

FINAL REPORT



143 COLUMBIA STREET WEST

WATERLOO, ONTARIO

NOISE AND VIBRATION IMPACT STUDY

RWDI #2401942

April 4, 2024

SUBMITTED TO

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VERSION HISTORY

Index	Date	Description	Prepared by	Reviewed by
1	April 4, 2024	Submitted for ZBA and SPA	Caelan Weber-Martin	Gillian Redman



EXECUTIVE SUMMARY

RWDI was retained to prepare a Noise and Vibration Impact Study for the proposed mixed-use development located at 143 Columbia Street West in Waterloo, Ontario. The proposed development will consist of 3 mixed-use buildings. This assessment was completed to support the Zoning By-law Amendment (ZBA) and Site Plan Approval (SPA) submissions as required by the Regional Municipality of Waterloo.

The following noise control measures are recommended for the proposed development:

1. Installation of central air-conditioning so that all suites' windows can remain closed.
2. The inclusion of noise warning clauses related to:
 - a. Transportation sound levels at the building façade
 - b. Proximity to commercial/industrial land-use

The site is exposed to noise from road traffic from: Columbia Street to the north, Lester Street to the east, University Avenue to the south, and Phillip Street to the west.

The potential noise levels from stationary sources of sound were evaluated. Based on the noise modeling results and setback distances, the land use compatibility of the proposed development with respect to the nearby commercial land-uses is considered acceptable from the noise assessment perspective. All sources in the vicinity of the proposed development are exempt from any environmental permitting. Based on preliminary modelling some exceedances of the Class 1 limits were noted. As sources are exempt from environmental permits, sound levels can be managed through on-building mitigation (i.e. installation of air conditioning, high STC windows). It is recommended that screening level modelling be refined prior to building permit to consider operating times, and measurements of surrounding equipment (if possible). At source mitigation, if feasible, should be implemented on surrounding buildings to reduce sound. However, based on preliminary modelling it is expected that on-building mitigation strategies will achieve a comfortable acoustic environment.

At this stage in design the noise levels produced by the development on itself and its surroundings could not be quantitatively assessed. However, the effect on both the building itself and its surroundings is expected to be feasible to meet the applicable criteria. We recommend that the building design is evaluated prior to building permit to ensure that the acoustical design is adequately implemented in order to meet the applicable criteria.

Based on the results of the analysis including implementation of the recommendations included with this assessment, the proposed development is feasible to meet the applicable sound and vibration criteria.



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1 INTRODUCTION

RWDI was retained to prepare a Noise and Vibration Impact Study for the proposed mixed-use development located at 143 Columbia Street West in Waterloo, Ontario. The proposed development will consist of 3 mixed-use buildings. The context site plan is shown in **Figure 1**.

The site is exposed to noise from road traffic from: Columbia Street to the north, Lester Street to the east, University Avenue to the south, and Phillip Street to the west.

A railway for Light Rail Transit (LRT) is located approximately 400m to the west of the proposed development. Due to the setback distance, an assessment of noise and vibration from the rail line is not required per the Railway Association of Canada's Guidelines for New Development in Proximity to Railway Operations (RAC, 2013).

An assessment of nearby stationary sources, which includes residential and commercial buildings, was conducted based on the Ministry of the Environment, Conservation, and Parks D-6 screening criteria.

This assessment was completed to support the Zoning By-Law Amendment (ZBA) and Site Plan Approval (SPA) application submissions as required by the Regional Municipality of Waterloo. This assessment was based on design drawings dated January 11, 2024, included in **Appendix A**.

2 APPLICABLE CRITERIA

Applicable criteria for transportation noise sources (road) and stationary noise sources are adopted the Regional Municipality of Waterloo Implementation Guideline for Noise Policies (RMOW, 2019) document in conjunction with the Ontario Ministry of the Environment, Conservation and Parks (MECP) NPC-300 Environmental Noise Guideline (MOECC, 2013), which supersedes the MECP LU-131 publication noted in RMOW's policies. A summary of the applicable criteria included with **Appendix B**.

The proposed development site would be characterized as a "Class 1 Area", which is defined according to NPC-300 as an 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."

3 THE EFFECTS OF THE ENVIRONMENT ON THE PROPOSED DEVELOPMENT

3.1 Transportation Source Assessment

3.1.1 Road Traffic Volume Data

Turning Movement Counts (TMCs) were obtained from the City of Waterloo and the Regional Municipality of Waterloo for the intersection of Columbia Street West at Phillip Street, and the intersection of University Avenue at Lester Street.

The TMCs were used to determine the Estimated Daily Traffic (EDT) volumes and types of vehicles on each link. These volumes were considered as the Annual Average Daily Traffic (AADT) volumes for each road segment. A 90%/10% daytime/nighttime local road split was applied for all roadways. Traffic volumes for each of the respective roadways were increased at a rate of 2% per year to a horizon year of 2034.

A summary of the traffic data used is included in **Table 1** below with more detailed information included in **Appendix C**.

Table 1: Road Traffic Volumes

Roadway	Segment	2034 Future Traffic (AADT)	% Day/Night	Speed Limit (km/hr.)	% Trucks
Phillip Street	South of Columbia Street	6,156	90% /10%	50	2.4
Columbia Street	East of Phillip Street	17,153	90% / 10%	50	2.9
Lester Street	North of University Avenue	1,575	90% / 10%	50	3.3
University Avenue	West of Lester Street	24,240	90% / 10%	50	6.9

3.1.2 Representative Receptors

The selection of receptors affected by transportation noise sources was based on the drawings reviewed for this assessment. Using the “building evaluation” feature of Cadna/A, each façade of the residential buildings was assessed.

Outdoor Living Areas (OLAs) would include outdoor areas intended and designed for the quiet enjoyment of the outdoor environment and which are readily accessible from the building. OLAs may include any common outdoor amenity spaces associated with a multi-unit residential development (e.g. courtyards, roof-top terraces), and/or private backyards and terraces with a minimum depth of 4 m provided they are the only outdoor living area for the occupant.

Daytime sound levels were assessed at the following identified OLAs:

- OLA_01: Building A - At-grade Common Patio
- OLA_02: Building B - At-grade Common Patio
- OLA_03: Building C - At-grade Common Patio 1
- OLA_04: Building C - At-grade Common Patio 2
- OLA_05: Building C - At-grade Sports Court

The OLAs are indicated in **Figure 2**.

3.1.3 Analysis and Results

Sound levels due to the adjacent transportation (road) sources were predicted using the RLS-90 standard (RLS,1990), as implemented in the Cadna/A software package. To assess the effect of transportation noise on suites, the maximum sound level on each façade was determined with the results summarized in **Table 2**.

A sample STAMSON calculation, implementing the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT) guidelines (MOE, 1989), is included in **Appendix C** for the north façade of the Building A Podium at a worst-case height of 8.5 meters. As the results from RLS-90 are approximately 1 dB higher than STAMSON, the assessment results are considered to be within a reasonable margin and application of RLS-90 is considered a conservative approach. The location of the façade receptor location used in the sample STAMSON calculation is illustrated in **Appendix C, Figure C.1**.

Table 2: Predicted Ground Transportation Source Sound Levels – Plane of Window

Building	Façade	Road		Notes
		Day L _{EQ} , 16hr	Night L _{EQ} , 8hr	
Building A - 6 Storey Podium (North Section)	North	65 dBA	58 dBA	1
	East	61 dBA	54 dBA	1
	West	61 dBA	54 dBA	1
Building A - 25 Storey Tower	North	62 dBA	56 dBA	1
	East	60 dBA	53 dBA	1
	South	49 dBA	43 dBA	-
	West	59 dBA	52 dBA	1
Building B - 6 Storey Podium (North Section)	North	54 dBA	47 dBA	-
	East	56 dBA	49 dBA	1
	West	51 dBA	44 dBA	-
Building B - 25 Storey Tower	North	55 dBA	48 dBA	-
	East	55 dBA	49 dBA	1
	South	49 dBA	42 dBA	-
	West	51 dBA	45 dBA	-
Building C – 25 Storey Tower	North	52 dBA	45 dBA	-
	East	53 dBA	46 dBA	-
	South	52 dBA	45 dBA	-
	West	52 dBA	45 dBA	-

Note(s):

1. Applicable for low and medium density developments: Provision for future installation of air-conditioning, NPC-300 warning clause "Type C". Applicable for developments where air-conditioning will be included in the project design: NPC-300 warning clause "Type D". Refer to **Appendix D** for guidance regarding air-conditioning as a noise mitigation measure.
2. The acoustical performance of building components must be specified to meet the indoor sound level criteria. Installation of air conditioning to allow for windows and doors to remain closed, NPC-300 warning clause "Type D". Refer to **Appendix D** for guidance regarding air-conditioning as a noise mitigation measure.

To assess the effect of transportation noise on the qualifying OLAs for the development, predicted sound level results are summarized in **Table 3**.

Table 3: Transportation Sound Levels in Outdoor Living Areas (OLAs)

Receptor	Description	Daytime L _{EQ} , 16hr	Notes
OLA_01	Building A - At-grade Common Patio	52 dBA	1
OLA_02	Building B - At-grade Common Patio	44 dBA	1
OLA_03	Building C - At-grade Common Patio 1	44 dBA	1
OLA_04	Building C - At-grade Common Patio 2	36 dBA	1
OLA_05	Building C - At-grade Sports Court	44 dBA	1

Note(s):

1. The predicted sound level meets the NPC-300 criterion for OLAs. Noise control measures are not required.
2. For OLA sound levels >55 dBA and ≤60 dBA, noise controls may be applied to meet the 55 dBA criterion. If noise control measures are not provided, NPC-300 warning clause "Type A" is recommended.
3. Noise mitigation is recommended to meet the ≤55 dBA OLA sound level criterion. If noise controls are not feasible to meet the 55 dBA criterion for technical, economic or administrative reasons, an exceedance of 5 dB may be acceptable (to a maximum sound level of 60 dBA). In this case, NPC-300 warning clause "Type B" is recommended.

3.2 Stationary Source Assessment

Stationary sources can be grouped into two categories: those that have a permit with the Ontario Ministry of the Environment, Conservation and Parks (MECP) through an Environmental Compliance Approval (ECA) or Environmental Activity and Sector Registry (EASR); and those that are exempt from ECA or EASR permit requirements.

In the case where a stationary source has an Environmental Compliance Approval (ECA) or Environmental Activity and Sector Registry (EASR) permit with the MECP, and would be put in a position where it is no longer in compliance with the applicable sound level criteria due to the encroachment of the proposed new development, source specific mitigation and/or formal classification of the proposed development lands as a "Class 4 Area" (refer to C.4.4.2 "Class 4 Area" in NPC-300) would be required. In this case, coordination and agreements between the stationary source owner, proposed new development owner, the land-use planning authority and potentially the MECP would be needed.

In the case where a stationary source is exempt from ECA or EASR permit requirements with the MECP, the noise provisions of the applicable Municipal Code / Noise By-Law and guidance from NPC-300 would be applicable. In this case, mitigation of sound levels due to stationary sources would be from a due diligence perspective to meet the sound level criteria in the local noise by-law, and to avoid nuisance complaints from future occupants of the proposed new development.

3.2.1 Land-Use Compatibility Review (D-6 Guideline Assessment)

The MECP Guideline D-6 (MOE, 1995) was used as a tool to classify the identified industries and assess their potential influence on the proposed development. The classifications and setback guidelines are summarized in **Appendix B**.

Commercial/residential Class I industries were identified within a 70 m radius of the proposed development and were included in this assessment.

The industrial building at 388 Phillip Street, to the north is currently vacant, and is therefore considered a Class I industry. There is potential that this facility could resume industrial activity as a Class II facility. However, an existing mixed-use high-rise building at 130 Columbia Street West is significantly closer to the industry. As the industry must be compliant with 130 Columbia Street West, it is predicted that the proposed development would not increase the burden on sound level emissions from any future industrial activities at 388 Phillip Street.

University of Waterloo campus buildings lie to the west of the proposed development. The University of Waterloo operates under an environmental permit (EASR) and is required to meet sound level criteria at the intervening high-rise buildings between the proposed development and the University. Therefore, the proposed development is not expected to affect the compliance of the University of Waterloo with its environmental permits.

No other Class II, or Class III facilities were identified within their respective zones of influence.

3.2.2 Stationary Source Modeling

Stationary sources of noise surrounding the proposed development were identified using a combination of source identification from publicly available aerial and street-level imagery, business listing, and the MECP Access Environment database.

Noise sources were identified within 70m of the proposed development at the following facilities:

- Bioformatics Solutions to the north
- 312 Lester Street mixed-use building to the southeast
- WCRI Fenwick residential building to the south
- 145 Columbia Street residential/mixed-use building to the west
- 330 Phillip Street mixed-use building to the west
- Tim Hortons to the west
- Mr. Mechanic auto repair shop to the west
- Shell gas station and car wash to the northwest

The Society 145 Condos high-rise apartment building at 145 Columbia Street West, located directly to the west of the proposed development, acts as screening from the Tim Hortons, Mr. Mechanic auto repair shop, and Shell gas station to the west. Moreover, as the stationary sources associated with those facilities are compatible with the Society 145 Condos, they are not predicted to cause adverse effects at the proposed 143 Columbia Street development as it has a greater setback distance. Therefore, stationary sources from Tim Hortons, Mr. Mechanic, and the Shell gas station are not presented in this report. Stationary sources associated with all other buildings listed above are presented in this report.

As the proposed development is proposed in a location with numerous existing surrounding high-rise and mid-rise residential/mixed-use buildings, the proposed development is anticipated to be compatible with the existing acoustic environment with regards to noise from stationary sources. Conservative assumptions were made regarding stationary source sound power levels and duty cycles. As the new surrounding buildings are required to be compliant with other existing sensitive uses, sound level reductions were assumed for stationary sources, assuming noise control methods and/or quieter equipment selection has been implemented for stationary sources associated with existing high-rise and mid-rise buildings to achieve compliance with surrounding sensitive uses.

RWDI proxy data were used for the sound power levels of all stationary sources included in the model. An emergency generator was identified at 330 Phillip Street. The generator was assumed to be tested during daytime hours only and is assessed separately from other stationary sources against an elevated limit as set out NPC-300 guidelines. The assumed sound power levels included in the stationary source assessment are presented in **Table 4**. The locations of the sources summarized in **Table 4** included in the stationary source assessment are illustrated in **Appendix E, Figure E.1**.

Table 4: Stationary Source Sound Power Level Assumptions

Source Description	Source ID (As shown in Figure E.1)	Proxy Data / Calculation	Sound Power Level (dBA)	Duty Cycle	
				Daytime and Evening (07:00h – 23:00h)	Nighttime (23:00h – 07:00h)
1-Fan HVAC Unit	HVAC_1F	Proxy Data	82 ^[3]	Continuous	30 minutes/hour ^[1]
2-Fan HVAC Unit	HVAC_2F	Proxy Data	85 ^[3]	Continuous	30 minutes/hour ^[1]
4-Fan HVAC Unit	HVAC_4F	Proxy Data	88	Continuous	30 minutes/hour ^[1]
8-Fan HVAC Unit	HVAC_8F	Proxy Data	91 ^[3]	Continuous	30 minutes/hour ^[1]
10-Fan HVAC Unit	HVAC_10F	Proxy Data	92 ^[3]	Continuous	30 minutes/hour ^[1]
Makeup Air Unit	MUA	Proxy Data	85 ^[3]	Continuous	30 minutes/hour ^[1]
Kitchen Exhaust Fan	Exhaust	Proxy Data	85 ^[3]	Continuous	30 minutes/hour ^[1]
Cooling Tower	CT	Proxy Data	100 ^[4]	Continuous	30 minutes/hour ^[1]
Emergency Generator	Gen	Proxy Data	95	Continuous	N/A ^[2]

Note(s):

1. Nighttime duty cycles of 30 minutes per hour were assumed for all stationary sources as a conservative approach.
2. Emergency Generator testing assumed to occur during daytime hours only (07:00-23:00).
3. A 5 dB reduction was applied to 1-Fan and 2-Fan HVAC Units, Kitchen Exhaust Fans associated with the 330 Phillip Street mixed-use building to the west and to the 8-Fan and 10-Fan HVAC units associated with the residential/mixed-use WCRI Fenwick building to the south to account for anticipated noise controls based on the required compatibility with other surrounding residential buildings.
4. A 12 dB reduction was applied to all Cooling Towers to account for anticipated noise controls based on the required compatibility with other surrounding residential buildings.

Assumptions regarding source sound power levels and duty cycles were made to conservatively represent the noise from stationary sources in a worst-case daytime and nighttime hour.

3.2.3 Analysis and Results

Stationary source noise modelling was carried out using the Cadna/A software package, a commercially available implementation of the ISO 9613 (ISO, 1994 and ISO, 1996) algorithms. The predicted sound levels are assessed against the Class 1 Area limits (refer to **Appendix B**). Sound levels at worst-case facade and outdoor receptors due to all stationary sources except the emergency generator are presented in **Table 5**.

Table 5: Predicted Sound Levels at Worst-case Receptor Locations – Continuous Stationary Sources

Building/Receptor	Façade	Time Period		Sound Level Criteria	Notes
		Daytime L _{EQ-1hr} 7:00-23:00	Nighttime L _{EQ-1hr} 23:00-7:00 ^[1]	Daytime / Nighttime L _{EQ-1hr}	
Building A - 6 Storey Podium (North Section)	North	48 dBA	45 dBA	50 / 45 dBA	Meets Sound Level Criteria
	East	37 dBA	34 dBA	50 / 45 dBA	Meets Sound Level Criteria
	West	49 dBA	46 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
Building A - 25 Storey Tower	North	47 dBA	44 dBA	50 / 45 dBA	Meets Sound Level Criteria
	East	38 dBA	35 dBA	50 / 45 dBA	Meets Sound Level Criteria
	South	51 dBA	48 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
	West	52 dBA	49 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
Building B - 6 Storey Podium (North Section)	North	44 dBA	41 dBA	50 / 45 dBA	Meets Sound Level Criteria
	East	38 dBA	35 dBA	50 / 45 dBA	Meets Sound Level Criteria
	West	52 dBA	49 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
Building B - 25 Storey Tower	North	53 dBA	50 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
	East	40 dBA	37 dBA	50 / 45 dBA	Meets Sound Level Criteria
	South	44 dBA	41 dBA	50 / 45 dBA	Meets Sound Level Criteria
	West	55 dBA	52 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
Building C - 25 Storey Tower	North	46 dBA	43 dBA	50 / 45 dBA	Meets Sound Level Criteria
	East	43 dBA	40 dBA	50 / 45 dBA	Meets Sound Level Criteria
	South	50 dBA	47 dBA	50 / 45 dBA	Exceeds Sound Level Criteria
	West	48 dBA	45 dBA	50 / 45 dBA	Meets Sound Level Criteria

Building/Receptor	Façade	Time Period		Sound Level Criteria	Notes
		Daytime L _{EQ-1hr} 7:00-23:00	Nighttime L _{EQ-1hr} 23:00-7:00 ^[1]	Daytime / Nighttime L _{EQ-1hr}	
OPOR_01	--	40 dBA	--	50 / -- dBA	Meets Sound Level Criteria
OPOR_02	--	42 dBA	--	50 / -- dBA	Meets Sound Level Criteria
OPOR_03	--	40 dBA	--	50 / -- dBA	Meets Sound Level Criteria
OPOR_04	--	42 dBA	--	50 / -- dBA	Meets Sound Level Criteria
OPOR_05	--	42 dBA	--	50 / -- dBA	Meets Sound Level Criteria

Note(s):

1. Outdoor areas are not assessed during nighttime period
2. Outdoor points of reception (OPORs) were assessed at the worst-case location within each OLA.

The main exceedances experienced at the proposed development are due to the cooling tower associated with the Society 145 Condos apartment building to the west. A small exceedance is also predicted along the south façade of Building C. The surrounding buildings do not have environmental permits, nor are they required to obtain one. These sources were assessed from a due diligence perspective to avoid nuisance complaints from future occupants of the proposed new development. Recommendations are presented in the following section.

The predicted maximum sound level experienced by the emergency generator identified at 330 Phillip Street was determined to be 54 dBA at the worst-case location on the development. Therefore, the emergency generator meets the Class 1 sound level limit of 55 dBA for emergency generator testing.

3.3 Recommendations

Based on the noise and vibration assessment results, the following recommendations were determined for the project. Recommendations are provided for both transportation sources and stationary sources.

3.3.1 Transportation Sources

The following recommendations are provided to address transportation sources.

3.3.1.1 Ventilation Recommendations

Due to the transportation sound levels at the plane of the façade, central air conditioning is recommended for the proposed development to allow for windows and doors to remain closed as a noise mitigation measure. Further, prospective purchasers or tenants should be informed by a warning clause "Type D".

3.3.2 Stationary Sources

The conservative sound power levels and duty cycles assumed for the stationary sources show that the development would exceed the NPC-300 sound level limits by up to 7 dB during the quietest nighttime hour at the worst-case receptor location. Prior to building permit, it is recommended that the conservative assumptions regarding duty cycle and sound power level of the cooling tower associated with Society 145 Condos be confirmed through measurements and/or discussion with the property owner. Should sound levels still be predicted to exceed the Class 1 limits, the feasibility of mitigation to reduce sound levels at source should be investigated. If these measures are not feasible, it is recommended that air conditioning is provided to allow windows to be closed. With windows closed, the indoor sound levels are expected to be acceptable, and the development is expected to be acoustically compatible with existing non-permitted stationary sources.

3.3.3 Warning Clauses

The following NPC-300 warning clauses are recommended for the proposed development:

1. NPC-300 Type D to address transportation sound levels at the plane of window.
2. NPC-300 Type E to address proximity to commercial/industrial facilities.

In addition to the NPC-300 warning clauses above, the following RMOW warning clause is recommended for the proposed development:

1. RMOW Type A to address transportation sound levels at the plane of window.

Warning clauses are recommended to be included on all development agreements, offers of purchase and agreements of purchase and sale or lease. The wording of the recommended warning clauses is included with **Appendix F**.

4 THE EFFECTS OF THE PROPOSED DEVELOPMENT ON ITS SURROUNDINGS AND ON ITSELF

On-site stationary sources for the development are expected to consist of HVAC related equipment in the roof-top mechanical penthouse as well as various exhaust fans. Further, consideration should be given to control airborne and structure-borne noise generated within the proposed development.

Within the development itself the main sources of noise that are likely to affect the uses of the building are the mechanical systems. The potential noise effect of the commercial component of the development is recommended to be reviewed during detailed design, to ensure the applicable criteria will be met.

Provided that best practices for the acoustical design of the building are followed, noise from building services equipment associated with the development are expected to be feasible to meet the applicable sound level criteria due to the nature (residential/mixed-use) of the proposed development.

We recommend that the potential noise effect of the proposed development is reviewed during detailed design to ensure the applicable sound level criteria will be achieved.

5 CONCLUSIONS

RWDI was retained to prepare a Noise and Vibration Impact Study for the proposed mixed-use development located in Waterloo, Ontario.

The following noise control measures are recommended for the proposed development:

1. Installation of central air-conditioning so that all suites' windows can remain closed.
2. The inclusion of noise warning clauses related to:
 - a. Transportation sound levels at the building façade
 - b. Proximity to commercial/industrial land-use

The potential noise levels from stationary sources of sound were evaluated. Based on the noise modeling results and setback distances, the land use compatibility of the proposed development with respect to the nearby commercial land-uses is considered acceptable from the noise assessment perspective. All sources in the vicinity of the proposed development are exempt from any environmental permitting. Based on preliminary modelling some exceedances of the Class 1 limits were noted. As sources are exempt from environmental permits, sound levels can be managed through on-building mitigation (i.e. installation of air conditioning, high STC windows). It is recommended that screening level modelling be refined prior to building permit to consider operating times, and measurements of surrounding equipment (if possible). At source mitigation, if feasible, should be implemented on surrounding buildings to reduce sound. However, based on preliminary modelling it is expected that on-building mitigation strategies will achieve a comfortable acoustic environment.

At this stage in design the noise levels produced by the development on itself and its surroundings could not be quantitatively assessed. However, the effect on both the building itself and its surroundings is expected to be feasible to meet the applicable criteria. We recommend that the building design is evaluated prior to building permit to ensure that the acoustical design is adequately implemented in order to meet the applicable criteria.

Based on the results of the analysis including implementation of the recommendations included with this assessment, the proposed development is feasible to meet the applicable sound and vibration criteria.

6 REFERENCES

1. Ontario Ministry of the Environment (MOE), August 2013, Publication NPC-300, Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning (MOE, 2013).
2. Richtlinien für den Lärmschutz an Strassen (RLS). BM für Verkehr, Bonn, 1990 (RLS, 1990).
3. Ontario Ministry of the Environment (MOE), 1989, ORNAMENT Ontario Road Noise Analysis Method for Environment and Transportation, Technical Publication (MOE, 1989)
4. Ontario Ministry of the Environment (MOE) Publication Guideline D-6, “Compatibility Between Industrial Facilities and Sensitive Land Uses”, July 1995 (MOE, 1995).
5. The Railway Association of Canada (RAC), Guidelines for New Development in Proximity to Railway Operations (RAC, 2013).
6. International Organization for Standardization (ISO), 1994b, International Standard ISO 9613-1:1994, Acoustics – Attenuation of Sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere. (ISO, 1994)
7. International Organization for Standardization (ISO), 1996, International Standard ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO, 1996)
8. Regional Municipality of Waterloo, “Implementation Guideline for Noise Policies”, Adopted by Regional Council July 14, 1999. Updated October 22, 2019 (RMOW, 2019).



STATEMENT OF LIMITATIONS

This report entitled 143 Columbia Street West was prepared by RWDI AIR Inc. ("RWDI") for New Generation Design Wave Inc. ("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 and recommendations contained in this report are based on the information available to RWDI when this report was prepared.

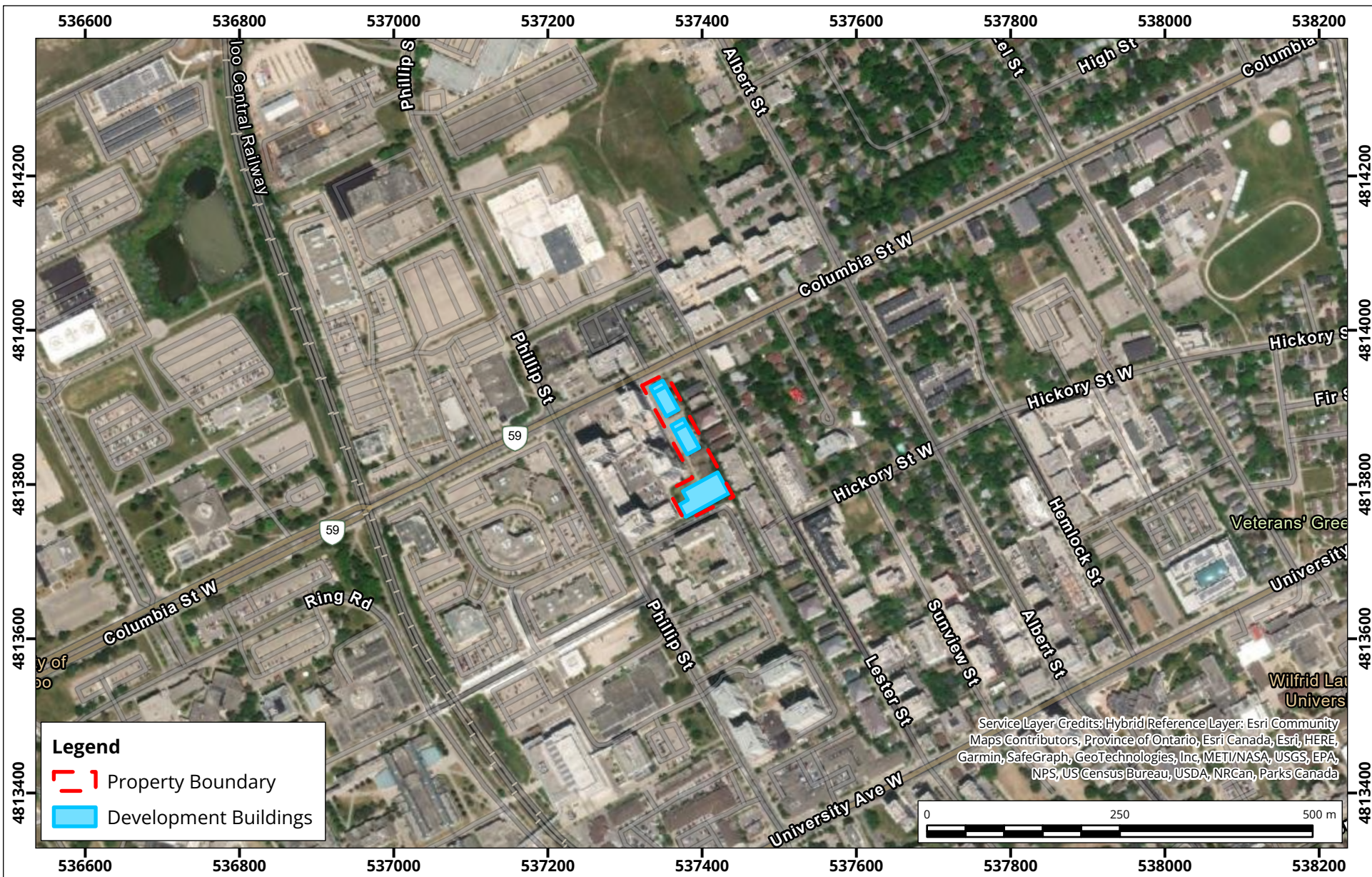
Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations 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 and recommendations 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 and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

FIGURES

Map Document: \\wvdlgroup\p\geoph\AM_Jobs\2024\2401942\03\WorkItems\206\Environmental\Noise\Analysis\ArcGIS\143 Columbia Street - Waterloo, Ontario.aprx



Site Context Plan

Map Projection: NAD 1983 UTM Zone 17N
143 Columbia Street - Waterloo, Ontario

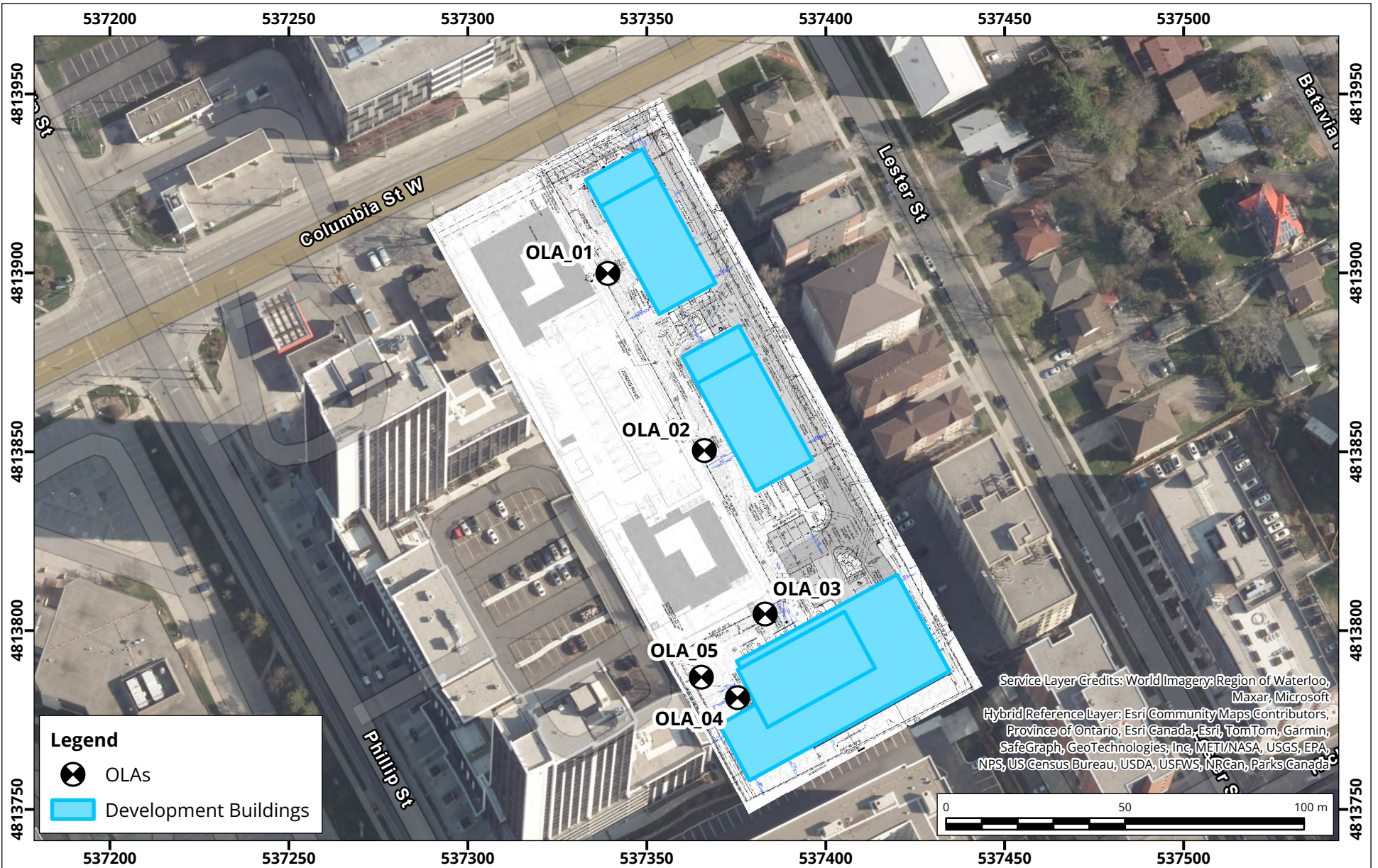


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Date Revised: Dec 18, 2023	

Project #: 2401942



Map Document: \\wv\group\wv\elph\AM_Jobs\2024\240194\203\WorkItems\206\Environmental\Noise\Analysis\ArcGIS\143 Columbia Street - Waterloo, Ontario.aprx



Outdoor Living Areas (OLAs) Locations Location of Common Outdoor Amenity Areas

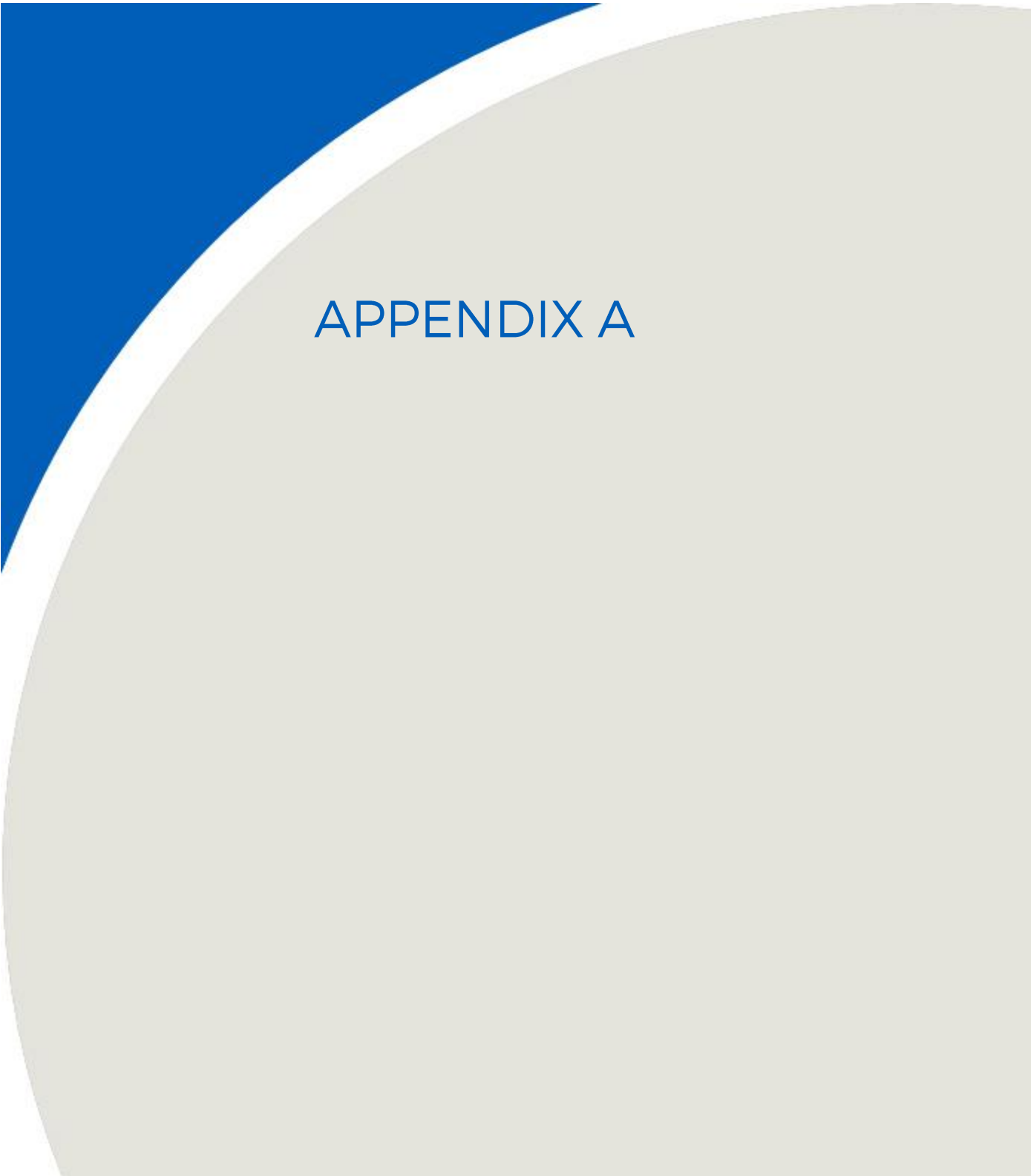
Map Projection: NAD 1983 UTM Zone 17N
143 Columbia Street - Waterloo, Ontario

True North
↑

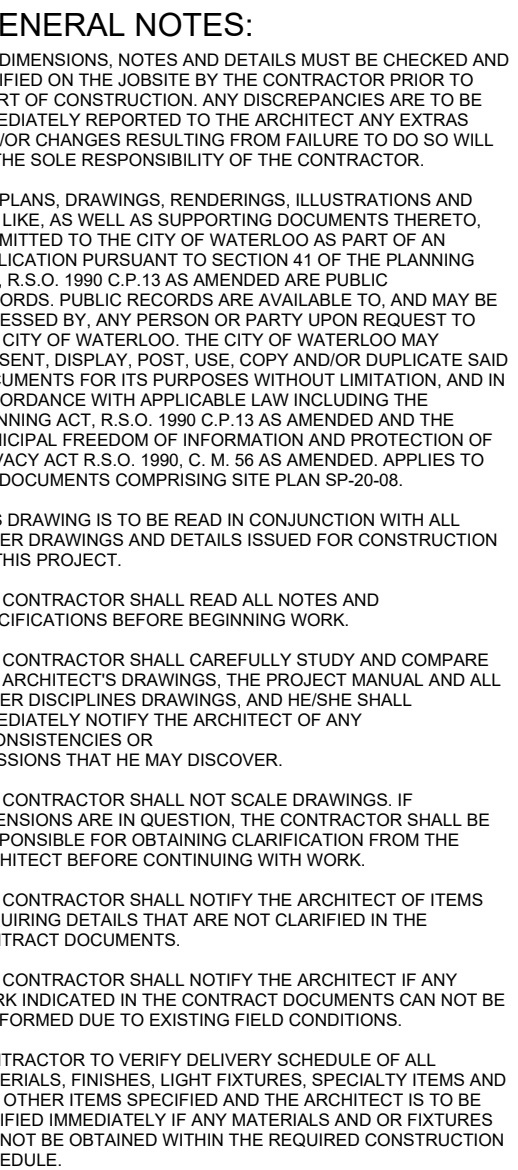
Drawn by: CWM	Figure: 2
Approx. Scale: 1:1,500	
Date Revised: Apr 4, 2024	

Project #: 2401942



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APPENDIX A



DATE	REVISED FOR	CH	BY
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REVISIONS:

[illegible]

2024.04.04	ZBA 2ND & SPA 4TH SUBMISSION		
2023.06.08	SPA 3RD SUBMISSION		
2023.04.04	SPA 2ND SUBMISSION		
2022.06.30	ZBA PRE-CONSULTATION		
2021.11.03	SPA 1ST SUBMISSION		
DATE	ISSUED FOR	CH	BY

DATE: 04/03/2010 03:24 PM

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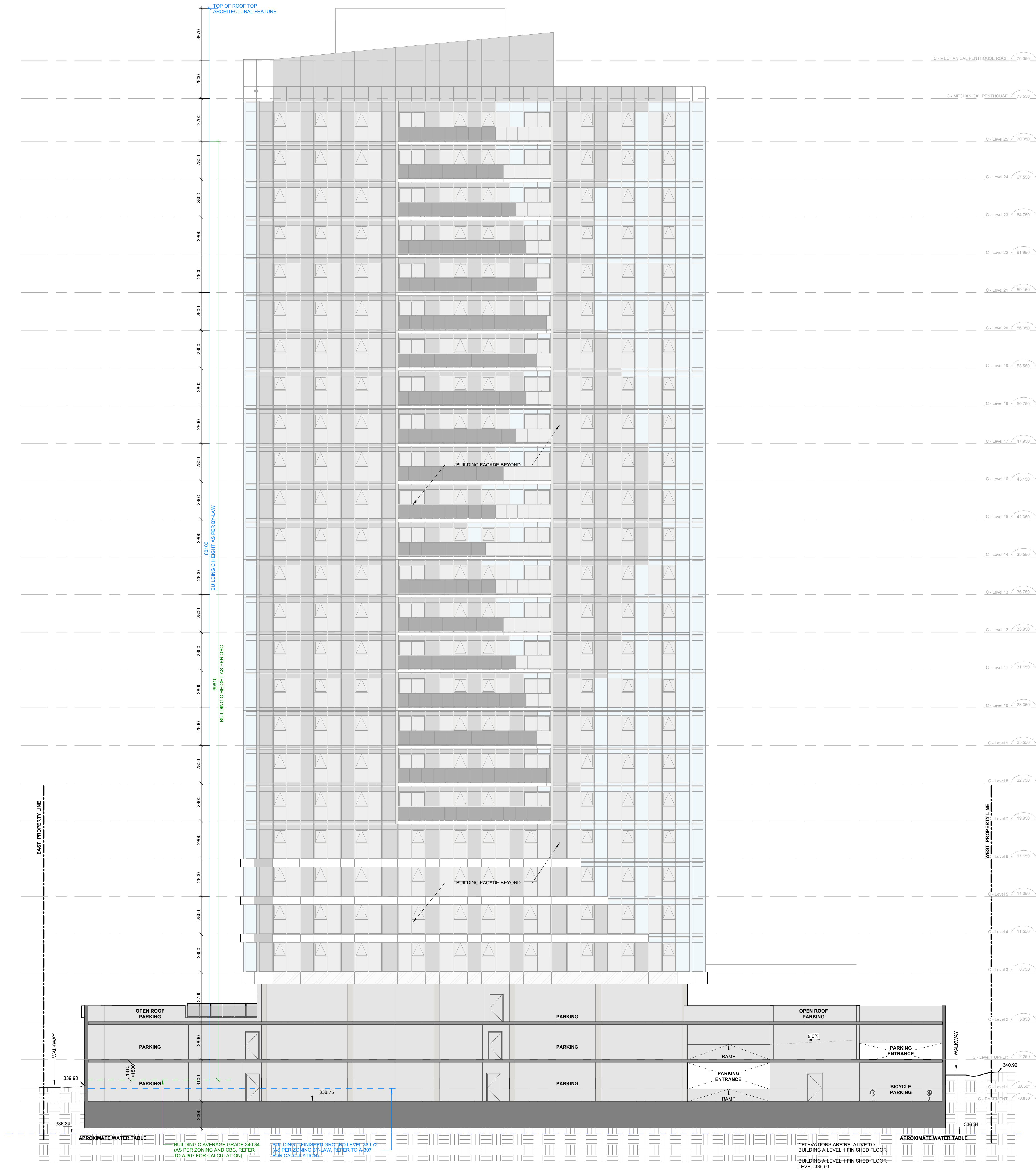
143 COLUMBIA INC.

TITLE:

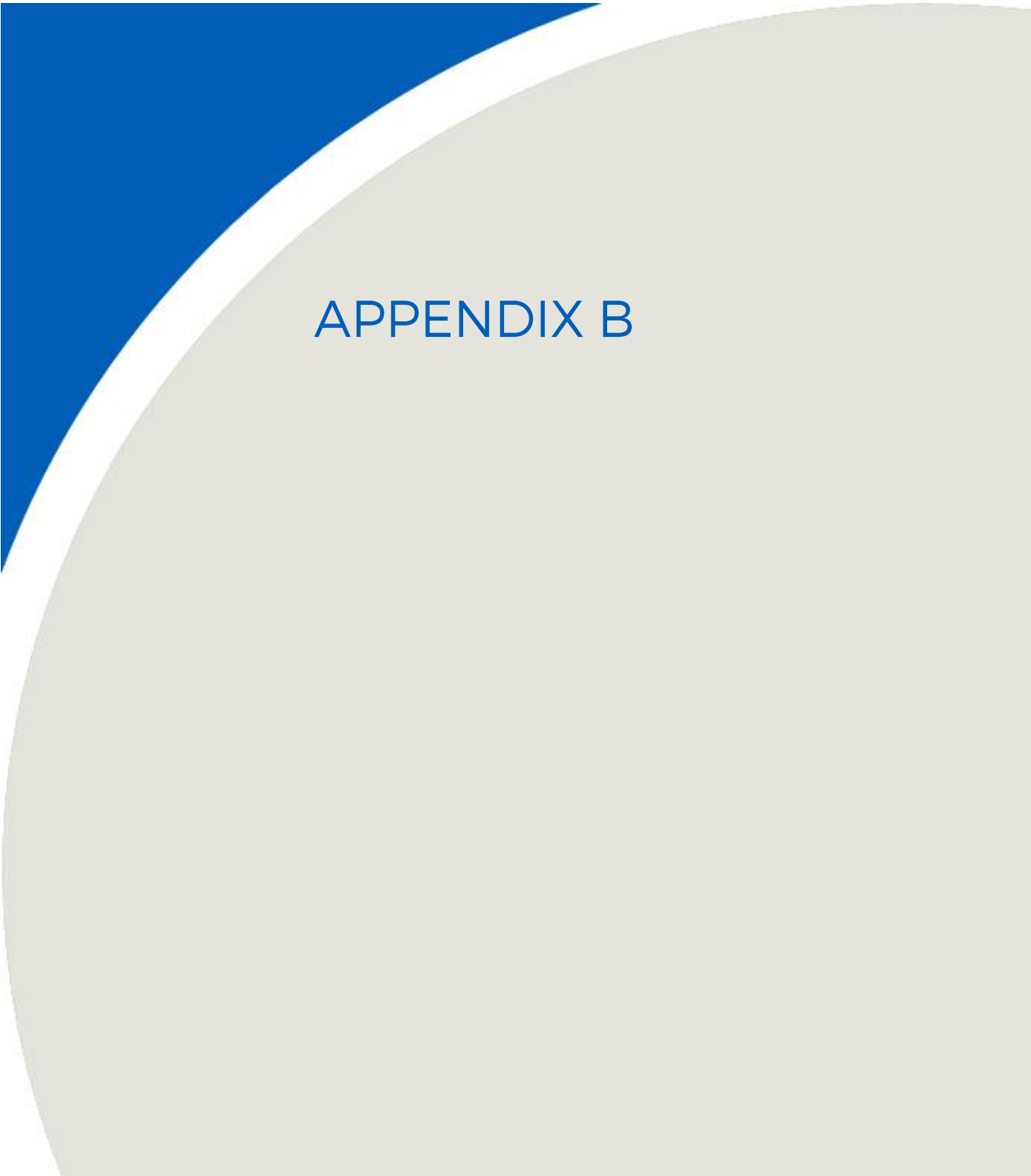
143 COLUMBIA STREET W.
143 COLUMBIA STREET W, WATERLOO ON.

DRAWING TITLE:

DESIGNED BY: KS	CHECKED BY:	PROJECT NUMBER: 18-143
DRAWN BY: MB	APPROVED BY:	DATE: 2024.01.11
SCALE: 1 : 125		DRAWING NUMBER: SPA 4.3
SHEET NUMBER:		



BUILDING C SECTION E-W
SCALE: 1:125

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APPENDIX B

CRITERIA

Transportation Sources

Guidance from the Ontario Ministry of the Environment, Conservation and Parks (MECP) NPC-300 Environmental Noise Guideline was used to assess environmental noise generated by transportation-related sources. There are three aspects to consider, which include the following:

- Transportation source sound levels in indoor living areas (living rooms and sleeping quarters), which determines building façade elements (windows, exterior walls, doors) sound insulation design recommendations.
- Transportation source sound levels at the plane of the window, which determines air-conditioning and ventilation system recommendations and associated warning clauses which inform the future occupants that windows and doors must be closed in order to meet the indoor sound level criteria.
- Transportation source sound levels in Outdoor Living Areas (OLAs), which determines OLA noise mitigation and related warning clause recommendations.

Road and Rail

Indoor Sound Level Criteria

For assessing sound originating from transportation sources, NPC-300 defines sound level criteria as summarized in **Table 1** for indoor areas of sensitive uses. The specified values are maximum sound levels and apply to the indicated indoor spaces with the windows and doors closed.

Table 1: Indoor Sound Level Criteria for Road and Rail Sources

Type of Space	Source	Sound Level Criteria (Indoors)	
		Daytime $L_{eq,16-hr}$ 07:00h – 23:00h	Nighttime $L_{eq,8-hr}$ 23:00h – 07:00h
Living Quarters Examples: Living, dining and den areas of residences, hospitals, nursing homes, schools and daycare centres	Road	45 dBA	
	Rail	40 dBA	
Sleeping Quarters	Road	45 dBA	40 dBA
	Rail	40 dBA	35 dBA

NPC-300 also provides guidelines for acceptable indoor sound levels that are extended to land uses and developments which are not normally considered noise sensitive. The guideline sound level criteria presented in **Table 2** are provided to inform good-practice design objectives.

Table 2: Supplementary Indoor Sound Level Criteria for Road and Rail Sources

Type of Space	Source	Sound Level Criteria (Indoors)	
		Daytime $L_{eq,16-hr}$ 07:00h – 23:00h	Nighttime $L_{eq,8-hr}$ 23:00h – 07:00h
General offices, reception areas, retail stores, etc.	Road	50 dBA	-
	Rail	45 dBA	-
Theatres, places of worship, libraries, individual or semi-private offices, conference rooms, reading rooms, etc.	Road	45 dBA	-
	Rail	40 dBA	-
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	Road	-	40 dBA
	Rail	-	35 dBA
Sleeping quarters of hotels/motels	Road	-	45 dBA
	Rail	-	40 dBA

Outdoor Living Areas (OLAs)

Outdoor Living Areas (OLAs) would include outdoor areas intended and designed for the quiet enjoyment of the outdoor environment and which are readily accessible from the building.

OLAs may include any common outdoor amenity spaces associated with a multi-unit residential development (e.g. courtyards, roof-top terraces), and/or private backyards and terraces with a minimum depth of 4m provided they are the only outdoor living area for the occupant. The sound level criteria for outdoor living areas is summarized in **Table 3**.

Table 3: Sound Level Criteria – Outdoor Living Area

Assessment Location	Sound Level Criteria (Outdoors)	
	Daytime $L_{eq,16-hr}$ 07:00h – 23:00h	Nighttime $L_{eq,8-hr}$ 23:00h – 07:00h
Outdoor Living Area (OLA) (Combined Road and Rail)	55 dBA	-

Outdoor and Plane of Window Sound Levels

In addition to the sound level criteria, noise control measures and requirements for ventilation and warning clauses requirements are recommended for residential land-uses based on predicted transportation source sound levels incident in the plane of window at bedrooms and living/dining rooms, and/or at outdoor living areas. These recommendations are summarized in **Table 4** below.

Table 4: Ventilation, Building Component, and Warning Clauses Recommendations for Road/Rail Sources

Assessment Location	Transportation Sound Level (Outdoors)		Recommendations
	Daytime $L_{eq,16-hr}$ 07:00h – 23:00h	Nighttime $L_{eq,8-hr}$ 23:00h – 07:00h	
Plane of Window (Road)	> 65 dBA	> 60 dBA	Installation of air conditioning to allow windows to remained closed. The sound insulation performance of building components must be specified and designed to meet the indoor sound level criteria. Warning clause “Type D” is recommended.
	> 55 dBA	> 50 dBA	Applicable for low and medium density development: Forced-air ventilation system to allow for the future installation of air-conditioning. Warning clause “Type C” is recommended. Applicable for high density development: Air conditioning to allow windows to remained closed. Warning clause “Type D” is recommended.
Plane of Window (Rail ^{1,2})	> 60 dBA	> 55 dBA	The acoustical performance of building façade components should be specified such that the indoor sound level limits are predicted to be achieved. Warning clause “Type D” is recommended.
	> 60 dBA ($L_{eq, 24hr}$) and < 100m from tracks		Exterior walls consisting of a brick veneer or masonry equivalent for the first row of dwellings. Warning clause “Type D” is recommended.
Outdoor Living Area (Combined Road and Rail ³)	≤ 60 dBA > 55 dBA	-	If sound levels are predicted to exceed 55 dBA, but are less than 60 dBA, noise controls may be applied to reduce the sound level to 55 dBA. If noise control measures are not provided, a warning clause “Type A” is recommended.
	> 60 dBA	-	Noise controls (barriers) should be implemented to meet the 55 dBA criterion. If mitigation is not feasible to meet the 55 dBA criterion for technical, economic or administrative reasons, an exceedance of 5 dB may be acceptable (to a maximum sound level of 60 dBA). In this case a warning clause “Type B” would be recommended.

Note(s):

1. Whistle noise is included (if applicable) in the determination of the sound level at the plane of window.
2. Some railway companies (e.g. CN, CP) may require that the exterior walls include a brick veneer or masonry equivalent for the façade facing the railway line, regardless of the sound level.
3. Whistle noise is not included in the determination of the sound level at the OLA.

Stationary Sources

NPC-300 Sound Level Criteria – Stationary Sources

Guidance from the MECP NPC-300 Environmental Noise Guideline is used to assess environmental noise generated by stationary sources, for example industrial and commercial facilities.

Noise from stationary sources is treated differently from transportation sources and requires sound levels be assessed for the predictable worst-case one-hour average sound level (L_{eq}) for each period of the day. For assessing sound originating from stationary sources, NPC-300 defines sound level criteria for two types of Points of Reception (PORs): outdoor and plane of window.

Continuous Sources – Regular Operations

The assessment criteria for all PORs is the higher of either the exclusion limit per NPC-300 or the minimum background sound level that occurs or is likely to occur at a POR. The applicable exclusion limit is determined based on the level of urbanization or “Class” of the area. The NPC-300 exclusion limits for continuously operating stationary sources are summarized in **Table 5**.

Table 5: NPC-300 Exclusion Limits – Continuous and Quasi-Steady Impulsive Stationary Sources ($L_{Aeq-1hr}$)

Time Period	Class 1 Area		Class 2 Area		Class 3 Area		Class 4 Area	
	Outdoor	Plane of Window	Outdoor	Plane of Window	Outdoor	Plane of Window	Outdoor	Plane of Window
Daytime 0700-1900h	50 dBA	50 dBA	50 dBA	50 dBA	45 dBA	45 dBA	55 dBA	60 dBA
Evening 1900-2300h	50 dBA	50 dBA	45 dBA	50 dBA	40 dBA	40 dBA	55 dBA	60 dBA
Nighttime 2300-0700h	--	45 dBA	--	45 dBA	--	40 dBA	--	55 dBA

Note(s):

1. The applicable sound level criterion is the background sound level or the exclusion limit, whichever is higher.
2. Class 1, 2 and 3 sound level criteria apply to a window that is assumed to be open.
3. Class 4 area criteria apply to a window that is assumed closed. Class 4 area requires formal designation by the land-use planning authority.

Continuous Sources - Emergency Equipment Testing

Sound level criteria for emergency backup equipment (e.g. generators) operating in non-emergency situations such as testing or maintenance are 5 dB greater than the applicable sound level criteria for stationary sources.

In addition, the operation of emergency equipment under maintenance and testing conditions is assessed separately from all other stationary noise sources.

Impulsive Sources

For impulsive sound, other than quasi-steady impulsive sound, from a stationary source, the sound level criteria at a POR is expressed in terms of the Logarithmic Mean Impulse Sound Level (L_{LM}). As with the continuous noise sources, the assessment criteria for all PORs is the higher of either the exclusion limit per NPC-300 or the minimum background sound level that occurs or is likely to occur at a POR.

A summary of the exclusionary sound level limits is summarized in **Table 6**.

Table 6: NPC-300 Exclusion Limits – Impulsive Stationary Sources (L_{LM})

Time Period	Number of Impulses in Period of 1-Hour	Class 1 and 2 Areas		Class 3 Areas		Class 4 Areas	
		Outdoor	Plane of Window	Outdoor	Plane of Window	Outdoor	Plane of Window
Daytime (0700-2300h)	9 or more	50 dBAI	50 dBAI	45 dBAI	45 dBAI	55 dBAI	60 dBAI
Nighttime (2300-0700h)		-	45 dBAI	-	40 dBAI	-	55 dBAI
Daytime (0700-2300h)	7 to 8	55 dBAI	55 dBAI	50 dBAI	50 dBAI	60 dBAI	65 dBAI
Nighttime (2300-0700h)		-	50 dBAI	-	45 dBAI	-	60 dBAI
Daytime (0700-2300h)	5 to 6	60 dBAI	60 dBAI	55 dBAI	55 dBAI	65 dBAI	70 dBAI
Nighttime (2300-0700h)		-	55 dBAI	-	50 dBAI	-	65 dBAI
Daytime (0700-2300h)	4	65 dBAI	65 dBAI	60 dBAI	60 dBAI	70 dBAI	75 dBAI
Nighttime (2300-0700h)		-	60 dBAI	-	55 dBAI	-	70 dBAI
Daytime (0700-2300h)	3	70 dBAI	70 dBAI	65 dBAI	65 dBAI	75 dBAI	80 dBAI
Nighttime (2300-0700h)		-	65 dBAI	-	60 dBAI	-	75 dBAI
Daytime (0700-2300h)	2	75 dBAI	75 dBAI	70 dBAI	70 dBAI	80 dBAI	85 dBAI
Nighttime (2300-0700h)		-	70 dBAI	-	65 dBAI	-	80 dBAI
Daytime (0700-2300h)	1	80 dBAI	80 dBAI	75 dBAI	75 dBAI	85 dBAI	90 dBAI
Nighttime (2300-0700h)		-	75 dBAI	-	70 dBAI	-	85 dBAI

Note(s):

1. The applicable sound level criterion is the background sound level or the exclusion limit, whichever is higher.

D-Series Guidelines

The MECP D-series guidelines (MOE, 1995) provide direction for land use planning to maximize compatibility of industrial uses with adjacent land uses. The goal of Guideline D-6 is to minimize encroachment of sensitive land uses on industrial facilities and vice versa, in order to address potential incompatibility due to adverse effects such as noise, odour and dust.

For each class of industry, the guideline provides an estimate of potential influence area and states that this influence area shall be used in the absence of the recommended technical studies. Guideline D-6 also recommends a minimum separation distance between each class of industry and sensitive land uses (see **Table 7**). Section 4.10 of D-6 identifies exceptional circumstances with respect to redevelopment, infill and mixed-use areas. In these cases, the guideline suggests that separation distances at, or less than, the recommended minimum separation distance may be acceptable if a justifying impact assessment is provided.

Table 7: Summary of Guideline D-6

Industry Class	Definition	Potential Influence Area ^[1]	Recommended Minimum Separation Distance ^[1]
Class I	Small scale, self-contained, daytime only, infrequent heavy vehicle movements, no outside storage.	70 m	20 m
Class II	Medium scale, outdoor storage of wastes or materials, shift operations and frequent heavy equipment movement during the daytime.	300 m	70 m
Class III	Large scale, outdoor storage of raw and finished products, large production volume, continuous movement of products and employees during daily shift operations.	1000 m	300 m

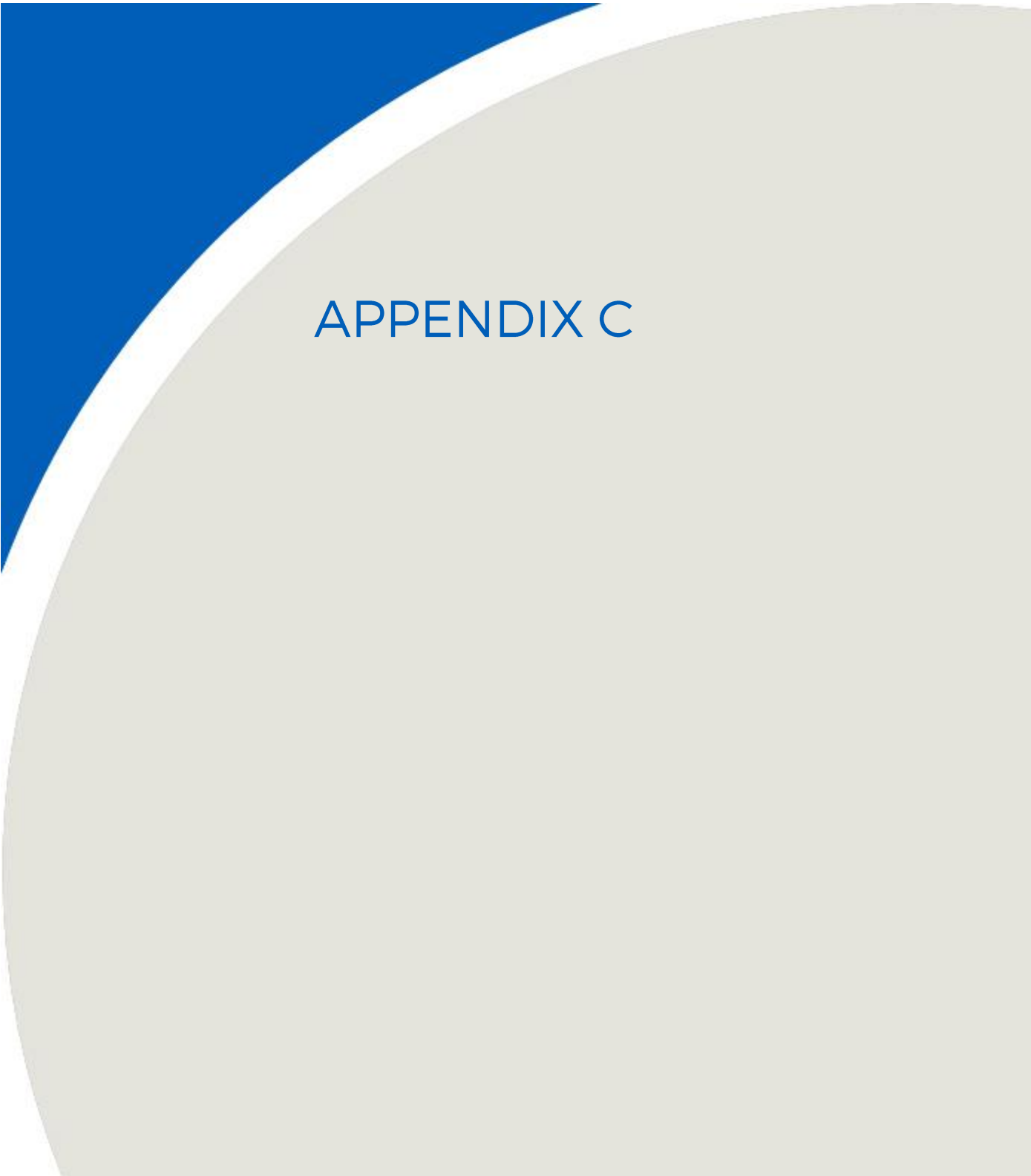
Note(s):

1. Measured from Property Line to Property Line.

Guideline D-6 provides criteria for classifying industrial land uses, based on their outputs, scale of operations, processes, schedule and intensity of operations. **Table 8** provides the classification criteria and examples.

Table 8: Guideline D-6 Industrial Categorization Criteria

Criteria	Class I	Class II	Class III
Outputs	• Sound not audible off property • Infrequent dust and/ or odour emissions and not intense • No ground-borne vibration	• Sound occasionally audible off property • Frequent dust and/ or odour emissions and occasionally intense • Possible ground-borne vibration	• Sound frequently audible off property • Persistent and intense dust and/ or odour emissions • Frequent ground-borne vibration
Scale	• No outside storage • Small scale plant or scale is irrelevant in relation to all other criteria	• Outside storage permitted • Medium level of production	• Outside storage of raw and finished products • Large production levels
Process	• Self-contained plant or building which produces / stores a packaged product • Low probability of fugitive emissions	• Open process • Periodic outputs of minor annoyance • Low probability of fugitive emissions	• Open process • Frequent outputs of major annoyances • High probability of fugitive emissions
Operation / Intensity	• Daytime operations only • Infrequent movement of products and/or heavy trucks	• Shift operations permitted • Frequent movements of products and/or heavy trucks with majority of movements during daytime hours	• Continuous movement of products and employees • Daily shift operations permitted
Examples	• Electronics Manufacturing • Furniture refinishing • Beverage bottling • Auto parts • Packaging services • Dairy distribution • Laundry and linen supply	• Magazine printing • Paint spray booths • Metal command • Electrical production • Dairy product manufacturing • Feed packing plant	• Paint and varnish manufacturing • Organic chemicals manufacturing • Breweries • Solvent recovery plant • Soap manufacturing • Metal manufacturing

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APPENDIX C

REGIONAL MUNICIPALITY OF WATERLOO

TURNING MOVEMENT COUNT



Estimated Daily Traffic

Total Factor = Monthly Factor 1 x Daily Factor 1 x 24 Hour Factor 1.74 = 1.740000

Municipality: Waterloo
Intersection: University Ave & Lester St
Control: Non Signalized
Major Road: University Ave

Weather conditions:
 Sunny

Person(s) who counted:
 AT08-MJ

GeoID: 7290
Count Date: Tuesday, 19-Mar-19

North Leg Total: 1,171
North Entering: 640
North Peds: N/A
Peds Cross: X

% Trks	2%	2%	5%	
Heavys	3	0	3	7
Trucks	3	2	5	10
Cars	376	85	162	623
Total	383	87	171	

Heavys: 7
Trucks: 16
Cars: 508
Total: 531

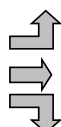
East Leg Total: 18,093
East Entering: 9,245
East Peds: N/A
Peds Cross: X

Heavys: 532
Trucks: 103
Cars: 8,615
Total: 9,250



University Ave

% Trks	4%	7%	1%	
Heavys	0	508	0	
Trucks	9	92	3	
Cars	226	7,666	259	
Total	235	8,267	263	
	508	104	8,152	



Lester St



Lester St



Total	254	8,707	284	
Cars	242	8,084	277	
Trucks	7	97	7	
Heavys	5	525	0	
% Trks	5%	7%	2%	
	8,603	111	531	

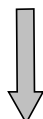
University Ave



Cars: 8,228
Trucks: 106
Heavys: 513
Total: 8,848

Peds Cross: X
West Peds: N/A
West Entering: 8,764
West leg Total: 18,014

Heavys: 0
Trucks: 12
Cars: 621
Total: 633



Total	160	42	411	
Cars	155	40	400	595
Trucks	2	0	9	10
Heavys	3	2	2	7
% Trks	3%	4%	3%	

Peds Cross: X
South Peds: N/A
South Entering: 612
South leg Total: 1,246

Comments

To determine the EDT (Estimated Daily Traffic), add all four leg totals and divide by two.
 This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example: $\frac{(\text{West leg total} + \text{South leg total} + \text{East leg total} + \text{North leg total})}{2}$ **EDT = 19,262**



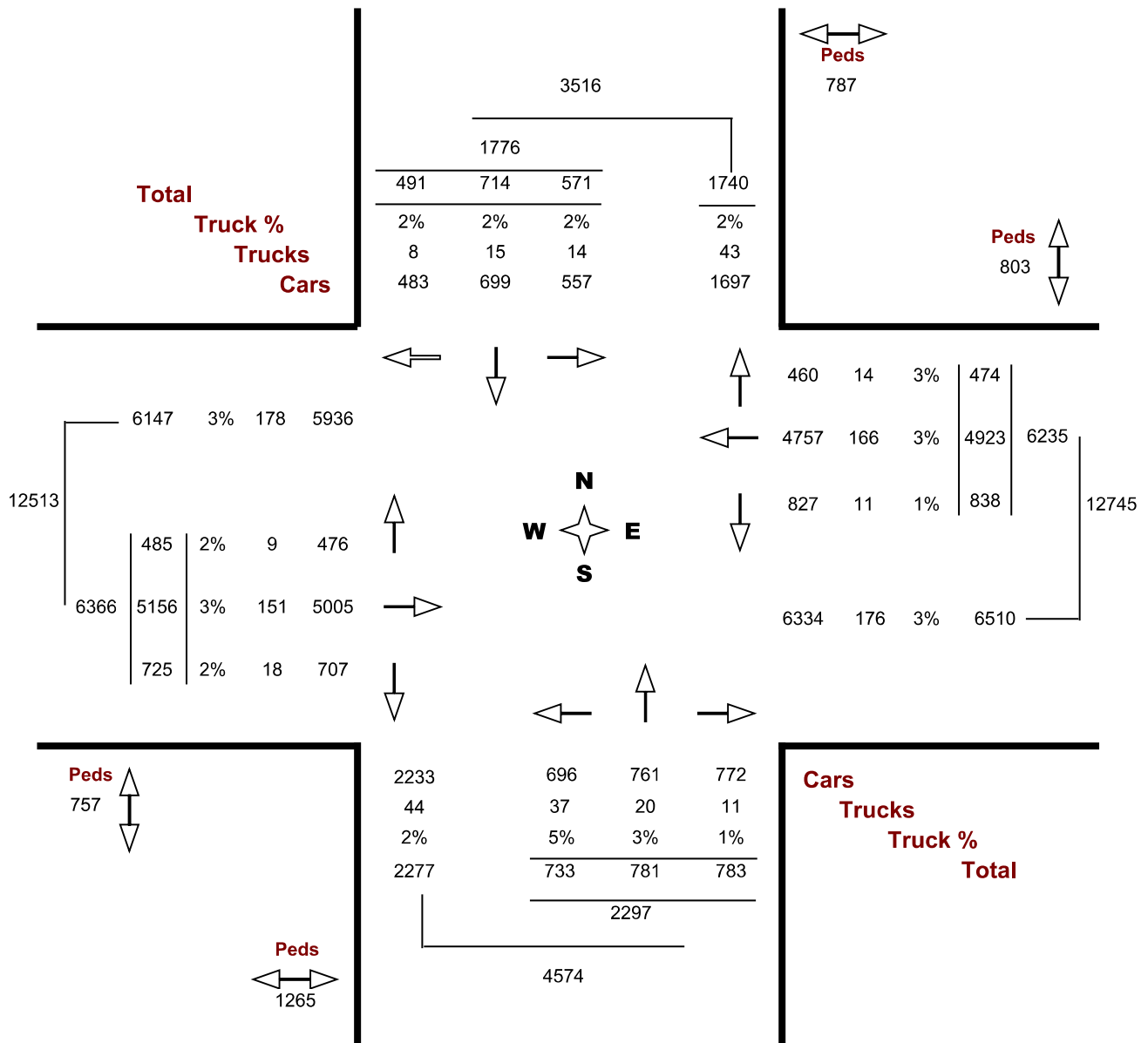
Turning Movements Count - Full Study Report

Location..... COLUMBIA ST W @ PHILLIP ST

Municipality..... Waterloo

GeoID..... 252

Count Date..... Wednesday, 30 October, 2019



STAMSON 5.0 NORMAL REPORT Date: 18-12-2023 11:25:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 143Colum.te Time Period: 16 hours
Description: Sample STAMSON Calc for 143 Columbia N Facade

Road data, segment # 1: Columbia St

Car traffic volume : 14993 veh/TimePeriod
Medium truck volume : 171 veh/TimePeriod
Heavy truck volume : 274 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Columbia St

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 23.00 m
Receiver height : 8.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑

Road data, segment # 2: Phillip St

Car traffic volume : 5405 veh/TimePeriod
Medium truck volume : 52 veh/TimePeriod
Heavy truck volume : 83 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: Phillip St

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 130.00 m
Receiver height : 8.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑

Results segment # 1: Columbia St

Source height = 1.15 m

ROAD (0.00 + 63.60 + 0.00) = 63.60 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.46	0.00	-1.86	0.00	0.00	0.00	0.00	63.60

Segment Leq : 63.60 dBA

↑

Results segment # 2: Phillip St

Source height = 1.11 m

ROAD (0.00 + 48.23 + 0.00) = 48.23 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	60.62	0.00	-9.38	-3.01	0.00	0.00	0.00	48.23

Segment Leq : 48.23 dBA

Total Leq All Segments: 63.72 dBA

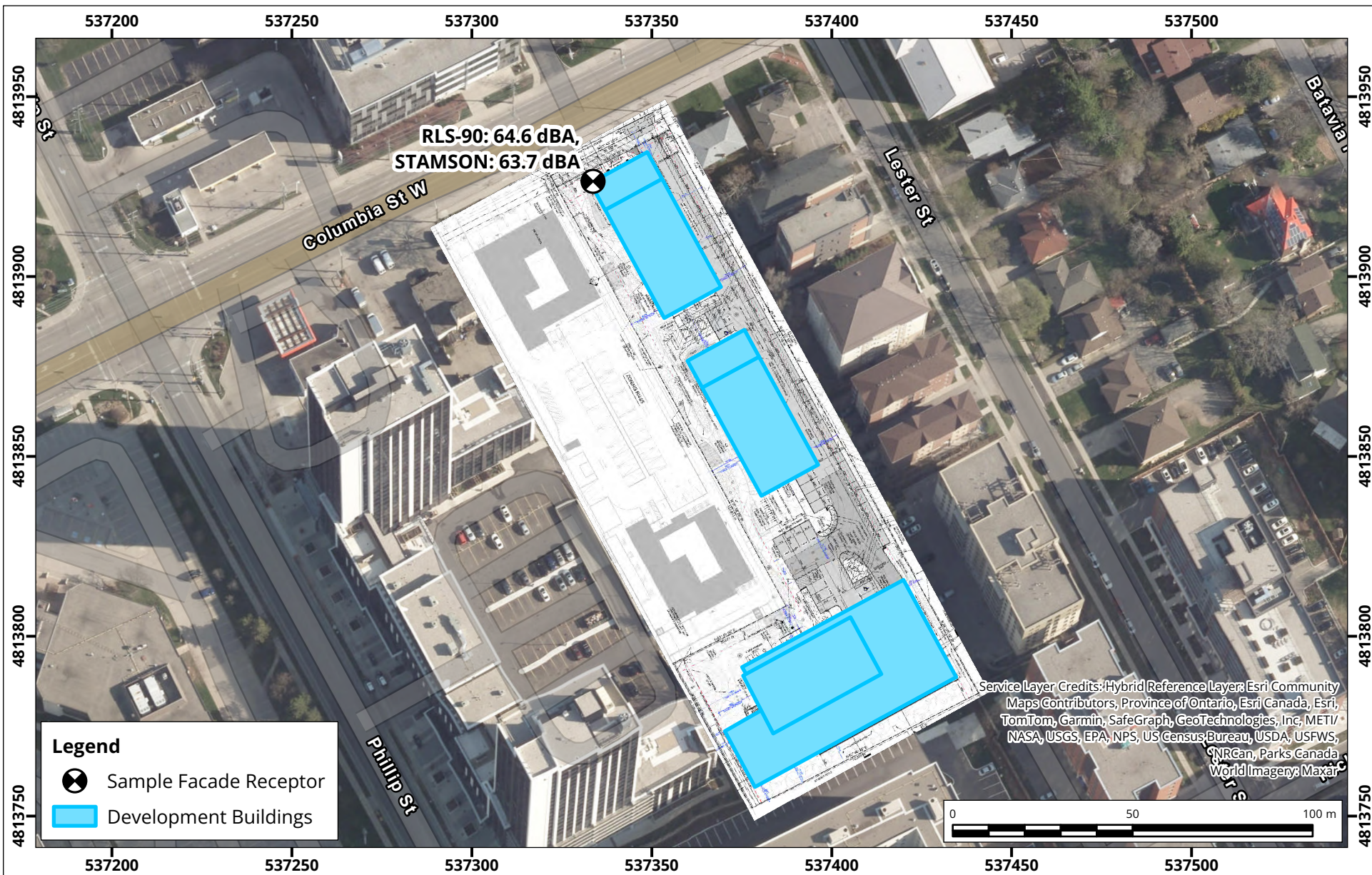
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TOTAL Leq FROM ALL SOURCES: 63.72

↑

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STAMSON Validation

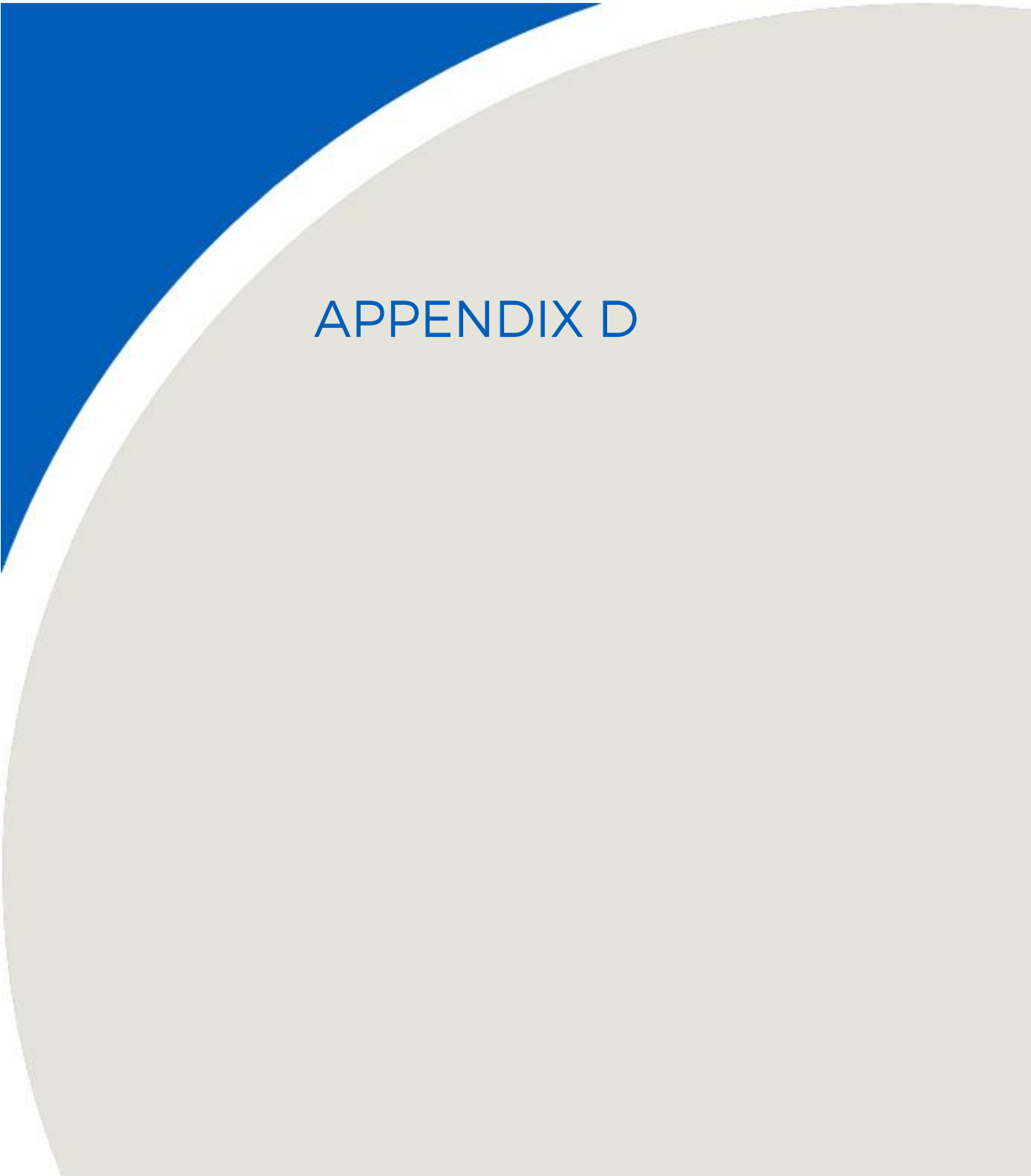
Map Projection: NAD 1983 UTM Zone 17N
143 Columbia Street - Waterloo, Ontario



Drawn by: CWM	Figure: C.1
Approx. Scale: 1:1,500	
Date Revised: Apr 4, 2024	

Project #: 2401942



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APPENDIX D

NOISE MITIGATION GUIDANCE

Acoustic/Noise Barrier

Transportation Noise

Generally, noise controls to attenuate transportation sound levels at Outdoor Living Areas (OLAs) would consist of the implementation of acoustic/noise barriers with materials that would meet the guidance included in NPC-300, for example:

- A wall, berm, wall/berm combination or similar structure, used as a noise control measure, and high enough to break the line-of-sight between the source and the receptor.
- The minimum surface density (face weight) is 20 kg/m²
 - Many materials could satisfy the surface density requirement, e.g. wood, glass, concrete, Plexiglas, Acrylite.
 - The required thickness can be determined by dividing the 20 kg/m² face weight by the material density (kg/m³). Typically, this would imply:
 - 50 mm (2") thickness of wood
 - 13 mm (0.5") thickness of lighter plastic (like Plexiglas or PVC)
 - 10 mm (0.4") thickness of heavier material (like aluminum, glass, concrete)
- The barrier should be structurally sound, appropriately designed to withstand wind and snow load, and constructed without cracks or surface gaps. Joints between panels may need to be overlapped to ensure surfaces are free of gaps, particularly for wood construction.
- Any gaps under the barrier that are necessary for drainage purposes should be minimized and localized, so that the acoustical performance of the barrier is maintained.
- If a sound absorptive face is to be included in the barrier design, the minimum noise reduction coefficient is recommended to be NRC 0.7.

Mechanical Equipment

Noise controls to attenuate mechanical equipment sound levels at Outdoor Points of Reception (OPOR) would consist of the implementation of acoustic/noise barriers for Transportation sources, with the exception of the following:

- The minimum surface density (face weight) is **10 kg/m²**.

All other barrier quality and characteristics would be consistent with the details provided above.

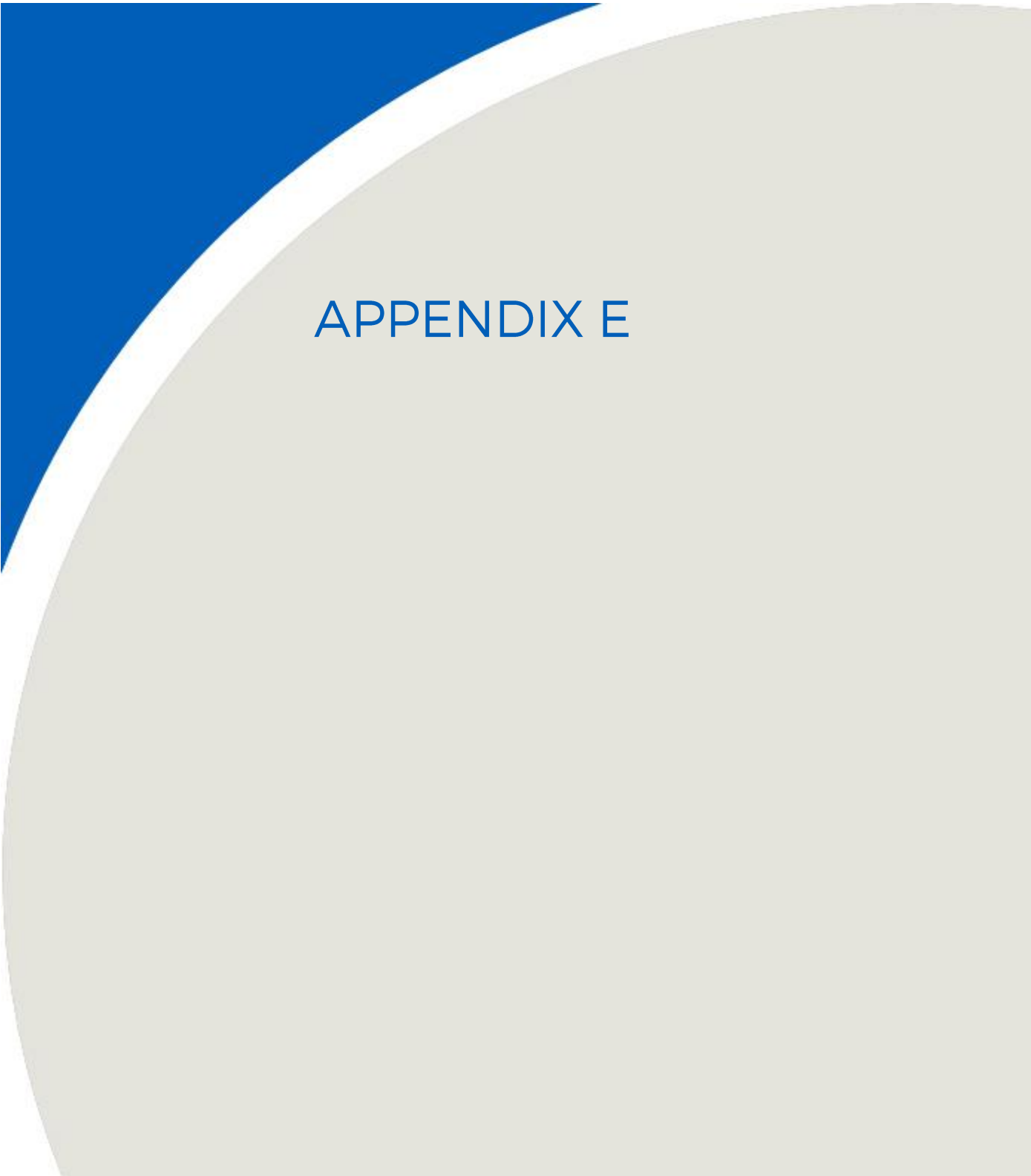
Building Ventilation and Air Conditioning

The use of air conditioning itself is not a noise control measure; however, it allows for windows and doors to remain closed, thereby reducing the indoor sound levels.

NPC-300 provides the following guidance with respect to implementation of building ventilation and air conditioning:

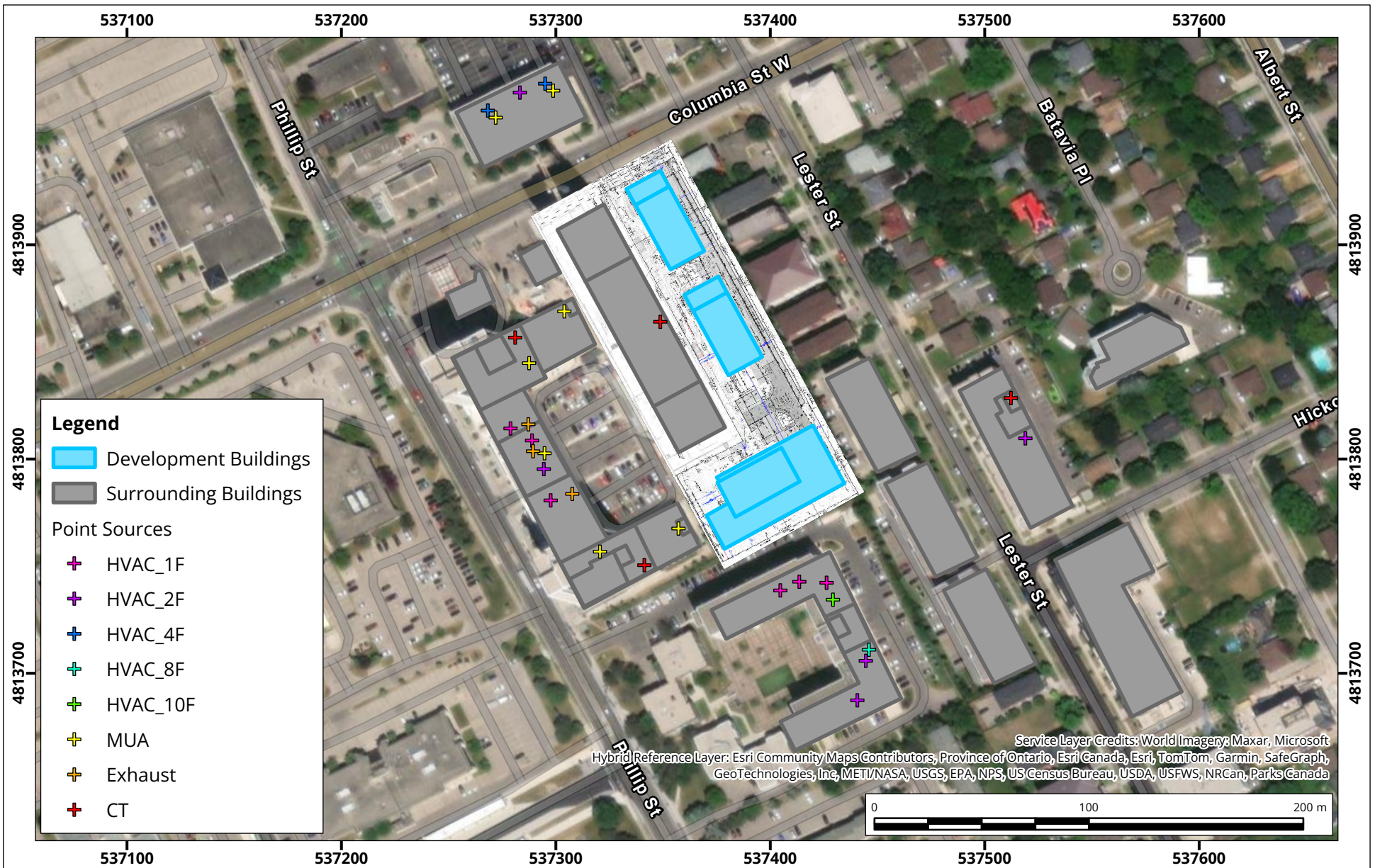
- a. the noise produced by the proposed ventilation system in the space served does not exceed 40 dBA. In practice, this condition usually implies that window air conditioning units are not acceptable;
- b. the ventilation system complies with all national, provincial and municipal standards and codes;
- c. the ventilation system is designed by a heating and ventilation professional; and
- d. the ventilation system enables the windows and exterior doors to remain closed.

Air conditioning systems also need to comply with Publication NPC-216, and/or any local municipal noise by-law that has provisions relating to air conditioning equipment.

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APPENDIX E

Map Document: \\wv\group\geoph\AM_Jobs\2024\240194203\WorkItems\206\EnvironmentalNoise\Analysis\ArcGIS\143 Columbia Street - Waterloo, Ontario.aprx



Stationary Sources Location of Stationary Sources in Relation to the Proposed Development

Map Projection: NAD 1983 UTM Zone 17N
143 Columbia Street - Waterloo, Ontario



Drawn by: CWM	Figure: E.1
Approx. Scale: 1:2,500	
Date Revised: Apr 4, 2024	

Project #: 2401942



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APPENDIX F

WARNING CLAUSES

Warning clauses are recommended to be included on all development agreements, offers of purchase and agreements of purchase and sale or lease. Warning clauses may be used individually or in combination.

The following warning clauses are recommended based on the applicable guidelines; however, wording may be modified/customized during consultation with the planning authority to best suit the proposed development:

Transportation Sources

NPC-300 Type C: Applicable for low and medium density developments only, recommended to address transportation sound levels at the plane of window.

"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."

NPC-300 Type D: Recommended to address transportation sound levels at the plane of window.

"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."

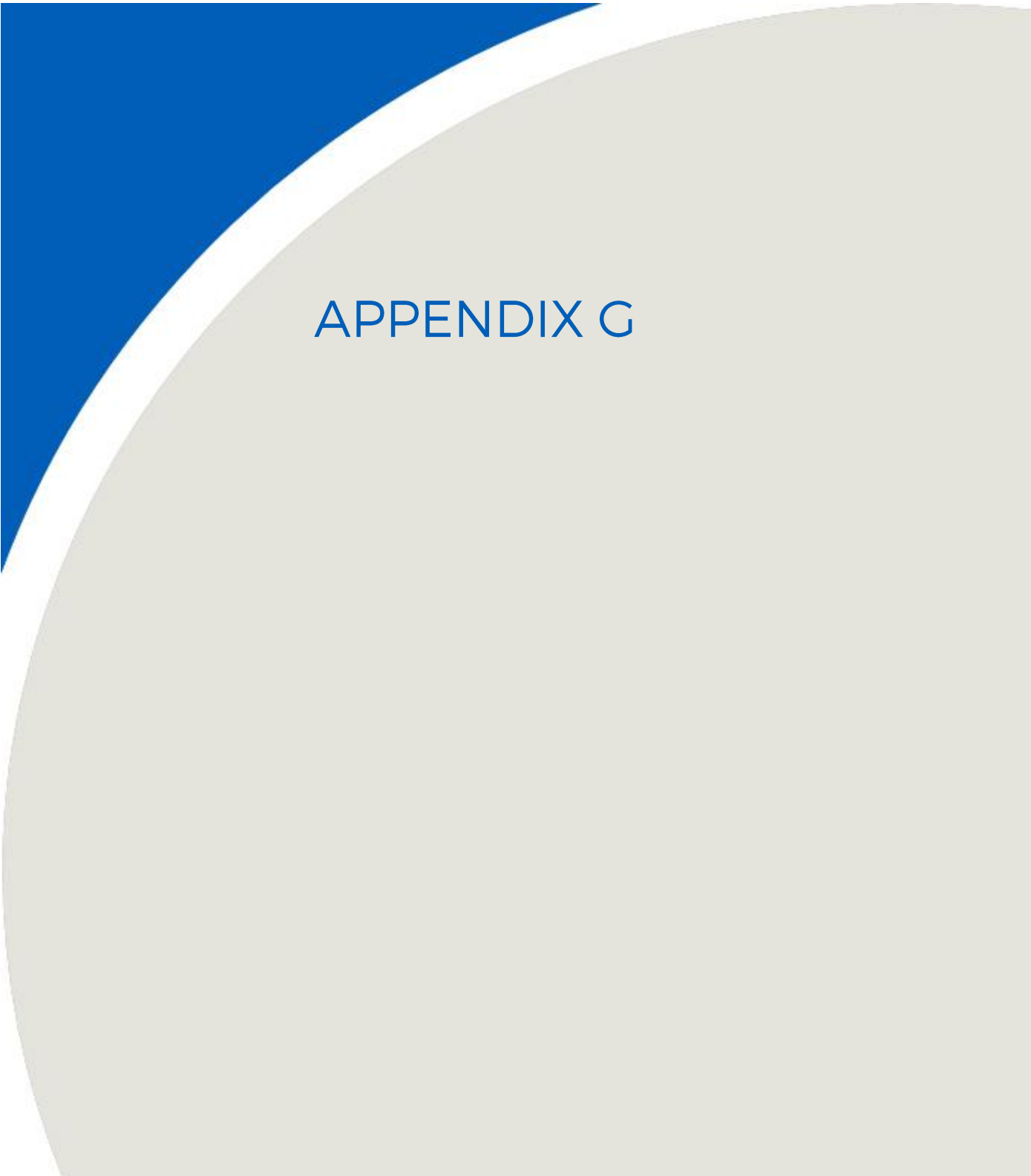
Stationary Sources

NPC-300 Type E: Recommended to address proximity to commercial/industrial land-use

"Purchasers/tenants are advised that due to the proximity of the adjacent industrial/commercial land-uses, noise from the industrial/commercial land-uses may at times be audible."

RMOW Warning Clauses

1. That the owner enter into an agreement with the Regional Municipality of Waterloo for [enter lot(s) or block(s) #], that the following clause be included in the offers to purchase and deeds or rental agreements:
 - a) "Due to its proximity to [enter street name or road #], projected noise levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals."
 - b) "Due to its proximity to [enter street name or road #], projected noise levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals. Moreover, this dwelling has been fitted with a forced air-ducted heating system suitably sized and designed to permit the future installation of a central air conditioning system by the occupants."
 - c) "Due to its proximity to [enter street name or road #], projected noise levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals. Moreover, this dwelling and the lands have been developed such that noise attenuation features are included."
 - d) "Due to its proximity to [enter street name or road #], projected noise levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals. Moreover, this dwelling has been developed such that noise attenuation features are included."
 - e) "Due to its proximity to [enter street name or road #], projected noise levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals. Moreover, these lands have been developed such that noise attenuation features are included."
 - f) "Due to its proximity to [enter street name or road #], projected noise levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals. Moreover, this dwelling has been fitted with a forced air-ducted heating system suitably sized and designated to permit the future installation of a central air conditioning system by the occupants, and the lands have been developed such that noise attenuation features are included."
 - g) "Purchasers are advised that, when [enter name of road], is constructed adjacent to this property, noise levels due to traffic may exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals."
 - g) **Noise Berm**

A large decorative graphic on the left side of the page, featuring a blue triangle at the top left and a large, light gray curved shape that resembles a quarter-circle or a stylized 'C' shape, with a white curved line separating the blue and gray areas.

APPENDIX G

CANADA	)	In the Matter of the
	)	Environmental Protection
PROVINCE OF ONTARIO	)	Act and the Planning Act
	)	
	)	
	)	And in the Matter of a Noise and
	)	Vibration Impact
	)	Study for 143 Columbia Street West
	)	in the City of Waterloo
	)	in the Regional Municipality
	)	of Waterloo

I, Gillian Redman, of the Township of Centre Wellington, in the Wellington County,
SOLEMNLY DECLARE THAT:

1. I am employed by RWDI AIR Inc. which holds a Certificate of Authorization and have personal knowledge of the matters set out below:
2. I was retained or employed as the principal consultant to undertake the assessment of noise impacts and recommendation of noise mitigation measures for the proposed property described as 143 Columbia Street West, Waterloo in the municipality of Waterloo.
3. I had the expertise required to perform these services. Any assessment activities or recommendations requiring the application of engineering principles have been undertaken or supervised by an engineer qualified to perform such services.
4. The information used in the study entitled "143 Columbia Street West, Waterloo, Ontario – Noise and Vibration Impact Study, RWDI Reference Number: 2401942", dated December 21, 2023 is the best available information as of the date of the study.
5. The noise level calculations, the interpretation of noise attenuation requirements, and the recommended measures are in accordance with Ministry of Environment Guidelines, Region of Waterloo Policies, and any applicable policy or guidelines of the Area Municipality, and any other applicable policy or guideline.
6. The physical noise attenuation measures proposed in this study are feasible to implement and will provide the level of attenuation indicated in the study.
7. I acknowledge that this study may be subject to a peer review conducted at RWDI AIR's cost.
8. I acknowledge that public authorities and future owners, occupants and others may rely on this statement.

AND I make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath.

DECLARED before me at the
City of Fergus, in the County
Of Wellington, this 21st
day of December, 2023.

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CANADA
PROVINCE OF ONTARIO

) In the Matter of the
) Environmental Protection
) Act and the Planning Act

)
)
) And in the Matter of a Noise Feasibility
) Study for 143 Columbia Street West
) in the City of Waterloo
) in the Regional Municipality
) of Waterloo

I, the owner, of the 143 Columbia St W, SOLEMNLY DECLARE THAT:

1. I am the owner of the property, or the owner's agent, and that I understand and agree with assessment of noise impacts and recommendation of noise mitigation measures for the proposed property described as 143 Columbia Street West, Waterloo, in the Regional Municipality of Waterloo in the study entitled "143 Columbia Street West, Waterloo, Ontario – Noise and Vibration Impact Study, RWDI Reference Number: 2401942", dated December 21, 2023.
2. The application has been designed to avoid the use of berms or walls as noise attenuation features where feasible. Where berms or walls are recommended, the Noise Study provides economic, planning and engineering justification.
3. If the application is changed in a way that may affect the noise level calculations, I will have a revised noise study submitted to the Region.

AND I make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath.

DECLARED before me at the City
of Waterloo this 21st
day of Dec. 2023.

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