Supporting Document 1-2

Noise Existing Conditions Report

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WM Canada

Watford, Ontario

May 2026

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Revision History

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1	November 2023
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Executive Summary

RWDI Air Inc. (RWDI) was contracted by HDR Corporation on behalf of WM Canada (WM) to prepare this Noise Existing Conditions Report for the Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project Environmental Assessment (EA).

The TCEC is located at 5768 Nauvoo Road in the Township of Warwick, within the County of Lambton. The TCEC lies to the north of the community of Watford and is generally bounded by Confederation Line to the south, Nauvoo Road to the west, Zion Line to the north, and agricultural lands to the east.

There are approximately 5 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed optimization would provide additional airspace of approximately 14.3 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043) and may be achieved through alternative landfill configurations or alternative methods within the existing 301 hectare TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

This report summarizes the existing noise conditions within the On-site Study Area (the existing TCEC), the Off-site Study Area (the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area), and the Off-site Haul Route Area (the area within 1 km of the primary haul route from Highway 402 to the site entrance).

Points of reception within the study areas were identified and the acoustic environment was characterized for them. Some of the points of reception were shown to have elevated background sound levels due to road traffic that is not related to the landfill. Descriptions of the character of the acoustic environment and demonstration of elevated background sound were used to develop sound level limits for on-site activities.

Existing sound levels are presented for the final approved phase of the existing landfill. On-site activities relevant to noise include landfilling, ancillary facilities (including emergency sources) and pest control devices are considered. The influence of the primary haul route was also considered. Existing traffic from Highway 402 to the landfill entrance was considered.

Information for this report was collected from aerial mapping, topographic data, land use zoning plans, proposed facility characteristics, as well as review of previous WM noise assessments. Field studies were conducted to perform off-site measurements, on-site measurements of acoustic sources, and to describe the characteristics of the existing acoustic environment.

Sound level criteria were determined based on existing sound levels not related to the landfill, in accordance with Ministry of the Environment, Conservation and Parks (MECP) guidance in NPC-300 and the Noise Guidelines for Landfill Sites. Modelling of road traffic sound was done using the ORNAMENT algorithms. Modelling of landfilling under approved existing conditions was performed using the ISO 9613 algorithms in the Cadna/A software.

The acoustic environment at POR locations during daytime is generally dominated by road traffic, while sounds of nature are more prominent during the evening and nighttime. This mixture of human and natural sounds most closely resembles the definition of a Class 2 area. As a result, all POR locations are considered to have a Class 2 acoustic environment.

Key representative POR locations were chosen that most accurately represent the existing facility sound levels in each of the cardinal directions and are expected to have the predictable worst-case future sound influence around the TCEC. At these key PORs, modelled existing sound levels:

- From landfilling ranged from 36 – 53 dBA;
- From ancillary facilities ranged from 29 – 42 dBA;
- From emergency sources were less than 25 dBA; and
- From pest control devices ranged from 20 – 55 dBAI.

Haul route modelling of existing sound levels was also completed. At the nearest houses, the worst-case one-hour haul route sound levels were modelled to range from 62 – 66 dBA.

This report describes the existing acoustic environment and its characteristics, as well as the landfill and haul route sound levels associated with the current approvals.

Acronyms, Units and Glossary

Acronyms

Acronym	Definition
D&O	Development & Operations
EA	Environmental Assessment
EAA	*Environmental Assessment Act*
$L_{A\ eq,\ 1\text{-}hr}$	One-hour A-weighted Equivalent Level
$L_{LM,\ 1\text{-}hr}$	One-hour Logarithmic Mean Impulse Level
MECP	Ministry of Environment, Conservation and Parks
NPC-300	Noise Pollution Control 300 – Environmental Noise Guideline – Stationary and Transportation Sources
ORNAMENT	Ontario Road Noise Analysis Method for Environment and Transportation
POR	Point of Reception
PWL	Sound Power Level
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	WM Canada

Units

Unit	Definition
dB	Decibel
dBA	Decibel, weighted to reflect human sensitivity to sound using the A-weighting scale.
ha	Hectare
km	Kilometre
m	Metre
m^3	Cubic metres

Glossary

Term	Definition
Approval	Permission granted by an authorized individual or organization for a project to proceed. This may be in the form of program approval, certificate of approval or provisional certificate of approval.
Capacity (Disposal Volume)	The total volume of air space available for disposal of waste at a landfill site for a particular design (typically in m^3); includes both waste and daily cover materials but excludes the final cover.
Composting	The controlled microbial decomposition of organic matter, such as food and yard wastes, in the presence of oxygen, into finished compost (humus), a soil-like material. Humus can be used in vegetable and flower gardens, hedges, etc.
Composting facility	A facility designed to compost organic matter either in the presence of oxygen (aerobic) or absence of oxygen (anaerobic).
Environment	As defined by the *Environmental Assessment Act*, environment means: • air, land or water; • plant and animal life, including human life; • the social, economic and cultural conditions that influence the life of humans or a community; • any building, structure, machine or other device or thing made by humans; • any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or • any part or combination of the foregoing and the interrelationships between any two or more of them (ecosystem approach).
Environmental Assessment (EA)	A systematic planning process that is conducted in accordance with applicable laws or regulations aimed at assessing the effects of a proposed project on the environment.
Evaluation criteria	Evaluation criteria are considerations or factors taken into account in assessing the advantages and disadvantages of various alternatives being considered.
Impulsive Sound	Short-duration sounds can often be described as impulsive. Examples are rail car shunting, metal scrap bin drops, and gun shots. A more technical definition is found in NPC-101 (MOE, 1997a).
Indicators	Indicators are specific characteristics of the evaluation criteria that can be measured or determined in some way, as opposed to the actual criteria, which are fairly general.
Landfill gas (LFG)	The gases produced from the wastes disposed in a landfill; the main constituents are typically carbon dioxide and methane, with small amounts of other organic and odour-causing compounds.
Landfill site	An approved engineered site/facility used for the final disposal of waste. Landfills are waste disposal sites where waste is spread in layers, compacted to the smallest practical volume, and typically covered by soil.
Mitigation	Measures taken to reduce adverse impacts on the environment.
Point of Reception (POR)	A location where noise from landfill operations, ancillary facilities, pest control devices or haul route is received which is: • on the façade of a dwelling; • on the property of, and within 30 m of a dwelling; • on the façade of a noise-sensitive commercial-purpose building (e.g., hotel, motel); or • on the façade of a noise-sensitive institutional-purpose building (e.g., hospital, day nursery, educational facility, place of worship not on commercially or industrially zoned land); • on a vacant lot zoned for noise-sensitive use that is accessible by road or navigable waterway.

Glossary

Term	Definition
Project	Is defined in the *Environmental Assessment Act* as: one or more enterprises or activities or a proposal, plan or program in respect of an enterprise or activity.
Proponent	A person who: • carries out or proposes to carry out a project; or • is the owner or person having charge, management or control of a project.
Quasi-steady Impulsive Sound	Occurs when a number of impulsive sounds are emitted in quick succession. A more technical definition is found in NPC-101 (MOE, 1997a).
Renewable Natural Gas (RNG)	Product of the decomposition of organic matter that is collected from the landfill site, as opposed to traditional natural gas, which is collected from deep wells.
Terms of Reference (ToR)	A terms of reference is a document that sets out detailed requirements for the preparation of an Environmental Assessment.
Waste	Refuse from places of human or animal habitation; unwanted materials left over from a manufacturing process.

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1 Introduction

This report presents a description of the existing conditions for the Noise environment for the WM Canada (WM) Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project in support of the environmental assessment (EA). The EA is being carried out in accordance with the requirements of the *Environmental Assessment Act* (*EAA*) and Terms of Reference (ToR), which was approved by the Ministry of Environment, Conservation and Parks (MECP) on December 13, 2022.

The approved ToR included a preliminary description of the existing conditions within the area surrounding the TCEC, with the commitment that a more detailed description of existing environmental conditions would be prepared as part of the EA. In accordance with the approved ToR, additional investigative studies were carried out as necessary to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the TCEC Landfill Optimization Project during the EA.

WM, the owner and operator of the TCEC in Watford, Ontario, has initiated the EA seeking approval to optimize the landfill design and operation, maximizing the use of the constructed infrastructure and the significant investment made at the TCEC. There are approximately 5 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed optimization would provide additional airspace of approximately 14.3 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043), and may be achieved through alternative landfill configurations or alternative methods within the existing 301 hectare (ha) TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

This Noise Existing Conditions Report is one component of the EA. The EA Study Report will incorporate the information presented herein as appropriate, and this report will be included with the EA Study Report as a supporting document.

2 TCEC and Study Areas

The TCEC is located at 5768 Nauvoo Road in the Township of Warwick, within the County of Lambton. The TCEC lies to the north of the community of Watford and is generally bounded by Confederation Line to the south, Nauvoo Road to the west, Zion Line to the north, and agricultural lands to the east. The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are:

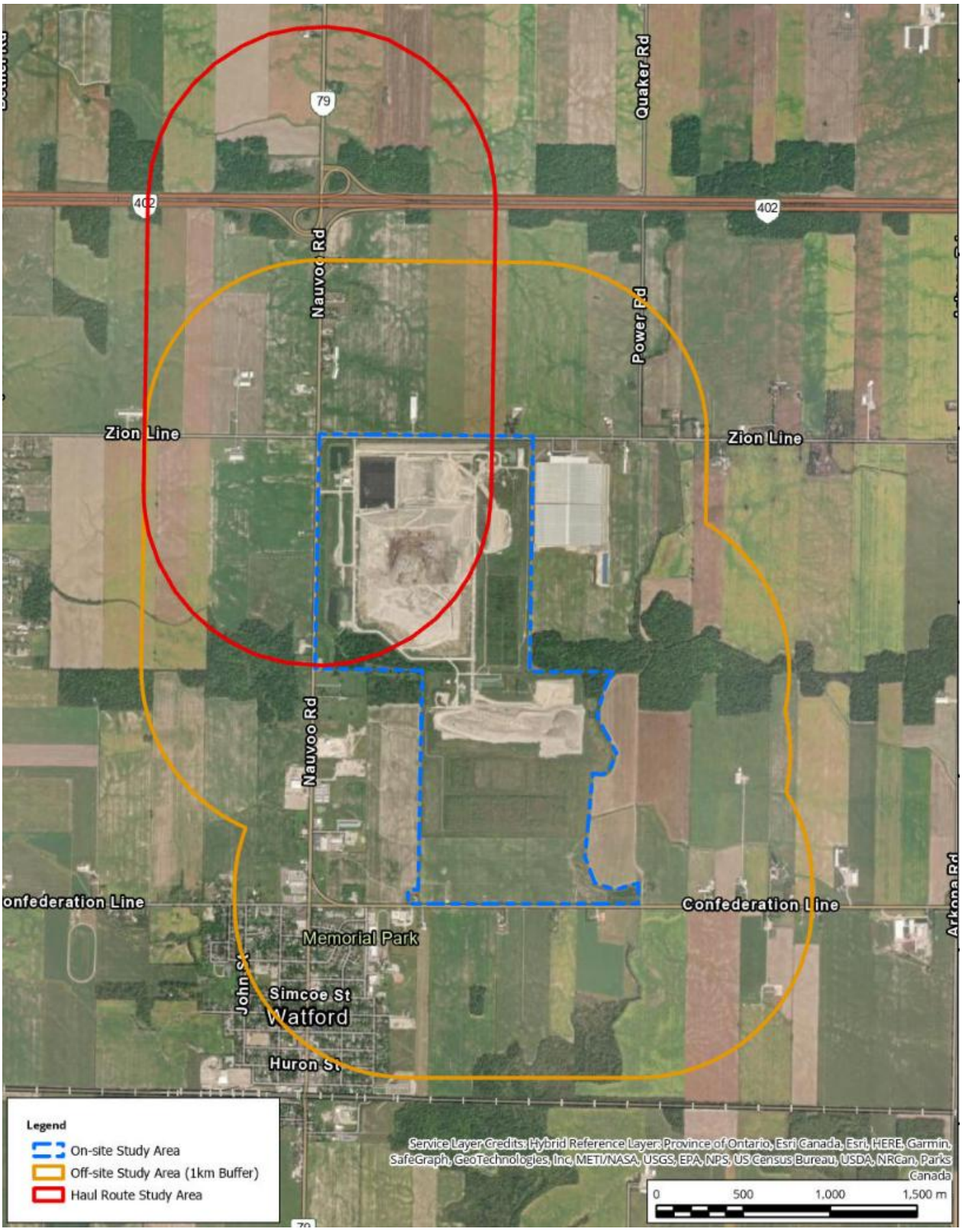
- On-site study area: the existing TCEC.
- Off-site study area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

For the Noise environment, these study areas were adopted along with an additional off-site study area:

- Off-site Haul Route Area, within 1 km of the primary haul route from Highway 402 to the site entrance.

The study areas for the Noise environment are provided in **Figure 2-1**.

Figure 2-1. On-site, Off-site and Haul Route Study Areas



3 Methods

This Noise Existing Conditions Report was developed based on the evaluation criteria, indicators, and data sources included in the approved ToR, which were developed in consultation with government agencies and other stakeholders. The evaluation criteria, rationale, indicators and data sources used for Noise as per the approved ToR are provided in **Table 3-1**.

Table 3-1. Evaluation Criteria, Indicators and Data Sources for Noise

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Atmospheric Environment			
Noise	Activities related to construction/rehabilitation, operation of the landfill and ancillary facilities, and the offsite haul route can result in an increase in off-site noise levels.	• Predicted site-related noise levels (measured in dBA or dBAI) • Change in sound levels (dB)	• Off-site noise monitoring • Annual on-site noise monitoring data • Noise measurement of on-site sources • Applicable MECP guidelines, technical standards and models • Aerial mapping and field reconnaissance to confirm off-site points of reception • Topographic and land-use mapping • Land use zoning plans • Proposed facility characteristics • Landfill design and operations data • Traffic counting, characterization and modelling studies, completed by HDR • Noise Assessment for the Twin Creeks Environmental Centre Renewable Natural Gas Facility (RWDI, 2023b) • Design & Operations Report Warwick Landfill Expansion (HPAL, 2008) • Proposed Expansion of WM Warwick Landfill: Noise Impact Assessment (AEL, 2007) • Volume 2C of the 2022 Compliance Monitoring Report

3.1 Data Collection and Review

Table 3-2 provides a description of the data collection and review methodology for the sources of data noted in **Table 3-1**.

Table 3-2. Collection and Review of Data Sources

Data Source	Collection	Review
Site visits on August 25, 2022, August 26, 2022 and July 18, 2023.	Off-site noise monitoring	Observations and spot measurements used to characterize the acoustic environment around the site.
Annual noise monitoring reports	The reports were reviewed.	Reviewed to determine number of complaints each year.

Data Source	Collection	Review
Site visits on August 2, 2018, August 25, 2022 and August 26, 2022	Noise measurements of on-site sources. Data provided in **Appendix B**.	Reviewed to determine the sound power levels of the measured sources.
MECP's Environmental Noise Guideline – Stationary and Transportation Sources, Publication NPC-300 (NPC-300) (MOE, 2013) and MECP's Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites (Landfill Noise Guideline) (MOE, 2012)	Applicable MECP guidelines, technical standards and models	Reviewed to understand the limits and required methodology for assessment of sound from landfilling activity, ancillary facilities, pest control devices, and haul route traffic. Definition for Class of acoustical environments and assessment criteria of the lowest background sound levels.
Aerial mapping and field reconnaissance to confirm off-site points of reception	Lambton County GIS online website.	Reviewed to determine property boundaries and zoning.
Noise Assessment Environmental Centre Renewable Natural Gas Facility (RWDI, 2023b)	The memorandum and associated noise models were reviewed.	Reviewed to determine the noise emission from the ancillary facilities, including existing TCEC facility and proposed Renewable Natural Gas (RNG) facility.
Design & Operations Report Warwick Landfill Expansion (HPAL, 2008)	The report and associated figures were reviewed.	Reviewed to determine the site plan including working face location and landfill site contours.
Noise Impact Assessment Proposed Expansion of WM Warwick Landfill (AEL, 2007)	The report and associated figures were reviewed.	Reviewed to determine the permitted landfill machinery and equipment, pest control devices and berms around the site.
Traffic study completed by HDR	Hourly traffic volumes with a detailed breakdown of vehicle types. Data provided in **Appendix C**.	Reviewed to determine worst-case haul route hour and quietest background hour.
Volume 2C of the 2022 Compliance Monitoring Report (RWDI, 2023c)	Site Contours as of December 2022	Reviewed to determine the height of the soil stockpile to the south of RNG Facility.

3.2 Field Studies

Off-site and on-site field measurements and observations were conducted during landfilling on August 25, 2022 and August 26, 2022. Field study at off-site points of reception (PORs) within the Off-site and Haul Route study areas represented potential worst-case noise-sensitive locations. Off-site measurements and observations on August 25 and August 26, 2022, are summarized in **Table 3-3**.

Table 3-3. August 25 and August 26, 2022, Off-Site Measurement Summary

Receptor ID	Receptor Description	Sound Level in the Absence of Traffic	Comments
R1	House on south side of Zion Line, east of landfill	45 – 47 dBA	Dominated by passing traffic on Zion Line, nearby refrigeration equipment related to the greenhouse, and sounds of nature
R2	House on north side of Zion Line, north of landfill	49 – 50 dBA	Collectively made up of vehicle traffic, sounds of nature, and frequent landfill sources including bulldozers and backup beepers
R5	House on east side of Nauvoo Road, north of landfill	< 51 dBA	Dominated by vehicle traffic from Nauvoo Road and sounds of nature
R6	House on south side of Zion Line, west of landfill	49 dBA	Dominated by passing traffic on Nauvoo Road and sounds of nature
R7	House on west side of Nauvoo Road, west of landfill	49 dBA	Dominated by passing traffic on Nauvoo Road and sounds of nature
R10	Parking lot on Nauvoo Road, south of landfill	49 – 50 dBA	Dominated by passing traffic on Nauvoo Road, activity at the Redi-Mix plant to the south, and sounds of nature
R11	House on north side of Confederation Line, south of landfill	47 dBA	Dominated by passing traffic on Confederation Line, sounds of nature, and equipment from the facilities across the road to the south, notably Autotube Limited and Watford Arena
R12	House on north side of Confederation Line, south of landfill	50 – 51 dBA	Dominated by passing traffic on Confederation Line and the sounds of nature.

On-site field study involved measurement of at-source noise emissions and collection of sound at the property boundary. At-source noise emissions are summarized in **Appendix B**. On-site measurements at the property boundary were conducted during landfill operations at the four existing monitoring locations. Measurement results are summarized in **Table 3-4**.

Table 3-4. August 25 and August 26, 2022, On-Site Measurement Summary

Location ID	Location Description	Sound Level Range
M1	Northwest edge of the landfill, 100 m north of the entrance	67 – 70 dBA
M2	Northeast of the landfill, 200 m south of Zion Line	51 – 54 dBA
M3	South of landfill, north of Confederation Line	46 – 47 dBA
M4	West side of landfill, south of woodlot	46 – 54 dBA

3.3 Characterization of Existing Conditions

The existing conditions for Noise were characterized as follows:

1. Information collected from the sources identified in **Section 3.1** were reviewed and summarized;
2. Field studies were undertaken, as described in **Section 3.2**; and
3. Information from all sources was compiled by environmental criterion.

3.4 Modelling

Noise modelling of on-site noise sources (landfill operations, including emergency sources; ancillary facilities; and pest control devices) was completed using the ISO 9613 (ISO, 1994 and ISO, 1996) algorithms implemented in the Cadna/A software package.

The modelling takes into account the following factors:

- Source sound power level;
- Distance attenuation;
- Source-receptor geometry including heights, elevations and topography;
- Barrier effects of the site and surrounding buildings;
- Ground and air (atmospheric) attenuation; and
- Meteorological effects on sound propagation.

The model inputs for source sound levels were taken from the requirements set out in the Proposed Expansion of WM Warwick Landfill Noise Impact Assessment (AEL, 2007). The overall sound power level (PWL) criteria in the AEL report was supplemented with acoustic descriptors from past RWDI audits on August 25, 2022, and August 26, 2022.

Berm locations were identified and confirmed using previous noise studies, publicly available aerial photography, and street-level imagery. Specifically, the Noise Impact Assessment (AEL, 2007) and Warwick Landfill Expansion Design & Operations Report (HPAL, 2008) provided geometries and locations of the perimeter berms, on-site berms, and on-site haul routes.

In addition to the modelled berms, on-site topography of the elevated landfill area and soil stockpile was also included. The Design & Operations Report (HPAL, 2008) provided contour lines of both the old landfill area at the eastern extent of the site and the current landfill area in the west part of the site. Volume 2C of the 2022 Compliance Monitoring Report (RWDI, 2023c) was the source of topography for the soil stockpile in the south part of the site.

4 Description of Existing Area

This section introduces the location of the identified PORs, identifies the representative PORs, describes the general acoustic environment in the areas surrounding the TCEC, and provides a description of the methodology to be used for modelling numerical results.

4.1 Noise-Sensitive POR Locations

As presented in **Section 3.2**, a POR is defined as a location where noise from landfill operations, ancillary facilities, pest control devices or haul route is received. Per NPC-300, these are:

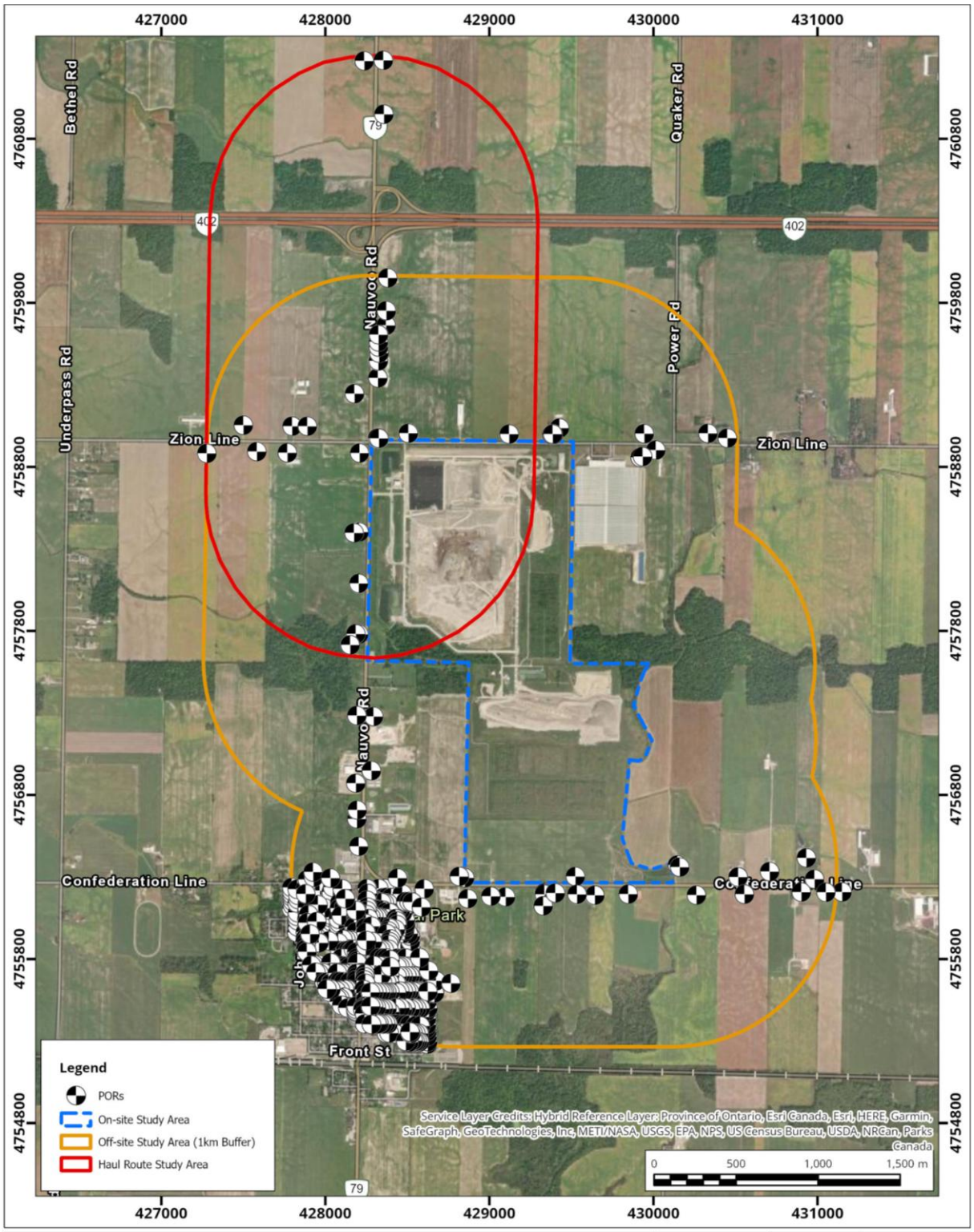
- On the façade of a dwelling;
- On the property of, and within 30 m of a dwelling;
- On the façade of a noise-sensitive commercial-purpose building (e.g., hotel, motel);
- On the façade of a noise-sensitive institutional-purpose building (e.g., hospital, day nursery, educational facility, place of worship not on commercially or industrially zoned land); or
- On a vacant lot zoned for noise-sensitive use that is accessible by public road or navigable waterway.

Over 500 POR locations were identified from field reconnaissance and County of Lambton online GIS information. They are existing residences and any accessible vacant lot where noise-sensitive uses are permitted. Their locations are presented in **Figure 4-1**.

All Points of Reception (PORs) have been modelled at heights of 1.5 m and 4.5 m above grade. The 1.5 m height is used to assess outdoor living areas (OLAs) noise levels during the day and evening periods. The 4.5 m height is applied for evaluating plane-of-window noise levels for two-storey houses and vacant lots, covering day, evening, and night periods. For single-storey houses, plane-of-window noise levels are assessed at 1.5 m. Points of reception are presented at discrete points on each property identified as a point of reception. Sound levels for points not explicitly assessed as PORs can be determined from sound level contours, which are presented in **Appendix A** at heights of both 1.5 and 4.5 m.

Of these POR locations, the locations closest to the landfill site in all cardinal directions were identified as key representative noise-sensitive POR locations. Key representative locations are shown in **Figure 4-2**. A description of the assessed PORs, including the identified number of storeys, and the locations are provided in **Table 4-1**. Sound levels from the landfill are tabulated at these POR locations as representative of worst-case impact from the proposal with the remaining POR locations addressed in **Appendix A**.

Figure 4-1. Noise-Sensitive POR Locations Within the Off-site Study Areas



Noise-Sensitive POR Locations Within the Off-site Study Areas

Map Projection: NAD 1983 UTM Zone 17N
Twin Creeks Environmental Centre - Watford, Ontario

True North

Project #: 2101750

Drawn by: JM	Figure: 4-1
Exact Scale:	1:32,000
Date Revised:	Nov 7, 2023

Figure 4-2. Key Representative Noise-Sensitive POR Locations

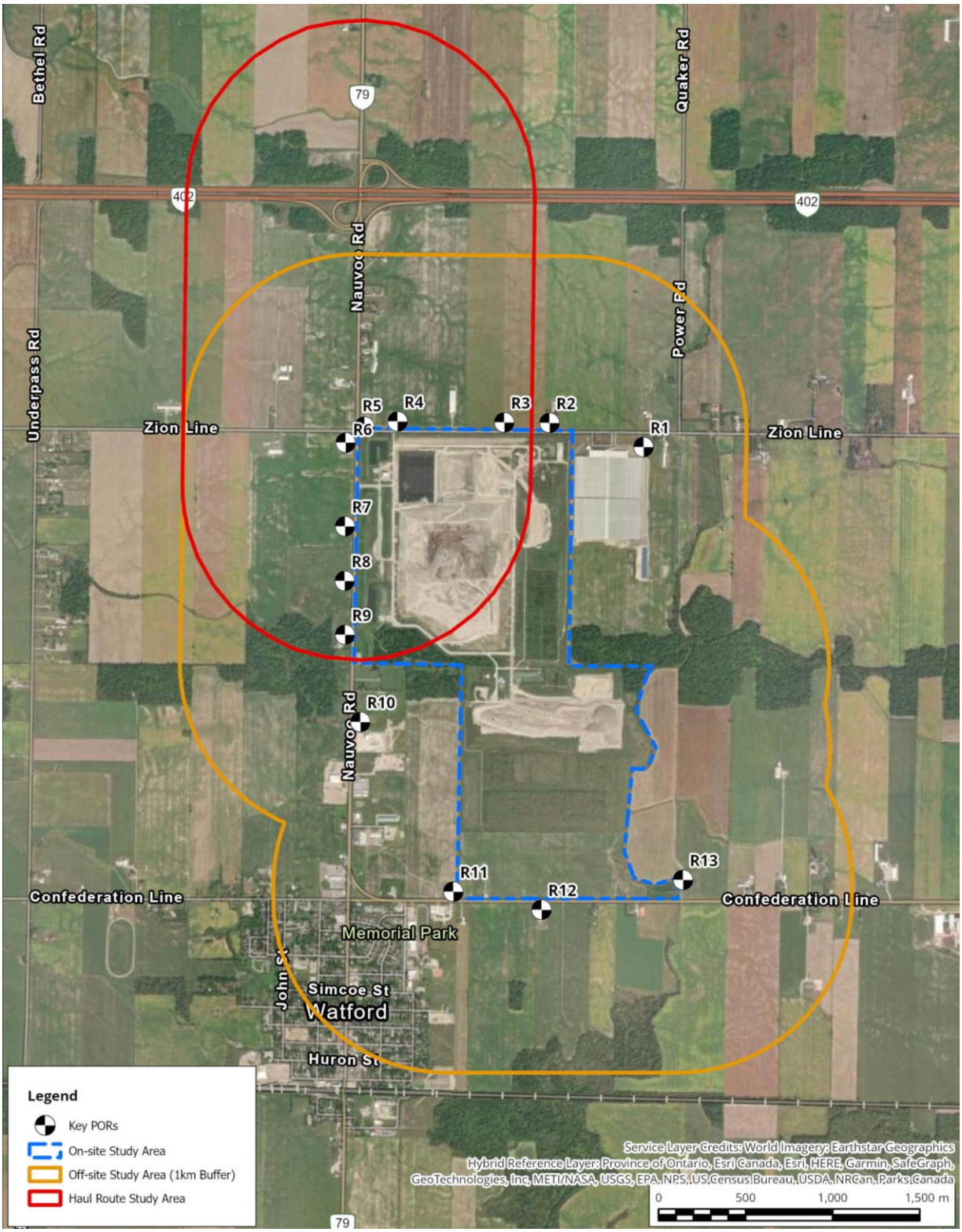


Table 4-1. POR Descriptions and Locations

POR Location	Description	Number of Storeys	Coordinates NAD 83 UTM 17N[3]	
			X (m)	Y (m)
R1	Residential Home	Single Storey	429920	4758857
R2	Residential Home	Two Storey	429380	4758997
R3	Vacant Lot Receptor (VLR)	-	429120	4759001
R4	Vacant Lot Receptor (VLR)	-	428506	4759005
R5[2]	Vacant Lot Receptor (VLR)	-	428317	4758975
R6	Vacant Lot Receptor (VLR)	-	428209	4758884
R7	Residential Home	Single Storey	428206	4758402
R8	Vacant Lot Receptor (VLR)	-	428204	4758089
R9[1]	Commercial Building	Two Storey	428205	4757780
R10	Vacant Lot Receptor (VLR)	-	428293	4757278
R11[2]	Residential Home	Single Storey	428827	4756305
R12	Residential Home	Two Storey	429334	4756201
R13	Residential Home	Two Storey	430146	4756372
R14	Residential Homes (Temporary Workers)	Single Storey	429609	4758996

Notes:

[1] R9 currently is used for commercial purposes.

[2] Location is under the ownership of WM.

[3] These coordinates represent discrete points where sound levels are calculated for reporting purposes. For PORs with dwellings, the coordinates generally represent the closest facades to landfilling activities. For VLR PORs, the coordinates were selected based on vacant lot guidance provided in NPC-300. Sound levels outside these points can be reviewed in the sound level contours provided at heights of 1.5 m and 4.5 m.

'-' Indicates that VLRs have no associated number of storeys and are evaluated at 4.5 m.

4.2 Characterization of the Acoustic Environment

The character of the acoustic environment was aurally observed by RWDI personnel during site visits on August 25, 2022, August 26, 2022, and July 18, 2023. Attention was paid to the contributions from human activity and the sounds of nature. Human activity commonly includes road or rail traffic, industrial and commercial activity.

The sounds of nature include insects, bird calls, frogs, nearby water streams and the wind rustling grass or trees.

At POR locations along Nauvoo Road north of Zion Line, the daytime acoustic environment is dominated by sounds of road traffic on Nauvoo Road, and during pauses in Nauvoo Road traffic, from Highway 402. During nighttime, the acoustic environment is characterized by the dominance of traffic on Highway 402.

At the intersection of Nauvoo Road and Zion Line the sounds of road traffic on Nauvoo Road dominate the daytime acoustic environment with Highway 402 clearly audible otherwise. During nighttime, the environment is characterized by hum from the cell phone tower and traffic on Highway 402.

Along Zion Line more than 300 m east and west of Nauvoo Road, the vehicles on Zion Line dominate the acoustic environment while they are within sight. In their absence the daytime acoustic environment is characterized by a consistent and distant hum from Highway 402. During nighttime, the environment is dominated by Highway 402 noise and fan noise from nearby barns.

Along the portion of Nauvoo Road up to 1.5 km south of Zion Line, the acoustic environment at POR locations is dominated by the sound from Nauvoo Road. During nighttime, the less-frequent Nauvoo Road traffic dominates when it is within sight, with the acoustic environment otherwise consisting of sounds of nature and distant Highway 402 noise.

The remainder of Nauvoo Road southwards to Confederation Line has a daytime acoustic environment that includes Nauvoo Road traffic, the Redi-Mix Concrete plant and maintenance activity at the Watford Ford Lincoln car dealership. During nighttime the less-frequent Nauvoo Road traffic dominates when it is within sight with the acoustic environment otherwise consisting of sounds of nature and distant Highway 402 noise.

At POR locations within the Village of Watford and within 800 m east of Nauvoo Road, the daytime acoustic environment is characterized by sounds of traffic on Nauvoo Road or Confederation Line, the stores lining Nauvoo Road, equipment at the Watford Arena, and Autotube Limited. Train pass-bys on the rail line to the south are clearly audible. During nighttime, especially near Confederation Line, the sounds of nature and a fan at the arena characterized the acoustic environment.

Eastwards along Confederation Line, beyond 800 m from Nauvoo Road, the acoustic environment is characterized by traffic along Confederation Line when it is within sight as well as regular train pass-bys on the rail line to the south. Distant fan noise and the sounds of nature are audible during quiet periods. During nighttime, traffic noise is distant and faint with the acoustic environment dominated by sounds of nature.

4.3 Modelling of Background Sound

The acoustic environment has road traffic noise that elevates the background sound for key representative noise-sensitive POR locations R5 through R10. POR locations R5 through R10 are exposed to the higher traffic volume on Nauvoo Road, while POR locations R1 through R4, and R11 through R13 are further away and are exposed to quieter roads with lower traffic volumes. The background sound has been calculated by modelling using the ORNAMENT algorithms (MOE, 1989), following the requirements of Publication NPC-206 Sound Levels Due to Road Traffic (MOE, 1995b). This road traffic noise includes only the contribution of vehicles from non-landfilling activities. The haul route traffic is not included in the traffic noise modelling for background sound. The modelling took into account the following factors:

- Road traffic parameters including traffic volume and speed limits; and
- Source-receptor characteristics, including heights, distances, and ground type.

Four road segments were modelled:

- Nauvoo Road from Highway 402 Confederation Line;
- Zion Line west of Nauvoo Road;
- Zion Line east of Nauvoo Road; and
- Confederation Line east of Nauvoo Road.

Traffic volumes were obtained from the traffic information provided by HDR while speed limits were confirmed during the July 18, 2023 site visit.

For ancillary sources, daytime, evening and nighttime are defined as the periods of time from 7 AM – 7 PM, from 7 PM – 11 PM, and from 11 PM – 7 AM, respectively, as per NPC-300 (MOE, 2013). For landfilling sources, daytime and nighttime are defined as the periods of time from 7 AM – 7 PM and from 7 PM – 7 AM, respectively, as per the Landfill Noise Guideline (MOE, 2012). These periods were modelled for each road segment using the vehicle traffic volume that was lowest in the time period. POR locations R5 and R6 were modelled using the sum of Nauvoo Road and Zion Line because of their proximity to the intersection. The other POR locations were modelled using the contribution of Nauvoo Road only.

The modelled sound levels during the quietest 1-hour periods of daytime, evening and nighttime traffic noise are tabulated in **Table 4-2**. ORNAMENT calculations are provided in **Appendix D**.

Table 4-2. Modelled Quietest Background Sound Level Due to Traffic (dBA)

POR	Daytime	Evening	Nighttime
	(7 AM – 7 PM)	(7 PM – 11 PM)	(11 PM – 7 AM)
R5	57	51	49
R6	53	48	45
R7	54	48	46
R8	54	49	47
R9	56	50	48
R10	55	49	47

These elevated background sound levels can be used to update the applicable limits used for landfilling (daytime and nighttime) and ancillary sources (daytime, evening and nighttime). This is described further in **Sections 5.1** and **5.4**.

4.4 History of Noise Complaints

The TCEC documents public complaints related to noise. A record of complaints can be found in the annual monitoring reports, which show that there have not been any noise complaints since 2012.

5 Sound Level Criteria

The sound level criteria for this assessment follow the requirements of the MECP's Landfill Noise Guideline (MOE, 2012) and NPC-300. Landfilling, Pest Control Devices and the Haul Route are addressed in the Landfill Noise Guideline. The Landfill Noise Guideline reference guidelines have been superseded by NPC-300 for assessment of ancillary facilities, including the use of emergency equipment in testing and maintenance situations. The applicable limits are summarized in the following sections.

5.1 Landfilling Operations

The Landfill Noise Guideline addresses landfilling by the use of construction equipment and conveyances. The applicable default limits are presented in **Table 5-1.**

Table 5-1. Default Landfilling Sound Level Limits (dBA)

Default Landfilling Limit	
Day (7 AM – 7 PM)	**Night (7 PM – 7 AM)**
55	45

Where background ambient sound levels are elevated due to sources such as road traffic, higher limits that match the elevated background sound levels can be used. The quietest hours of background ambient sound level unrelated to landfilling were modelled for POR locations R5 through R10, as presented in **Section 4.3**. The updated applicable landfilling sound level limits are provided in **Table 5-2**.

Table 5-2. Applicable Landfilling Sound Level Limits (dBA) for Key POR Locations

POR Location	Landfilling Limit	
	Day (7 AM – 7 PM)	**Night (7 PM – 7 AM)**
R1	55	45
R2	55	45
R3	55	45
R4	55	45
R5	57	49
R6	55	45
R7	55	46
R8	55	47
R9	56	48
R10	55	47
R11	55	45

POR Location	Landfilling Limit	
	Day (7 AM – 7 PM)	Night (7 PM – 7 AM)
R12	55	45
R13	55	45

5.2 Pest Control Devices

Pest control devices are subject to limits provided in the Landfill Noise Guideline. Pest control devices relevant to noise can include a propane cannon, and pyrotechnics described as bangers, crackers, whistlers and screamers. The guideline sets the sound level limit for pest control devices at off-site POR locations as a one-hour logarithmic mean impulse level, $L_{LM, 1\text{-}hr}$, of 70 dBAI.

5.3 Haul Route

The Landfill Noise Guideline addresses sound from haul route traffic by requiring that the route be selected to result in the minimum noise impact at POR locations. Unlike other sources of sound at TCEC, no comparison to a set of criteria is mandated; i.e., there are no maximum limits for haul route noise.

5.4 Ancillary Facilities

The sound level limits of NPC-300 are applied for ancillary facilities. NPC-300 sets default limits based on the level of urbanization of the acoustic environment using classes. The classes are defined in the following manner:

- **Class 1 area**: "area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as 'urban hum.'"
- **Class 2 area**: "area with an acoustical environment that has qualities representative of both Class 1 and Class 3 areas:
  - Sound levels characteristic of Class 1 during daytime (07:00 to 19:00 or to 23:00 hours); and
  - Low evening and night background sound level defined by natural environment and infrequent human activity starting as early as 19:00 hours (19:00 or 23:00 to 07:00 hours)."
- **Class 3 area**: "a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as:
  - A small community;
  - Agricultural area;
  - A rural recreational area such as a cottage or a resort area; or

- A wilderness area."

The characterization of the acoustic environments in **Section 4.2** informs the classification of each POR location. The environment at POR locations during daytime are generally dominated by road traffic, while sounds of nature are more prominent during the evening and nighttime. This mixture of human and natural sounds most closely resembles the definition of a Class 2 area. Therefore, all of the POR locations within the Off-site Study Area are considered to have a Class 2 acoustic environment. The default limits for a Class 2 area are provided in **Table 5-3**.

Table 5-3. Default Ancillary Facility Sound Level Limits (dBA)

Acoustic Environment	Ancillary Facility Default Limit (Façade/Outdoor Living Area)		
	Day (7 AM – 7 PM)	Evening (7 PM – 11 PM)	Night (11 PM – 7 AM)
Class 2	50/50	50/45	45/-

Similar to the landfilling operations, where the quietest background ambient sound levels are elevated due to non-landfill related noise sources, such as road traffic, the sound level limits are the quietest background ambient sound levels. The quietest hours of background ambient sound level unrelated to landfilling were modelled for POR locations R5 through R10, as presented in **Section 4.3**. The updated applicable landfilling sound level limits are provided in **Table 5-4**.

Table 5-4. Applicable Ancillary Facility Sound Level Limits (dBA)

POR Location	Ancillary Facility Limit		
	Day (7 AM – 7 PM)	Evening (7 PM – 11 PM)	Night (11 PM – 7 AM)
R1	50	45	45
R2	50	45	45
R3	50	45	45
R4	50	45	45
R5	57	51	49
R6	53	48	45
R7	54	48	46
R8	54	49	47
R9	56	50	48
R10	55	49	47
R11	50	45	45
R12	50	45	45
R13	50	45	45

5.5 Emergency Sources

Emergency equipment being operated for testing or maintenance is assessed separately from other sources of sound under NPC-300. It is subject to limits that are 5 dB greater than the limits for ancillary facilities as shown in **Table 5-4**.

6 Current Existing Conditions

The sound from landfilling as it occurred on August 25, 2022 and August 26, 2022 at existing noise-sensitive PORs in association with the 2022 Acoustic Audit (RWDI, 2023a). The current POR numbering of this report is used instead of the numbering used in the 2022 Acoustic Audit.

At R1, audit measurements were dominated by sounds of nature, passing traffic on Zion Line, and nearby mechanical equipment related to the greenhouse. Cricket chirping was constantly audible.

Other sounds of nature, such as birds chirping, were present, as well as occasionally audible construction activity from a bulldozer at the landfill gravel pile. Measurements were paused during periods of vehicle traffic on nearby Zion Line. The average measured sound level was 50 dBA, although the sound levels were between 45 and 47 dBA during lulls in gravel stockpile activity. The dominant sound being the nearby mechanical equipment at the nearby greenhouse.

Audit measurements at R2 were not dominated by any one source, but were affected collectively by sounds of nature, such as the constant chirping of crickets, occasional cicada buzzing, birds chirping, and leaves rustling; semi-constant sounds of vehicle traffic in the distance; and frequent landfill sources, such as bulldozer tracks and back-up beepers. Measurements were paused to ensure the occasional vehicle traffic on Zion Line was not included in the measurements. Average measured sound levels during lulls in traffic were 49 to 50 dBA.

Sounds of nature and passing traffic on Nauvoo Road dominated the audit at R7. The chirping of crickets was constantly audible, with other sounds of nature such as birds chirping also present. The sound of accelerating trucks and some vehicle activity from on-site landfill vehicles was also audible. Measurements were paused for an overhead aircraft. Road-noise contributions were calculated based on observed traffic volume and subtracted from the overall background sound levels. Average sound levels without road traffic were 49 dBA.

At R11, audit measurements were dominated by sounds of nature, passing traffic on Confederation Line, and equipment from the facilities across the road to the south, notably Autotube Limited and Watford Arena. Traffic counts were conducted, used to calculate road-noise contributions, and the road noise subtracted from the overall background sound levels. Average sound levels in the absence of road traffic were 47 dBA. Cricket chirping was constantly audible. Other sounds of nature, such as birds chirping and dogs barking, were present, as well as trucks and fans at an industry

on the south side of Confederation Line. A distant loader and back-up beeper in the direction of the nearby subdivision were audible. Sound from the area of the landfill was not audible during this measurement.

At all other PORs discussed in the audit report, audited levels attributed to landfilling did not exceed the applicable limits.

7 Future of Existing Operations Modelling

This section presents the results for the future state of the landfill based on the existing conditions modelling for the final landfill phase of the current TCEC. This corresponds to the conditions present at the start of the Landfill Optimization Project. The Effects Assessment will be completed using the modelling presented in this section.

7.1 On-Site Source Modelling

7.1.1 Landfilling

Existing noise from the site was modelled at the final TCEC landfilling phase that is currently permitted, with landfilling occurring roughly at the highest point of the landfill at an elevation of 278 m. After landfilling is complete, approximately 2 m of cover soil will be added, bringing the total final height of the landfill to 280 m. However, since the addition of cover soil is not considered landfilling, this modelling will consider sources up to 278 m, only.

Landfilling modelled sound level results are presented in **Table 7-1**, for key POR locations. Sound from landfilling will not always be at the predicted sound levels but will be quieter at times due to the temporal and spatial variability of landfilling. Nighttime landfilling is not expected so only daytime levels are presented. The landfill equipment quantities, types, hours of operation and overall sound level were provided in **Table 8-1** of the Noise Impact Assessment (AEL, 2007). On-site truck traffic was also modelled as shown in **Figure A1a** of **Appendix A**. Note that the limit values are those presented in **Table 5-2**. Results for the remaining POR locations are provided in **Appendix A**.

Table 7-1. Existing Landfilling Sound Levels (dBA)

POR Location	Predicted Levels	Landfilling Limit
	Day 1.5 m / 4.5 m	Day
R1	42 / 46	55
R2	46 / 47	55
R3	48 / 49	55
R4	48 / 49	55
R5	48 / 49	57

POR Location	Predicted Levels	Landfilling Limit
	Day 1.5 m / 4.5 m	Day
R6	48 / 51	55
R7	53 / 55	55
R8	53 / 54	55
R9	51 / 53	56
R10	45 / 48	55
R11	38 / 39	55
R12	37 / 38	55
R13	36 / 37	55

7.1.2 Ancillary Facilities

Ancillary facilities include the public waste drop-off, generators used for non-emergency purposes, flares, and the planned RNG Facility. Noise from the planned RNG Facility operation was described in the report Noise Assessment Environmental Centre Renewable Natural Gas Facility (RWDI, 2023b). All other ancillary facilities were modelled according to the sound levels measured during the RWDI audits on August 2, 2018, August 25, 2022, and August 26, 2022. The modelling results for key POR locations are shown in **Table 7-2**. Note that the limit values are those presented in **Table 5-4**. Results for the remaining POR locations are provided in **Appendix A**.

Table 7-2. Existing Ancillary Facilities Sound Levels (dBA)

POR Location	Ancillary Facilities Predicted Levels			Ancillary Facilities Limits		
	Day 1.5 m / 4.5 m	Evening 1.5 m / 4.5 m	Night 1.5 m / 4.5 m	Day	Evening	Night
R1	31 / 32	31 / 32	31 / 32	50	45	45
R2	32 / 33	32 / 33	32 / 33	50	45	45
R3	30 / 32	30 / 32	30 / 32	50	45	45
R4	31 / 33	31 / 33	31 / 33	50	45	45
R5	29 / 34	29 / 34	29 / 34	57	51	49
R6	32 / 34	32 / 34	32 / 34	53	48	45
R7	35 / 37	35 / 37	35 / 37	54	48	46
R8	37 / 39	37 / 39	37 / 39	54	49	47
R9	38 / 39	38 / 39	38 / 39	56	50	48
R10	40 / 42	40 / 42	40 / 42	55	49	47
R11	32 / 33	32 / 33	32 / 33	50	45	45
R12	32 / 32	32 / 32	32 / 32	50	45	45
R13	30 / 31	30 / 31	30 / 31	50	45	45

7.1.3 Emergency Sources

The TCEC site includes both generators used solely for emergency purposes as well as those used for non-emergency purposes. The emergency generators are diesel emergency generator located to the south of the RNG Facility, which are associated with the planned RNG Facility as described in the report Noise Assessment Environmental Centre Renewable Natural Gas Facility (RWDI, 2023b). The modelling results for key POR locations are shown in **Table 7-3**. Note that the limit values are established in **Section 5.5**. Results for the remaining POR locations are provided in **Appendix A**.

Table 7-3. Existing Emergency Source Testing (dBA)

POR Location	Existing Emergency Source Testing			Existing Emergency Source Limits		
	Day 1.5 m / 4.5 m	Evening 1.5 m / 4.5 m	Night 1.5 m / 4.5 m	Day	Evening	Night
R1 - R4	NA[a]	NA	NA	55	50	50
R5	NA	NA	NA	62	56	54
R6	NA	NA	NA	58	53	50
R7	NA	NA	NA	59	53	51
R8	NA	NA	NA	59	54	52
R9	6 / 7	6 / 7	6 / 7	61	55	58
R10	20 / 22	20 / 22	20 / 22	60	54	52
R11	12 / 13	12 / 13	12 / 13	55	50	50
R12	10 / 11	10 / 11	10 / 11	55	50	50
R13	12 / 13	12 / 13	12 / 13	55	50	50

Note [a] NA indicates that the sound level is below the threshold of human audibility.

7.1.4 Pest Control Devices

The pest control devices available to WM were modelled using data from the Noise Impact Assessment (AEL, 2007), with supplementary acoustic description taken from RWDI audits on August 2, 2018, August 25, 2022, and August 26, 2022. Pest control devices were established as impulsive control devices and therefore the limit of 70 applies.

The propane cannon is not currently used but was modelled at the last location of its use. Pest control devices are used during daytime only. The results for key POR locations are shown in **Table 7-4**. Results for the remaining POR locations are provided in **Appendix A**.

Table 7-4. Existing Pest Control Devices Sound Levels (dBAl)

POR Location	Pest Control Device Sound Level				Pest Control Device Limit
	Propane Cannon 1.5 m / 4.5m	Whistler Cartridge 1.5 m / 4.5m	Cracker Cartridge 1.5 m / 4.5m	Electronic Distress 1.5 m / 4.5m	
R1	20 / 29	40 / 41	39 / 44	41 / 42	70
R2	25 / 26	41 / 41	45 / 45	45 / 45	70
R3	26 / 27	43 / 43	47 / 48	46 / 47	70
R4	38 / 40	43 / 48	47 / 48	46 / 47	70
R5	40 / 40	47 / 47	47 / 51	46 / 46	70
R6	40 / 40	46 / 47	50 / 51	45 / 46	70
R7	46 / 46	50 / 51	55 / 55	49 / 49	70
R8	50 / 51	49 / 50	54 / 55	48 / 48	70
R9	50 / 51	47 / 48	52 / 52	46 / 47	70
R10	47 / 48	42 / 42	45 / 45	42 / 43	70
R11	36 / 38	33 / 34	33 / 34	35 / 36	70
R12	34 / 36	32 / 33	32 / 33	35 / 35	70
R13	29 / 30	30 / 32	30 / 31	34 / 34	70

7.2 Haul Route Modelling

Noise modelling for the off-site haul route was completed using a spreadsheet model of the ORNAMENT algorithms, following the requirements of NPC-206.

The modelling took into account the following factors:

- Road traffic parameters including traffic volume and speed limits, as provided by HDR; and
- Source-receptor characteristics, including heights, distances and ground type.

ORNAMENT calculations are provided in **Appendix D**.

The haul route considered is from Highway 402 to the TCEC entrance. Sound levels were modelled for each of the noise-sensitive receptors shown in **Figure 7-1** below. The daytime and nighttime hour with the highest total traffic volume were each modelled. The highest daytime traffic occurs between 11 AM and 12 PM. Although landfill traffic occurs primarily during the daytime, some landfill traffic occurs prior to the opening of the landfill at 7 AM. The total traffic during the 6 AM to 7 AM nighttime hour was modelled. The current sound levels will be compared with the future sound levels. Results are shown in **Table 7-5**.

Figure 7-1. Noise-Sensitive POR Locations along Haul Route

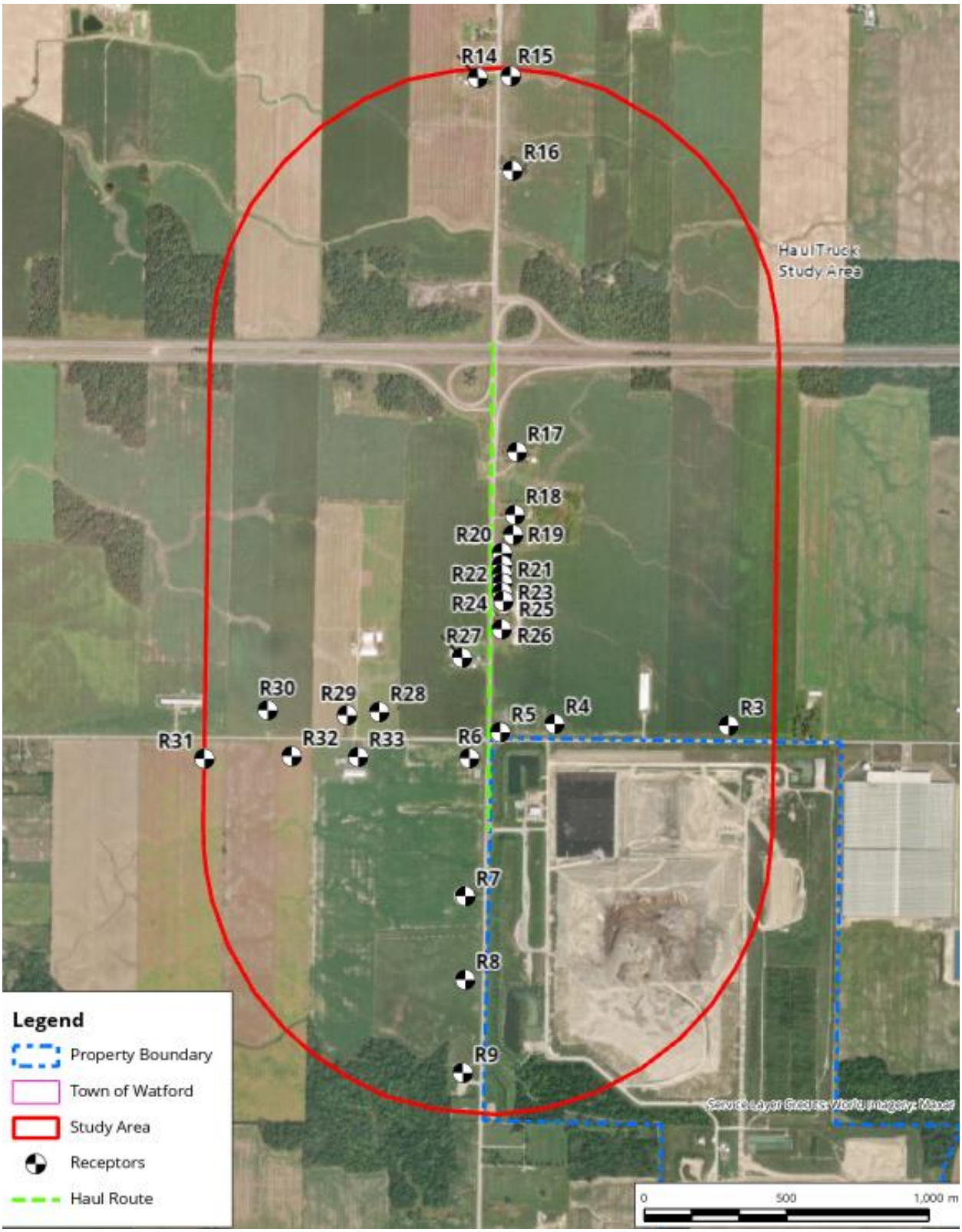


Table 7-5. Existing Haul Route Sound Levels (dBA)

Route	Receptor	Distance	Daytime (1.5 m)	Daytime (4.5 m)	Nighttime (1.5 m)	Nighttime (4.5 m)
Haul Route	R3	843	40	42	35	37
	R4	229	51	52	46	48
	R5	40	64	65	59	60
	R6	67	60	61	56	56
	R7	78	45	47	41	42
	R8	74	41	42	36	37
	R9	78	38	39	33	34
	R14	67	35	36	30	32
	R15	49	37	39	32	34
	R16	59	42	44	37	39
	R17	86	59	59	54	55
	R18	81	59	60	54	55
	R19	76	60	60	55	56
	R20	39	64	65	59	60
	R21	39	64	65	59	60
	R22	40	64	65	59	60
	R23	41	64	65	59	60
	R24	41	64	65	59	60
	R25	44	63	64	59	59
	R26	40	64	65	59	60
	R27	98	58	59	53	54
	R28	387	47	48	42	44
	R29	498	45	46	40	41
	R30	778	41	43	36	38
	R31	999	38	40	33	35
	R32	693	42	43	37	38
	R33	459	45	47	40	42

8 Summary of Existing Conditions

The existing acoustic environment as well as the landfill and haul route sound levels associated with the current approvals have been described. The acoustic environment at POR locations during daytime is generally dominated by road traffic, while sounds of nature are more prominent during the evening and nighttime. This mixture of human and natural sounds most closely resembles the definition of a Class 2 area. As a result, all POR locations are considered to have a Class 2 acoustic environment.

Key representative POR locations were chosen that most accurately represent existing facility sound levels in each of the cardinal directions and are expected to have the predictable worst-case future sound influence around the TCEC. At these key PORs, modelled existing sound levels:

- From landfilling ranged from 36 – 53 dBA;
- From ancillary facilities ranged from 29 – 42 dBA;
- From emergency sources were less than 25 dBA; and
- From pest control devices ranged from 20 – 55 dBAI.

Haul route modelling of existing sound levels was also completed. At the nearest houses, the haul route modelled sound levels ranged from 62 – 66 dBA.

9 References

Aercoustics Engineering Limited (AEL)

2007 Proposed Expansion of WM Warwick Landfill: Noise Impact Assessment

Henderson Paddon & Associates Limited (HPAL)

2008 Development & Operations Report Warwick Landfill Expansion

Ministry of the Environment (MOE)

1977a Publication NPC-101: Technical Definitions, originally published as part of the Model Municipal Noise Control By-Law

1977b Publication NPC-102: Instrumentation, originally published as part of the Model Municipal Noise Control By-Law

1977c Publication NPC-103: Procedures, originally published as part of the Model Municipal Noise Control By-Law

1977d Publication NPC-104: Sound Level Adjustments, originally published as part of the Model Municipal Noise Control By-Law

1995a Publication NPC-205: Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban)

1995b Publication NPC-206: Sound Levels Due to Road Traffic

1995c Publication NPC-232: Sound Level Limits for Stationary Sources in Class 3 Areas (Rural)

1995d Publication NPC-233: Information to be Submitted for Approval of Stationary Sources of Sound

1998 Noise Guidelines for Landfill Sites (October 1998 Draft)

2012 Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites

2013 Publication NPC-300: Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning

RWDI

2018 Twin Creeks Environmental Centre: Acoustic Audit

2023a Twin Creeks Environmental Centre: Acoustic Audit

2023b Noise Assessment for the Twin Creeks Environmental Centre Renewable Natural Gas Facility

2023c Volume 2C of the 2022 Compliance Monitoring Report

Waste Management of Canada Corporation (WM)

2022 Terms of Reference: Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WSP

2023 Landfill Base Preparation Cell 6B

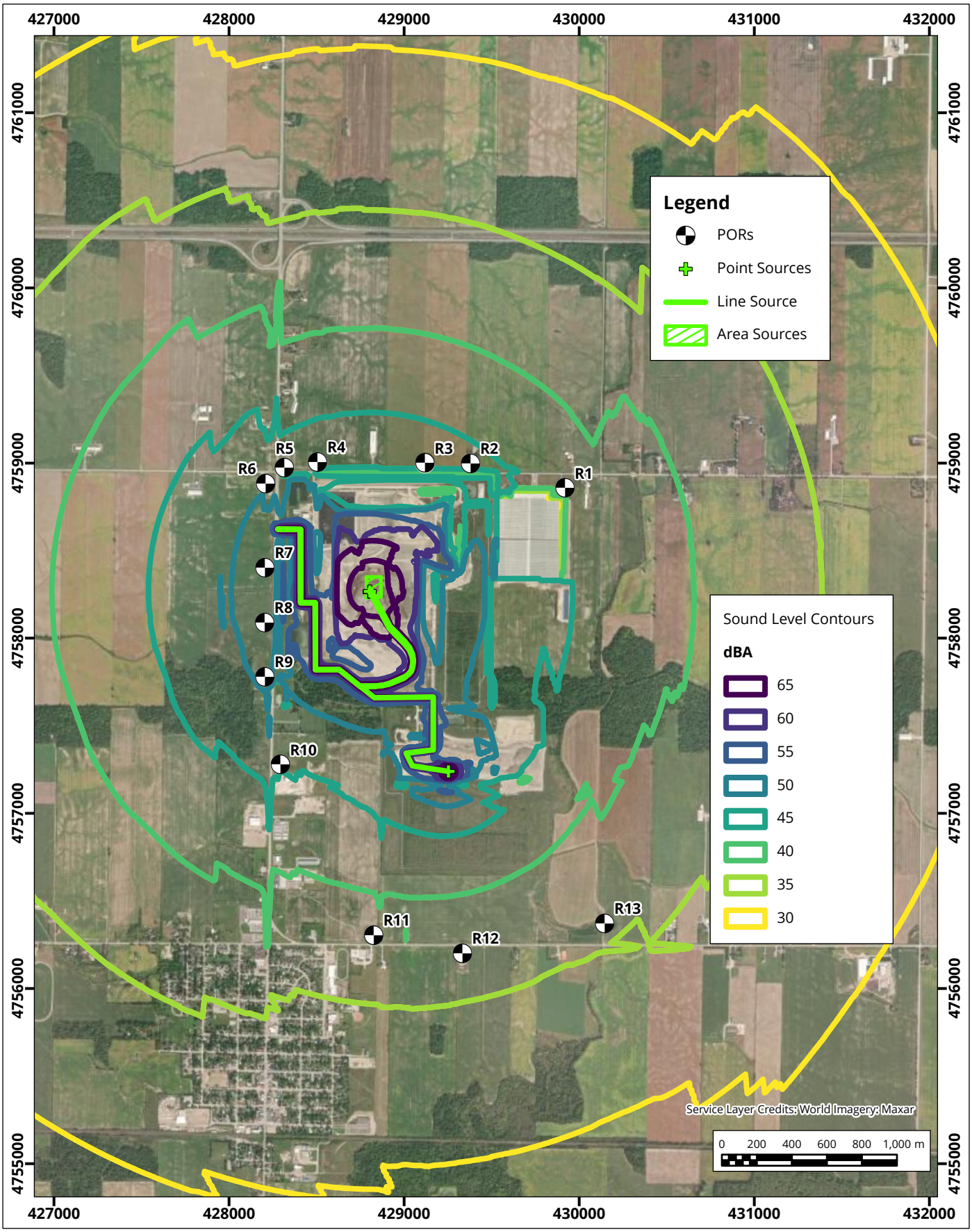
10 Statement of Limitations

This report entitled Noise Existing Conditions Report was prepared by RWDI AIR Inc. ("RWDI") for Waste Management of Canada Corporation ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the Project described herein ("Project"). The conclusions contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final assumptions and information for the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the Project to verify that the results provided in this report have been correctly interpreted in the final design of the Project.

The conclusions contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions in this report carefully review the stated assumptions contained herein to understand the different factors which may impact the conclusions provided.

APPENDIX A



Predicted Landfill Sources Sound Level Contours, Daytime, 1.5 m Contour Height

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A1a
Approx. Scale:	1:30,000
Date Revised:	Jul 28, 2023

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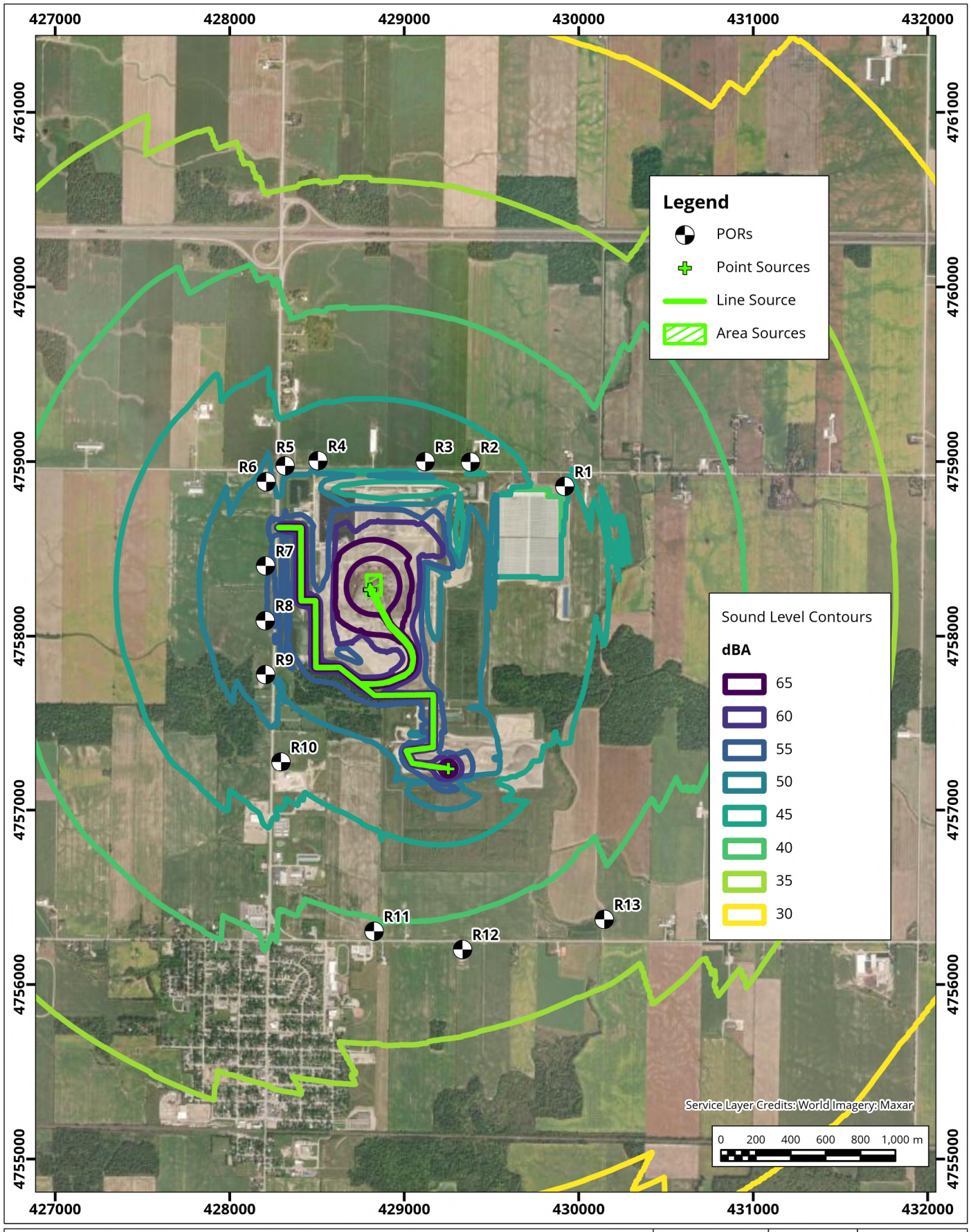

Predicted Landfill Sources Sound Level Contours, Daytime, 4.5 m Contour Height

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A1b
Approx. Scale:	1:30,000
Date Revised:	Jun 28, 2024

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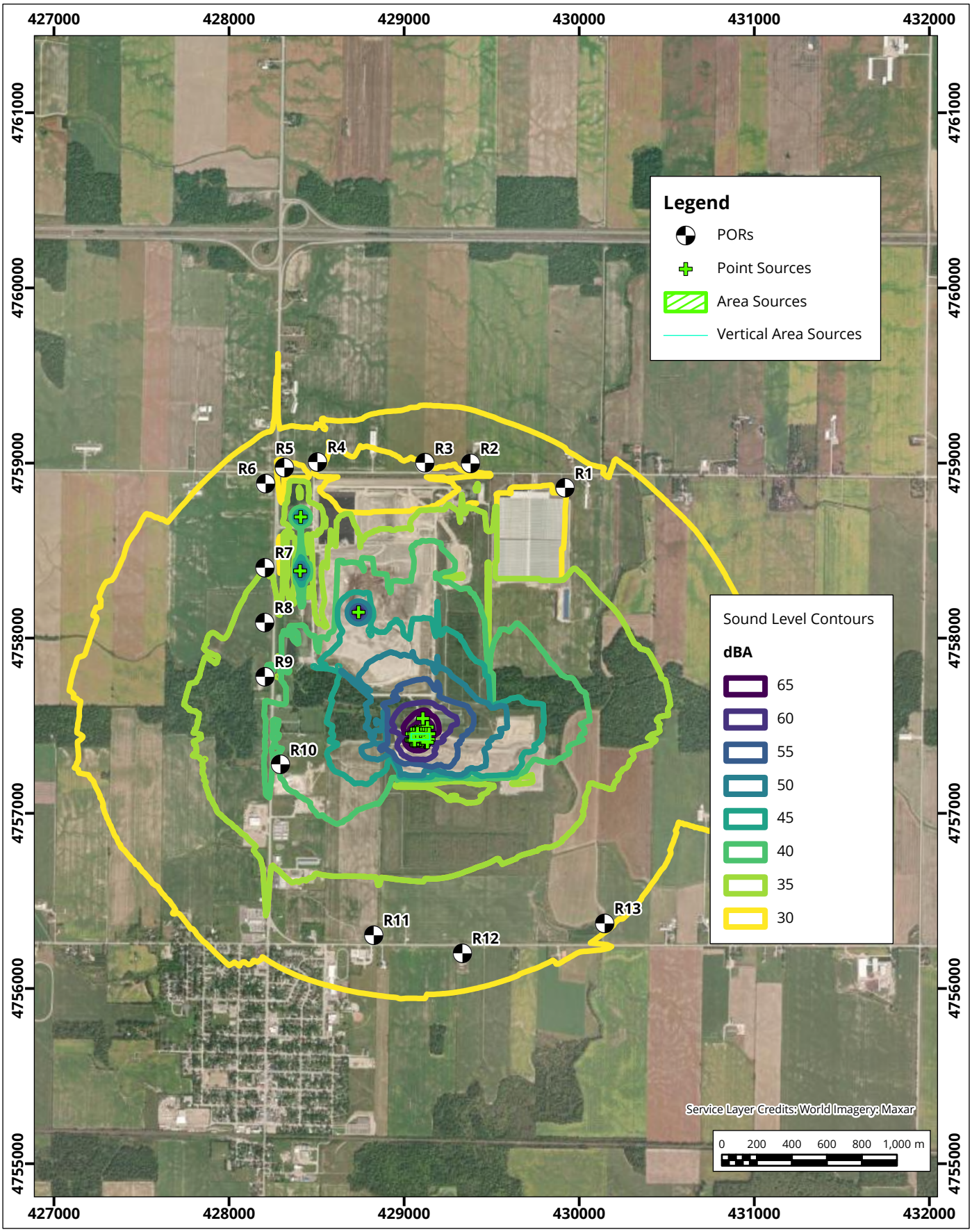

Predicted Ancillary Sources Sound Level Contours, Daytime/Evening/Nighttime, 1.5 m Contour Height

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by:	JM	Figure:	A2a
Approx. Scale:	1:30,000		
Date Revised:	Jul 28, 2023		

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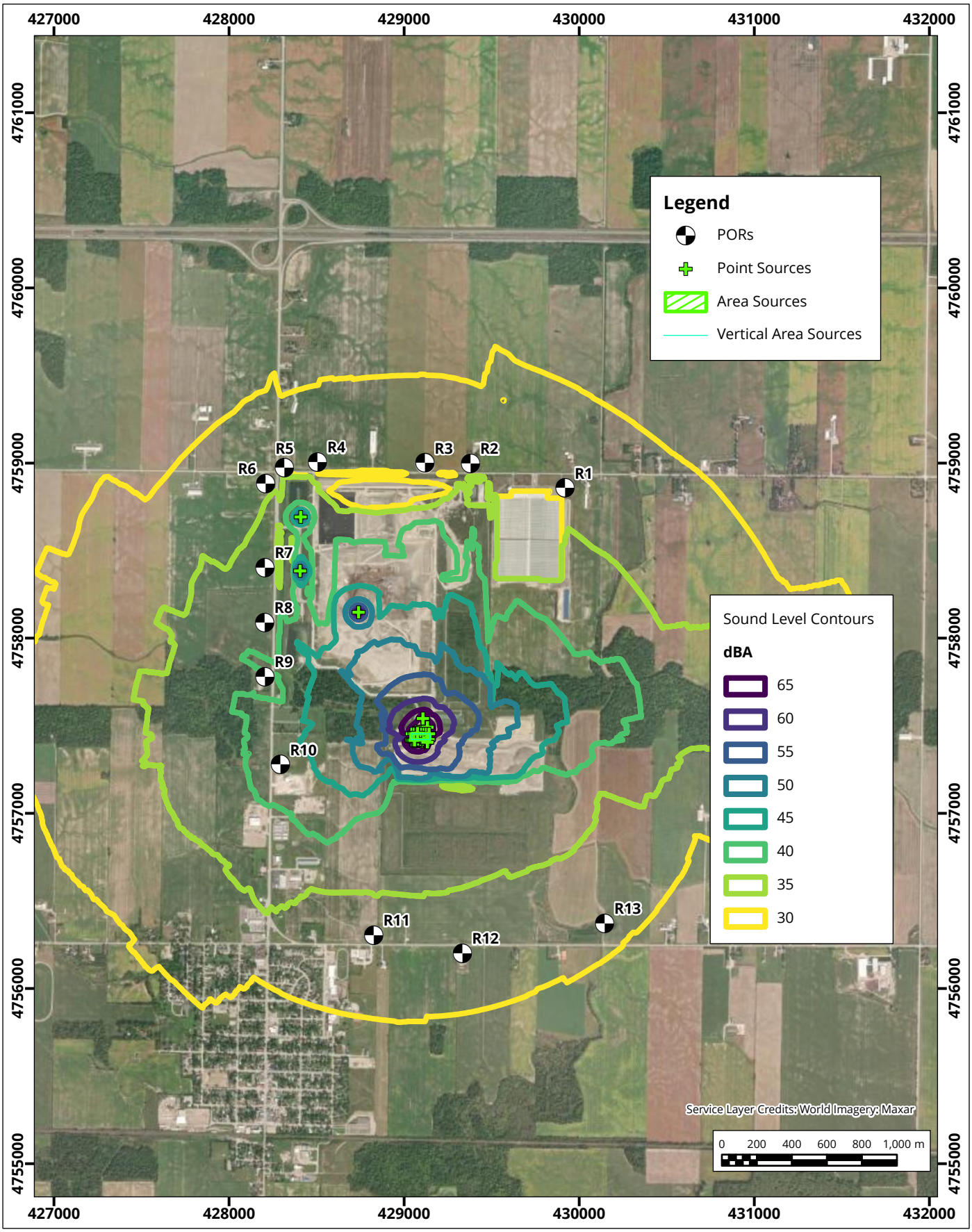


Predicted Ancillary Sources Sound Level Contours, Daytime/Evening/Nighttime, 4.5 m Contour Height

True North

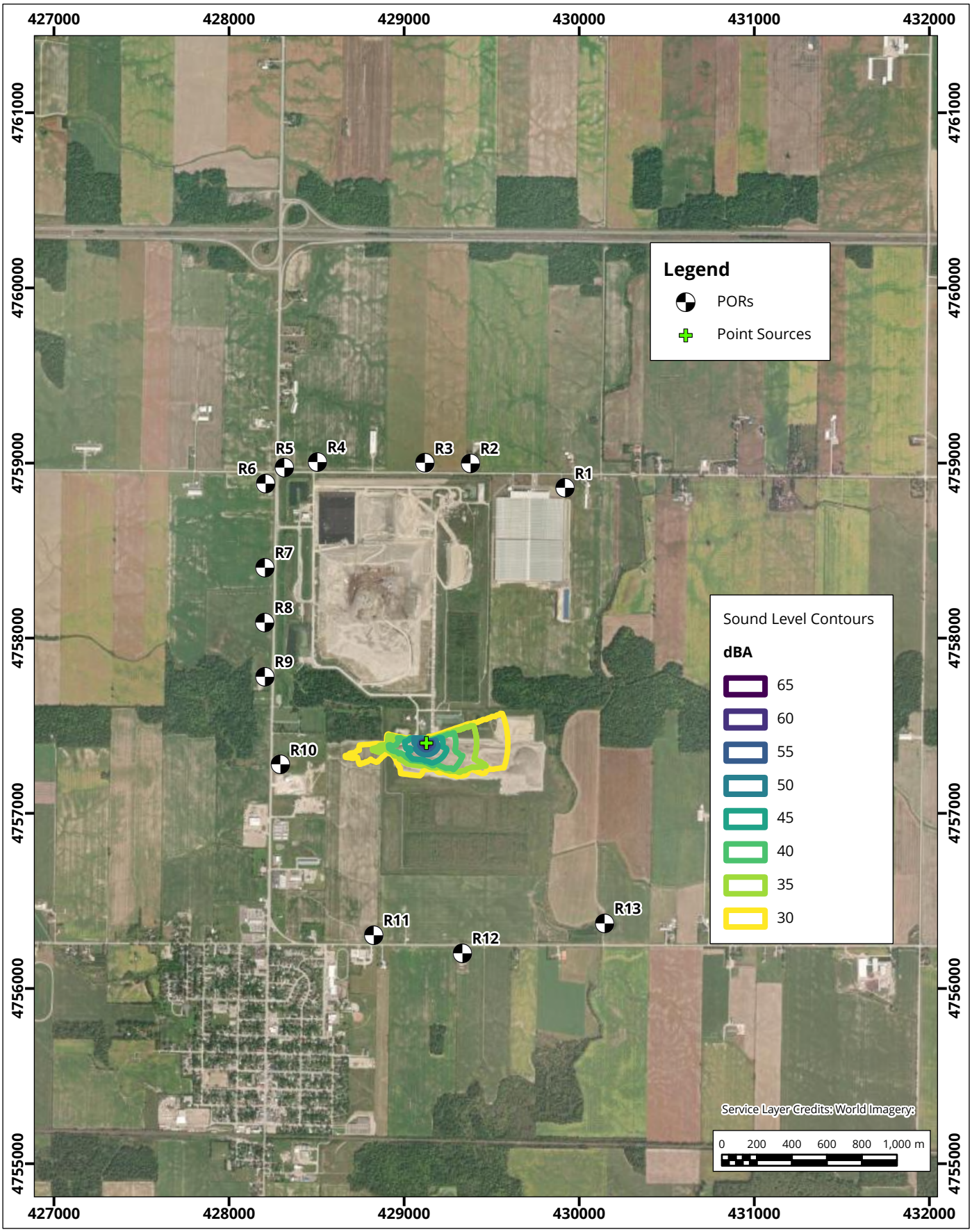
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A2b
Approx. Scale:	1:30,000
Date Revised:	Jul 28, 2023

Map Document: \\rwdigroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Ancillary EveningNighttime.aprx



Predicted Emergency Sources Sound Level Contours, Daytime/Evening/Nighttime, 1.5 m Contour Height

True North

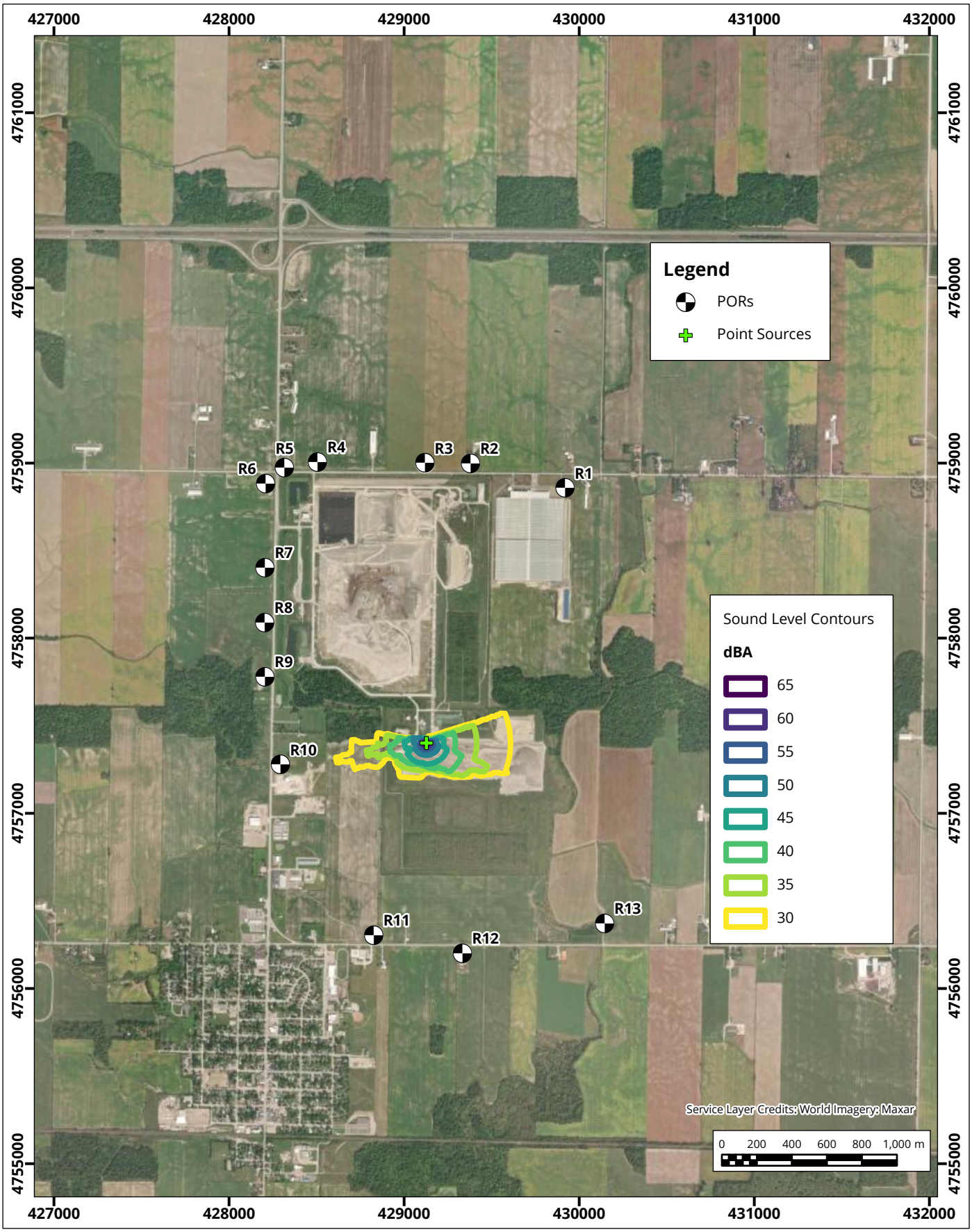
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by:	JM	Figure:	A3a
Approx. Scale:	1:30,000		
Date Revised:	Jul 28, 2023		

Map Document: \\rwdigroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Emergency Daytime Template.aprx



Predicted Emergency Sources Sound Level Contours, Daytime/Evening/Nighttime, 4.5 m Contour Height

True North

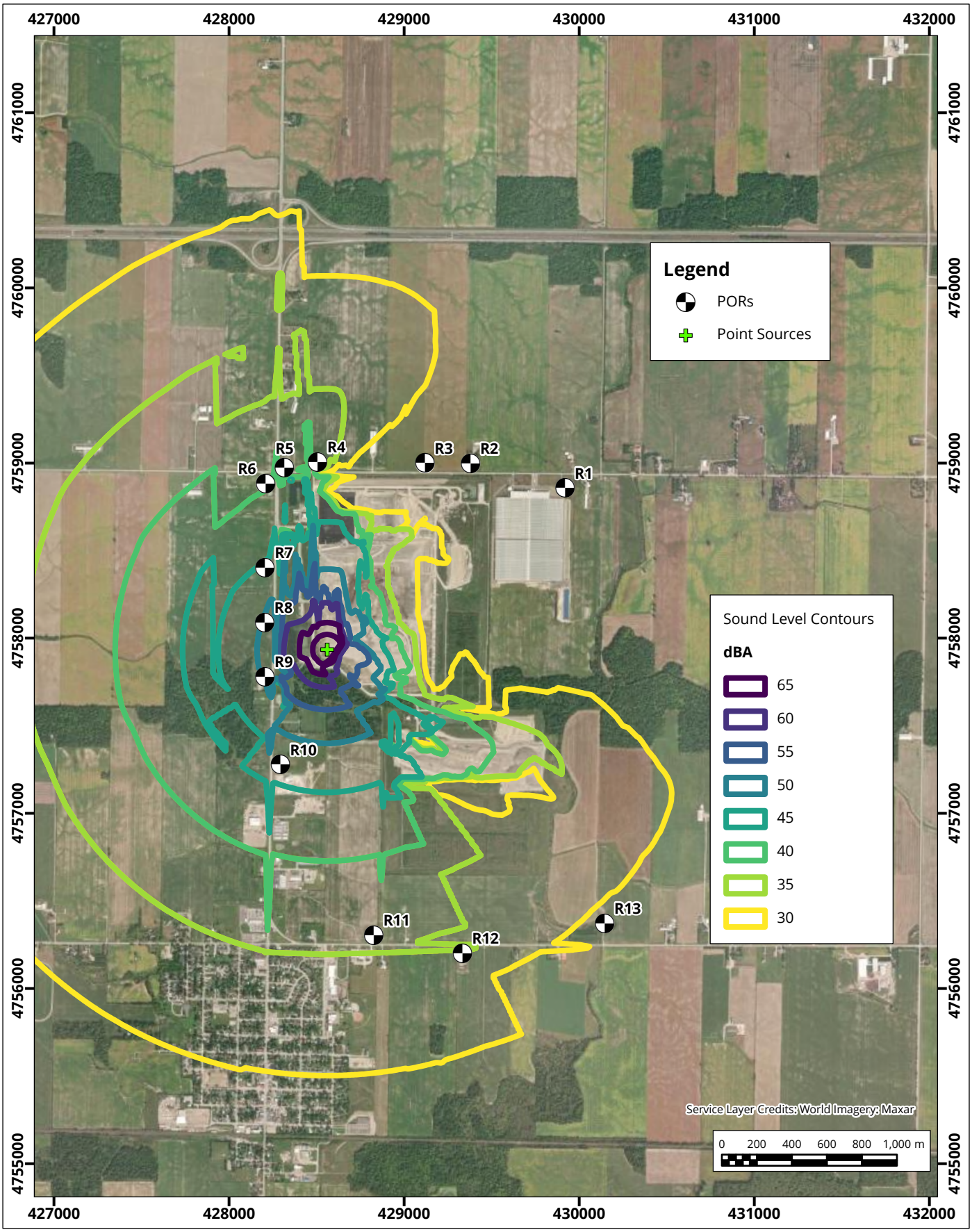
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by:	JM	Figure:	A3b
Approx. Scale:	1:30,000		
Date Revised:	Jul 28, 2023		

Map Document: \\rwdigroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Emergency EveningNighttime.aprx



Predicted Propane Cannon Sound Level Contours, Daytime, 1.5 m Contour Height

True North

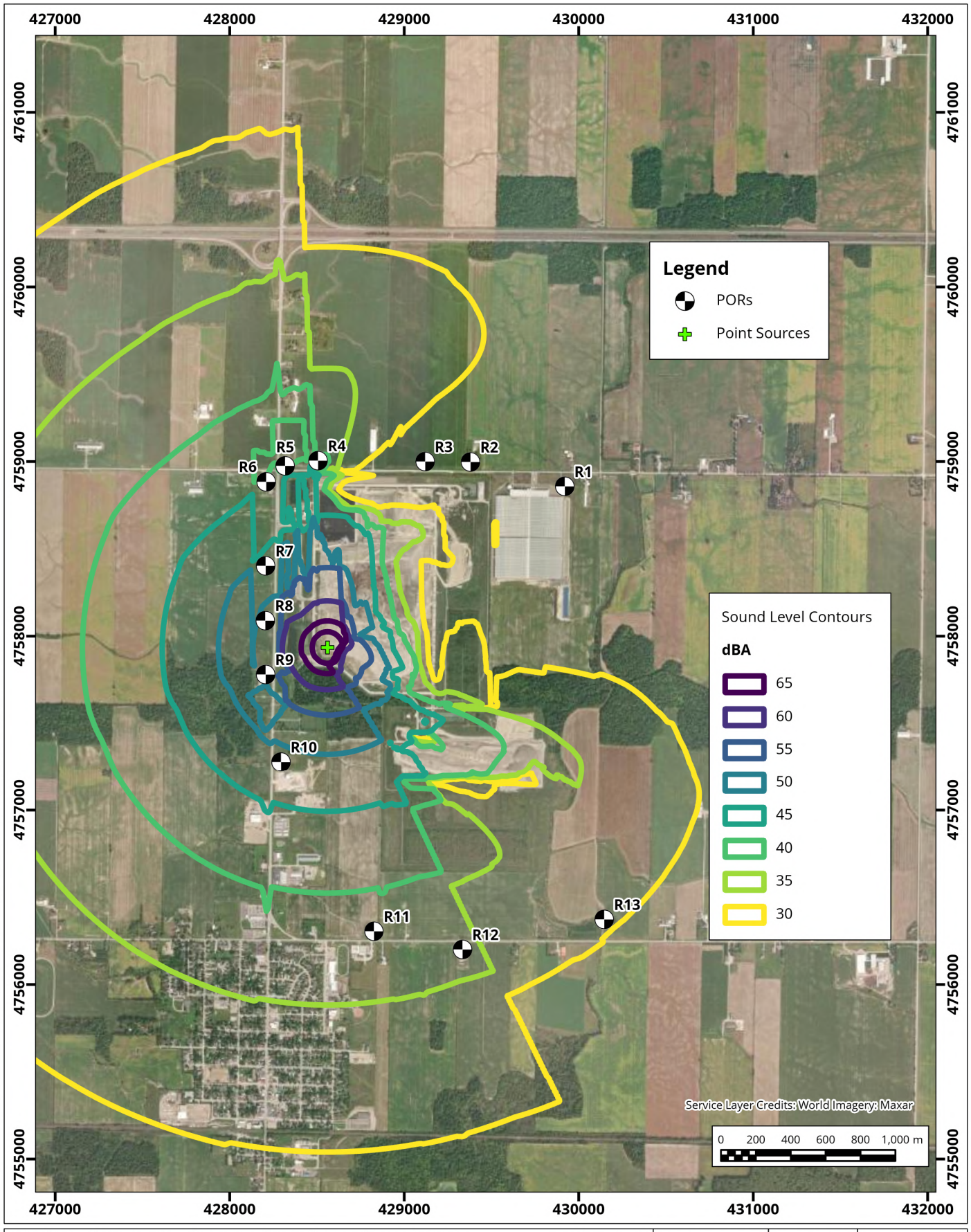
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A4a
Approx. Scale:	1:30,000
Date Revised:	Jul 28, 2023

Map Document: \\rwdgroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0ArchiveFigures\20230720 Twin Creeks\Propane Cannon Daytime.aprx



Predicted Propane Cannon Sound Level Contours, Daytime, 4.5 m Contour Height

True North

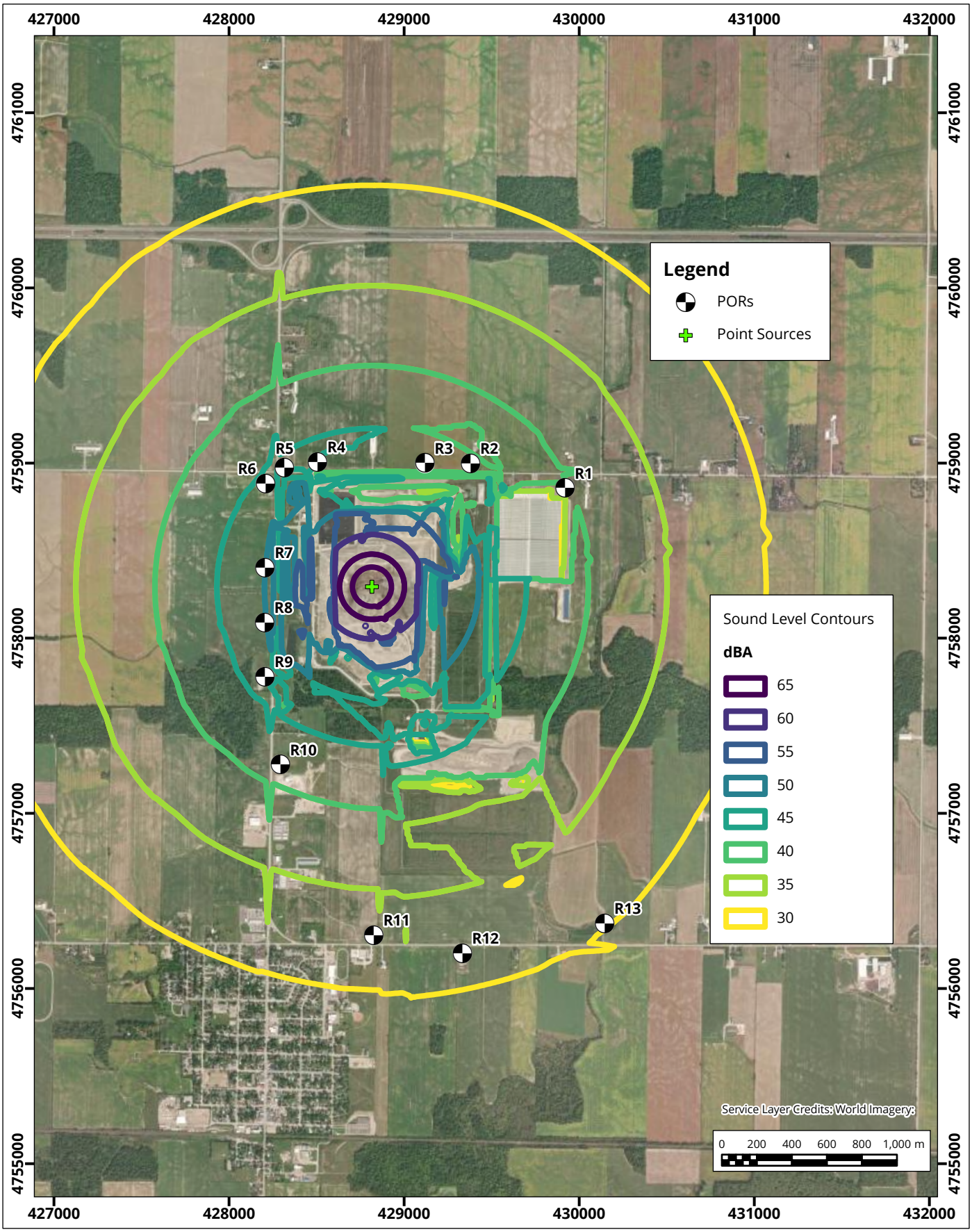
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A4b
Approx. Scale:	1:30,000
Date Revised:	Jun 27, 2024

Map Document: \\gue-nsif-f01\wlam-jobs-dfs\jobs\2021\2101750\6. Deliverables\20230731 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Propane Cannon Daytime.aprx



Predicted Whistler Sound Level Contours, Daytime, 1.5 m Contour Height

True North

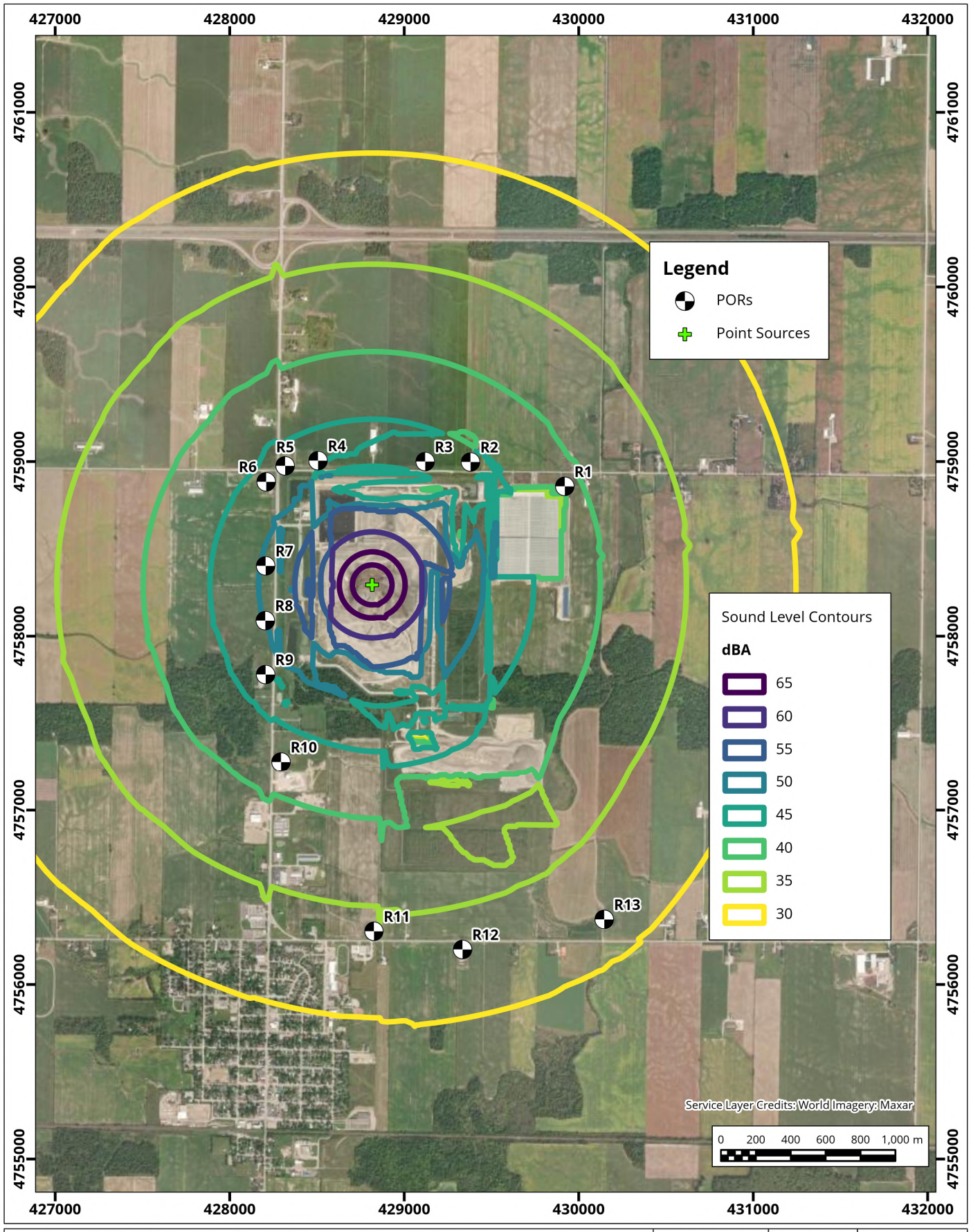
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by:	JM	Figure:	A5a
Approx. Scale:	1:30,000		
Date Revised:	Jul 28, 2023		

Map Document: \\rwdgroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0ArchiveFigures\20230720 Twin Creeks\Whistler Daytime.aprx



Predicted Whistler Sound Level Contours, Daytime, 4.5 m Contour Height

True North

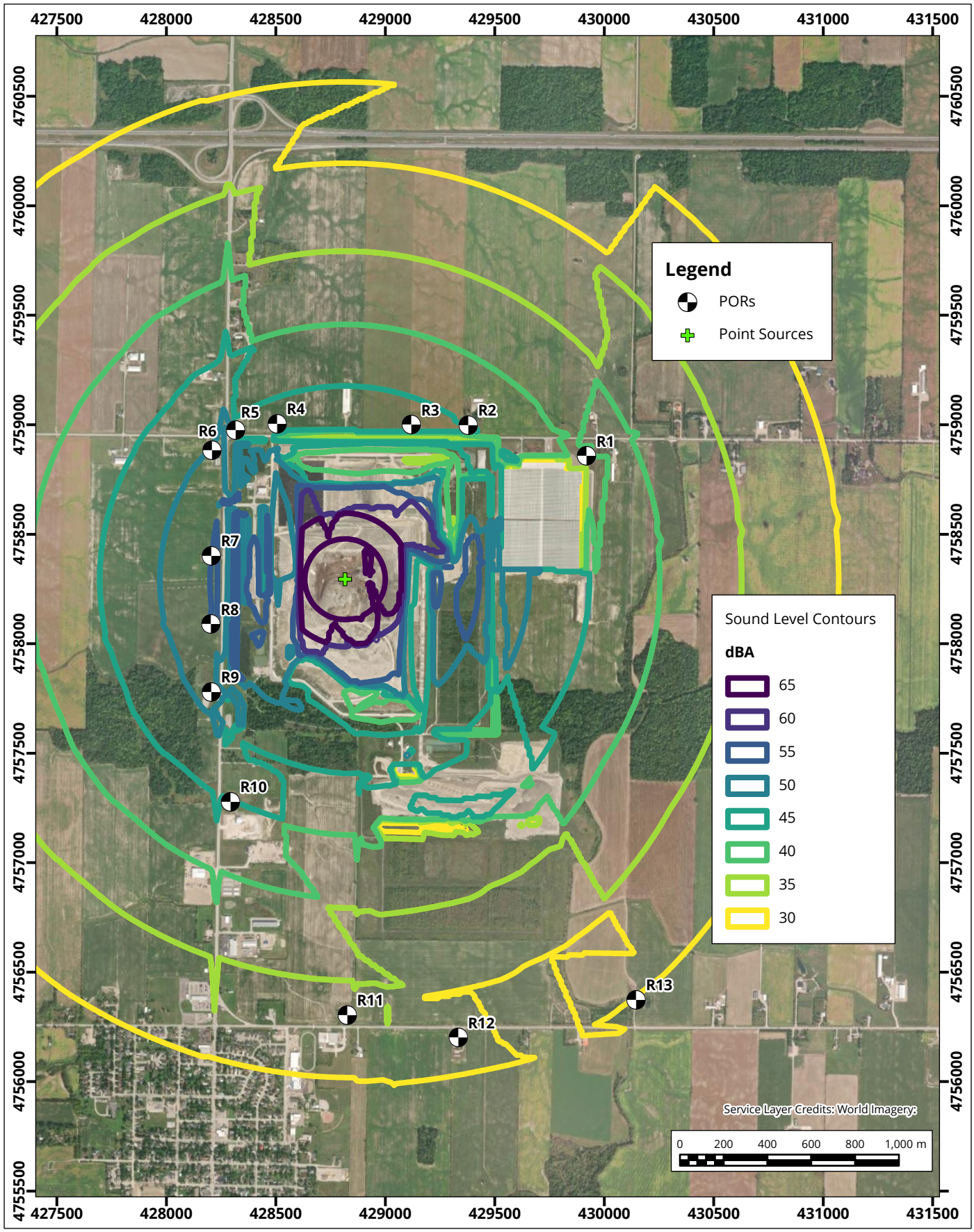
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A5b
Approx. Scale:	1:30,000
Date Revised:	Jun 27, 2024

Map Document: \\gue-nsif-f01\wolam-jobs-dfs\jobs\2021\2101750\6. Deliverables\20230731 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Whistler Daytime 4.5.aprx



Predicted Cracker Sound Level Contours, Daytime, 1.5 m Contour Height

True North

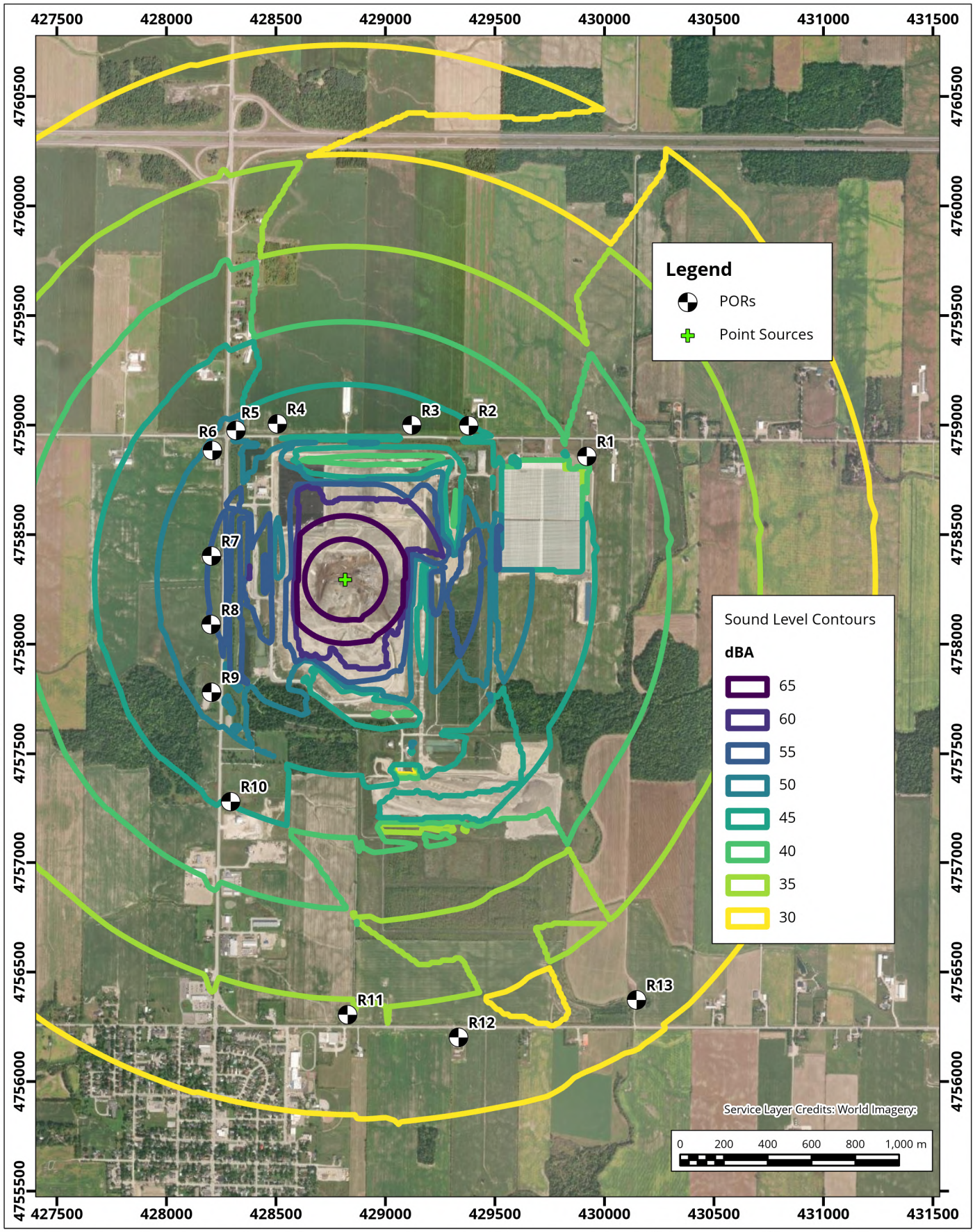
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by:	JM	Figure:	A6a
Approx. Scale:	1:24,000		
Date Revised:	Jul 28, 2023		

Map Document: \\rwdgroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0ArchiveFigures\20230720 Twin Creeks\Cracker Daytime.aprx



Predicted Cracker Sound Level Contours, Daytime, 4.5 m Contour Height

True North

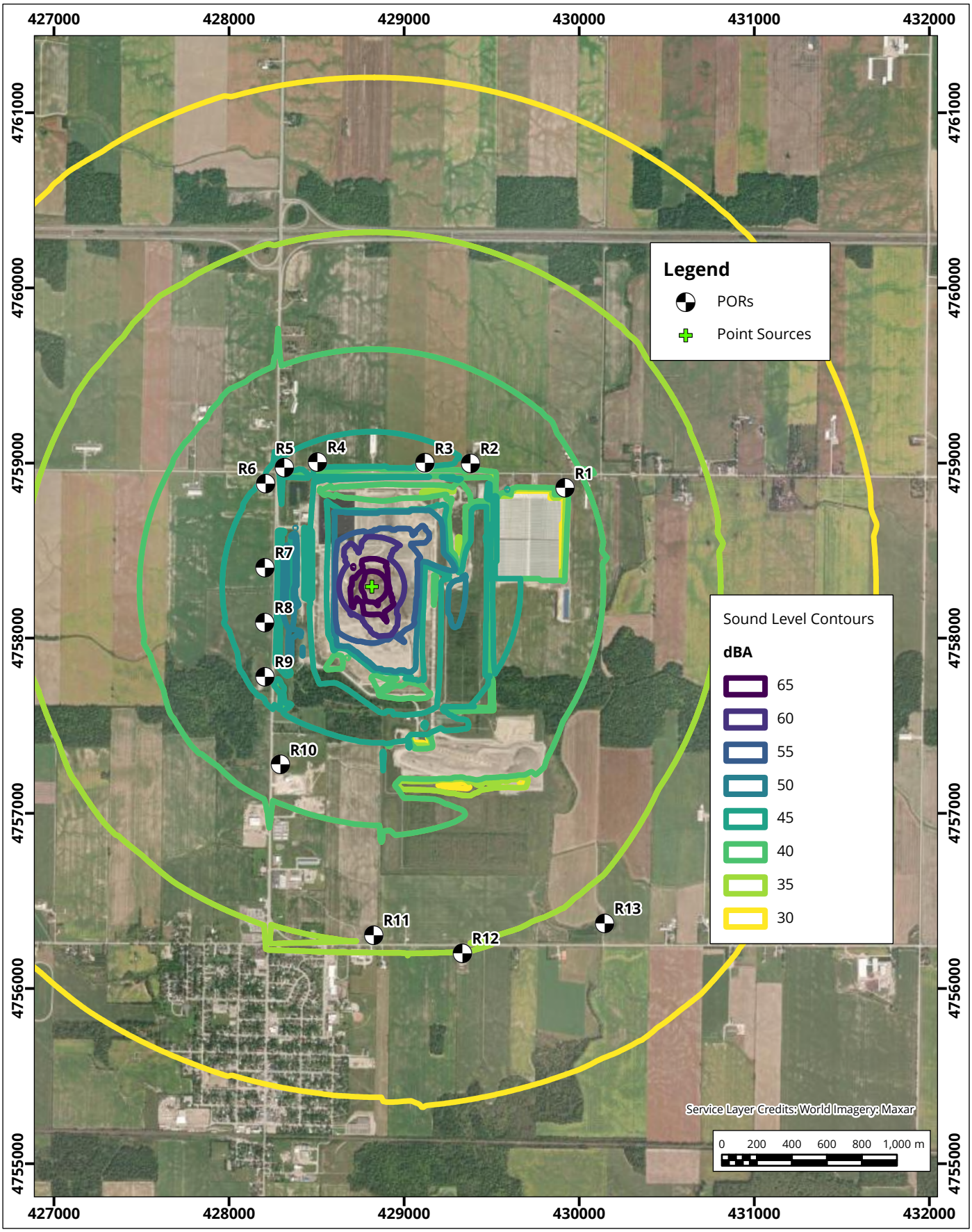
Drawn by: JM	Figure: A6b
Approx. Scale:	1:24,000
Date Revised:	Jun 27, 2024

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Map Document: \\gue-nsif-f01\wolam-jobs-dfs\jobs\2021\2101750\6. Deliverables\20230731 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Cracker Daytime.aprx



Predicted Electronic Distress Sound Level Contours, Daytime, 1.5 m Contour Height

True North

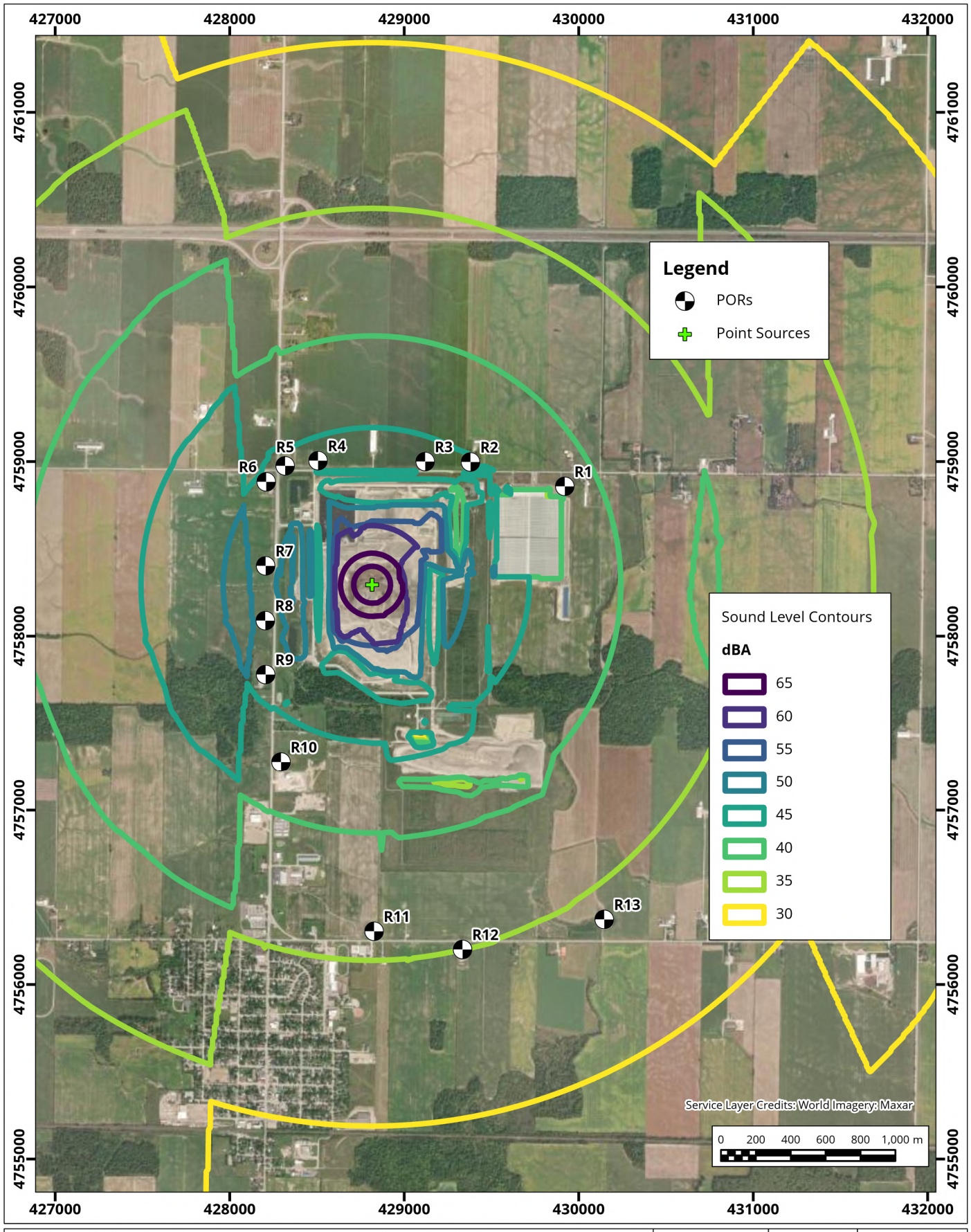
Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A7a
Approx. Scale:	1:30,000
Date Revised:	Jul 28, 2023

Map Document: \\rwdigroup\guelph\Jobs_3\2101750\6. Deliverables\20221014 Existing Conditions Report\0ArchiveFigures\20230720 Twin Creeks\Electronic Distress Daytime.aprx



Predicted Electronic Distress Sound Level Contours, Daytime, 4.5 m Contour Height

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre Existing Conditions - Watford, ON

Project #: 2101750

Drawn by: JM	Figure: A7b
Approx. Scale:	1:30,000
Date Revised:	Jun 24, 2024

Map Document: \\gue-nsif-f01\wlam-jobs-dfs\jobs\2021\2101750\6. Deliverables\20230731 Existing Conditions Report\0Archive\Figures\20230720 Twin Creeks\Electronic Distress Daytime.aprx

APPENDIX B

Table B.1 : SOURCE LEVEL DATA
Twin Creeks - Watford, ON, 2101750

Source Description	Octave Band Sound Power Level Data (dB)									Total (dBA/dBAI)
	31.5	63	125	250	500	1000	2000	4000	8000	
Cat D8R dozer	103.5	105.3	105.4	105.3	106.2	104.6	103.9	97.8	93.5	109.8
Volvo EC350 excavator	105.5	106.0	107.6	107.0	104.1	103.6	99.6	95.1	94.0	107.9
Cat D6 dozer	106.1	106.0	108.8	110.1	106.9	107.5	101.3	104.4	94.9	111.8
Cat 836 compactor	99.1	103.2	116.0	100.7	102.4	104.1	97.7	91.9	91.3	107.5
Volvo A406 articulated hauler	99.8	101.6	100.2	94.4	93.9	94.9	90.5	84.7	79.3	98.3
Cat 140 grader						111.5				111.5
Propane Cannon	107.7	114.9	120.6	117.1	115.3	115.0	111.5	108.9	106.7	119.5
Cracker Cartridge	98.8	101.9	99.5	92.2	99.6	98.8	113.1	103.7	96.0	114.9
Electronic Distress						121.6				121.6
Whistler Cartridge (Screamer)	92.6	96.3	95.4	101.1	110.1	115.6	118.4	111.2	106.0	121.9

APPENDIX C

Accu-Traffic Inc.
85 West Wilmot St., Unit 13,
Richmond Hill, ON, L4B 1K7
Tel: 1- 416-910-0171 Fax: 1-888-711-3125
E-mail: solutions@accu-traffic.ca
URL: http://www.accu-traffic.ca

Site Code: 143901
Station ID: MC52
CR 39 Confederation Line E
of Limits of Watford
Latitude: 0' 0.0000 Undefined
Longitude: 0' 0.0000 Undefined

EB, WB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
09/29/22	0	8	1	0	1	0	0	0	0	0	0	0	0	10
01:00	0	0	0	0	1	0	0	0	0	0	0	0	0	1
02:00	0	3	0	0	0	0	0	0	0	0	0	0	0	3
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	2
04:00	0	7	0	0	0	0	0	0	0	0	0	0	0	7
05:00	0	28	14	0	1	0	0	0	0	0	0	0	0	43
06:00	0	64	36	1	**4**	2	0	0	0	0	0	0	0	107
07:00	1	**86**	43	4	3	2	0	0	0	0	0	0	0	**139**
08:00	0	80	35	4	1	3	0	0	1	0	0	0	0	124
09:00	0	69	**46**	**8**	3	3	0	**1**	**5**	**1**	0	0	0	136
10:00	0	49	30	3	4	**5**	0	0	4	0	0	0	0	95
11:00	**2**	82	31	4	2	2	0	0	0	0	0	0	0	123
12 PM	0	59	31	2	**3**	2	0	0	1	1	0	0	0	99
13:00	**1**	62	38	2	3	2	0	0	1	1	0	0	0	110
14:00	0	92	39	**4**	3	1	0	**1**	1	0	0	0	0	141
15:00	1	**113**	48	4	0	**3**	0	0	**4**	**2**	0	0	0	**175**
16:00	0	82	**61**	3	1	2	0	0	0	0	0	0	0	149
17:00	1	101	47	1	3	0	0	0	0	1	0	0	0	154
18:00	0	72	32	1	3	0	0	0	0	1	0	0	0	109
19:00	0	43	18	0	2	0	0	0	0	0	0	0	0	63
20:00	0	30	10	1	0	0	0	0	1	0	0	0	0	42
21:00	0	17	3	0	1	1	0	0	0	1	0	0	0	23
22:00	0	9	7	0	0	0	0	0	1	0	0	0	0	17
23:00	0	10	4	0	0	0	0	0	0	0	0	0	0	14
Total	6	1168	574	42	39	28	0	2	19	8	0	0	0	1886
Percent	0.3%	61.9%	30.4%	2.2%	2.1%	1.5%	0.0%	0.1%	1.0%	0.4%	0.0%	0.0%	0.0%	
AM Peak	11:00	07:00	09:00	09:00	06:00	10:00		09:00	09:00	09:00				07:00
Vol.	2	86	46	8	4	5		1	5	1				139
PM Peak	13:00	15:00	16:00	14:00	12:00	15:00		14:00	15:00	15:00				15:00
Vol.	1	113	61	4	3	3		1	4	2				175
Grand Total	6	1168	574	42	39	28	0	2	19	8	0	0	0	1886
Percent	0.3%	61.9%	30.4%	2.2%	2.1%	1.5%	0.0%	0.1%	1.0%	0.4%	0.0%	0.0%	0.0%	
ADT		ADT 1,886		AADT 1,886										

Summary of Traffic Volumes: Haul Route 2-way traffic (north of the Nauvoo Road driveway)												
Year	2019 Background Traffic				Site Traffic (all years)				2019 Total Traffic			
Veh. Size	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
0:00	11	0	0	11	-	-	-	-	11	0	0	11
1:00	4	0	2	6	-	-	-	-	4	0	2	6
2:00	7	1	2	10	-	-	-	-	7	1	2	10
3:00	10	2	0	12	-	-	-	-	10	2	0	12
4:00	10	2	2	14	-	-	-	-	10	2	2	14
5:00	72	4	3	79	-	-	-	-	72	4	3	79
6:00	173	2	10	185	0	1	14	15	173	3	24	200
7:00	269	9	16	294	0	6	44	50	269	15	60	344
8:00	247	25	32	304	1	1	33	35	248	26	65	339
9:00	230	10	31	271	0	9	24	33	230	19	55	304
10:00	216	11	21	248	4	8	27	39	220	19	48	287
11:00	240	9	49	298	3	10	27	40	243	19	76	338
12:00	208	7	26	241	3	20	23	46	211	27	49	287
13:00	223	12	50	285	1	8	22	31	224	20	72	316
14:00	238	9	31	278	3	2	21	26	241	11	52	304
15:00	263	15	27	305	0	2	8	10	263	17	35	315
16:00	311	16	26	353	0	0	4	4	311	16	30	357
17:00	269	6	19	294	-	-	-	-	269	6	19	294
18:00	177	2	10	189	-	-	-	-	177	2	10	189
19:00	115	1	0	116	-	-	-	-	115	1	0	116
20:00	79	0	4	83	-	-	-	-	79	0	4	83
21:00	58	0	3	61	-	-	-	-	58	0	3	61
22:00	54	0	2	56	-	-	-	-	54	0	2	56
23:00	28	2	3	33	-	-	-	-	28	2	3	33
Daily Total	3512	145	369	4026	15	67	247	329	3527	212	616	4355
Average	146	6	15	168	1	6	22	30	147	9	26	181

Assumptions:

Annual Growth Trend: 2.00%

Summary of Traffic Volumes: Haul Route 2-way traffic (south of the Nauvoo Road driveway)												
Year	2019 Background Traffic				Site Traffic (all years)				2019 Total Traffic			
Veh. Size	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
0:00	11	0	0	11	-	-	-	-	11	0	0	11
1:00	4	0	2	6	-	-	-	-	4	0	2	6
2:00	7	1	2	10	-	-	-	-	7	1	2	10
3:00	10	2	0	12	-	-	-	-	10	2	0	12
4:00	10	2	2	14	-	-	-	-	10	2	2	14
5:00	72	4	3	79	-	-	-	-	72	4	3	79
6:00	173	3	21	197	0	0	3	3	173	3	24	200
7:00	269	13	48	330	0	2	9	11	269	15	57	341
8:00	245	26	58	329	3	0	7	10	248	26	65	339
9:00	229	17	50	296	1	2	5	8	230	19	55	304
10:00	212	17	43	272	8	2	5	15	220	19	48	287
11:00	237	17	71	325	6	2	5	13	243	19	76	338
12:00	205	22	44	271	6	4	5	15	211	26	49	286
13:00	221	17	67	305	3	2	5	10	224	19	72	315
14:00	235	11	48	294	6	0	4	10	241	11	52	304
15:00	263	17	33	313	0	0	2	2	263	17	35	315
16:00	311	16	29	356	0	0	1	1	311	16	30	357
17:00	269	6	19	294	-	-	-	-	269	6	19	294
18:00	177	2	10	189	-	-	-	-	177	2	10	189
19:00	115	1	0	116	-	-	-	-	115	1	0	116
20:00	79	0	4	83	-	-	-	-	79	0	4	83
21:00	58	0	3	61	-	-	-	-	58	0	3	61
22:00	54	0	2	56	-	-	-	-	54	0	2	56
23:00	28	2	3	33	-	-	-	-	28	2	3	33
Daily Total	3494	196	562	4252	33	14	51	98	3527	210	613	4350
Average	146	8	23	177	3	1	5	9	147	9	26	181

Assumptions:

Annual Growth Trend: 2.00%

Zion(East of Nauvoo) EB+WB

Date	Veh Group / Time	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT
9/29/2022	0:00	0	2	0	0	0	0	0	0	0	0	0
	1:00	0	0	0	0	0	0	0	0	0	0	0
	2:00	0	2	0	0	0	0	0	0	0	0	0
	3:00	0	2	0	0	0	0	0	0	0	0	0
	4:00	0	3	0	0	0	0	0	0	0	0	0
	5:00	0	6	4	0	0	0	0	0	0	0	0
	6:00	0	13	8	0	0	0	0	0	0	0	0
	7:00	0	19	10	0	0	0	0	0	0	0	0
	8:00	0	21	10	1	0	0	0	0	0	0	0
	9:00	0	18	10	2	0	0	0	0	0	0	0
	10:00	0	15	9	0	0	2	0	0	0	0	0
	11:00	0	20	8	0	0	0	0	0	0	0	0
	12:00	0	16	8	0	0	0	0	0	0	0	0
	13:00	0	18	10	0	0	0	0	0	0	0	0
	14:00	0	21	8	0	0	0	0	0	0	0	0
	15:00	0	22	12	0	0	0	0	0	0	0	0
	16:00	0	22	13	0	0	0	0	0	0	0	0
	17:00	0	21	10	0	0	0	0	0	0	0	0
	18:00	0	16	6	0	0	0	0	0	0	0	0
	19:00	0	10	4	0	0	0	0	0	0	0	0
	20:00	0	6	4	0	0	0	0	0	0	0	0
	21:00	0	6	2	0	0	0	0	0	0	0	0
	22:00	0	4	2	0	0	0	0	0	0	0	0
	23:00	0	2	2	0	0	0	0	0	0	0	0
	Daily Total	0	285	140	3	0	2	0	0	0	0	0
	Percent	0.0%	66.3%	32.6%	0.7%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%
	Average	0	12	6	0	0	0	0	0	0	0	0

#12 6A-MT	#13 Other	Total
0	0	2
0	0	0
0	0	2
0	0	2
0	0	3
0	0	10
0	0	21
0	0	29
0	0	32
0	0	30
0	0	26
0	0	28
0	0	24
0	0	28
0	0	29
0	0	34
0	0	35
0	0	31
0	0	22
0	0	14
0	0	10
0	0	8
0	0	6
0	0	4
0	0	430
0.0%	0.0%	
0	0	18

Zion(West of Nauvoo) EB+WB

Date	Veh Group / Time	#1 Cycle	#2 Cars	#3 2A-4T	#4 Buses	#5 2A-SU	#6 3A-SU	#7 4A-SU	#8 4A-ST	#9 5A-ST	#10 6A-ST	#11 5A-MT
9/29/2022	0:00	0	2	0	0	0	0	0	0	0	0	0
	1:00	0	0	0	0	0	0	0	0	0	0	0
	2:00	0	2	0	0	0	0	0	0	0	0	0
	3:00	0	2	0	0	0	0	0	0	0	0	0
	4:00	0	3	0	0	0	0	0	0	0	0	0
	5:00	0	5	3	0	0	0	0	0	0	0	0
	6:00	0	12	7	0	0	0	0	0	0	0	0
	7:00	0	18	9	0	0	0	0	0	0	0	0
	8:00	0	19	9	1	0	0	0	0	0	0	0
	9:00	0	16	9	2	0	0	0	0	0	0	0
	10:00	0	14	9	0	0	1	0	0	0	0	0
	11:00	0	18	7	0	0	0	0	0	0	0	0
	12:00	0	15	7	0	0	0	0	0	0	0	0
	13:00	0	16	9	0	0	0	0	0	0	0	0
	14:00	0	20	7	0	0	0	0	0	0	0	0
	15:00	0	21	11	0	0	0	0	0	0	0	0
	16:00	0	20	12	0	0	0	0	0	0	0	0
	17:00	0	20	9	0	0	0	0	0	0	0	0
	18:00	0	15	6	0	0	0	0	0	0	0	0
	19:00	0	9	4	0	0	0	0	0	0	0	0
	20:00	0	6	3	0	0	0	0	0	0	0	0
	21:00	0	5	1	0	0	0	0	0	0	0	0
	22:00	0	3	2	0	0	0	0	0	0	0	0
	23:00	0	2	2	0	0	0	0	0	0	0	0
	Daily Total	0	263	126	3	0	1	0	0	0	0	0
	Percent	0.0%	66.9%	32.1%	0.8%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	Average	0	11	5	0	0	0	0	0	0	0	0

#12 6A-MT	#13 Other	Total
0	0	2
0	0	0
0	0	2
0	0	2
0	0	3
0	0	8
0	0	19
0	0	27
0	0	29
0	0	27
0	0	24
0	0	25
0	0	22
0	0	25
0	0	27
0	0	32
0	0	32
0	0	29
0	0	21
0	0	13
0	0	9
0	0	6
0	0	5
0	0	4
0	0	393
0.0%	0.0%	
0	0	16

APPENDIX D

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.09

Job No. 2101750
Job Name Twin Creeks

ROAD CHARACTERISTICS | **SOURCE-RECEIVER-BARRIER-TOPOGRAPHY CHARACTERISTICS**

ID	Description	Time Period	Number of Vehicles			Speed (km/h)	Road Gradient (%)	Two Way? (y/n)	Pavement Type	Road Viewable Angle		Source-Receiver Distance (m)	Ground Type (Hard/Soft)	Topo-graphy Type	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Adjustment (dB)	Reason For Adjustment	**Total Segment L_{eq} (dBA)**
			Autos	Medium	Heavy					θ_1	θ_2										
R5 (Daytime)	25m away from Zion East of Nauvoo	1	2200	0	0	50	0	y	1	-90	90	25.0	Soft	A	0.1	0.0	1.5	0.0	-20.0	correction for traffic volume	41
	40m away from Nauvoo	1	177	2	10	80	0	y	1	-90	90	40.0	Soft	A	1.5	0.0	1.5	0.0			57
	sum of two roads above																				57
R6 (Daytime)	65m away from Zion West of Nauvoo	1	2100	0	0	50	0	y	1	-90	90	65.0	Soft	A	0.1	0.0	1.5	0.0	-20.0	correction for traffic volume	33
	65m away from Nauvoo	1	177	2	10	80	0	y	1	-90	90	65.0	Soft	A	1.5	0.0	1.5	0.0			53
	sum of two roads above																				53
R7 (Daytime)	57m away Navoo Road	1	177	2	10	80	0	y	1	-90	90	57.0	Soft	A	1.5	0.0	1.5	0.0			54
R8 (Daytime)	55m away Navoo Road	1	177	2	10	80	0	y	1	-90	90	55.0	Soft	A	1.5	0.0	1.5	0.0			54
R9 (Daytime)	47m away Navoo Road	1	177	2	10	80	0	y	1	-90	90	47.0	Soft	A	1.5	0.0	1.5	0.0			56
R10 (Daytime)	51m away Navoo Road	1	177	2	10	80	0	y	1	-90	90	51.0	Soft	A	1.5	0.0	1.5	0.0			55

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.09

Job No. 2101750
Job Name Twin Creeks

ROAD CHARACTERISTICS | **SOURCE-RECEIVER-BARRIER-TOPOGRAPHY CHARACTERISTICS**

ID	Description	Time Period	Number of Vehicles			Speed (km/h)	Road Gradient (%)	Two Way? (y/n)	Pavement Type	Road Viewable Angle		Source-Receiver Distance (m)	Ground Type (Hard/Soft)	Topography Type	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Adjustment (dB)	Reason For Adjustment	**Total Segment L_{eq} (dBA)**
			Autos	Medium	Heavy					θ_1	θ_2										
R5 (Evening)	25m away from Zion East of Nauvoo	1	600	0	0	50	0	y	1	-90	90	25.0	Soft	A	0.1	0.0	4.5	0.0	-20.0	correction for traffic volume	35
	40m away from Nauvoo	1	54	0	2	80	0	y	1	-90	90	40.0	Soft	A	1.4	0.0	4.5	0.0			51
	sum of two roads above																				51
R5 (Nighttime)	25m away from Zion East of Nauvoo	1	0	0	0	50	0	y	1	-90	90	25.0	Soft	A	-	0.0	4.5	0.0			-
	40m away from Nauvoo	1	400	0	200	80	0	y	1	-90	90	40.0	Soft	A	2.4	0.0	4.5	0.0	-20.0	correction for traffic volume	49
	sum of two roads above																				49
R6 (Evening)	65m away from Zion West of Nauvoo	1	500	0	0	50	0	y	1	-90	90	65.0	Soft	A	0.1	0.0	4.5	0.0	-20.0	correction for traffic volume	28
	65m away from Nauvoo	1	54	0	2	80	0	y	1	-90	90	65.0	Soft	A	1.4	0.0	4.5	0.0			47
	sum of two roads above																				48
R6 (Nighttime)	65m away from Zion West of Nauvoo	1	0	0	0	50	0	y	1	-90	90	65.0	Soft	A	-	0.0	4.5	0.0			-
	65m away from Nauvoo	1	400	0	200	80	0	y	1	-90	90	65.0	Soft	A	2.4	0.0	4.5	0.0	-20.0	correction for traffic volume	45
	sum of two roads above																				45
R7 (Evening)	57m away Navoo Road	1	54	0	2	80	0	y	1	-90	90	57.0	Soft	A	1.4	0.0	4.5	0.0			48
R7 (Nighttime)	57m away Navoo Road	1	400	0	200	80	0	y	1	-90	90	57.0	Soft	A	2.4	0.0	4.5	0.0	-20.0	correction for traffic volume	46
R8 (Evening)	55m away Navoo Road	1	54	0	2	80	0	y	1	-90	90	55.0	Soft	A	1.4	0.0	4.5	0.0			49
R8 (Nighttime)	55m away Navoo Road	1	400	0	200	80	0	y	1	-90	90	55.0	Soft	A	2.4	0.0	4.5	0.0	-20.0	correction for traffic volume	47
R9 (Evening)	47m away Navoo Road	1	54	0	2	80	0	y	1	-90	90	47.0	Soft	A	1.4	0.0	4.5	0.0			50
R9 (Nighttime)	47m away Navoo Road	1	400	0	200	80	0	y	1	-90	90	47.0	Soft	A	2.4	0.0	4.5	0.0	-20.0	correction for traffic volume	48
R10 (Evening)	51m away Navoo Road	1	54	0	2	80	0	y	1	-90	90	51.0	Soft	A	1.4	0.0	4.5	0.0			49
R10 (Nighttime)	51m away Navoo Road	1	400	0	200	80	0	y	1	-90	90	51.0	Soft	A	2.4	0.0	4.5	0.0	-20.0	correction for traffic volume	47

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.2

Job No. 2101750
Job Name Twin Creeks

Scenario 1.5m height

Notes:
1. Topography Type "A" means Flat or Gently Sloping (ORNAMENT types 1, 2, 6 and 7)

ROAD CHARACTERISTICS | **SOURCE-RECEIVER-TOPOGRAPHY CHARACTERISTICS**

ID	Description	Time Period	Number of Vehicles			Speed (km/h)	Road Gradient (%)	Two Way? (y/n)	Pavement Type	Road Viewable Angle		Source-Receiver Distance (m)	Ground Type (Hard/Soft)	Topography Type[1]	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Adjustment (dB)	Reason For Adjustment	Total Segment L_{eq} (dBA)
			Autos	Medium	Heavy					θ_1	θ_2										
Haul Route North of TCEC (Daytime)	R3	1	243	19	76	80	0	y	1	-61	23	842.6	Soft	A	2.2	0.0	1.5	0.0			40.23
	R4	1	243	19	76	80	0	y	1	-82	58	228.8	Soft	A	2.2	0.0	1.5	0.0			51.26
	R5	1	243	19	76	80	0	y	1	-89	83	40.2	Soft	A	2.2	0.0	1.5	0.0			64.13
	R6	1	243	19	76	80	0	y	1	-76	87	66.8	Soft	A	2.2	0.0	1.5	0.0			60.41
	R7	1	243	19	76	80	0	y	1	71	87	78.1	Soft	A	2.2	0.0	1.5	0.0			45.44
	R8	1	243	19	76	80	0	y	1	81	88	73.9	Soft	A	2.2	0.0	1.5	0.0			40.57
	R9	1	243	19	76	80	0	y	1	84	88	77.7	Soft	A	2.2	0.0	1.5	0.0			37.69
	R14	1	243	19	76	80	0	y	1	-89	-86	66.9	Soft	A	2.2	0.0	1.5	0.0			34.68
	R15	1	243	19	76	80	0	y	1	86	88	49.0	Soft	A	2.2	0.0	1.5	0.0			36.89
	R16	1	243	19	76	80	0	y	1	82	88	58.8	Soft	A	2.2	0.0	1.5	0.0			42.20
	R17	1	243	19	76	80	0	y	1	-81	86	86.2	Soft	A	2.2	0.0	1.5	0.0			58.66
	R18	1	243	19	76	80	0	y	1	-85	85	81.4	Soft	A	2.2	0.0	1.5	0.0			59.09
	R19	1	243	19	76	80	0	y	1	-85	85	75.9	Soft	A	2.2	0.0	1.5	0.0			59.60
	R20	1	243	19	76	80	0	y	1	-88	87	39.4	Soft	A	2.2	0.0	1.5	0.0			64.29
	R21	1	243	19	76	80	0	y	1	-88	87	39.4	Soft	A	2.2	0.0	1.5	0.0			64.28
	R22	1	243	19	76	80	0	y	1	-88	87	40.2	Soft	A	2.2	0.0	1.5	0.0			64.13
	R23	1	243	19	76	80	0	y	1	-88	87	41.2	Soft	A	2.2	0.0	1.5	0.0			63.96
	R24	1	243	19	76	80	0	y	1	-88	87	40.6	Soft	A	2.2	0.0	1.5	0.0			64.08
	R25	1	243	19	76	80	0	y	1	-88	86	44.1	Soft	A	2.2	0.0	1.5	0.0			63.49
	R26	1	243	19	76	80	0	y	1	-89	86	40.0	Soft	A	2.2	0.0	1.5	0.0			64.18
	R27	1	243	19	76	80	0	y	1	-81	85	98.3	Soft	A	2.2	0.0	1.5	0.0			57.70
	R28	1	243	19	76	80	0	y	1	-47	74	387.2	Soft	A	2.2	0.0	1.5	0.0			47.05
	R29	1	243	19	76	80	0	y	1	-39	71	498.5	Soft	A	2.2	0.0	1.5	0.0			44.93
	R30	1	243	19	76	80	0	y	1	-28	61	778.0	Soft	A	2.2	0.0	1.5	0.0			41.05
	R31	1	243	19	76	80	0	y	1	-14	58	999.0	Soft	A	2.2	0.0	1.5	0.0			38.33
	R32	1	243	19	76	80	0	y	1	-20	66	693.4	Soft	A	2.2	0.0	1.5	0.0			41.65
	R33	1	243	19	76	80	0	y	1	-29	73	459.4	Soft	A	2.2	0.0	1.5	0.0			45.15
Haul Route North of TCEC (6-7am)	R3	1	173	3	24	80	0	y	1	-61	23	842.6	Soft	A	1.9	0.0	1.5	0.0			35.32
	R4	1	173	3	24	80	0	y	1	-82	58	228.8	Soft	A	1.9	0.0	1.5	0.0			46.40
	R5	1	173	3	24	80	0	y	1	-89	83	40.2	Soft	A	1.9	0.0	1.5	0.0			59.33
	R6	1	173	3	24	80	0	y	1	-76	87	66.8	Soft	A	1.9	0.0	1.5	0.0			55.60
	R7	1	173	3	24	80	0	y	1	71	87	78.1	Soft	A	1.9	0.0	1.5	0.0			40.56
	R8	1	173	3	24	80	0	y	1	81	88	73.9	Soft	A	1.9	0.0	1.5	0.0			35.67
	R9	1	173	3	24	80	0	y	1	84	88	77.7	Soft	A	1.9	0.0	1.5	0.0			32.77
	R14	1	173	3	24	80	0	y	1	-89	-86	66.9	Soft	A	1.9	0.0	1.5	0.0			29.75
	R15	1	173	3	24	80	0	y	1	86	88	49.0	Soft	A	1.9	0.0	1.5	0.0			31.98
	R16	1	173	3	24	80	0	y	1	82	88	58.8	Soft	A	1.9	0.0	1.5	0.0			37.31
	R17	1	173	3	24	80	0	y	1	-81	86	86.2	Soft	A	1.9	0.0	1.5	0.0			53.84
	R18	1	173	3	24	80	0	y	1	-85	85	81.4	Soft	A	1.9	0.0	1.5	0.0			54.26
	R19	1	173	3	24	80	0	y	1	-85	85	75.9	Soft	A	1.9	0.0	1.5	0.0			54.78
	R20	1	173	3	24	80	0	y	1	-88	87	39.4	Soft	A	1.9	0.0	1.5	0.0			59.50

	R21	1	173	3	24	80	0	y	1	-88	87	39.4	Soft	A	1.9	0.0	1.5	0.0			59.49
	R22	1	173	3	24	80	0	y	1	-88	87	40.2	Soft	A	1.9	0.0	1.5	0.0			59.34
	R23	1	173	3	24	80	0	y	1	-88	87	41.2	Soft	A	1.9	0.0	1.5	0.0			59.17
	R24	1	173	3	24	80	0	y	1	-88	87	40.6	Soft	A	1.9	0.0	1.5	0.0			59.28
	R25	1	173	3	24	80	0	y	1	-88	86	44.1	Soft	A	1.9	0.0	1.5	0.0			58.69
	R26	1	173	3	24	80	0	y	1	-89	86	40.0	Soft	A	1.9	0.0	1.5	0.0			59.39
	R27	1	173	3	24	80	0	y	1	-81	85	98.3	Soft	A	1.9	0.0	1.5	0.0			52.87
	R28	1	173	3	24	80	0	y	1	-47	74	387.2	Soft	A	1.9	0.0	1.5	0.0			42.17
	R29	1	173	3	24	80	0	y	1	-39	71	498.5	Soft	A	1.9	0.0	1.5	0.0			40.04
	R30	1	173	3	24	80	0	y	1	-28	61	778.0	Soft	A	1.9	0.0	1.5	0.0			36.14
	R31	1	173	3	24	80	0	y	1	-14	58	999.0	Soft	A	1.9	0.0	1.5	0.0			33.41
	R32	1	173	3	24	80	0	y	1	-20	66	693.4	Soft	A	1.9	0.0	1.5	0.0			36.75
	R33	1	173	3	24	80	0	y	1	-29	73	459.4	Soft	A	1.9	0.0	1.5	0.0			40.26

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.2

Job No. 2101750
Job Name Twin Creeks

Scenario 4.5m height

Notes:
1. Topography Type "A" means Flat or Gently Sloping (ORNAMENT types 1, 2, 6 and 7)

ROAD CHARACTERISTICS | **SOURCE-RECEIVER-TOPOGRAPHY CHARACTERISTICS**

ID	Description	Time Period	Number of Vehicles			Speed (km/h)	Road Gradient (%)	Two Way? (y/n)	Pavement Type	Road Viewable Angle		Source-Receiver Distance (m)	Ground Type (Hard/Soft)	Topography Type[1]	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Adjustment (dB)	Reason For Adjustment	Total Segment L_{eq} (dBA)
			Autos	Medium	Heavy					θ_1	θ_2										
Haul Route North of TCEC (Daytime)	R3	1	243	19	76	80	0	y	1	-61	24	842.6	Soft	A	2.2	0.0	4.5	0.0			41.86
	R4	1	243	19	76	80	0	y	1	-82	58	228.8	Soft	A	2.2	0.0	4.5	0.0			52.43
	R5	1	243	19	76	80	0	y	1	-89	83	40.2	Soft	A	2.2	0.0	4.5	0.0			64.66
	R6	1	243	19	76	80	0	y	1	-76	87	66.8	Soft	A	2.2	0.0	4.5	0.0			61.13
	R7	1	243	19	76	80	0	y	1	71	87	78.1	Soft	A	2.2	0.0	4.5	0.0			46.71
	R8	1	243	19	76	80	0	y	1	81	88	73.9	Soft	A	2.2	0.0	4.5	0.0			42.14
	R9	1	243	19	76	80	0	y	1	84	88	77.7	Soft	A	2.2	0.0	4.5	0.0			39.39
	R14	1	243	19	76	80	0	y	1	-89	-86	66.9	Soft	A	2.2	0.0	4.5	0.0			36.48
	R15	1	243	19	76	80	0	y	1	86	88	49.0	Soft	A	2.2	0.0	4.5	0.0			38.58
	R16	1	243	19	76	80	0	y	1	82	88	58.8	Soft	A	2.2	0.0	4.5	0.0			43.68
	R17	1	243	19	76	80	0	y	1	-81	86	86.2	Soft	A	2.2	0.0	4.5	0.0			59.48
	R18	1	243	19	76	80	0	y	1	-85	85	81.4	Soft	A	2.2	0.0	4.5	0.0			59.89
	R19	1	243	19	76	80	0	y	1	-85	85	75.9	Soft	A	2.2	0.0	4.5	0.0			60.38
	R20	1	243	19	76	80	0	y	1	-88	87	39.4	Soft	A	2.2	0.0	4.5	0.0			64.82
	R21	1	243	19	76	80	0	y	1	-88	87	39.4	Soft	A	2.2	0.0	4.5	0.0			64.81
	R22	1	243	19	76	80	0	y	1	-88	87	40.2	Soft	A	2.2	0.0	4.5	0.0			64.67
	R23	1	243	19	76	80	0	y	1	-88	87	41.2	Soft	A	2.2	0.0	4.5	0.0			64.51
	R24	1	243	19	76	80	0	y	1	-88	87	40.6	Soft	A	2.2	0.0	4.5	0.0			64.62
	R25	1	243	19	76	80	0	y	1	-88	86	44.1	Soft	A	2.2	0.0	4.5	0.0			64.06
	R26	1	243	19	76	80	0	y	1	-89	86	40.0	Soft	A	2.2	0.0	4.5	0.0			64.71
	R27	1	243	19	76	80	0	y	1	-81	85	98.3	Soft	A	2.2	0.0	4.5	0.0			58.57
	R28	1	243	19	76	80	0	y	1	-47	74	387.2	Soft	A	2.2	0.0	4.5	0.0			48.40
	R29	1	243	19	76	80	0	y	1	-39	71	498.5	Soft	A	2.2	0.0	4.5	0.0			46.37
	R30	1	243	19	76	80	0	y	1	-28	61	778.0	Soft	A	2.2	0.0	4.5	0.0			42.65
	R31	1	243	19	76	80	0	y	1	-14	58	999.0	Soft	A	2.2	0.0	4.5	0.0			40.03
	R32	1	243	19	76	80	0	y	1	-20	66	693.4	Soft	A	2.2	0.0	4.5	0.0			43.21
	R33	1	243	19	76	80	0	y	1	-29	73	459.4	Soft	A	2.2	0.0	4.5	0.0			46.56
Haul Route North of TCEC (6-7am)	R3	1	173	3	24	80	0	y	1	-61	23	842.6	Soft	A	1.9	0.0	4.5	0.0			36.95
	R4	1	173	3	24	80	0	y	1	-82	58	228.8	Soft	A	1.9	0.0	4.5	0.0			47.57
	R5	1	173	3	24	80	0	y	1	-89	83	40.2	Soft	A	1.9	0.0	4.5	0.0			59.87
	R6	1	173	3	24	80	0	y	1	-76	87	66.8	Soft	A	1.9	0.0	4.5	0.0			56.31
	R7	1	173	3	24	80	0	y	1	71	87	78.1	Soft	A	1.9	0.0	4.5	0.0			41.84
	R8	1	173	3	24	80	0	y	1	81	88	73.9	Soft	A	1.9	0.0	4.5	0.0			37.24
	R9	1	173	3	24	80	0	y	1	84	88	77.7	Soft	A	1.9	0.0	4.5	0.0			34.48
	R14	1	173	3	24	80	0	y	1	-89	-86	66.9	Soft	A	1.9	0.0	4.5	0.0			31.56
	R15	1	173	3	24	80	0	y	1	86	88	49.0	Soft	A	1.9	0.0	4.5	0.0			33.67
	R16	1	173	3	24	80	0	y	1	82	88	58.8	Soft	A	1.9	0.0	4.5	0.0			38.79
	R17	1	173	3	24	80	0	y	1	-81	86	86.2	Soft	A	1.9	0.0	4.5	0.0			54.66
	R18	1	173	3	24	80	0	y	1	-85	85	81.4	Soft	A	1.9	0.0	4.5	0.0			55.07
	R19	1	173	3	24	80	0	y	1	-85	85	75.9	Soft	A	1.9	0.0	4.5	0.0			55.56
	R20	1	173	3	24	80	0	y	1	-88	87	39.4	Soft	A	1.9	0.0	4.5	0.0			60.03

	R21	1	173	3	24	80	0	y	1	-88	87	39.4	Soft	A	1.9	0.0	4.5	0.0			60.02
	R22	1	173	3	24	80	0	y	1	-88	87	40.2	Soft	A	1.9	0.0	4.5	0.0			59.87
	R23	1	173	3	24	80	0	y	1	-88	87	41.2	Soft	A	1.9	0.0	4.5	0.0			59.71
	R24	1	173	3	24	80	0	y	1	-88	87	40.6	Soft	A	1.9	0.0	4.5	0.0			59.82
	R25	1	173	3	24	80	0	y	1	-88	86	44.1	Soft	A	1.9	0.0	4.5	0.0			59.26
	R26	1	173	3	24	80	0	y	1	-89	86	40.0	Soft	A	1.9	0.0	4.5	0.0			59.92
	R27	1	173	3	24	80	0	y	1	-81	85	98.3	Soft	A	1.9	0.0	4.5	0.0			53.74
	R28	1	173	3	24	80	0	y	1	-47	74	387.2	Soft	A	1.9	0.0	4.5	0.0			43.52
	R29	1	173	3	24	80	0	y	1	-39	71	498.5	Soft	A	1.9	0.0	4.5	0.0			41.48
	R30	1	173	3	24	80	0	y	1	-28	61	778.0	Soft	A	1.9	0.0	4.5	0.0			37.74
	R31	1	173	3	24	80	0	y	1	-14	58	999.0	Soft	A	1.9	0.0	4.5	0.0			35.11
	R32	1	173	3	24	80	0	y	1	-20	66	693.4	Soft	A	1.9	0.0	4.5	0.0			38.31
	R33	1	173	3	24	80	0	y	1	-29	73	459.4	Soft	A	1.9	0.0	4.5	0.0			41.68