrestrial biological resources)	no

Component/ Sub-component[1]	Potential Effects of Boyne Road Landfill Expansion	Farming Operations
Transportation	Traffic along the haul routes	no
Socio-economic/Visual	Change in views of the landfill from the south	no

Notes: [1] Only those components with potential negative, residual effects are listed.

15.3 Analysis of Effects

Overlaps in terms of components in timing or space of effect between the negative, residual effects of the Boyne Road Landfill expansion and the potential residual effects of the other existing activities in the vicinity of the landfill were identified in Table 15-2.

Table 15-3 below provides a further discussion of the identified overlaps of potential cumulative effects results from the proposed Boyne Road Landfill expansion and other projects and activities in the area. Additional mitigation and/or monitoring strategies are identified where applicable and possible.

Table 15-3: Potential Cumulative Effects

Component / Indicators[1]	Potential Effects of the Boyne Road Landfill Expansion	Existing or Proposed Activities that Overlap in Time or Space	Proposed Mitigation or Monitoring	Potential Remaining Cumulative Effects
Atmosphere • Expected concentrations of air quality indicator compounds (selected regulated air contaminants to represent this type of project), including dust, at the property boundary and nearby sensitive receptors. • Expected site-related odour at off-site sensitive receptors. • Expected GHG emissions.	Expansion is expected to result in a variable increase in concentrations of most air quality indicator compounds, odour and GHG. Air quality and odour associated with the expansion are predicted to meet relevant Ontario Regulations at the property boundary or sensitive receptors.	Continued active farming, has the potential to contribute to reduced air quality. Farming operations can contribute to odours and GHG emissions.	General best management practices and operations as part of the design are anticipated to mitigate the Boyne Road Landfill expansion air quality and odour effects to within regulatory limits.	The air quality assessment completed concludes the effects will be within the compliance limits.

Component / Indicators[1]	Potential Effects of the Boyne Road Landfill Expansion	Existing or Proposed Activities that Overlap in Time or Space	Proposed Mitigation or Monitoring	Potential Remaining Cumulative Effects
Atmosphere • Noise levels at off-site PORs, or vacant lots that accommodate the future construction of PORs.	Site operations and ancillary equipment are expected to operate below the applicable sound level limits. Change in traffic noise levels between the existing landfill and proposed landfill expansion is insignificant to noticeable; this is considered an acceptable change.	Continued farming operations can have potential noise effects.	General best management practices and operations as part of the landfill expansion design and operations will mitigate potential noise effects.	The noise assessment completed concludes the effects will be within acceptable limits.

Note: [1] Only those components with negative, residual effects for the landfill expansion and negative effects for other projects and activities are listed.

16.0 Monitoring and Contingency

The following sections present the proposed monitoring programs for the landfill expansion (Section 16.1), followed by contingency plans (Section 16.2). Efforts have been made to conservatively estimate potential impacts associated with the proposed Boyne Road Landfill expansion; however, there is always some potential for variability between predicted and actual conditions. Effective monitoring and contingency measures are intended to address this potential variability and confirm the assumptions used in this assessment.

16.1 Monitoring

Groundwater and surface water monitoring programs have been ongoing at the Boyne Road Landfill site for approximately 30 years. These programs have evolved over time as additional hydrogeological investigations have been carried out, new monitoring wells have been installed, and the annual reports have been reviewed and commented on by MECP. As such, there is long, continuous history of monitoring data available at this site. The site-specific data obtained; the hydrogeological setting and understanding of groundwater flow; the limited surface water in the vicinity of the site; the location of the proposed expansion relative to the relative to the existing landfill footprint; and the proposed expansion design and mitigation measures, provide the justification for departures from the generic monitoring programs set out in *O.Reg.* 232/98. For the proposed expansion, it is proposed that the groundwater and surface water monitoring programs that are ongoing as part of the site operations continue, modified as appropriate for the expansion.

The proposed groundwater and surface water monitoring programs for the landfill expansion are summarized below and will be finalized and confirmed during the ECA amendment application for the expansion. The existing groundwater and surface water trigger mechanisms will also be reviewed and modified as appropriate at that time.

In view of the site setting and the findings of the impact assessments for the proposed expansion, there are no other monitoring programs recommended for the other disciplines as ECA conditions. It is note that there may be monitoring requirements associated with DFO authorization/approval requirements related to surface water works and/or in association with Species at Risk as part of a permit issued under the *Endangered Species Act* (*O.Reg.* 242/08).

16.1.1 Groundwater Monitoring

For the proposed landfill expansion, the continued objectives of the groundwater monitoring program are to monitor the quality of leachate and groundwater to determine the extent and degree of leachate effects on groundwater quality and assess site compliance with the MECP Reasonable Use Guideline as required by O.Reg. 232/98. The proposed groundwater monitoring program is summarized below.

For the proposed landfill expansion, the continued objectives of the groundwater monitoring program are to monitor the quality of leachate and groundwater to determine the extent and degree of leachate effects on groundwater quality and assess site compliance with the MECP Reasonable Use Guideline as required by *O.Reg.* 232/98. The proposed groundwater monitoring program for the expansion is summarized below and shown on Figure 16-1.

Existing monitoring wells MW7, MW12, BRW3, MW15-1 and 15-2 are within or immediately adjacent to the proposed expansion. These monitoring wells will need to be decommissioned.

Monitoring Locations: MW1, MW4, MW5, MW9, MW13, MW14, MW16, MW17, MW18, MW19, BRW1-A, BRW1-B, BRW1-C, BRW2, MW06-20, MW06-21, MW06-22R, MW07-23, MW07-24, MW07-25, BRW07-26, BRW15-3, BRW16-1A, MW16-1B, MW16-2, BRW16-3A, MW16-3B, MW16-3C, BRW22-A, MW22-B

Monitoring Frequency: Spring, Late Summer

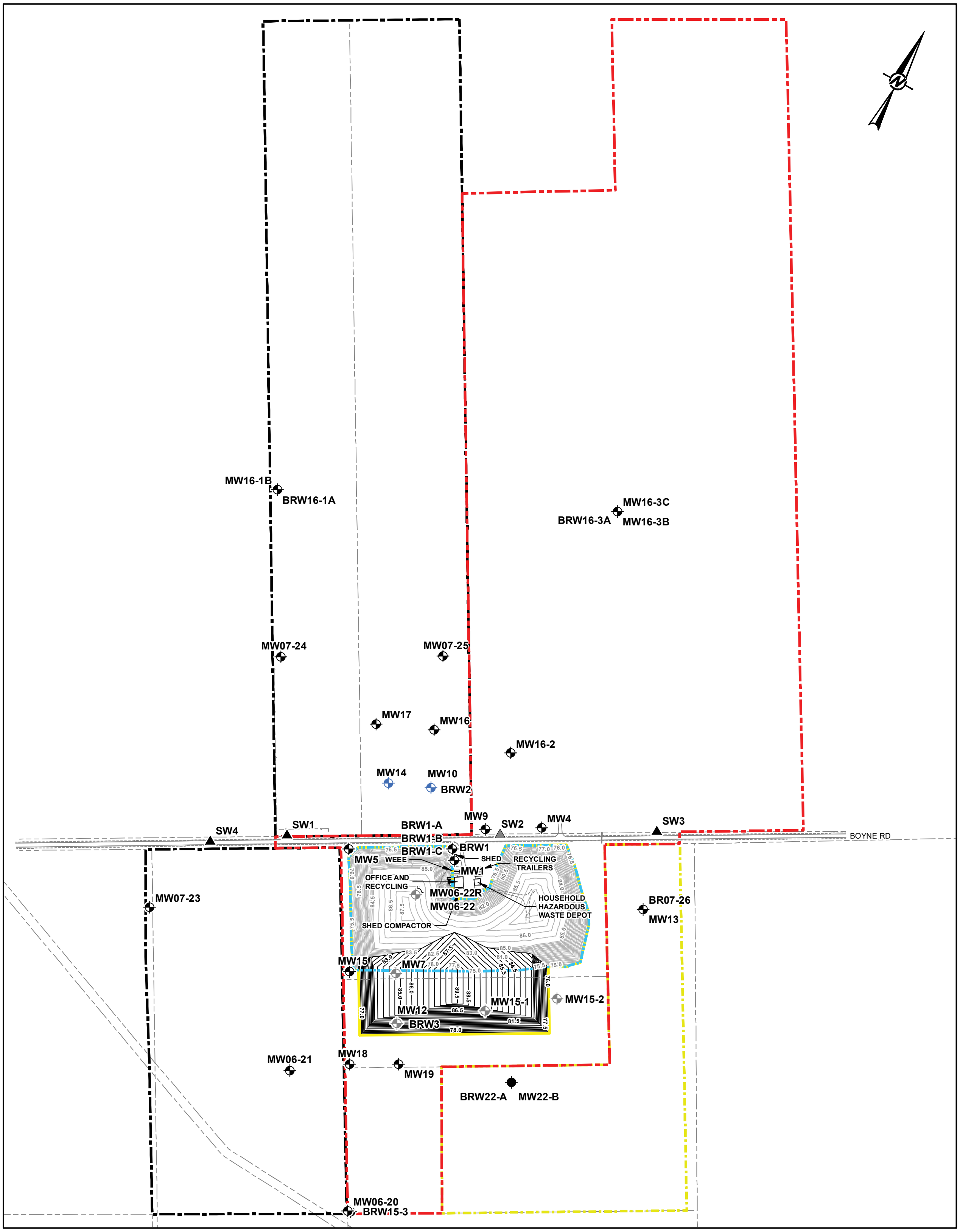
Field Measured Parameters: groundwater levels at all accessible monitoring wells, temperature, conductivity, pH

Laboratory Analytical Parameters: potassium, boron, iron, manganese, barium, aluminum, cadmium, chromium, cobalt, lead, zinc, TDS, alkalinity, sulphate, sodium, nitrate, chloride, BOD, DOC, ammonia, dissolved reactive phosphorous (DRP), phenols, hardness (calculated from laboratory calcium and magnesium analysis), copper, nickel; VOCs (at MW06-22R, MW1, MW4, MW5, and MW16 only)

16.1.2 Surface Water Monitoring

16.1.2.1 Surface Water Program

There are currently four surface water monitoring stations located within the drainage ditch (Volks Drain) along the north side of Boyne Road (on the opposite side of the road from the disposal area). SW1 and SW4 are located upstream of the landfill site, SW2 is located opposite the disposal area, and SW3 is located downstream of the landfill site. The locations of the four existing surface water monitoring stations are indicated on Figure 9-9. The sampling locations are proposed to remain with the exception of SW2, which will be removed from the monitoring program when the current open section of Volks Drain opposite the disposal area is converted to either a closed pipe or a lined ditch as part of the landfill expansion design. The proposed surface water monitoring program is summarized below.



LEGEND

- EXISTING LANDFILL FILL AREA
- PROPOSED LIMIT OF WASTE FOR THE LANDFILL EXPANSION AREA
- APPROXIMATE BOUNDARY OF CONTAMINATION ATTENUATION ZONE
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT
- APPROXIMATE LANDFILL SITE PROPERTY BOUNDARY
- GROUND SURFACE CONTOURS (mASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (mASL)
- APPROXIMATE SURFACE WATER MONITORING LOCATION
- HISTORIC SURFACE WATER MONITORING LOCATION
- APPROXIMATE GROUNDWATER MONITORING LOCATION
- HISTORIC GROUNDWATER MONITORING LOCATION
- NEW PROPOSED GROUNDWATER MONITORING LOCATION
- WATER LEVEL ONLY MONITORING LOCATION

REFERENCES

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. COORDINATE SYSTEM: MTM ZONE 9 NAD83.

0 60 120 180 240 300

1:6,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS RESIDUAL WASTE MANAGEMENT PLAN

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-01-27
PREPARED	JEM/MG
DESIGN	PLE
REVIEW	YJM
APPROVED	PLE

TITLE
PROPOSED LANDFILL EXPANSION GROUNDWATER AND SURFACE WATER MONITORING PROGRAM LOCATIONS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1648253	2.0/2.2.0	0	16-1

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

Monitoring Locations: SW1, SW3, SW4 – refer to Figure 16-1

Monitoring Frequency: Spring, Late Summer, Late Fall

Field Measured Parameters: temperature, conductivity, pH, dissolved oxygen, approximate flow rate

Field Observations at Sampling Locations: aquatic plants, algae growth, litter/debris

Laboratory Analytical Parameters: boron, iron (total and dissolved), manganese, barium, aluminum, cadmium, chromium, cobalt, lead, zinc, alkalinity, nitrate, nitrite, chloride, BOD, ammonia, total phosphorous, phenols, potassium, copper, nickel, sodium, sulfate, TDS, TSS, chemical oxygen demand, DOC, total kjeldahl nitrogen, hardness (calculated from laboratory calcium and magnesium analysis), unionized ammonia (calculated from ammonia and field temperature analysis)

The surface water monitoring program, triggers and contingencies will be re-assessed during the Environmental Compliance Approval.

16.1.2.2 Stormwater Program

There is no existing stormwater management infrastructure at the site. It is proposed for the expansion that a sampling location be added at the outfall for the stormwater management pond, and it be sampled four times per year after significant rainfall events, once in spring and fall and two other sampling events. The samples collected will be analyzed for the same field measured parameters and laboratory parameters as listed above for surface water.

16.2 Contingency Measures

The following contingency measures are proposed and will be finalized and confirmed during the ECA amendment application for the expansion.

16.2.1 Groundwater

Both the existing landfill and the proposed expansion are intended to operate in compliance with the Reasonable Use Guideline B-7 as a natural attenuation landfill using adequate CAZ lands to provide the required attenuation of leachate effects on groundwater quality at the CAZ boundaries. The approved contingency plan for the existing landfill is considered appropriate for the proposed expansion as described in the following.

Should the ongoing groundwater monitoring program at any of the Compliance Evaluation Monitoring Wells define the existence of, or potential for, unacceptable impacts on groundwater quality beyond the CAZ boundaries, the Township will prepare and present a mitigation plan for the approval of the MECP Director and/or the District Manager. Contingency actions to be taken by the Township to prevent or remediate the off-property impacts could consist of:

- Delineation of the extent of the leachate impact on groundwater, and acquisition of additional CAZ land to bring the site into compliance with MECP Guideline B-7.
- Gaining control over the contaminated groundwater to bring the site into compliance.

- Developing and implementing groundwater control/treatment measures (for example, a groundwater interceptor trench in overburden or purge wells in bedrock) to bring the site into compliance with Guideline B-7.

16.2.2 Surface Water

During normal site operations, the valve on the stormwater management pond will be open. The results of the stormwater pond discharge quality sampling will be compared to proposed trigger values, which will be developed as part of the ECA application and approval process for the landfill expansion.

In the event of an exceedance of a trigger, additional stormwater sampling and analysis would be conducted at the wetland pond to confirm the result. If the second sample results in an exceedance, then the stormwater management pond would be operated in batch discharge mode with the gate valve closed.

During batch discharge mode operation, surface sampling would occur prior to the discharge of any surface water. When the concentration for each trigger parameter is less than the corresponding trigger concentration, the surface water would be released to the downstream receiver (Volks Drain). If the impounded stormwater quality does not meet the trigger concentrations, it could be slowly infiltrated back into the landfill for a short term period only as required, or possibly pumped into a tanker and hauled to the municipality's sewage lagoons.

17.0 Other Approvals

The following describes the additional approvals that will or may be required for the expansion of the Boyne Road Landfill site, in addition to the EA approval process.

17.1 Environmental Compliance Approvals

The *EPA*, Section 27 stipulates that "…no person shall use, operate, establish, alter, enlarge or extend a waste management system or a waste disposal site except under and in accordance with an environmental compliance approval [ECA]." The application to MECP for an amendment to the waste ECA under Part 5 of the *EPA* must be supported by a detailed report that complies with *O. Reg.* 232/98 Landfilling Standards and describes the proposed design and operations of the expanded Boyne Road Landfill site.

The *Ontario Water Resources Act (OWRA)*, Section 53 states "…no person shall use, operate, establish, alter, extend or replace new or existing sewage works except under and in accordance with an environmental compliance approval" (Ontario, 1990e). Sewage works in this context refer to collecting, transmitting, treating and/or discharging of stormwater. An ECA amendment from the MECP for 'sewage works' will be required for the proposed stormwater management system associated with the expanded landfill. The application must be supported by a stormwater management system design brief and ECA-level drawing for the proposed system.

17.2 Fisheries Act

Preparation and submission of a DFO Request for Review will be required to determine any additional mitigation and potential compensation in consultation with DFO.

17.3 Endangered Species Act

As habitat for SAR bats (little brown myotis) cannot be avoided within the proposed expansion, a permit under the *ESA* (*O. Reg.* 242/08) may be required. Consultation with the MECP through submission of an Information Gathering Form will be required.

17.4 Drainage Act

It is expected that an approval will be required under the provincial *Drainage Act* for the alternations/improvements in the portion of the Volks Drain on the north side of Boyne Road opposite the landfill site to construct the proposed mitigation measures.

17.5 Planning Act

Re-zoning of the landfill is not required to accommodate the proposed landfill expansion. However, it is recommended that once the EA has been approved confirming that the additional land to the south and east is to be reserved as part of the landfill site property for buffer area, the Township rezone the lands to ensure that the 500 m study area is correctly identified when using the land use schedule to the Zoning By-law, as this is the only tool available to the general public in regard to potential development within the 500 m restricted zone around the landfill site.

17.6 South Nation Conservation

A work permit from the Conservation Authority is expected to be required to undertake the site work associated with the expansion, i.e., since the expansion is within an area with a wetland land classification and/or because of the work to be carried out in the Volks Drain or associated with the perimeter drain.

18.0 Summary of Commitments

Compliance monitoring of the proposed Boyne Road Landfill expansion will be carried out to confirm that it has been constructed, implemented and operated in accordance with the commitments made by the Township during the preparation of the EA and any conditions of EA approval. This section lists the commitments made by the Township of North Dundas during the ToR (Table 18-1) and during the EA study process (Table 18-2). This list does not include items that will be legally required according to existing provincial regulations.

The following table (Table 18-1) summarizes the commitments made by the Township during the development of the ToR and during consultation for the ToR, and the status of fulfilling each of the commitments.

Table 18-1: List of ToR Commitments

ID	ToR Commitment	Status and How Commitment was Fulfilled
1	The EA will be prepared in accordance with subsections 6(2)(a) and 6.1(2) of the *EA Act*.	Completed Described in Section 2.3.1 of this EASR.
2	The Township will contact Indigenous groups to discuss their consultation needs and their involvement in the EA.	Completed Contact and consultation with Indigenous groups is provided in Sections 4.4.2 and 4.7 of this EASR and associated portions of Volume 4 Consultation Record.
3	The Township will consider the stated purpose of the EA during the EA process and will refine the purpose statement, if required. The final purpose statement will be provided in the EA Study report.	Completed As described and provided in Section 2.1 of this EASR.
4	Additional information on waste disposal and diversion projections will be provided during the EA to further support the need for the equivalent of 400,000 m^3 of additional waste disposal capacity (excluding final cover).	Completed A diversion study was completed, and proposed diversion activities and diversion predictions are summarized in Sections 6.3.5 and 7.0 of this EASR, with details provided in Volume 3 Appendix J. Revised residual waste disposal projections over the 25 year expansion operating period considering the predicted diversion are provided in Section 7.0 of this EASR.

ID	ToR Commitment	Status and How Commitment was Fulfilled
5	The Township commits to completing a Waste Diversion Study to assess further opportunities for at-source residential diversion in the Township.	Completed A study of further diversion opportunities for residential waste in the Township was completed and is summarized in Sections 6.3.5 and 7.0 of this EASR, with details provided in Volume 3 Appendix J.
6	The Township commits to updating the consultation plan to align with the Code of Practice: Consultation in Ontario's Environmental Assessment Process (2014).	Completed The consultation plan was updated in alignment with the Code of Practice (MOECC, 2014a) as described in Sections 4.1 through 4.3 of this EASR.
7	During the EA, the Township will develop evaluation criteria and indicators to be used to compare 'Alternative Methods', in consultation with the MECP, GRT, Indigenous communities and the public.	Completed Evaluation criteria for comparison of 'Alternative Methods' of landfill expansion were developed as described in Section 8.0 of this EASR. Input received from consultation on the proposed criteria is described in Section 11.3 of this EASR.
8	During the EA, the appropriate Study Areas for assessment of impacts from 'Alternatives To' and 'Alternative Methods' will be determined and described in the EA Study report.	Completed Appropriate Study Areas for the 'Alternatives To' and 'Alternative Methods" were determined and are described in Sections 5.1 and 8.1, respectively, of this EASR.
9	During the EA, detailed technical work plans for each of the environmental components will be developed in consultation with the agencies, Indigenous communities and the public. Where relevant, the Township will provide the detailed work plans to the appropriate regulatory agency for review and concurrence prior to undertaking the work.	Completed The development of detailed work plans and consultation on and agency review of the proposed work plans are as described in Section 8.2 of this EASR, and in Volume 4 Consultation Record – Appendix G1.
10	During the EA, a more detailed description of the existing conditions relevant to the preferred 'Alternative To' and 'Alternative Methods' will be prepared using a combination of sources of existing information and site-specific studies and will be provided in the EA Study report.	Completed A more detailed description of existing conditions for the 'Alternatives To' and 'Alternative Methods" was prepared and is described in Sections 5.2 - 5.9 and 9.0, respectively, of this EASR.

ID	ToR Commitment	Status and How Commitment was Fulfilled
11	The Township will provide in the EA Study report a final detailed description of the proposed undertaking once the preferred 'Alternative Method' has been identified.	Completed A final description of the preferred 'Alternative Method', which is the proposed Boyne Road Landfill expansion, is provided in Section 12.0 of this EASR.
12	The preferred alternative will be assessed from the perspective of climate change.	Completed An assessment of the proposed landfill expansion in terms of climate change is provided in Section 14.0 of this EASR.
13	A cumulative impact assessment of the preferred alternative will be completed and provided in the EA Study report.	Completed A cumulative impact assessment considering the proposed landfill expansion is provided in Section 15.0 of this EASR.
14	The Township commits to developing a monitoring framework during the preparation of the EA.	Completed A monitoring program framework is provided in Section 16.0 of this EASR.
15	The Township commits to circulating a draft EA Study report prior to submission of the final EA Study report.	Completed The Township circulated a Draft EASR on May 27, 2022 for a 4 week comment period.
16	The Township commits to determining and describing the other regulatory approvals required to proceed with the preferred alternative and including this in the EA Study report.	Completed Other regulatory approvals required to proceed with the proposed landfill expansion are provided in Section 17.0 of this EASR.
17	The list of ToR commitments will be provided in the EA Study report together with the way in which these commitments were addressed during the EA and the location of the information within the EA documents. The EA Study report will also include a list of commitments made by the Township during the preparation of the EA studies and during consultation throughout the EA process.	Completed The list of ToR commitments and how they were fulfilled during the EA, as well as a list of EA commitments by the Township, are provided in Section 18.0 of this EASR.

The following table (Table 18-2) summarizes the commitments made by the Township of North Dundas during the EA.

Table 18-2: List of Commitments made by the Township during the EA

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
A	-	Implementation of all required Site effects monitoring and reporting programs. (EASR – Section 16)	Construction, operations and post-closure
B	-	The Township commits to implement the practices set out in the Waste Diversion Study. (EASR – Volume 3 Appendix J)	Operations
C	Atmosphere/Air Quality	The Township will operate the active disposal area with approx. 200 m^2 maximum working face and will apply daily cover of the waste. (EASR – Section 13.1.1.7)	Operations
D	Atmosphere/Air Quality	Landfill areas will be capped progressively as cells are completed (EASR – Section 13.1.1.7)	Operations and post-closure
E	Atmosphere/Air Quality	Township will implement dust mitigation measures related to vehicles. (EASR – Section 13.1.1.7)	Operations and post-closure
F	Atmosphere/Noise	The Township will implement best management practices to control potential off-site noise effects. (EASR - Section 13.1.2.4)	Operations
G	Geology and Hydrogeology	The Township commits, in future, to obtain control over an additional 400 m of groundwater travel distance towards the south as CAZ through either property acquisition or groundwater easement below this land area. (EASR – Section 13.2)	Operations and post-closure
H	Surface Water/Quantity	Design stormwater management system to match post-expansion outlet of surface water flows to corresponding pre-expansion flows to convey design storm flows. (EASR – Sections 12.5 and 13.3)	Pre-construction

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
HH	Surface Water/Quantity	Off-Site flows that flow onto the proposed expansion area will be directed around (not towards or through) the proposed expansion area/waste mound. (EASR – Section 12.5)	Pre-construction
I	Surface Water/Quality	Design stormwater management controls to provide Enhanced Level Protection (80% TSS removal) as defined by the MECP SWM Planning and Design Manual (MECP, 2003). (EASR – Sections 12.5 and 13.3)	Pre-construction
J	Surface Water/Quality	Design stormwater management controls to provide water quality storage requirements based on Table 3.2 of the Ontario Stormwater Management Planning and Design Manual (MECP, 2003). (EASR – Sections 12.5 and 13.3)	Pre-construction
K	Surface Water/Quality	Surface drainage from potentially contaminated areas, i.e., originating from active landfilling areas, will be contained locally within berms and will discharge into the waste. Surface drainage from non-contaminated areas such as road areas and areas with interim or final landfill cover will be conveyed to the SWM wetland via the internal drainage ditches. (EASR – Sections 12.5 and 13.3)	Pre-construction
KK	Surface Water/Quality	As a result of comments on the draft EASR the surface water monitoring, trigger mechanisms and contingencies will be re-assessed during the ECA application. (EASR – Sections 16.2.2.	Pre-construction
L	Biology/Terrestrial Ecosystem	Because the expansion will result in loss of habitat for little brown myotis, which is designated endangered under the ESA, an Information Gathering Form will be prepared and submitted to the MECP prior to any works being undertaken to determine permitting needs, if any, under the ESA (*O.Reg.* 242/08). (EASR – Section 13.4)	Pre-construction

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
M	Biology/Terrestrial Ecosystem	Clearing of vegetation should take place outside of the breeding bird nesting period (April 1 – August 31). If clearing must occur during this time, a nest survey must be performed by a qualified biologist within 24 hours prior to the proposed works. (EASR – Section 13.4)	Construction and operations
N	Biology/Terrestrial Ecosystem	Prepare and implement a Wildlife Observation Protocol to outline the steps to take in the event of an encounter with wildlife, including SAR, during the construction stage. All on-site personnel should be trained on the contents of the protocol. (EASR – Section 13.4)	Pre-construction, construction and operations
O	Biology/Aquatic Ecosystem	Prepare Sediment and Erosion Control Plan and Spill Management Plan for construction activities and site operations. (EASR – Section 13.4)	Pre-construction, construction and operations
P	Biology/Aquatic Ecosystem	Prepare and submit a Request for Review application to DFO to determine if habitat compensation measures are required for fish habitat affected by the landfill expansion. Obtain required DFO approvals. (EASR – Section 13.4)	Pre-construction

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
Q	Biology/Aquatic Ecosystem and Surface Water/Quality	As an alternative to the closed culvert pipe proposed to be installed in the portion of the Volks Drain on the north side of Boyne Road opposite the landfill site frontage, consideration would be given to an open lined ditch alternative at the ECA design and amendment application stage to mitigate both 1) the potential for leachate-impacted groundwater to the north roadside ditch(Volks Drain) and thereby protect surface water quality and 2) reduce the overall amount of impact on fish habitat and potential effects due to the loss of fish habitat in the Volks Drain if a closed pipe is used. (EASR – Sections 13.3 and 13.4)	Pre-construction
R	Biology/Aquatic Ecosystem and Surface Water/Quality	Prepare and submit an application for a work permit to South Nation Conservation to undertake the construction work associated with the expansion. (EASR – Section 17.6)	Pre-construction
S	Biology/Aquatic Ecosystem	Complete in-water work/mitigation measures between June 29 and March 14 to avoid adverse aquatic effects. (EASR – Section 13.4)	Construction and operations
SS	Biology/Aquatic and Terrestrial Ecosystem	Above the wetted surface of the stormwater management pond, native species will be considered for revegetation. (EASR – Section 4.7.6)	Construction and Operations
T	Cultural Heritage Resources/Archaeological Resources	Should archaeological resources be unexpectedly encountered during the landfill expansion, a licensed archaeologist will be contacted to assess the need for additional archaeological assessment. (EASR – Section 13.7.1)	Construction and operations
U	Land Use Planning	Rezone the lands to be added to the landfill site property as Special Rural – Waste Disposal (SRD). (EASR – Section 13.5)	Operations

ID	Component/Sub-component (if applicable)	Commitment (Location of Where Commitment was Made in the EA Document Package)	Project Phase
V	Socio-economic/Residents and Community	Prepare complaints response protocol. (EASR – Section 13.8.2)	Pre-construction and operations
W	Socio-economic/Visual	Plant additional trees within the tree line between the proposed expansion and the southwestern property boundaries. (EASR- Section 13.8.3)	Operations
X	Design and Operations	In the expansion design, provide a minimum separation of 1 m between the high groundwater table and the base of the waste in the expansion area. (EASR – Section 12.2)	Pre-construction
Y	Design and Operations	Preparing a landfill development phasing plan for the expansion. (EASR – Section 13.10)	Pre-construction

18.1 Potential Project Modifications

In accordance with section 4.2.5 of the MECP Code of Practice for Preparing and Reviewing Environmental Assessments in Ontario (MOECC, 2014), and subject to *O. Reg.* 101/07, minor modifications to the undertaking may be made following approval, subject to consultation with the MECP Environmental Assessment Branch to confirm any requirements with respect to such modifications under the *Environmental Assessment Act*.

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