6.0 Phase 4: Define the Parameters of the Study

This Phase of the EA frames the parameters for the evaluation of Alternative Methods for Carrying out the Undertaking (hereafter referred to as the Alternatives). The parameters of the study include:

- The Study Areas (see Section 6.1);
- The timeframe to be considered (see Section 6.2);
- The methodology for characterizing the existing environment (see Section 6.3);
- The existing environment within which the Undertaking will be implemented (see Section 6.4).
- The Alternatives to be assessed (see Section 7.1); and
- The indicators used to measure effects for the comparative evaluation (see Section 7.2).

6.1 Study Area

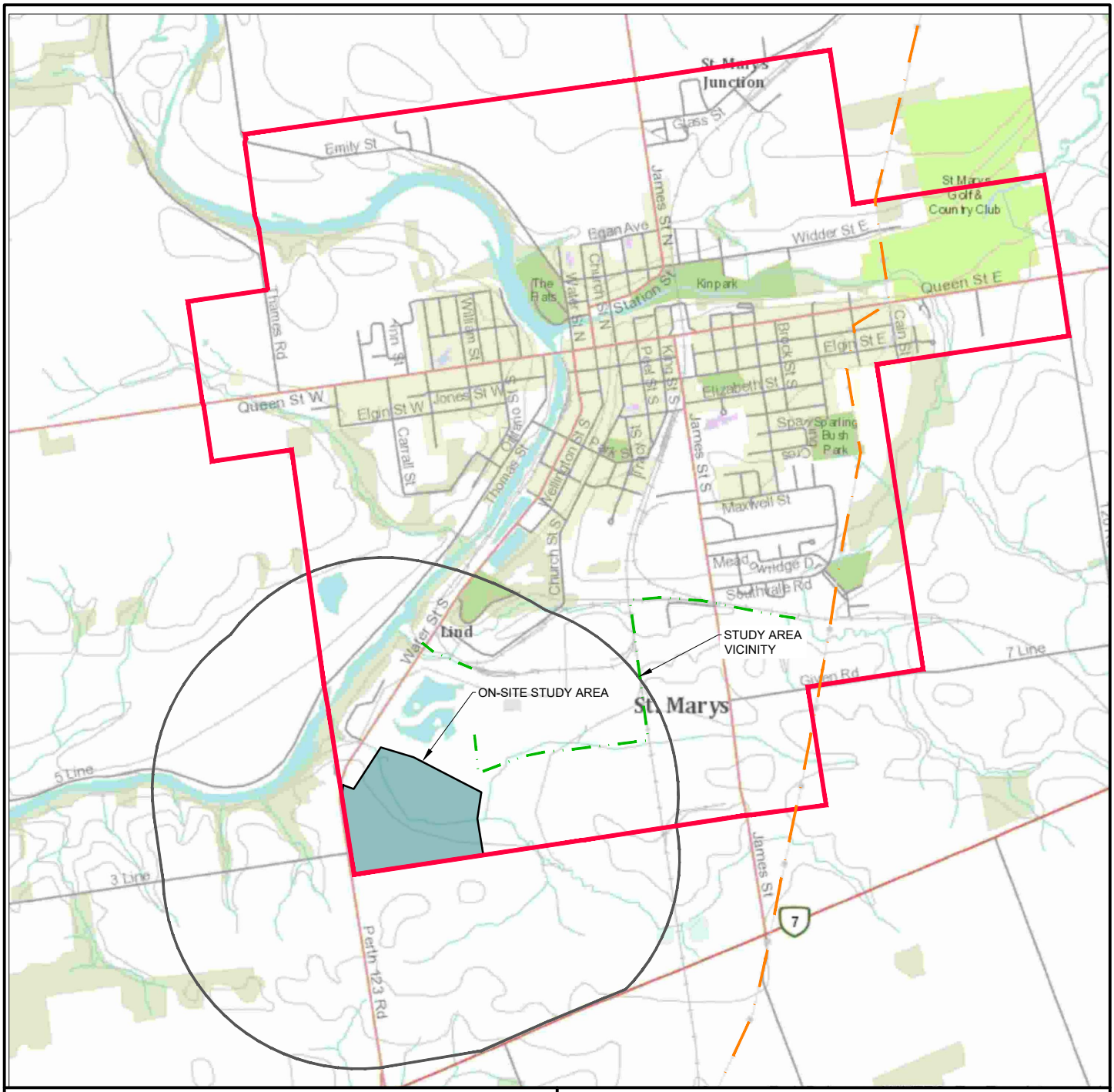
In accordance with the Code of Practice – Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario (MOECC, January 2014), the Study Area is "the area within which activities associated with the undertaking will occur and where potential environmental effects will be studied."

The effects of the landfill expansion are likely to be felt at the landfill site and on surrounding lands. As such, two specific Study Areas have been identified, which were used as the basis for defining and characterizing the natural, social, cultural, and built environments that may be potentially affected by the expansion.

The Study Areas are as follows:

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

The Study Areas are presented on Figure 6-1.



LEGEND:

- ST. MARYS LANDFILL
- TOWN BOUNDARY
- ELECTRICAL DISTRIBUTION LINES
- ELECTRICAL TRANSMISSION LINES

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

BURNSIDE

Client

TOWN OF ST. MARYS

Figure Title

FUTURE SOLID WASTE DISPOSAL EA

STUDY AREAS

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	**6-1**
Scale		Project No.	
N.T.S.		300032339	

File Name:GIS (\\elmo)\Projects\300\032339 (St.Mary's)\2022 Solid Waste Disposal EA\ 032339 2022 Waste Disposal EA Drawing Set.dwg Date Plotted: June 5, 2022 - 7:55 PM

6.2 Timeframe of the Study

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

- Construction of the new landfill footprint- 2023[39];
- Operation of the landfill over a 40-year period, ending December 31, 2056[40]; and
- Closure of the landfill beginning in 2057.

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

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

6.3 Methodology for Characterizing the Existing Environment

Existing environmental conditions have been characterized in further detail. That characterization was to be completed using a combination of:

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

The following Work Plans were created in the early stages of the EA process:

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

---

[39] Construction is anticipated to commence in 2023 and will occur prior to the development of new cells as discussed in Section 8.4. Construction activities will occur while the landfill is operating.

[40] As described in Section 3.1.3.8, the 40-year planning period is assumed to have commenced on January 1, 2017. All waste disposed after that time is assumed to be part of the new capacity being approved through this EA.

Work Plans provided a detailed methodology for characterizing each component of the environment and how the evaluation would be carried out. Work Plans are provided in Volume II, Appendices A though E of this report.

Work Plans were circulated to relevant agencies for review and comment. Work Plans were also circulated to Indigenous communities and presented to the public at the first Public Information Centre. The actual field studies and the assessment methodology took into account any comments received on the Work Plans. Comments are presented as part of the consultation summary in Volume IV, Appendix E. Methodologies used to describe the existing environment are included in the following sections.

6.4 Description of the Existing Environment

6.4.1 Natural Environment

6.4.1.1 Air Quality and Odour

Methodology

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

Dispersion modelling was completed in accordance with the MECP's Air Dispersion Modelling Guideline for Ontario, ver 3.0 (2016). The following dispersion model and pre-processors were used in the assessment:

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

MECP provided site specific meteorological data based on AERMOD v16216 for use in this assessment.

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

Existing Air Quality and Odour

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

Modelling of existing conditions is provided in Table 6-1. The modelled emissions are based on the size and location of the open face of the landfill, the number and type of equipment and vehicles used at the site and the landfill's daytime operating hours [41]. The assessment examined the impact of 13 different contaminants [42]. The various air quality standards are based on averages over various time periods (i.e., some standards refer to air quality averages over a ten-minute period, 24-hour period or a year). Some standards also include multiple averaging periods for the same contaminant (i.e., there is a standard for the quantity of contaminants over a 10-minute period and a standard for the same contaminant over a 24-hour period). The various periods identified in the relevant provincial and federal standards are listed in Table 6-1.

There is no provincially regulated standard for odour. For the purposes of modelling, the composition of waste was assumed to be the same as the Ridge Landfill in Blenheim, Ontario. The Ridge Landfill was used as the composition of waste in the St. Marys landfill was not available; however, it is likely that the St. Marys landfill receives less putrescent and organic waste and more waste from industrial, commercial and institutional uses than the Ridge Landfill. It is the putrescent waste that is the most significant cause of odours. Although modelling suggested that there is a high level of odour at the landfill boundary, as noted in Table 6-1, this is likely an overrepresentation of actual odour experienced, based on the landfill's limited record of complaints.

All of the contaminants except odour and particulate matter are less than 50% of their respective criteria under the worst-case scenario. The contaminant with the highest off-property impact was particulate matter at 74% of the 24-hour criterion of 120 $\mu g/m^3$.

---

[41] The landfill currently operates four days per week between 8:30 am and 4:30 pm. There is no intent to change this; however, unforeseen circumstances of the next forty years could result in a change to operating hours. Therefore, for modelling purposes it was assumed that the landfill could operate any time during daylight hours, i.e., 7 am to 7 pm.

[42] The 50 contaminants known to be present in landfill gas were considered; however, the most sensitive 13 contaminants were assessed. When results showed concentrations of these at limits below the provincial standards, it can be extrapolated that the remaining contaminants will also be below provincial limits.

Table 6-1 Existing Levels of Air Contaminants

Contaminant	Modelled Existing Conditions (µg/m^3)	Criteria (µg/m^3)	Averaging Period of Criterion	Regulation Schedule # [43]	Percentage of Criteria (%)
PM10	24.2	50	24hrs	AAQC	48.3%
PM2.5	2.5	27	24hrs	CAAQS 2020	9.4%
PM2.5	0.4	8.8	1 year	CAAQS 2020	4.4%
Odour	99.4	N/A	10 mins		
Methane	4249.0	37330	24 hrs	SL-PA	11.4%
Vinyl chloride	0.2	1	24 hrs	AAQC	24.2%
Vinyl chloride	0.03	0.2	1 year	AAQC	12.7%
Dimethyl sulphide	1.2	30	10 mins	AAQC	4.1%
Dichlorofluoromethane	0.1	500	24 hrs	SL-JSL	0.0%
Chlorobenzene	0.1	4500	10 mins	AAQC	0.0%
Chlorobenzene	0.0	3500	1 hr	AAQC	0.0%
Carbon Dioxide	11660.0	255800	24 hrs	SL-PA	4.6%
Carbon monoxide	201.2	36200	1 hr	AAQC	0.6%
Carbon monoxide	98.5	15700	8 hrs	AAQC	0.6%
Hydrogen sulphide	3.1	13	10 mins	AAQC	23.8%
Hydrogen sulphide	0.6	7	24 hrs	AAQC	9.3%
Nitrogen oxides	26.2	400	1 hr	AAQC	6.5%
Nitrogen oxides	26.2	78.96	1 hr	CAAQS 2025	33.1%
Nitrogen oxides	7.1	200	24 hrs	AAQC	3.6%

AAQC= Ontario's Ambient Air Quality Criteria
CAAQS= Canadian Ambient Air Quality Standards
SL-PA= Screening Level- Previously Approved
SL-JSL= Screening level- Jurisdictional Screening Level

Contaminant	Modelled Existing Conditions (µg/m^3)	Criteria (µg/m^3)	Averaging Period of Criterion	Regulation Schedule # [43]	Percentage of Criteria (%)
Nitrogen oxides	0.6	22.56	1 year	CAAQS 2025	2.9%
Total particulate matter	89.2	120	24 hrs	AAQC	74.3%
Total particulate matter	14.0	60	1 year	AAQC	23.3%

Under baseline conditions, the worst-case odour effects occurs at the property line. The highest impact is 99 Odour Units (OU). This is an estimate occurring at the landfill boundary and appears to be a significant over-representation of existing conditions under a worst-case scenario. Odour must be assessed at sensitive receptors, none of which are on the property line of the landfill. Based on the landfill's complaints record, the impact of 6 OU appears to match the level of odour at which complaints tend to be received. Under current conditions, approximately ten receptors are estimated to experience impacts of 6 OU or more up to 0.7% of the time. The likelihood of odour impacts under existing conditions is summarized in Table 6-2. The location of receptors is shown in Figure 6-2.

Complaints due to odour have been relatively minimal. In 2018, the Town revised its operating practises to use a thicker cover and more localized cover stockpiles. No odour-related complaints were received in 2019 to 2020.

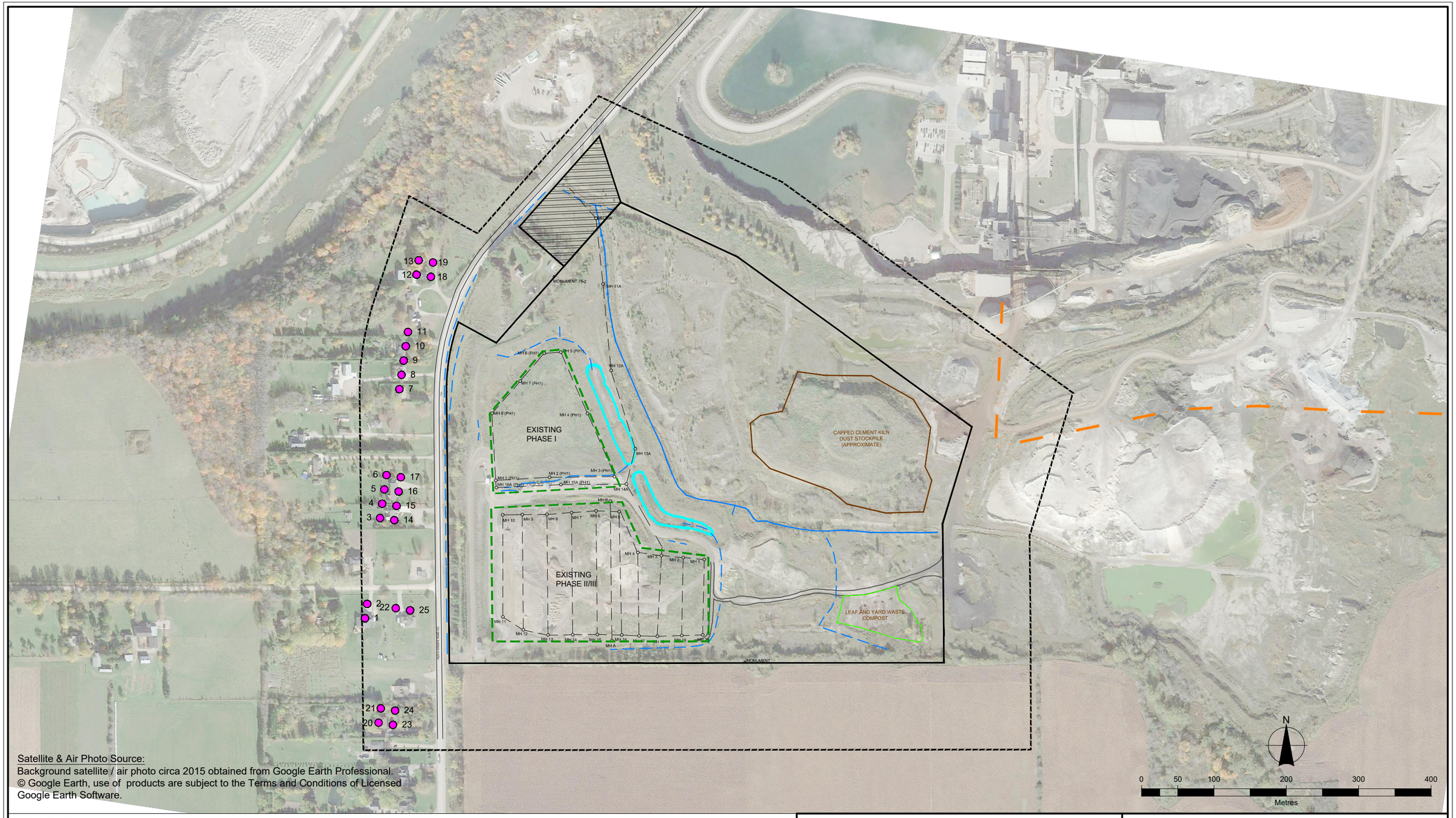
Complaints received between 2013 and 2020 are as follows:

- 2013 – One (1) complaint from a resident on Line 3;
- 2014 – Two (2) complaints from residents on Perth Road 123;
- 2015 – Six (6) complaints from two (2) residents on Perth Road 123 (five (5) directly from residents, one (1) via MECP);
- 2016 – Two (2) complaints from residents on Perth Road 123;
- 2017 – No formal complaints reported;
- 2018 – Five (5) complaints from two (2) residents on Perth Road 123;
- 2019 – No formal complaints reported; and
- 2020 - No formal complaints reported.

Table 6-2 Existing Odour Conditions

Receptor	< 1 OU (%)	1 to 6 OU (%)	> 6 OU (%)
1	97.62%	2.38%	
2	97.52%	2.48%	
3	96.96%	2.57%	0.47%
4	96.98%	2.50%	0.52%
5	97.19%	2.28%	0.53%
6	97.32%	2.23%	0.45%
7	97.83%	2.13%	0.04%
8	97.86%	2.13%	0.01%
9	98.03%	1.97%	

Receptor	< 1 OU (%)	1 to 6 OU (%)	> 6 OU (%)
10	98.14%	1.86%	
11	98.23%	1.77%	
12	98.58%	1.42%	
13	98.65%	1.35%	
14	96.68%	2.75%	0.58%
15	96.71%	2.59%	0.70%
16	96.89%	2.43%	0.69%
17	97.10%	2.33%	0.58%
18	98.56%	1.44%	
19	98.65%	1.35%	
20	98.66%	1.34%	
21	98.52%	1.48%	
22	97.35%	2.65%	
23	98.61%	1.39%	
24	98.51%	1.49%	
25	97.34%	2.66%	



Satellite & Air Photo Source:
Background satellite / air photo circa 2015 obtained from Google Earth Professional.
© Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

LEGEND

- PROPERTY BOUNDARY
- 120M BUFFER
- EXISTING WASTE FOOTPRINT
- WATERCOURSE
- DRAINAGE SWALE
- LEACHATE COLLECTION SYSTEM
- STORM WATER MANAGEMENT BASIN
- LEACHATE COLLECTION SYSTEM MANHOLE
- COMPOST AREA
- ELECTRICAL DISTRIBUTION LINES
- ODOUR RECEPTOR LOCATION
- CAPPED CEMENT KILN DUST STOCKPILE (APPROXIMATE)
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title

FUTURE SOLID WASTE DISPOSAL EA

LOCATION OF ODOUR RECEPTORS

Drawn	Checked	Date	Figure No.
SK	TR	JUNE 2022	6-2
Scale		Project No.	
1:5000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figure 6-2.dwg Date Plotted: June 8, 2022 - 12:33 PM

6.4.1.2 Noise

Methodology

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

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

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

Closest sensitive residential Points of Reception (POR) or Outdoor Points of Reception (OPOR), also referred to as "receptors" were identified from aerial photographs and are summarized in Table 6-3. Receptors were more specifically located in the plane of a window where sound originating from the landfill is received, assumed to be at a height of 1.5 m and 4.5 m unless otherwise stated.

Table 6-3 Points of Reception

POR	POR Description	POR Location	Height (m)
POR_01_A	Two Storey Residential House	1025 Water Street South	1.5
POR_01_B	Two Storey Residential House	1025 Water Street South	4.5
OPOR_01_A	Outdoor Receptor	1025 Water Street South	1.5
POR_02_A	Two Storey Residential House	1774 Water Street South	1.5
POR_02_B	Two Storey Residential House	1774 Water Street South	4.5
OPOR_02_A	Outdoor Receptor	1774 Water Street South	1.5
POR_03_A	One Storey Residential House	1827 Water Street South	1.5
POR_03_B	One Storey Residential House	1827 Water Street South	4.5
OPOR_03_A	Outdoor Receptor	1827 Water Street South	1.5
POR_04_A	Two Storey Residential House	4461 3 Line	1.5
POR_04_B	Two Storey Residential House	4461 3 Line	4.5

POR	POR Description	POR Location	Height (m)
OPOR_04_A	Outdoor Receptor	4461 3 Line	1.5
POR_05_A	Two Storey Residential House	1646 Perth Road 123	1.5
POR_05_B	Two Storey Residential House	1646 Perth Road 123	4.5
OPOR_05_A	Outdoor Receptor for	1646 Perth Road 123	1.5
POR_06_A	Two Storey Residential House	1579 Perth Road 123	1.5
POR_06_B	Two Storey Residential House	1579 Perth Road 123	4.5
OPOR_06_A	Outdoor Receptor	1579 Perth Road 123	4.5

St. Marys Landfill contains three significant sources of noise: on-site traffic, a compactor, and a loader. All noise sources associated with road traffic travelling to/from St. Marys Landfill, as well as all traffic in the Study Area were included in the assessment. Passenger vehicles [44] are generally considered to have negligible noise emissions when travelling at 20 km/h or less. All vehicles are restricted to 20 km/h while on-site so any noise associate with passenger vehicles were excluded.

There is only one equipment operator at the landfill site. The operator therefore runs either the loader or the compactor. There are no times when both pieces of equipment are operated simultaneously. While typically the compactor does not run more than 20 minutes of any one hour, the noise model assumes that the compactor runs for the entire hour so the noise model is very conservative. Operation of the loader instead of the compactor would result in less noise.

The worst-case scenario was selected for investigation. Under this scenario, it was assumed that all relevant on-site noise sources listed above, operate simultaneously and at their maximum load. It was also assumed that operations would occur at their closest point on the landfill to these receptors. These choices mean that there are substantial periods of time when the activity will be substantially less than modelled and/or that activity will be further from the receptors than modelled so the impacts will be less than predicted.

Existing Noise

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

[44] Passenger vehicles include cars, mini-vans, SUV's, and pick-up trucks.

Existing conditions were modeled at each of the receptors identified in Table 6-4. Existing conditions were modeled using the modeling programs previously described. Modeling results identified that the highest impact was found at POR_04_B with a noise level of 51 dBA. This is lower than the provincial criterion (allowable limit) of 55 dBA. All other receptors also experience noise at a level below the provincially set limit.

Table 6-4 Existing Noise Conditions

POR#	Existing Conditions (dBA)
POR_01_A	44
POR_01_B	45
OPOR_01_A	44
POR_02_A	40
POR_02_B	44
OPOR_02_A	37
POR_03_A	47
POR_03_B	51
OPOR_03_A	41
POR_04_A	49
POR_04_B	51
OPOR_04_A	46
POR_05_A	37
POR_05_B	40
OPOR_05_A	37
POR_06_A	30
POR_06_B	32
OPOR_06_A	30

6.4.1.3 Groundwater

Methodology

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

- Published geology and hydrogeology maps and reports;
- Landfill hydrogeological investigations and design documents (1982 and 1992);
- Landfill monitoring reports (2010 to 2015);
- Historic aerial photography and satellite imagery;
- Thames-Sydenham and Region Source Protection Plan; and,

- Specific data provided upon request from:
  - Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA);
  - Ontario Ministry of Natural Resources and Forestry (MNRF);
  - Ontario Ministry of the Environment and Climate Change (MOECC);
  - Upper Thames River Conservation Authority;
  - Environment Canada;
  - Town of St. Marys; and
  - St. Marys Cement Co. (SMC).

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

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

Additional monitoring was conducted in the spring of 2022 and included:

- Five monitoring wells and two boreholes installed between the watercourse and the CKD pile.
- Water level, hydraulic conductivity, soil quality, groundwater flow and groundwater quality sampled in each of the new wells and boreholes.

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

6.4.1.3.1 Human-made Influences on Groundwater Flow

Groundwater flow in the bedrock below the Landfill Site is from the east toward the west and northwest. There is a similar flow direction through the overburden. However, flow

along major rivers are toward those rivers. Therefore, in the St. Marys area, flow in the overburden is toward Trout Creek and the North Thames River.

There is significant human influence on flow direction at the landfill property and surrounding lands. The surface of the landfill property has been impacted by industrial activity since around 1960. It was around that time that the quarry operation to the north progressed onto what is now the landfill site. It is likely that there were impacts to the groundwater prior to that time with earlier dewatering of the quarry. By 1978, none of the landfill property was in a natural state. The topography of the landfill property today is a result of the overburden stripping/filling east of the watercourse, kiln dust stockpiling, a previous realignment of the watercourse, clay mining over most of the Site west of the watercourse, and construction of the landfill. Figure 6-3 shows the site features.

The highest elevation on the site today is the cement kiln dust stockpile (CKD) at 334 masl[45]. from historic SMC operations. Historic aerial photographs show that the stockpile has been in place for approximately 30 years. The elevation of the existing fill area is approximately 327 m. The lowest elevations on the site occur along the watercourse. This channel enters the east side of the site at an elevation of approximately 310.0 masl and exits at the north end under Water St. S. at 306.8 masl. Water St. S. is a topographic ridge on the west side of the site and acts as a drainage divide. West of the ridge, runoff flows to the Thames River. East of the road, runoff is eastward toward the landfill stormwater retention basins and the watercourse.

The proximity of the SMC quarries to the landfill and the potential for mutual interference in the future makes the quarry activity important to the landfill assessment. SMC has historically dewatered both the plant north of the landfill and the Thomas Street Quarry west of Water St. S. They have also used water supply wells on the plant site to provide processing water.

Dewatering at the plant site quarry is expected to continue for the life of the landfill since the cement plant is located on the quarry floor. Communication with the SMC Environmental Coordinator in 2015 confirmed that there are no plans for future dewatering locations. Based on current resources and production assets, the estimated lifespan of the two quarries is approximately 60 years.

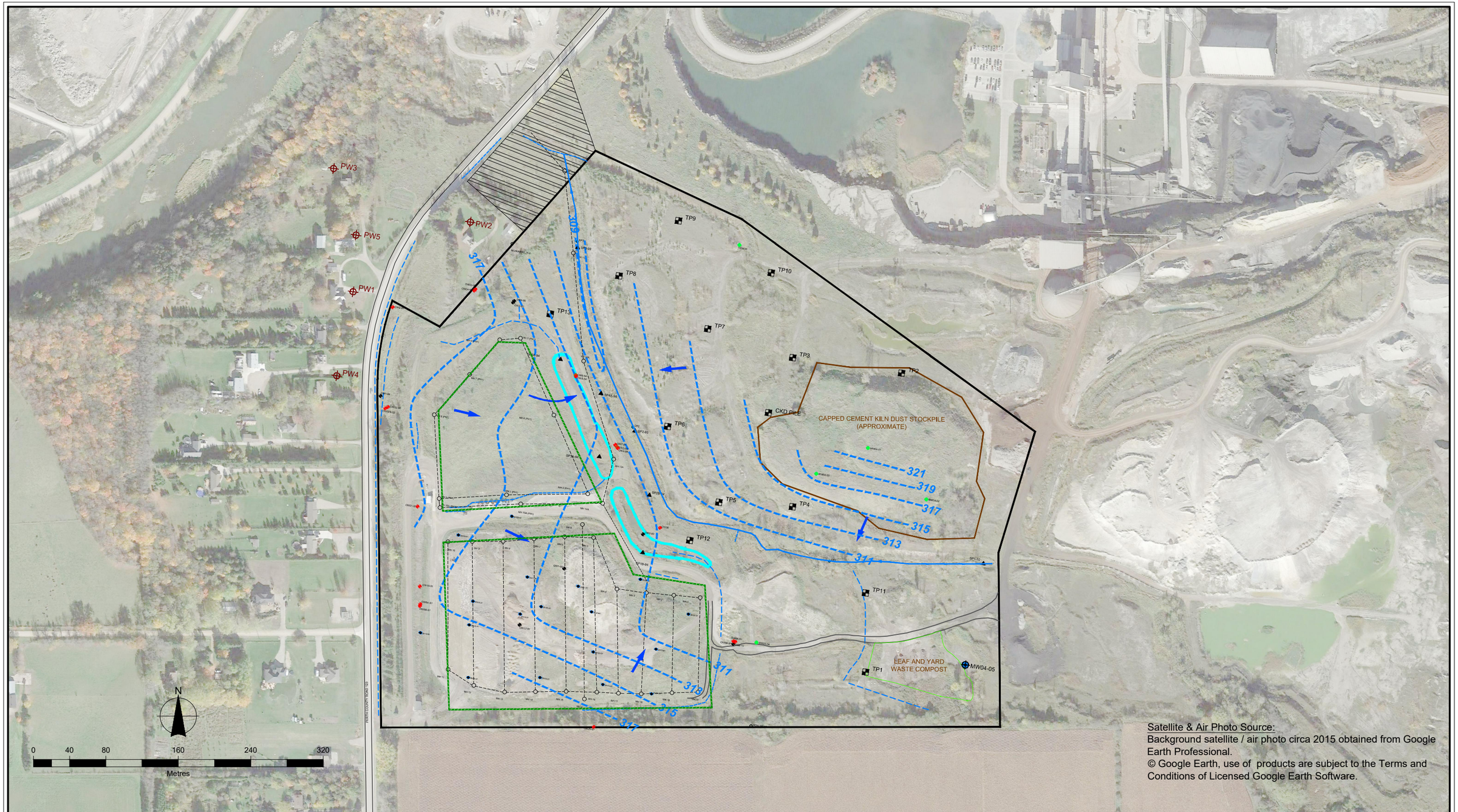
Dewatering of the quarry below the water level in the bedrock will affect the water levels in the bedrock at the landfill. There are no documented pre-quarry water levels at the landfill site as the quarry pre-dates the landfill. Therefore, the quarry impact on landfill water levels cannot be known. The dewatering at the Thomas Street quarry to levels below 280 m will be depressing the bedrock water levels in that area, but natural flow is

[45] Meters above sea level

from the landfill toward the quarry. The dewatering may be steepening the gradient, thereby increasing the flow rate, but not affecting flow direction.

The northeast portion of the landfill property contains a Cement Kiln Dust (CKD) stockpile from historic SMC operations. Historic aerial photographs show that the stockpile has been in place for approximately 30 years. The cap and side slopes are well vegetated, and no erosion has been noted during recent field work in the area. The current watercourse wraps around the south and west sides of the stockpile. There is a groundwater mound below the CKD stockpile. Water levels within the stockpile indicate elevated levels and radial flow outwards from the pile, including westward toward the watercourse.

Groundwater flow directions, monitoring wells and landfill features are shown on Figure 6-3.



Satellite & Air Photo Source:
Background satellite / air photo circa 2015 obtained from Google Earth Professional.
© Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

LEGEND

- PROPERTY BOUNDARY
- EXISTING LIMIT OF WASTE
- WATERCOURSE
- LEACHATE COLLECTION SYSTEM
- STORM WATER MANAGEMENT BASIN
- LANDFILL OBSERVATION WELL
- LANDFILL OBSERVATION WELL (ABANDONED AND SEALED)
- EA MONITORING WELL
- BOREHOLE
- PRIVATE DOMESTIC WELL (APPROXIMATE LOCATION)
- SURFACE WATER MONITORING LOCATION
- TEST PIT
- DRIVE POINT PIEZOMETER
- INTERPRETED GROUNDWATER CONTOUR (masl)
- INTERPRETED GROUNDWATER FLOW DIRECTION
- RIGHT-OF-WAY AND SEWER EASEMENT

BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title: **FUTURE SOLID WASTE DISPOSAL EA**

GROUNDWATER CONDITIONS

Drawn	Checked	Date	Figure No.
SK	JH	JUNE 2022	6-3
Scale		Project No.	
1:4000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figure 6-3.dwg Date Plotted: June 9, 2022 - 2:15 PM

6.4.1.3.2 Existing Geology

Overburden

The regional overburden is the result of successive glacial till and inter-till deposits. The large continental ice sheets alternated between advances (when glacial tills were laid down) and retreats (when meltwater deposited layers of sorted gravel, sand, silt, and clay). The inter-till meltwater deposits can be small and isolated or significant and regional. On the landfill site, they typically provide more permeable soils than the surrounding till.

The typical stratigraphic sequence (i.e., layers of material) from the surface to the bedrock are as follows:

Lacustrine: Little of this soil remains on the site. Approximately 3 to 5 m of material may have been removed across the site while 7 to 10 m of material was removed along the south edge of the site. Most of the soil logs on site record till at surface.

Fill: At the same general location as the lacustrine soils in the stratigraphic sequence, soil was noted at ground surface east of the watercourse that may have been overburden stripped during quarrying or the previous realignment of the watercourse.

Upper and Lower Till: Till was reported at all of the drilling locations on the site. It is of variable thickness across the site. The till is predominantly silt (36 to 55%) with a clay content of 21 to 32% and sand content of 10 to 29%. It is this till that primarily forms that landfill liner.

Inter-Till Meltwater Deposit: Found between the upper and lower till, this local unit consists of clay, silt, sand and/or gravel. A seam of sand and gravel is below the existing Phase II/III landfill area. The deposit becomes silt and clay north, east, and south of this seam. The unit is present but discontinuous across the rest of the landfill property. This deposit is more permeable than the surrounding till and creates discontinuous conduits for groundwater movement.

Till – Bedrock Interface: Sand was reported between the oldest till and the bedrock at one borehole and two monitoring wells that extended to bedrock. It was not reported in six other boreholes. It is expected to be a very local deposit.

Bedrock: The cross-sections show a general downward slope on the bedrock surface from east to west with local variations.

6.4.1.3.3 Leachate Quality

Leachate samples are taken regularly from two manholes on the site:

- MH-1 captures leachate from the original Phase I of the landfill;
- MH-3 captures leachate from the subsequent Phases II and III.

Table 6-5 shows the range of typical leachate parameters reported from 1991 to 2015.

Table 6-5: Leachate Concentrations 1991 to 2015

Parameter	Units	MH-1 (Phase I)		MH-3 (Phase II/III)	
		Range	Current	Range	Current
Chloride	mg/L	<40 – 760	423	13 – 3,050	1,760
Conductivity (field)	µS/cm	485 – 7,800	3312	1,320 – 15,700	5,923
BOD	mg/L	4.3 – 250	51	21 – 4,695	232
COD	mg/L	23 – 1,110	131	80 – 7,348	692
Ammonia	mg/L	0.8 – 248	142	32 – 1,132	414
Nitrate	mg/L	<0.1 – 3.84	<2.5	<0.1 – 1.79	<5
Total Phosphorous	mg/L	0.04 – 79.4	0.28	0.45 – 39.9	10.4
Iron	mg/L	0.51 - 694	46.2	1 - 290	1.06
Phenols	mg/L	<0.001 - 0.065	0.025	<0.001 – 1.9	0.072

Leachate sampling from both phases of the landfill show large variations and there is considerable variation during both the active and closed stages. Current concentrations in both phases are mid-range values, relative to the range of historical samples.

The results show concentrations are higher in Phase II/III. This is expected as the Phase II/III is active, and the leachate is younger. Sampling of the Phase I perimeter LCS did not start until 1991, approximately two years before the Phase was completed. Phase I was only active for 9 years, while Phase II/III has been active for 23 years and has a greater mass of waste.

Chloride was identified during the 1992 investigation as the critical contaminant for evaluation of groundwater impact. The chloride concentration in Phase I has declined from the highest recorded concentration of 760 mg/L in 1991 but is still above background. The current chloride concentration in Phase II/III (1,760 mg/L) is typical for landfill leachate and is lower than previous highs of 2,480 to 3,050 mg/L (2003 to 2004).

As expected, ammonia is high, and nitrate is low. Nitrate is expected to increase away from the reducing environment of the landfill. Iron is also high, particularly in Phase I.

VOC testing has reported sporadic occurrences of selected parameters since testing began in 1991 and 1993 (for Phase I and Phase II/III respectively). The concentration detected in 2014 and 2015 are contained in Table 6-6.

Table 6-6: 2015 VOC Concentrations

	Sewer Use By-Law	MH1 (Phase I)	MH3 (Phase II/III)
Chlorobenzene (µg/L)		<1.00	<1.00
Chloroethane (µg/L)		<2.00	<2.00
Benzene (µg/L)	10	3.5	<2.00
Ethylbenzene (µg/L)	60	<1.00	12
Toluene (µg/L)	20	5.6	11
m,p- Xylenes (µg/L)		<2.00	22
o-Xylene (µg/L)		<1.00	7.1
Xylenes (Total) (µg/L)	300	<2.00	29

The results are compared to the Town's sewer use bylaws, currently *By-Law Number 46 of 2014, Schedule E - Limits for Sanitary and Combined Sewer Discharge*. All concentrations are below the sewer use criteria, indicating that there is no concern with leachate being treated at the Town's WWTP.

6.4.1.3.4 Groundwater Quality

Annual monitoring at the site, outside of the LCS, is conducted in accordance with the requirements of the ECA in place at the time of each round of monitoring. Monitoring of groundwater and surface water on the Site began in 1984. Current monitoring locations are shown on Figure 6-3. Samples of leachate, groundwater and surface water are collected in the spring and fall each year and analyzed for general chemistry, metals, and volatile organic compounds (VOC).

There is little indication of landfill impacts at the site. Downgradient wells in the shallow overburden (OW4-84 and OW36) show only minor impacts. This is due to the combination of the low permeable till and the leachate collection systems (LCS). The LCS has been controlling leachate migration from the landfill footprints since 1993. Leachate levels in the LCS manholes are checked twice yearly. The levels are consistently low indicating that the leachate is being effectively drained and there is no leachate mounding.

OW4-84 (located downgradient of Phase I) has been monitored twice a year since 1984. There was water in the well at every monitoring event from 1984 to February 1993. The Phase I LCS was installed in the early 1990s when the Phase was closed. After 1993, the water levels in OW4-84 declined and the well became intermittently dry. The

Phase I LCS is capturing leachate from the area upgradient of OW4-84, lowering the water level below the footprint and downgradient of the footprint. The water level elevation west of Phase I is higher than the LCS. The chloride concentrations at OW4-84 from 1984 to 1993 climbed from a background level to a high of 354 mg/L. After 1993, when the LCS was added to Phase I, the concentration declined and by 2002 was again at background.

OW36 (located downgradient of Phase II/III) and overflow from MHB have been added to the monitoring program in recent years. MHB is a manhole at the north end of a drainpipe that passes through the meltwater deposits below the LCS in Phase II/III. Chloride is slightly elevated at these monitoring points with concentrations around 20 mg/L at OW36 and 100 mg/L from MHB. The cause of the slightly elevated concentrations is under investigation. The concentrations are still quite low compared with the leachate chloride concentration of 1,000 to 3,000 mg/L.

Water quality samples from the watercourse since 1985 (as part of the landfill monitoring) have not detected an impact from the landfill or the CKD stockpile. The water quality upstream is typically similar to the water quality downstream.

Cement Kiln Dust (CKD) Stockpile

In 2005, a report on the CKD stockpile was compiled by Golder Associates for SMC. The report estimated the total volume to be approximately 350,000 to 400,000 m^3. Samples of the material were tested and compared to the 2004 *Soil, Groundwater and Sediment Standards; Table 3: Full Depth Site Conditions in Non-Potable Groundwater, Industrial/Commercial Use*. The results indicated that the material generally did not exceed the Table 3 standards for petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCB) or polycyclic aromatic hydrocarbons (PAH). There was one minor exceedance for cadmium, all other metals were below Table 3 standards.

In June 2019, groundwater samples were collected from three monitoring wells located in the stockpile. The results were compared to samples taken in 2005 and to the Province's Table 2: Full Depth Site Conditions in Potable Groundwater (referred to as Table 2). Table 6-7 shows the parameters that exceeded the province's Table 2 standards. Where a parameter exceeds the standards, it is marked with an "X".

Table 6-7: Groundwater – Table 2 Potable Water Exceedances

	MW04-01 Centre		MW04-03 SW Corner		MW04-02 SE Corner
	2005	2019	2005	2019	2019
Chloride	X	X	X	X	-
Sodium	X	X	X	-	-
Arsenic	X	-	-	-	-
Molybdenum	X	X	-	X	-
Selenium	-	X	-	-	-
Uranium	X	-	-	-	-
Vanadium	X	X	-	-	-
PCB	-	-	-	-	-
PAH	-	-	-	-	-

It is noted that these exceedances were expected, given the type of materials present in the CKD pile. There is no expectation that water below the CKD pile will be used as a drinking water source or will meet drinking water standards. Two conclusions from the water quality testing were:

- The water quality is not homogeneous throughout the stockpile. The water quality at the southeast corner of the stockpile is considerably better than the quality in the centre.
- The water quality data shows an overall improvement with concentrations of many parameters lower in 2019 than 2005.

Additional monitoring was conducted in the spring of 2022 with a focus on the CKD pile. Results indicated a difference in water quality between the groundwater downgradient of the CKD pile and background groundwater conditions. The concentrations of various parameters including hardness, conductivity, alkalinity, chloride, sulphate, calcium, sodium, manganese, and magnesium are higher than background at monitoring wells downgradient of the CKD pile.

It is inferred that groundwater downgradient of the CKD pile has been mildly impacted by CKD waste. Continued monitoring is required to assess whether groundwater chemistry is stable or changes over time. More groundwater quality data is required at these locations to determine long term trends.

Table 6-8 and Table 6-9 summarize typical groundwater quality measures and more detailed groundwater chemistry, respectfully, at OW2 (a sampling well away form the CKD pile) and the new manholes and wells located at the centre of the CKD pile, near its southwest corner and in the surrounding till and meltwater deposits (sand and silt, and sand, silt and silty clay conditions. Boxes shaded grey denote exceedances.

Table 6-8 Groundwater Quality in Wells Associated with the CKD Pile

Inorganics	PWQO	Units	MW04-01 CKD Centre	MW04-03 CKD SW Corner	OW37D-22 Till	OW37I-22 Sand & Silt	OW38S-22 Sand & Silt /Sily & Clay
pH	6.5-8.5	mg/L	9.84	7.91	7.59	7.62	7.32
Specific Conductivity		uS/cm	37800	5110	1740	1590	1900
Alkalinity		mg/L CaCO3	5500	648	426	414	643
C-Hardness		mg/L CaCO3	172.0	410	1030	893	1020
DOC		mg/L	86.3	20.9	2.7	2.4	9.7
Bromide		mg/L	<2.8	<0.28	2.19	1.83	3.09
Chloride		mg/L	3370	356	167	141	244
Fluoride		mg/L	<1.3	<0.13	<0.05	<0.05	<0.05
Nitrate		N mg/L	<3.6	<0.36	<0.07	<0.05	<0.07
Nitrite		N mg/L	<2.7	<0.27	<0.05	<0.05	<0.05
TKN		N mg/L	31.0	3.2	0.31	0.17	0.53
Phosphate		mg/L	67.70	<0.65	<0.13	<0.10	<0.13
Sulphate		mg/L	11700	1380	476	374	171
Phenols	0.001	mg/L	0.08	0.04	0.036	0.041	0.069
TDS		mg/L	39000	4250	1380	1150	1210
Bicarbonate (as CaCO3)			3350	648	426	414	643
Carbonate (as CaCO3)			2150	<5	<5	<5	<5

Table 6-9 Groundwater Chemistry in Wells Associated with the CKD Pile

Inorganics	PWQO	Units	OW2	MW04-01	MW04-03	OW37D-22	OW37I-22	OW38S-22
			Background	CKD Centre	CKD SW Corner	Till	Sand & Silt	Sand & Silt /Sily & Clay
Metals								
Aluminum	0.075	mg/L	-	1.15	0.028	0.052	0.044	0.075
Antimony	0.020	mg/L	-	<0.002	<0.001	<0.001	<0.001	<0.001
Arsenic	0.1	mg/L	-	0.0220	0.0010	0.003	0.004	<0.001
Barium		mg/L	-	0.0400	0.0470	0.109	0.05	0.067
Beryllium	1.1	mg/L	-	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005
Bismuth		mg/L	-	<0.004	<0.002	<0.002	<0.002	<0.002
Boron	0.2	mg/L		0.05	0.02	0.061	0.052	0.036
Cadmium	0.0002	mg/L		0.00370	0.00010	<0.0001	<0.0001	<0.0001
Calcium		mg/L		69.00	148	221	208	255
Chromium	0.00089	mg/L		0.0270	*<0.002*	<0.002	<0.002	<0.002
Cobalt	0.0009	mg/L		0.00250	0.0006	0.0007	0.0013	0.0023
Copper	0.005	mg/L		0.009	<0.001	0.001	<0.001	0.001
Iron	0.3	mg/L		1.860	7.9	0.142	0.783	0.045
Lead	0.025	mg/L		0.312	<0.0005	<0.0005	<0.0005	<0.0005
Magnesium		mg/L		<5	9.9	116	90.8	94
Manganese		mg/L		0.209	0.475	0.109	0.172	0.667
Mercury	0.0002	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	0.04	mg/L		0.550	0.365	0.006	0.003	<0.002
Nickel	0.025	mg/L		0.054	0.005	0.002	0.002	0.006
Phosphorus		mg/L		0.48	<0.02	<0.02	<0.02	<0.02

Inorganics	PWQO	Units	OW2	MW04-01	MW04-03	OW37D-22	OW37I-22	OW38S-22
			Background	CKD Centre	CKD SW Corner	Till	Sand & Silt	Sand & Silt /Sily & Clay
Potassium		mg/L		11400	1160	7.85	5.19	5.83
Selenium	0.1	mg/L		0.037	0.007	<0.001	0.003	0.006
Silicon		mg/L		23	3.79	10.6	10.1	7.88
Silver	0.0001	mg/L		<0.0002	0.0002	<0.0001	<0.0001	0.0002
Sodium		mg/L		1280	73	46.5	26.3	48.4
Strontium		mg/L		0.1280	0.399	1.79	0.735	0.925
Thallium		mg/L		0.0018	<0.0003	<0.0003	<0.0003	<0.0003
Tin		mg/L		<0.004	<0.002	<0.002	<0.002	<0.002
Titanium		mg/L		0.05700	0.007	0.013	0.007	<0.002
Uranium	0.005	mg/L		0.01490	0.00080	0.0034	0.0028	0.0037
Vanadium	0.006	mg/L		0.018	0.002	<0.002	<0.002	<0.002
Zinc	0.03	mg/L		0.048	<0.005	<0.005	<0.005	<0.005
PAHs								
Phenanthrene	0.03	µg/L		0.11	<0.10	0.11	0.11	<0.10
Chrysene	0.0001	µg/L		0.11	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Benzo(b)fluoranthene		µg/L		0.11	<0.10	<0.10	<0.10	<0.10
Benzo(k)fluoranthene	0.0002	µg/L		0.11	*<0.10*	*<0.10*	*<0.10*	*<0.10*

Source Water Protection

In 2006, the provincial government passed the Clean Water Act, which aims to protect municipal drinking water in the Province with a multi-barrier approach, starting with Source Water Protection.

The Town of St. Marys obtains its water supply from three bedrock wells located northeast of the landfill. The landfill is more than 1,000 m from Wellhead Protection Areas.

Two Highly Vulnerable Aquifers (HVA) are present within the Study Area Vicinity. These areas generally correspond to the quarry sites both north of the landfill (SMC plant) and the Thomas Street Quarry west of the landfill. They are considered to be vulnerable because the surficial soil has been removed and the bedrock aquifer has been exposed. A small area in the northeast corner of the Landfill Site is within an HVA.

Residential properties along Water St. S. are outside the Town water supply system and are supplied by private wells. The landfill monitoring program includes five of these properties.

The approximate locations of the private wells are shown on Figure 6-3. The well owners are provided with the laboratory reports for their wells annually.

The wells are only sampled if the owners are present as the sampling points are inside the residences. For that reason, some wells are only sampled periodically. Table 6-10 contains the results of sampling at each well.

Table 6-10: Groundwater Concentrations – Private Wells

Well	Date of Sample	Chloride (mg/L)	Hardness (mg/L)	Conductivity (µS/cm)	Dissolved Organic Carbon (mg/L)
		Provincial Criteria: 250	**Provincial Criteria: 100**	**Provincial Criteria: N/A**	**Provincial Criteria: 5**
Overburden					
PW2	Oct 2013	131	285	891	2.0
	May 2015	137	317	988	1.8
Bedrock					
PW1	May 2015	3.52	258	664	1.2
	Sep 2015	4.36	286	573	0.9
PW3	Nov 2012	557	318	574	1.1
	May 2013	62.8	269	726	1.2
PW4	May 2015	3.09	299	761	1.2

Well	Date of Sample	Chloride (mg/L)	Hardness (mg/L)	Conductivity (µS/cm)	Dissolved Organic Carbon (mg/L)
		Provincial Criteria: 250	**Provincial Criteria: 100**	**Provincial Criteria: N/A**	**Provincial Criteria: 5**
PW5	Sep 2015	3.50	321	605	1.1
	May 2015	29.4	291	732	1.1
	Sep 2015	16.3	319	619	1.0

A summary of private well conditions is as follows:

- There are no concerns with drinking water quality at any of the wells.
- All wells are below provincial drinking water standards for chlorides and dissolved organic carbon. Water in all wells is relatively hard but that is typical for southern Ontario. A water softener may be required.
- PW2: This well has displayed historically fluctuating levels of chloride. Chloride has ranged from 22 mg/L (May 1985) to 326 mg/L (September 2003). PW2 is reportedly susceptible to seasonal water level fluctuations and has occasionally become dry during summer months. In the past, a licensed water hauler has reportedly filled the well with imported water in such instances. For these reasons, the meaningfulness of the monitoring results is questionable.
- PW1: The dug well at PW1 was replaced by a drilled bedrock well in 2011. Two samples were obtained during 2015. The concentrations of calcium, chloride, hardness and DOC in the new bedrock well are significantly lower than the historical concentrations in the old overburden well.
- PW3: This well has not been sampled since May 2013 as there has not been a resident available to provide access permission. Historically, the chloride concentration has been relatively stable and consistent within a range of 30 to 100 mg/L. The first sample in 1985 was 82.5 mg/L. The waste placement in Phase I began in December 1984, therefore the chloride may be naturally occurring in the bedrock aquifer. The well did have two isolated spikes, one in March 2011 at 1,130 mg/L and one in November 2012 at 557 mg/L. Both times the next sample returned to normal levels.
- PW4: The groundwater quality at PW4 has been stable and is consistent with background concentrations.

  PW5: This well displayed parameter concentrations similar to background groundwater quality for the current reporting period with the exception of chloride. Chloride concentrations in the range of 24 to 38 mg/L are higher than PW1 and PW4

but lower than PW3. Other parameters analyzed at this location are consistent with historical data and the background bedrock aquifer concentrations.

6.4.1.4 Surface Water

Methodology

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

Data from various sources was collected including data from the Annual Monitoring Reports for the Landfill that have collected surface water data since 1984. Additional field data was collected that included:

- Water levels in drive point piezometers installed along the watercourse.
- Monthly surface water flows at the upstream surface water station and the downstream surface water station through the spring into summer of 2016.

  Geomorphic study of the existing watercourse completed by Matrix Solutions Inc. during the summer of 2015 as part of the Ecological Work Plan.

Existing Surface Water Features

The Site is within the Upper (North) Thames River Drainage Basin. The North Thames River lies northwest of the Site limits. Locally, the river flows in a southwesterly direction from St. Marys.

The primary surface water features of the Landfill Site are the watercourse and the two stormwater management basins. The unnamed watercourse flows through the Site from the southeast corner to the northwest corner. This man-made watercourse provides drainage for the SMC lands up-gradient of the landfill, as well as industrial and agricultural land further upstream. It has a relatively small drainage area of approximately 3.5 km^2. This small watershed is bounded to the north and east by Trout Creek, to the south by Gregory Creek, and to the west by small creeks that flow the North Thames River.

Clean surface water from the west side of the Site is directed through a series of perimeter ditches and swales around the landfill footprints and along the interior roadways. The ditches and swales convey runoff to two stormwater retention basins. The outline of these basins and the sampling stations are shown on Figure 6-3.

These stormwater basins attenuate the peak flows during storm events and allow sedimentation. Surface water collected from the cover of the completed Phase I is directed Basin A (north basin). Surface water collected from the completed stages and

perimeter of Phase II/III is directed to Basin B (south basin). The stormwater basins outlet to the watercourse via control features.

Drainage on the east side of the Site is less defined. Surface water runoff from the slopes of the cement kiln dust stockpile flows radially in all directions, including west toward the watercourse and north toward the quarry. There are relatively flat areas between the stockpile and the watercourse with isolated seasonally water-filled depressions.

The watercourse leaves the Site by a culvert under Water St. S. and eventually discharges into the Thames River approximately 500 m downstream of the Site.

Surface Water Monitoring

Semi-annual surface water monitoring is conducted as part of the landfill monitoring program. Water samples are collected in spring and fall from the watercourse and the two stormwater management basins. In the watercourse this includes upstream and downstream monitoring stations as well as a mid-site station between the stormwater basins. Samples are also collected from the inlets and outlets of basins. The main water quality indicators have been chloride, total phosphorus, iron and TSS.

Water levels are measured at all surface water stations during each monitoring event and stream flows are measured at the watercourse downstream station.

Basin A

Samples for Basin A are collected at two inlet points (north and south) and one outlet. Historically, chloride concentrations tended to be the highest at the north inlet which receives water from the north end of Phase I. The concentrations for 2004 to 2012 were in the 60 to 160 mg/L range. This sampling point has been dry since 2013. The concentrations at the south inlet were typically below 100 mg/L and it has also been sporadically dry.

The chloride concentrations at the Basin A outlet range from 30 to 130 mg/L. Iron and total phosphorus concentrations at the outlet are sporadically above the PWQO. TSS levels have had a historical range of less than 10 mg/L.

Basin B

Samples for Basin B are collected at one inlet point and one outlet. These sampling stations are sporadically dry. Chloride concentrations at the inlet are typically higher than the outlet and exceeded the Aquatic Protection Value (APV) of 180 mg/L on two occasions (August 2012 and November 2014). Iron and phosphorous have been elevated levels typically exceeding the PWQO at both sampling stations. TSS at the outlet has generally been below 50 mg//L with occasional spikes to 60 to 80 mg/L. The quality at the Basin A outlet is better than the quality from Basin B.

On-Site Watercourse

Flows have been measured at the downstream surface water station since 1994. Flow rates vary from highs ranging from 200 to 600 L/s to lows of less than 5 L/s. The channel has also been dry. This reflects the small drainage area upstream of the site. As part of the EA work, flows were measured monthly in 2016 at the upstream and downstream locations from March to July and again in October. The comparison of flows between the stations showed the stream gaining water between upstream and downstream in the spring and fall. In the summer, the stream lost water between upstream and downstream.

There are three water quality sampling stations along the watercourse. Typically, the water quality is similar between upstream and downstream. This indicates no landfill impact on the watercourse. Chlorides at the upstream station have varied from 13 to 887 mg/L, phosphorus from less than detection limit to 0.69 mg/L and iron from 0.05 to 127 mg/L. Iron and phosphorous typically exceed PWQO at all three locations.

Benthic surveys were conducted in the watercourse in 1993, 1994, 1995, 1996, 1998, 2000, 2002, 2004 and 2006. The surveys compared qualitative and quantitative samples taken from upstream and downstream. The results of these surveys indicated no landfill impact on the benthic communities in the watercourse.

Five new monitoring wells were installed between the watercourse and the CKD pile in 2022. Two boreholes were drilled along the watercourse realignment. The groundwater levels in all monitoring wells between the CKD pile and the watercourse are higher than the base of the watercourse. It is therefore possible that a hydraulic connection exists between the CKD pile and watercourse. As such, groundwater could migrate through the more permeable soils (i.e., sand and silt meltwater deposits) towards the watercourse. However, Annual Monitoring concludes that no CKD impacts to the existing watercourse have been detected to date (2020 Monitoring Report by GM BluePlan Engineering, 2021).

6.4.1.5 Ecology

Methodology

Existing conditions were determined through a comprehensive search of existing records and a series of field investigations.

The records review covered lands within the On-site Study Area and Study Area Vicinity. Records, mapping, and databases included in the search were:

- Natural Heritage Information Center;
- Land Information Ontario, publicly available mapping;
- MNRF Interactive Map of Species at Risk by County/Region;
- Ontario Breeding Bird Atlas (OBBA 2001-2005);
- Conservation Authority/Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping;
- Ontario Reptile and Amphibian Atlas (ORAA);
- OMAFRA Soil Surveys of Ontario;
- OMAFRA Agricultural Capability/Soils Classification;
- Upper Thames River Conservation Authority (UTRCA) Regulation Limit mapping;
- Town of St. Marys Official Plan;
- Perth County Official Plan;
- Aquatic Species at Risk in the Thames River Watershed (Cudmore et. al., 2004);
- Aquatic Ecosystem Recovery in the Thames River Watershed (Taylor 2004);
- The Thames River, Ontario Canadian Heritage Rivers System Ten Year Monitoring Report 2000-2012; and
- Plover Mills Watershed Report Card 2012.

The purpose of the site investigations was to verify the information collected through the background records review, further characterize known features, and identify any additional features not previously recorded. The site investigations and methodologies used are summarized in Table 6-11. Further information regarding the survey methodologies used are summarized and described in the Natural Heritage Assessment Report (Volume III, Appendix D).

Table 6-11: Methodology of Natural Heritage Field Investigations

Field Study	Purpose	Methodology	Date(s)
Ecological Land Classification	To characterize vegetation communities.	**On-Site Study Area:** Ecological Land Classification for Southern Ontario (Lee et. al., 1998), including updated communities found in the 2008 draft version of the ecosystem catalogue for Southern Ontario. Vegetation classified to the Vegetation Type level.	May 8, 2015 August 21, 2015 Surveys occurred 9:30 a.m. to 4:00 p.m.
		Study Area Vicinity: Ecological Land Classification for Southern Ontario (Lee et. al., 1998) classified to the Community Series or Ecosite level through air photo interpretation and windshield survey only.	
Breeding Bird Surveys	To identify bird species which may be nesting at the site.	**On-Site Study Area:** Ontario Breeding Bird Atlas Guide for Participants (BSC, March 2001).	June 4, 2015 June 22, 2015 July 3, 2015 Surveys occurred 6:30 a.m. to 10:30 a.m.
		Study Area Vicinity: No surveys conducted. Bird communities identified from background records.	
Bobolink and Eastern Meadowlark Surveys	To confirm he presence or absence of Bobolink and Eastern Meadowlark which are Threatened Species protected under the ESA, 2007.	**On-Site Study Area:** Draft Survey Methodology under the ESA 2007 for Bobolink (2011).	June 4, 2015 June 22, 2015 July 3, 2015 Surveys occurred 6:30 a.m. to 10:30 a.m.
		Study Area Vicinity: No surveys conducted. Bird communities identified from background records.	
		On-Site Study Area:	April 30, 2014

Field Study	Purpose	Methodology	Date(s)
Amphibian Call Surveys	To confirm the presence or absence of amphibians in on-site surface water features.	Marsh Monitoring Program Participant's Handbook for Surveying Amphibians (BSC, 2009). **Study Area Vicinity:** No surveys conducted. Amphibian communities identified from background records.	May 20, 2014 June 24, 2014 Surveys occurred 9:30 p.m. to 10:30 p.m.
Turtle Basking Surveys	To confirm the use of on-site surface water features by turtles.	**On-Site Study Area:** Visual search for basking turtles during bird surveys and snake coverboard searches. **Study Area Vicinity:** No surveys conducted. Reptile communities identified from background records.	In conjunction with ELC and breeding bird surveys.

Field Study	Purpose	Methodology	Date(s)
Snake coverboard Surveys	To confirm the potential presence of two species listed as Special Concern under the ESA 2007 46: Eastern Milksnake (*Lampropeltis triangulum*) and Eastern Ribbonsnake (*Thamnophis sauritus*).	**On-Site Study Area:** Eastern Milksnake surveys were conducted by a combination of active hand searches (i.e., looking under and turning over potential cover objects by hand) cover board surveys, whereby artificial covers (1 m x 1 m plywood) were installed within the On-site Study Area to attract Eastern Milksnake seeking shelter. These cover boards were uniquely identified and labeled. Eastern Ribbonsnake surveys were conducted by walking transects and visually inspecting shoreline and wetland edges within the landfill limits for snakes moving around or basking. The Eastern Ribbonsnake is generally not found under cover materials.	May 8, 2015 June 4, 2015 June 12, 2015 June 22, 2015 July 3, 2015 August 21, 2015. Surveys were conducted on sunny days when air temperature was between 8°C and 25°C.
		Study Area Vicinity: No surveys conducted. Reptile communities identified from background records.	

[46] As of June 15, 2016, Eastern Milksnake is no longer a species at risk under the Ontario Endangered Species Act. Although the Milksnake is still listed as a species of special concern under the federal Species at Risk Act, the Committee on the Status of Species at Risk in Ontario (COSSARO) has downlisted this species to “Not at Risk”. According to the MNRF,” the status change was based largely on the fact that Milksnakes are relatively widespread in Ontario, there is no evidence of decline throughout most of its Canadian (Ontario) range, and threats to this species are limited outside of southern Ontario.” This status change has been updated throughout the remainder of this Report.

Field Study	Purpose	Methodology	Date(s)
Bat Maternity Roosting Habitat Surveys	To identify potential roosting habitats for: Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*Myotis septentrionalis*) both listed as Endangered.	**On-Site Study Area:** A search was conducted during ELC surveys for any large, mature trees with cavities which could provide habitat for bats.	May 8, 2015 August 21, 2015 Surveys occurred 9:30 a.m. to 4:00 p.m.
		Study Area Vicinity: No surveys conducted. Bat habitat identified from background records and air photo interpretation.	
Fish Habitat Characterization	To characterize aquatic habitat features and functions.	**On-Site Study Area:** Fish habitat was characterized using MTO/DFO/MNRF Fisheries Protocol – Environmental Guide for Fish and Fish Habitat (June 2009). The entire length of the subject watercourse was observed for morphology, function, as well as fish habitat and potential enhancement opportunities and limitations.	April 30, 2014 June 22, 2015
		Study Area Vicinity: No surveys conducted. Fish habitat identified from background records and air photo interpretation.	
Fish Community Sampling	To identify fish species present.	**On-Site Study Area:** A fish presence investigation was conducted using baited minnow traps as well as targeted dip-net sampling. In total, seven minnow traps were set and distributed throughout the watercourse where conditions allowed	June 22, 2015 June 23, 2015

Field Study	Purpose	Methodology	Date(s)
		(water depth) and where fish were most likely to be present (relatively deep pools). Traps were retrieved approximately 12 hours later, and their inventory was recorded. Targeted dip-net surveys were also conducted at locations throughout the complete length of watercourse within the site property.	
		Study Area Vicinity: No surveys conducted. Fish communities identified from background records.	
Incidental flora and fauna observations	To document incidental sightings of flora and fauna which may not have been the target of specific field studies.	Visual observations of animals, tracks or scat and compilation of a plant inventory during all site visits.	Completed during all field investigations.

Existing Ecology

Both the On-Site Study Area and Study Area Vicinity are significantly disturbed and include a high number of human-influenced features and landscapes. The Natural Heritage Assessment, found in Volume III, Appendix D, identified whether any of the following natural features were present:

- Significant wetlands/significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat;
- Significant Areas of Natural and Scientific Interest (ANSIs);
- Fish and Fish Habitat;

- Habitat of Endangered and Threatened species; and
- Other features identified in the Town's Official Plan.

The presence and absence of these types of features is described in the following sections.

Vegetation

Vegetation communities are summarized in Table 6-12 and shown on Figure 6-4. None of these vegetation communities are rare or protected.

Table 6-12: Vegetation Communities in the On-Site Study Area and Study Area Vicinity

Vegetation Community Name	Community Description
On-Site Study Area	
Dry-Fresh Graminoid Meadow (MEGM3)	This community represents the majority of the Site. Cool season grasses, including Smooth Brome (*Bromus inermis*), Quack Grass (*Elymus repens*) and Fescue species (*Festuca sp.*) are the dominant vegetation type found throughout this community. Tree and shrub cover in the canopy, subcanopy and understory is sparse (<10% total coverage) within scattered small groupings and individual trees in less active areas of the landfill: groupings (inclusions) of Eastern Cottonwood (*Populus deltoides ssp. deltoides*), Black Walnut (*Juglans nigra*) and Eastern White Cedar (*Thuja occidentalis*) were documented and single open-grown Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood and Black Locust (*Robinia pseudoacacia*) are also found. Common Buckthorn (*Rhamnus cathartica*) is found establishing throughout the meadow. Garden species, mainly annuals, likely originating from the compost area at the southeast corner of the Site, were recorded spreading southward into the meadow.
Graminoid Mineral Shallow Marsh (MASM1)/Willow Mineral Deciduous Thicket Swamp (SWTM3)	This mixed wetland represents the watercourse that extends from the northwest corner of the Site to the central east property limit, at the base of the slopes. Dominant vegetation found within the wetland varies between graminoid marsh dominated by Reed Canary Grass (*Phalaris arundinacea*), Common Reed or Narrowleaf Cattail, or deciduous swamp dominated by shrub

Vegetation Community Name	Community Description
	Willow species: *Salix eriocephala*, *S. petiolaris*, *S. exigua* and *S. lucida*, as well as Cracked Willow (*Salix x rubens*).
Cultural Woodland	This community is located on the east side of the Site, growing on the south facing portion of the slope. The dominant trees, Eastern Cottonwood and Manitoba Maple (*Acer negundo*), represent early successional species that indicate that this community is in the early stages of its establishment. Meadow species, such as Canada Goldenrod and cool season grasses are found throughout the majority of the community.
Cultural Hedgerows	There are three Cultural Hedgerows identified within the On-Site Study Area: one at the west limit and the other along the south property limit. The former is predominantly White Spruce that has been planted to screen the landfill from Water Street South and the adjacent residences. Large deciduous species of Eastern Cottonwood and Green Ash are also found in the hedgerow, as well as groupings of Common Buckthorn. The hedgerow at the south property limit is dominated by Manitoba Maple with meadow groundcover (i.e., Smooth Brome, Canada Goldenrod) in the base in the western portion of the community. The hedgerow is much denser, with no groundlayer vegetation and is dominated by Apple (*Malus pumila*) with abundant Common Buckthorn. The third hedgerow is located at the northwest corner of the site, adjacent to the rural residence. It is comprised of a mix of mid-aged Eastern White Cedar, Black Walnut (*Juglans nigra*), Norway Spruce (*Picea abies*). It is contiguous with the hedgerows that surround the periphery of the residence.
Study Area Vicinity	
Fresh-Moist Lowland Deciduous Forest (FODM7)	This forest is located on the east side of the Thames River and is dominated by Willow with associates of White Elm (*Ulmus americana*) and Manitoba Maple. A cultural mixed wooded area is found north of On-Site Study Area, immediately east of Water Street South. Hedgerows associated with the roadside and separating agricultural properties generally consist of a single tree species including Black Walnut, Eastern Cottonwood, and Green Ash.

Vegetation Community Name	Community Description
	A spruce-dominated plantation, ornamental trees associated with rural residences and vegetated drainage features are also found within 1,000 m of the On-Site Study Area.

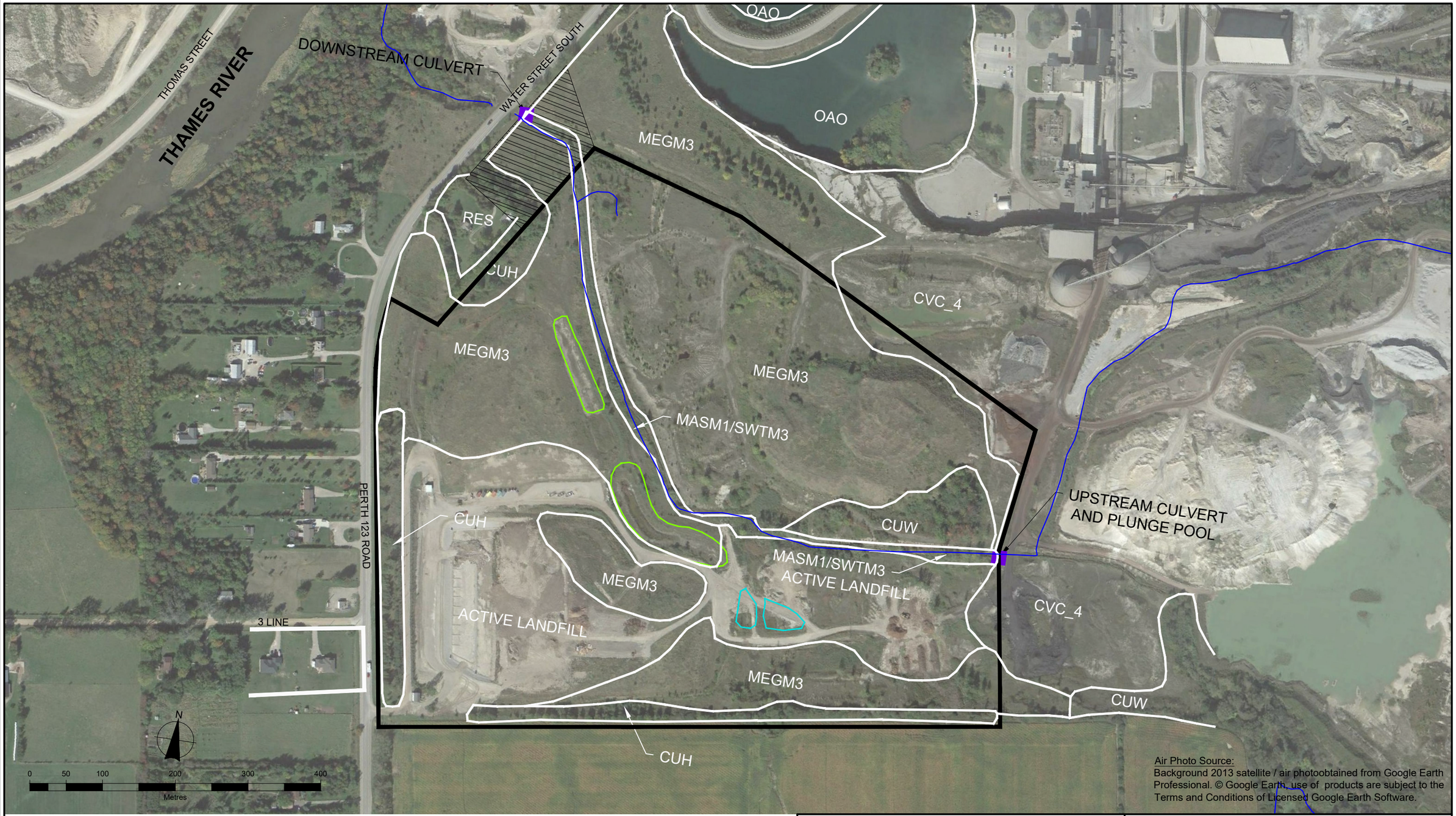
Significant Wetlands, Woodlands, Valleylands and ANSIs

There are no Significant Wetlands, Woodlands, Valleylands or ANSIs in the On-Site Study Area. With the exception of Significant Wetlands, all of these features are present in the Study Area Vicinity. Significant Woodlands and Valleylands are associated with the Thames River and the treed areas along its banks. The boundaries of the valley, including floodplain and adjacent vegetation are limited to the western side of Water Street South and do not extend onto the On-Site Study Area.

One ANSI was identified through the background information review: the St. Marys Cement Company Provincially Significant Earth Science ANSI. This ANSI is located west of the Thames River within the Study Area Vicinity. No other ANSIs were identified within the Study Area Vicinity.

Within the On-Site Study Area, there are no wetlands which could potentially meet the criteria for significance. There are two narrow stormwater management basins along the central portion of the Site. These are man-made and serve a stormwater control function. Due to their nature, stormwater management basins typically contain relatively poor water quality that could inhibit their use by wildlife. The habitat provided from these basins/ponds is marginal and does not include any habitat structures (i.e., logs, rocks). Both basins/ponds are also subject to ongoing disturbance from landfill activities and regular clean-out requirements. Some wetland vegetation is found within the riparian corridor along the existing watercourse. Species include Reed Canary Grass, Common Reed, Narrowleaf Cattail, and a variety of shrub willow species. There is little wetland function provided by this narrow strip of vegetation.

There are two ponds to the north of the On-Site Study Area within the St. Marys Cement operations. These are remnant pits from aggregate extraction activities and habitat features are minimal. No other wetlands were observed within the Study Area Vicinity.



Air Photo Source:
Background 2013 satellite / air photoobtained from Google Earth Professional. © Google Earth, use of products are subject to the Terms and Conditions of Licensed Google Earth Software.

LEGEND

- APPROXIMATE ON-SITE STUDY AREA
- WATERCOURSE
- STORMWATER MANAGEMENT BASIN
- WET DEPRESSION
- RIGHT-OF-WAY AND SEWER EASEMENT

ECOLOGICAL LAND CLASSIFICATION

CUH	CULTURAL HEDGEROW
CUW	CULTURAL WOODLAND
MEGM3	DRY-FRESH GRAMINOID MEADOW
OAO	OPEN WATER
CVC_4	EXTRACTION
RES	RESIDENTIAL (URBAN OR RURAL)

COMMUNITY COMPLEX

MASM1	GRAMINOID MINERAL SHALLOW MARSH
SWTM3	WILLOW MINERAL DECIDUOUS THICKET SWAMP

BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title: **FUTURE SOLID WASTE DISPOSAL EA**

VEGETATION COMMUNITIES

Drawn	Checked	Date	Figure No.
CD	JH	JUNE 2022	6-4
Scale		Project No.	
1:4000		300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figure 6-4.dwg Date Plotted: June 9, 2022 - 2:20 PM

Avifauna

At total of 35 summer resident bird species exhibiting some level of breeding evidence were observed within the On-Site Study Area during the breeding bird surveys conducted in 2015.

Four bird species listed as either provincially and/or federally significant were observed within the On-Site Study Area during the breeding bird surveys: Bald Eagle, Bank Swallow, Barn Swallow, and Eastern Meadowlark. Bald Eagle was a flyover observation only; no key habitat features required by this species are present at the site.

Barn Swallow was observed foraging over the graminoid meadows present within the landfill. No nesting habitat for this species is present within the On-Site Study Area.

A pair of Bank Swallows was observed at the beginning of the breeding bird season attempting to nest in a soil stockpile in the composting area of the landfill. Nesting habitat was confirmed at the active windrow composting area in the southeast portion of the landfill. One pair was observed on June 4, 2015 entering and exiting excavated burrows located on the vertical slopes of a topsoil pile. On subsequent visits during breeding bird surveys on June 22 and July 3, 2015, the topsoil pile was found to have slumped causing the entrances to the excavated burrows to partially collapse. An unidentified animal burrow was also noted immediately adjacent to the excavated sites. No Bank Swallows were observed utilizing the topsoil pile on these subsequent visits. The pair was likely forced to abandon the site when the site became unsuitable. MNRF was consulted after the first observation of breeding evidence on June 4, 2015 to determine what, if any, mitigation measures were required to be in place during active landfill operations in order to avoid disturbance or destruction to Bank Swallow habitat. A 50 m setback from the nesting site was implemented where disturbance was not permitted. Due to absence of breeding evidence at the topsoil pile on subsequent surveys, it was confirmed with MNRF that if no further evidence of breeding was observed at the site after the final and third breeding bird survey, it was safe to assume that the habitat was no longer suitable or occupied by this species and the Town could resume activities at the topsoil pile and surrounding area (pers. comm. with Graham Buck, June 24, 2015).

Nesting and foraging habitat for Eastern Meadowlark was confirmed in the Study Area. The extent of suitable nesting habitat for this species includes the two capped areas of the landfill that have been characterized as ELC community MEGM3 “Dry-Fresh Graminoid Meadow”. These two capped areas of the landfill are not currently active areas of the landfill operations.

Amphibians and Reptiles

One Midland Painted Turtle was observed in the existing watercourse on May 27, 2015. A second individual was observed on July 3, 2015 in the stormwater management basin located in the central portion of the landfill. Potential hibernation habitat for Midland Painted Turtle may be present within the existing watercourse. Observations made from the shoreline indicated that the plunge pool at the upstream culvert on the east side of the On-Site Study Area was noted to be approximately 2.5 to 3 m wide and could potentially have the depth and substrate required for turtle hibernation (i.e., to bury beneath the frost line). No evidence of turtle nesting was observed within the On-Site Study Area. Turtle habitat for species that are highly aquatic and that inhabit mainly larger waterbodies such as the Thames River is present within the Study Area Vicinity and the Thames River generally (e.g., Spiny Softshell and Northern Map Turtle). Given the large-perched culvert located at the downstream end of the landfill watercourse at Water Street South (i.e., draining into the Thames River), this culvert is considered a significant barrier for these two highly aquatic turtle species to access the watercourse present within the On-Site Study Area.

Three species of snakes were observed under cover board materials or materials adjacent to cover boards: Dekay's Brownsnake (*Storeria dekayi*), Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) and Eastern Milksnake. Based on these observations, it is possible that reptile hibernaculum is present within the landfill limits. Anthropogenic features that may be suitable include mammal burrows and crevices that may be present within the landfill. A portion of the landfill was a former clay pit. Large excavations that have disturbed underlying material may have created suitable crevices that snakes can reach below the frost line during the winter months. No specific features that could support reptile hibernation were observed. Any features that may be present are anthropogenic in nature and will offer poor habitat conditions due to the nature of below ground materials which include CKD and waste. As such, any potential features which may be present is not considered provincially significant.

Terrestrial Crayfish

Some terrestrial crayfish are considered to be rare in the province. As such, crayfish burrows can be identified as a type of SWH. Because the presence of burrows or chimneys is often the only indicator of species presence, observance or collection of individuals is very difficult. Eight terrestrial crayfish burrows were incidentally observed on July 3, 2015 during breeding bird surveys/snake cover board surveys. The burrows were observed at the edges of damp Common Reed pockets that have established in the area northwest of the capped cement kiln dust pile.

Insect Habitat

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

Mammal Habitat

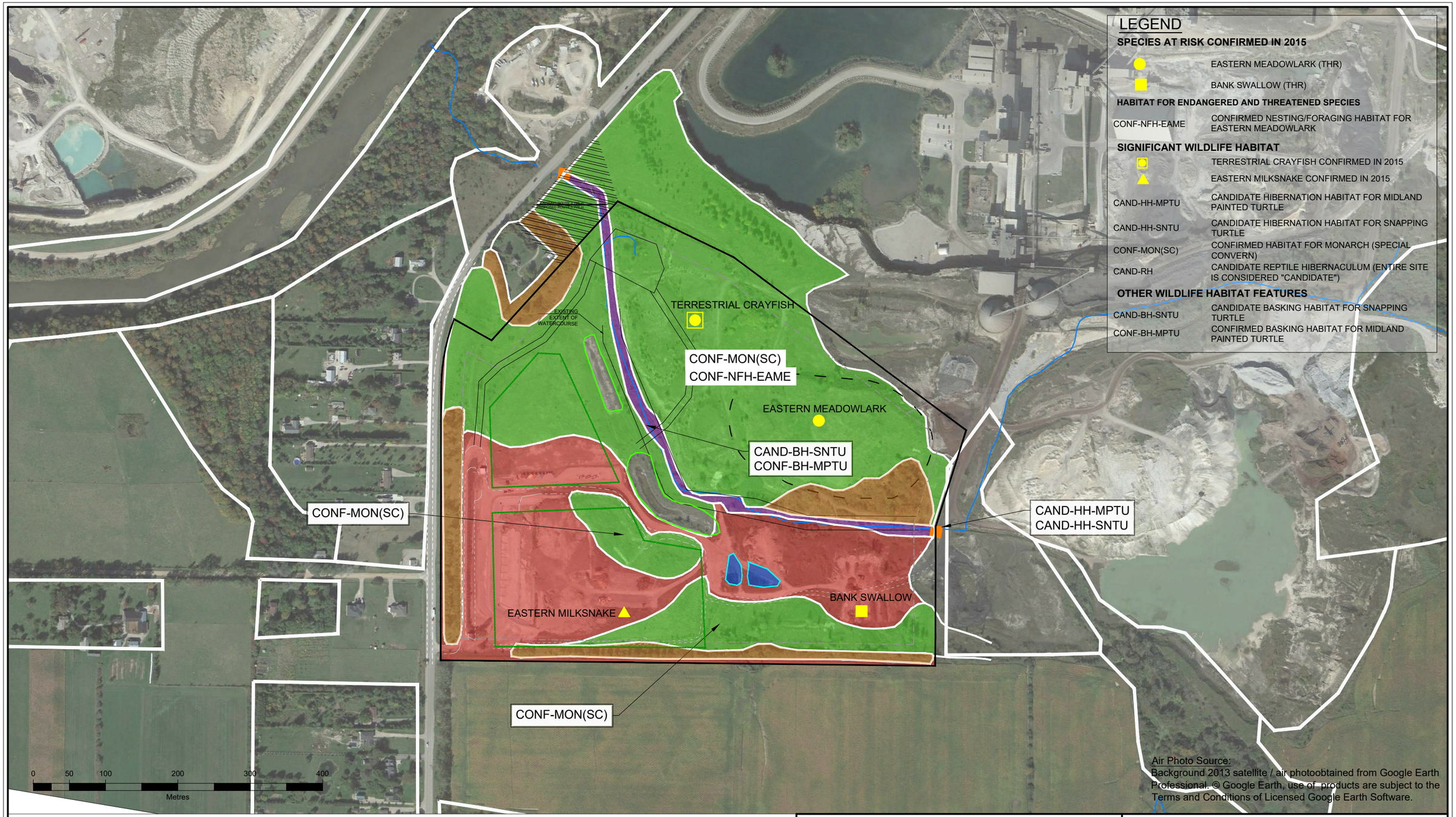
Several incidental observations of mammals were documented during the field investigations. These include: Muskrat (*Ondatra zibethicus*), White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*), Ermine (*Mustela ermine*), Striped Skunk (*Mephitis mephitis*) and Star-nosed Mole (*Condylura cristata*). White-tailed Deer appear to utilize the On-Site Study Area based on extensive tracks and signs (i.e., scat, browsing) observed during field investigations. Muskrat lodges were observed in one of the small ponds within the landfill. None of these species are listed as provincially and/or federally significant; all are considered to be common, widespread and abundant in the province.

Significant Wildlife Habitat

Based on the species observed and ecosystems present, three types of SWH have been confirmed present, including:

- Habitat for Terrestrial Crayfish;
- Habitat for Monarch Butterfly ; and,
- Turtle Overwintering Areas.

Several additional wildlife habitats may exist in the Study Area Vicinity, particularly within the Thames River and surrounding woodlands. This includes possible habitats for turtles, reptiles, amphibians and woodland birds. Significant Wildlife Habitats are shown in Figure 6-5.



LEGEND

- APPROXIMATE ON-SITE STUDY AREA
- WATERCOURSE
- EXISTING LIMIT OF WASTE
- STORMWATER MANAGEMENT BASIN
- WET DEPRESSION
- RIGHT-OF-WAY AND SEWER EASEMENT

ELC CLASSIFICATION

- CULTURAL
- MEADOW
- WETLAND
- CONSTRUCTED
- OTHER

BURNSIDE

Client: **TOWN OF ST. MARYS**

Figure Title: **FUTURE SOLID WASTE DISPOSAL EA**

SIGNIFICANT WILDLIFE HABITAT

Drawn	Checked	Date	Figure No.
CD	JH	JUNE 2022	**6-5**
Scale: 1:5000		Project No.: 300032339	

File: O:\Project\300\032339 (St. Marys)\2022 Solid Waste Disposal EA\032339 Figure 6-5.dwg Date Plotted: June 9, 2022 - 4:55 PM

Fish Habitat

With the exception of one “Common” Crayfish, no fish were visually observed or captured during the aquatic assessment and fish presence survey. This result, combined with the results of the background information (fish restricted to downstream and a pond upstream), and the lack of direct connectivity with the Thames River, indicates that this section of watercourse is not considered to be direct fish habitat. As such, the watercourse on-site does not contain or provide habitat for any fish SAR. However, because the subject watercourse is connected upstream to the Sgariglia Drain, and downstream to the Thames River, it is considered to be indirect fish habitat and contributes to the water quality and quantity of the Thames River. The Thames River provides habitat for a variety of fish species and several aquatic SAR. Due to amendments to the Fisheries Act (August 2019), any harmful alteration, disruption or destruction (HADD) to waters frequented by fish must be avoided or adequately mitigated as part of the proposed site works.

6.4.2 Cultural Environment

6.4.2.1 Built Heritage Resources and Cultural Heritage Landscapes

Methodology

A Cultural Heritage Resource Assessment (CHRA): Built Heritage Resources and Cultural Heritage Landscapes- Existing Conditions was undertaken by ASI in November 2015[47]. The CHRA assessed the presence of Built Heritage Resources and Cultural Heritage Landscapes in accordance with the Standards and Guidelines for Conservation of Provincial Heritage Properties (April 2010), Provincial Policy Statement and policies listed in the Town of St. Marys Official Plan (2007 Consolidation, Section 2.3). The assessment consisted of data collection, background historic research, review of secondary source material and field review. The purpose was to present an inventory of known or potential built heritage resources and/or cultural heritage landscapes as well as identify any potential impacts and proposed appropriate mitigation measures to minimize effects. The CHRA can be found in Volume III, Appendix E.

[47] This Study was conducted as part of the evaluation of Alternative Methods and its findings were not available at the time of the evaluation of Alternatives To the Undertaking. The evaluation of Alternatives to the Undertaking was reviewed in light of this new information. It is not believed that this would change the overall results of that earlier evaluation, described in Section 3.8.3.

Existing Built Heritage and Cultural Heritage Landscapes

The background research, data collection, and field review conducted for the Study Area determined that 12 cultural heritage resources are located within the Study Area Vicinity, as summarized in Table 6-13. Of these, 11 are Cultural Heritage Landscapes and one is a Built Heritage Resource.

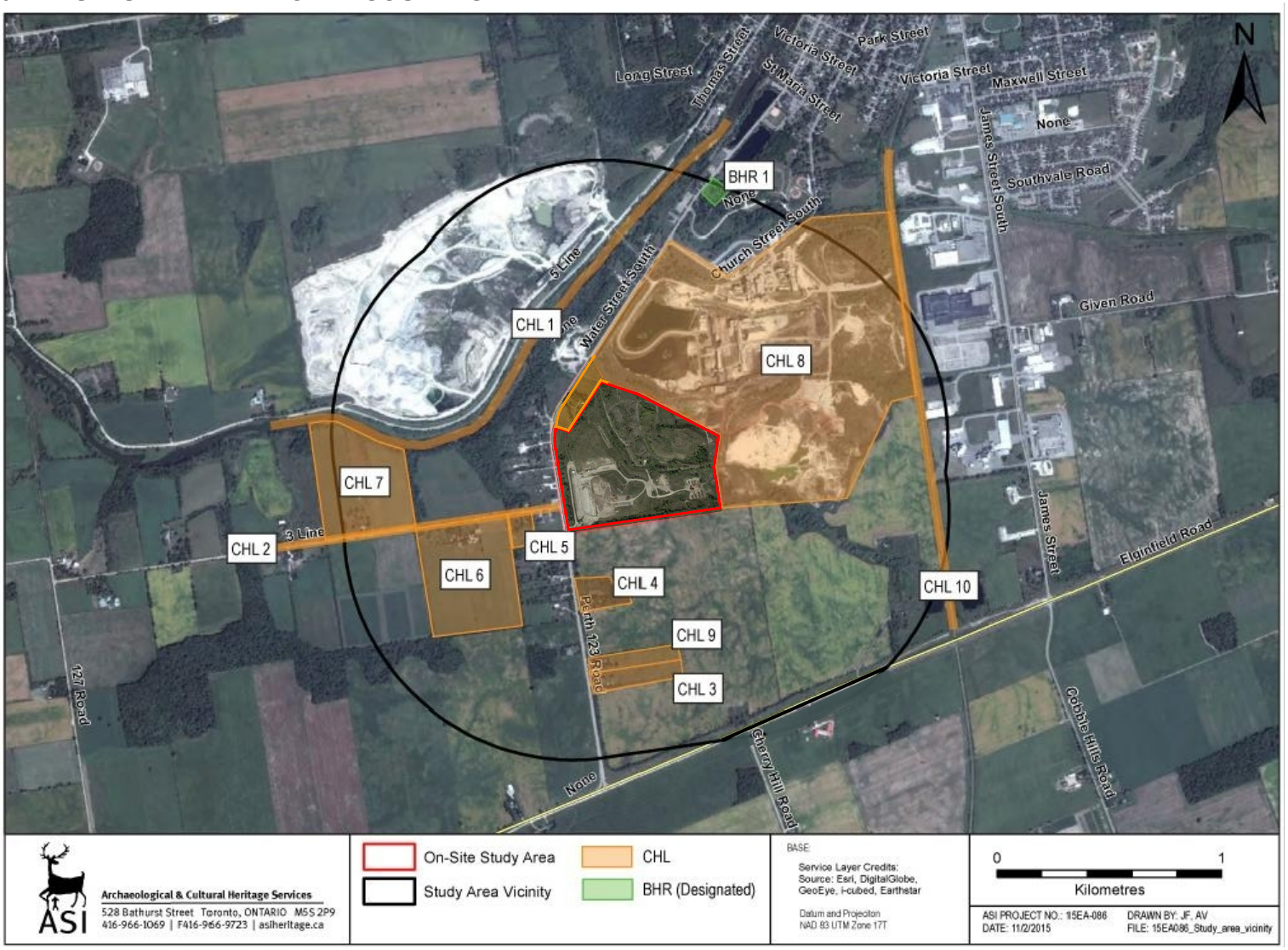
No cultural heritage resources were identified within the On-Site Study Area. Figure 6-6 shows the location of the cultural heritage resources.

Table 6-13: Cultural Heritage Resources in the Study Area Vicinity

Resource	Type	Location	Recognition
CHL 1	Waterscape and associated features	Thames River	Identified as a Canadian Heritage River
CHL 2	Roadscape	3 Line	Identified during background research/field review
CHL 3	Farmscape	1579 Perth Road 123	Identified during background research/field review
CHL 4	Farmscape	1631 Perth Road 123	Identified during background research/field review
CHL 5	Farmscape	4469 3 Line	Identified during background research/field review
CHL 6	Farmscape	4495 3 Line	Identified during background research/field review
CHL 7	Farmscape	4544 3 Line	Identified during background research/field review
CHL 8	Industrial Complex	St. Marys Cement Plant	Identified during background research/field review
CHL 9	Farmscape	1595 Perth Road 123	Identified during background research/field review
CHL 10	Railscape	Canadian National Rail Line	Identified during background research/field review
CHL 11	Farmscape	1025 Water Street South	Identified during background research/field review
BHR 1	Residence	481 Water Street South	Designated under Part IV of the Ontario Heritage Act (By-law 63-2008)

The closest resources to the landfill site are the St. Marys Cement Plant which covers the entirety of the St. Marys Cement active operations directly to the north and east of the landfill. The resource identified as CHL 11 in Table 6-13 is a farm property on Water St. S. which is directly adjacent to the landfill and surrounded by the landfill property on it northern, eastern, and southern borders.

6-14 CULTURAL HERITAGE RESOURCES



6.4.2.2 Archaeological Resources

Methodology

A Stage 1 Archaeological Assessment (under Project Information Form number P392-0171- 2015) was completed by ASI. A Stage 1 assessment consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition and contacting MHSTCI to find out whether, or not, there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and further archaeological assessment (e.g., Stage 2-4) as necessary. The Stage 1 assessment was conducted in accordance with the *Ontario Heritage Act* and the Standards and Guidelines for Consultant Archaeologists (Ministry of Tourism and Culture, 2011).

Existing Archaeological Resources

The Stage 1 Archaeological Assessment report has been entered into the Ontario Public Register of Archaeological Reports. The report concluded that the entire on-site study area has been documented to not retain archaeological potential and that these lands do not require further archaeological assessment.

The Stage 1 Archaeological Assessment is included in Volume III - Appendix F.

6.4.3 Transportation

Methodology

A Traffic Impact Study (TIS) was prepared as part of the EA process. The following background reports were reviewed to identify existing traffic conditions:

- Official Plan of the Town of St. Marys (Town of St. Marys, October 2007);
- Population Discussion Paper prepared to support the Official Plan Update;
- Town of St. Marys 2011 Development Charge Background Study (Watson & Associates, September 29, 2017);
- St. Marys Engineering Design Guidelines and Supplemental Specifications for Municipal Services – draft (Town of St. Marys, May 3, 2017);
- Town of St. Marys Road Assessment Study Asset Management Plan (R.J. Burnside & Associates Limited, October 2014); and
- County of Perth Official Plan (County of Perth, consolidated April 2015).

The TIS can be found in Volume III, Appendix H.

Existing Traffic Conditions

The St. Marys Landfill access is a tar and chip driveway, located on the east side of Water St. S. The landfill site access is stop-sign controlled and forms a T-intersection with Water St. S. All traffic into and out of the site uses this entrance. The TIS conducted for the EA provides detailed analysis on the traffic patterns in the areas outside of the landfill facility. The TIS assessed traffic patterns, accounting for the transportation links to the landfill and adjacent arterial roads.

Water St. S. (also referred to as Perth Road 123) is a two-lane arterial road, which has a posted speed of 80 km/hr in the landfill access area. This road is under the jurisdiction of the County of Perth. Roughly 470 m north of the landfill entrance, the road becomes under the jurisdiction of St. Marys. The road has a posted speed of 50 km/hr.

There are no new developments or planned road improvements in the Study Area that may impact traffic on Water Street S. near the landfill. There are no existing traffic concerns associated with the entrance or major access routes to the landfill.

6.4.4 Land Use

Methodology

Land Use was studied in conjunction with the Socio-economic conditions and is described in the Socio-economic Impact Assessment found in Volume III, Appendix G. Existing land uses were identified through a review of the following documents and data sources:

- Official Plan of The Town of St. Marys October 1987 (Consolidated October 1, 2007).
- County of Perth Official Plan (Consolidated February 2016).
- Town of St. Marys Zoning By-law, consolidated December 2018.
- Township of Perth South Consolidated Zoning By-law 4-1999.
- Agricultural Information Atlas (OMAFRA, accessed April 2016)

In addition, a windshield survey was conducted in May 2015 to document farm types.

Existing Land Use

The Town of St. Marys, located on the banks of the Thames River in Southwestern Ontario, has a thriving tourism sector and places significant importance on its natural and cultural heritage sites. St. Marys recognizes the importance of maintaining its historical and cultural heritage sites. The landfill property is located along the southwestern edge of the Town, bordering the Township of Perth South in the County of Perth. Adjacent lands, therefore, span multiple jurisdictions.

Official Plans

According to the Towns of St. Marys Official Plan, the landfill property is identified as an Environmental Constraint area. Surrounding land uses within the Town include Extractive Industrial uses to the north, northeast and west that encompass the operations of St. Marys Cement.

The Township of Perth South lies adjacent to the western and southern boundaries of the landfill. The Township does not have its own Official Plan and, instead, defers to the County of Perth Official Plan. According to Schedule A of the Perth County Official Plan, lands to the immediate south and east fall outside of the Town's limits but are designated as Licensed Quarry Pit/Limestone Resource and Agricultural Lands with a small amount of Natural Resources/Environment adjacent to the Thames River. A small number of residences are located on the east side of Water St. S. immediately adjacent to the landfill.

Zoning By-laws

The Town of St. Marys Zoning By-law identifies the southwestern portion of the landfill property as Extractive Industrial. This Extractive Industrial zoning corresponds with the aggregate extraction license previously in effect for this portion of the property. Lands surrounding the landfill to the north and east are all identified as Extractive Industrial. The small residential property immediately to the west of the landfill is zoned as Development. This indicates that its existing residential use is permitted. New development within this zone would require additional study to ensure compatibility with the landfill. Currently, no properties have been assigned this zone as no future developments are proposed in close proximity to the landfill.

The Township of Perth South Zoning By-law does not include any special provisions for development on lands adjacent to the landfill. Township lands adjacent to the St. Marys Landfill are currently zoned Mineral Aggregate Resource to the south and Agricultural to the west. There is also a small Institutional designation to the west associated with the Union Gas pipeline pumping station located on the northwest corner of Water Street and 3rd Line. A Natural Resources/Environmental Zone Two designation is present for a small area along the Thames River.

Agricultural Land Uses

Agriculture is important is the local economy. Perth County has a large agricultural industry with over 2,200 farms operating within the County (Perth County Agriculture and Food, 2012). In 2006, primary agricultural industries accounted for 18% of the County's labour force and since 2001, the total land on farms increased 0.7% to 506,291 acres, with an average farm size of 225 acres. Perth County has a high concentration of labour

in agriculture and food compared to the rest of southwestern Ontario (County of Perth, 2010).

The Agriculture, Value Added Agriculture and Agri-Food Sector provide 5,535 jobs and employ 5,340 residents in the region. The region is a net importer of 195 agriculture-related jobs (Town of St. Marys, 2015). According to 2006 Census data, many of the jobs are on farms (3,775) and in food manufacturing (1,610). It was estimated that the specialty food sector has been growing by 9% annually (prior to 2010) and is expected to rise by a further 12% annually through 2015 (County of Perth, 2010). Indeed, the County of Perth, Town of St. Marys and City of Stratford combined (also referred to as "the region") have a significant agricultural heritage since much of the land base and climatic conditions are suited for agricultural and farming activities (County of Perth, 2010).

Several assessments conducted during the development of the County of Perth, Town of St. Marys and City of Stratford Economic Development Strategy and Action Plan (2010) determined that overall, the region's growth has been driven by a strong agricultural and manufacturing economy and that the region's agriculture industry is a dominant employment industry. It was concluded that, despite the declining employment growth in this industry, any further economic development efforts need to include agriculture and farming.

Agricultural production is present in rural areas throughout the Township of Perth South, including lands adjacent to the landfill. The agricultural industry relies on high quality agricultural soils and a clean water source for irrigation, where required. The existing landfill has not affected surrounding agricultural soils or water sources and agricultural production has successfully coexisted adjacent to the landfill to date.

It is noted, however, that during the preparation of the TOR, correspondence was received indicating that a neighbouring farm was affected by odour from the landfill. The letter stated that strong odour had deterred customers from purchasing their produce, hence negatively impacting farmgate sales.

Agricultural lands are present in the Study Area Vicinity to the south and west of the landfill. Agricultural lands appear to be primarily in cash crop production. As noted above, the agricultural lands adjacent to the southern boundary of the landfill are zoned Mineral Extractive. According to the Agricultural Information Atlas (Ontario Ministry of Agriculture, Food and Rural Affairs, accessed April 2016), some adjacent farmland is tile drained. The actual number of farms within the Study Area Vicinity is difficult to ascertain as landownership data is not readily available and multiple fields may be in single ownership. Farming is concentrated to the southwest and south of the landfill, with approximately six farms within the Study Area Vicinity, encompassing approximately 320 ha of agricultural land.

Compatibility with Adjacent Land Uses

Sixteen residences are located within 120 m of the landfill and an additional 28 residences are located within the 1 km Study Area Vicinity. Land use related conflicts, including odour, noise and dust concerns, between residents are landfills are not unusual. Annual Monitoring Reports (AMRs) have been prepared since landfill operations began in 1984 [48]. Monitoring events are completed twice a year; in the Spring and in the Fall, in compliance with the site's Environmental Compliance Approval (ECA). A review of AMRs reveals that there were no complaints received in the reporting periods 2010, 2011 and 2012. From 2013 through 2015 a total of nine complaints have been received from residents related to odour from the landfill. Town complaint summaries indicate that odour issues are influenced by wind direction (from the east or northeast) following wet site conditions. The Complaint Summary, presented in Table 6-14, shows two odour complaints in 2016 and four odour complaints in 2018 with no odour complaints in 2017, 2019, 2020, 2021 and through May 4, 2022 [49]. The 2019 to date cessation of odour complaints can likely be attributed to the Town's revised operating practise of using a thicker cover and more localized cover stockpiles, as recommended in the 2018-09-19 and 2018-09-23 investigations.

Table 6-14: Complaint Summary (2013 to 2022)

Date	Type
Calendar 2013, 2014 and 2015	Odour – Nine complaints
2016-04-14	Odour
2016-04-27	Odour
2018-03-10	Odour
2018-07-09	Odour
2018-09-19	Odour
2018-09-23	Odour
2019-04-10	Noise – Backup beeper
2020	None
2021	None
2022	None received through 2022-May-4

In recent years, visual impacts to the area have been significantly reduced through the placement of earthen berms and tree screens near the site boundaries where visual impacts could occur.

[48] Burnside completed AMRs for 2013 through 2017, inclusive.
[49] Confirmed by Town email dated May 5, 2022 (D.Blake to J.Hollingsworth)

6.4.5 Socio-Economic Environment

6.4.5.1 Employment

Methodology

Employment characteristics were obtained from the following documents and data sources:

- County of Perth, Town of St. Marys and City of Stratford Economic Development Strategy and Action Plan: 2010-2014.
- Final Economic Prosperity CIP, March 9, 2015 – The Town of St Marys Community Improvement Plan (Draft 2015).
- Final Report, Town of St. Marys, Community Based Strategic Plan, February 2010.
- 2016 Census of Canada (Statistics Canada).

Existing employment levels at the landfill were obtained from the City.

Additional information can be found in the Socio-economic Impact Assessment provided in Volume III, Appendix G.

Existing Employment

Income and Employment Characteristics

Surveys conducted by Statistics Canada for the National Household Survey in 2011 reveal that for St. Marys, 3,525 people were employed and 195 were unemployed for a total labour force of 3,720. In 2011, the employment rate for St. Marys was at 64.3% and the unemployment rate was at 5.2%. This is slightly better than Ontario as a whole.

The top occupations are in Service support and other service occupations, Labourers in processing, agriculture, manufacturing, arts, entertainment and recreation, wholesale trade, construction and utilities, and Professional occupations in education services (County of Perth, 2010). In 2016, 25.6% of St. Marys labour force was employed in management occupations, educational and social services, business, and finance, or as health care practitioners.

In 2010, the combined total income for the Town was $206.6 million (Statistics Canada, 2011). The median employment income was $45,263 for the working population (age 15 and over) compared to $50,116 for Ontario as a whole. Statistics obtained from the Town's Community Based Strategic Plan (2010), suggests that the Town has a higher percentage of income earners between $30,000 and $99,999 when compared to other regions (Perth, Stratford and the GTA) but lags in the percentage of households earning $100,000 or over.

Direct Landfill Related Employment

There are eight persons employed at the existing landfill:

- Site Attendant – a full time position;
- Compactor Operator – a part-time position;
- (Four) Equipment Operators – as occasionally needed;
- Supervisor of Environmental Services – as occasionally needed; and
- Supervisor of Operations – as occasionally needed.

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

6.4.5.2 Social Conditions

In total, there are 16 residences within 120 m of the landfill and 28 residences within the 1 km Study Area Vicinity. Several commercial and light industrial businesses are present along James Street South, east of St. Marys Cement. The Canadian Baseball Hall of Fame and Museum, Hall of Fame baseball diamonds and other recreational facilities are located north of St. Marys Cement, outside of the Study Area Vicinity.

The Study Area Vicinity is characterized by industrial uses and a small number of houses and businesses. The landfill provides a social service to the community by providing a safe and sanitary means of disposing of the Town’s solid waste. There are no community spaces, public parks or other social services provided in the Study Area Vicinity.

6.4.6 Indigenous Communities and Treaty Rights

Indigenous and Treaty Rights are protected under Section 35 of the *Constitution Act, 1982*. Indigenous Rights are associated with practices, customs or traditions that are integral to the distinctive culture of the Indigenous community claiming the right. Treaty Rights are those specified in historic treaties signed between Indigenous people and the Crown.

The St. Marys Landfill is located in close proximity to the Thames River, which was an important travel corridor, source of sustenance and culturally significant feature for the Indigenous people who historically lived in the area. The unnamed watercourse running through the landfill property outlets to the Thames River. The Thames River continues

to be important to several Indigenous communities. The river is used for fishing, drinking water, collecting traditional and medicinal plants and as a source of spiritual connection.

Traditional practices continue to occur along the Thames River but have not occurred on the landfill property since before St. Marys Cement was active on the site.

The St. Marys Landfill is located within lands subject to Treaty 29, 1827. Aamjiwnaang First Nation, Caldwell First Nation, Chippewas of Kettle and Stony Point, Chippewas of the Thames First Nation and Walpole Island First Nation and the Haudenosaunee Confederacy have Indigenous and Treaty Rights associated with lands in, and around, the landfill, as described in Section 3.7.1.2. The most proximate Haudenosaunee communities to the St. Marys Landfill are Oneida Nation of the Thames and Six Nations of the Grand River.