

RIVERFRONT COMMUNITY PHASE 2A

NIAGARA FALLS, ONTARIO

NOISE IMPACT STUDY

RWDI #2206772

September 8, 2023

SUBMITTED TO

Feng Shi

Chief Engineer

fengshi@gr-gp.com

GR (CAN) Investment Co. Ltd.

4342 Queen Street, Suite 203

Niagara Falls, ON L2E 7J7

T: 905.233.4427

SUBMITTED BY

Khalid Hussein, P.Eng.

Project Manager

Khalid.Hussein@rwdi.com

Gillian Redman, M.Sc., P.Eng.

Senior Noise and Vibration Engineer

Gillian.Redman@rwdi.com

Ben Coulson, M.A.Sc., P.Eng.

Senior Consultant, Principal

Ben.Coulson@rwdi.com

RWDI AIR Inc.

Consulting Engineers & Scientists

600 Southgate Drive

Guelph, ON N1G 4P6

T: 519.823.1311

F: 519.823.1316



VERSION HISTORY

Index	Date	Description	Prepared by	Reviewed by
1	Feb 27 th , 2023	Draft	Colin Jakubec	Gillian Redman
2	July 10 th , 2023	Updated Site Plan	Colin Jakubec	Gillian Redman
3	September 8 th , 2023	Updated Site Plan	Colin Jakubec	Gillian Redman

EXECUTIVE SUMMARY

GR(CAN) Investment Co. Ltd. retained RWDI to prepare a Noise and Vibration Impact Study for the proposed Phase 2A development of the Riverfront Community development located in Niagara Falls, Ontario. This assessment has been completed to support a zoning by-law amendment for a mixed-use development including retail and residential uses.

Noise and vibration levels due to rail traffic are predicted to meet the applicable criteria following the implementation of control measures outlined in this report.

The following noise and vibration control measures are recommended for the proposed development.

1. Installation of central air-conditioning in residential buildings so windows can remain closed.
2. The inclusion of noise warning clauses related to:
 - a. Transportation sound levels at the building façade;
 - b. Proximity to railway line.
3. Minimum sound isolation performance:
 - a. Suite bedroom window glazing with minimum sound isolation performance of STC 29 for the senior condominium and STC 31 for the first row of town houses.
 - b. Brick veneer or equivalent masonry construction for townhouse façades facing the rail corridor.
4. Vibration mitigation for the first row of townhouses. Vibration levels should be confirmed through measurement during site plan approval when final building locations are known.
5. Construction of perimeter noise barriers along the outdoor amenity areas if feasible, with the applicable warning clause.

This assessment was based on assumptions regarding basic building construction, so the resulting recommendations are broad. The selection of building materials, such as windows and doors should be reviewed by an acoustical engineer prior to construction to ensure the applicable limits are met.

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.



TABLE OF CONTENTS

1	INTRODUCTION	4
2	APPLICABLE CRITERIA	4
3	THE EFFECTS OF THE ENVIRONMENT ON THE PROPOSED DEVELOPMENT	5
3.1	Land-Use Compatibility Review (D-6 Guideline Assessment).....	5
3.1.1	Class III Industries	5
3.1.2	Class II Industries	5
3.1.3	Class I Industries	5
3.2	Transportation Source Assessment	5
3.2.1	Rail Traffic Volume Data	5
3.2.1	Representative Receptors.....	6
3.2.2	Analysis and Results	6
3.3	Rail Vibration Assessment.....	7
3.4	Recommendations	8
3.4.1	Rail Noise	8
3.4.2	Rail Vibration	10
3.4.3	Warning Clauses.....	11
3.4.4	Industrial Spur Line Requirements	12
4	THE EFFECTS OF THE DEVELOPMENT ON ITS SURROUNDINGS AND ITSELF.....	12
4.1	Mixed-use Development and Senior Condominium	12
4.2	Townhouses and Detached Residential Dwellings.....	12
5	CONCLUSIONS	13
6	REFERENCES	14
7	STATEMENT OF LIMITATIONS.....	15

LIST OF TABLES

Table 1:	Indoor Sound Level Criteria for Road and Rail Sources
Table 2:	Predicted Ground Transportation Source Sound Levels – Plane of Window
Table 3:	Transportation Sound Levels in Outdoor Living Areas (OLAs)
Table 4:	Recommended Facade Component Minimum Sound Insulation Rating
Table 5:	Barrier Height Recommendations for OLAs



LIST OF FIGURES

- Figure 1:** Context Site Plan
- Figure 2:** Location of Receptors
- Figure 3:** Rail Vibration Setback Limits
- Figure 4:** Vibration Levels at Different Distances from the Rail Track
- Figure 5:** Examples of Vibration Isolation for Low-Rise Buildings (per RAC)
- Figure 6a:** Outdoor Living Areas(OLAs) Mitigation to 55dBA
- Figure 6b:** Outdoor Living Areas(OLAs) Mitigation to 60dBA

LIST OF APPENDICES

- Appendix A:** Drawings
- Appendix B:** Criteria
- Appendix C:** Transportation Volume Data
- Appendix D:** CP traffic Data and CP requirements
- Appendix E:** STEAM Rail Noise Calculations

1 INTRODUCTION

GR(CAN) Investment Co. Ltd. retained RWDI to prepare a Noise and Vibration Impact Study for the proposed Phase 2A development of the Riverfront Community development located in Niagara Falls, Ontario. This assessment has been completed to support a zoning by-law amendment for a mixed-use development including retail and residential uses. A site context plan is included in **Figure 1**.

The Riverfront Community phase 2A site is exposed to noise and vibration from Canadian Pacific Rail freight traffic to the south.

There are industries located in the vicinity of the proposed development to the east, north, and west. A screening level assessment of nearby industries was conducted.

Aircraft flyovers are distant and are not expected to influence sound levels at the site. The Queen Elizabeth Parkway is over 580m away and is not expected to influence sound levels at the site. Road traffic along the Dorchester Road to the west portion of the development is not anticipated to be significant due to low volumes. Road traffic is not assessed further.

This assessment was completed to support the Zoning By-law Application (ZBA) submission as required by the City of Niagara Falls. This assessment was based on updated design drawings dated August 17, 2023. A copy of the drawings is included in **Appendix A**.

2 APPLICABLE CRITERIA

Applicable criteria for transportation noise sources (road and rail), stationary noise sources and rail vibration are adopted from the Ontario Ministry of the Environment, Conservation and Parks (MECP) NPC-300 Environmental Noise Guideline (MOE, 2013), the Railway Association of Canada's Guidelines for New Development in Proximity to Railway Operations (RAC, 2013), and Canadian Pacific Railway Industrial Spur Line Requirements (a summary of the applicable criteria is included with **Appendix B**).

The proposed development site would be characterized as a "Class 2 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 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. There are no industries located within the relevant areas of influence for each classification. The classifications and setback guidelines are summarized in **Appendix C**.

3.1.1 Class III Industries

There are no Class III Industries located within 1000 m of the proposed development.

3.1.2 Class II Industries

There are several Class II industries within the 1000 m area surrounding the proposed development. However, none of the Class II industries are within the applicable Guideline D-6 potential influence area of 300 m from the proposed development. A summary of the Class II facilities is provided in **Table C-1** in **Appendix C**.

3.1.3 Class I Industries

There are multiple Class I industries within 1000 m area surrounding the proposed development that have been classified as Class I. However, none of the Class I facilities are within the applicable Guideline D-6 potential influence area of 70 m of the proposed development. A summary of these facilities within a 1000 m radius has been provided in **Table C-1** in **Appendix C**.

3.2 Transportation Source Assessment

3.2.1 Rail Traffic Volume Data

Rail traffic data obtained from correspondence with Canadian Pacific Rail Line CP contains forecasted volumes. CP classifies the rail line through the subject lands as an industrial spur line with its main purpose to serve existing industry on an on-demand basis. The rail volume data was grown to a 10-year horizon year (2033) assuming a 2.5% growth rate. The rail traffic data is summarized in **Table 1** and included in **Appendix D**.

Table 1: Rail Volumes and Configuration

Train Type	2033 Volumes		Type of Locomotive	No of Locomotives	No of Cars	Speed (km/h)
	Daytime	Nighttime				
Freight Train	16	7	Diesel	2	19	40

3.2.1 Representative Receptors

Sensitive receptors include the residential neighborhood (A06) the Senior Condominium (A05), the Hotel Condo (A01-2), and the Condominium(A01-1) located above the east side of the commercial uses (A01-1).

Modelled receptors are presented in **Figure 2**. The first row of houses closest to the rail line for the Residential Neighborhood (A06) is represented by receptor R1, located approximately 19 m from the tracks. The second row of houses in the Residential Neighborhood (A06) is represented by receptor R2 approximately 70 m from the tracks. The Senior Condominium (A05) is represented by receptor R3 and R4, located approximately 60 m from the tracks. The Condominium (A01-1) is represented by R5, located approximately 150 m from the tracks.

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. The locations of the OLAs are indicated in **Figure 2**. Daytime sound levels were assessed at the worst-case backyard of the first row of town houses (OLA_1) and the backyard for the second row of houses (OLA_2).

3.2.2 Analysis and Results

Sound levels were estimated using the Sound from Trains Environmental Analysis Method (STEAM) algorithms (MOE, 1990). The predicted sound levels for the receptor facades and the OLAs are presented in **Tables 2 and 3**, respectively.

The modelling considered a conservative approach where information was not available, such as jointed track, hard ground between the track and the receptors, maximum volume and speed, full exposure to the track, and all trains on the nearest track. If actual tracks are continuously welded, noise levels would be less. There is currently one at-grade crossing on Dorchester Road However, CP has confirmed that no whistles and bells occur. The STEAM calculations are provided in **Appendix E**.

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

Receptor	Rail		Sound Level Limit		Meets Limit?		Notes
	Day L _{EQ} , 16hr (dBA)	Night L _{EQ} , 8hr (dBA)	Day L _{EQ} , 16hr (dBA)	Night L _{EQ} , 8hr (dBA)	Day	Night	
R1-First Row Townhouse	61	60	55	50	no	no	3,4
R2-Second Row Townhouse	55	51	55	50	yes	no	1
R3-Senior Condominium - North	57	57	55	50	no	no	2,3
R4-Senior Condominium - South	58	58	55	50	no	no	2,3
R5- Condominium	55	54	55	50	yes	no	2

Notes:

1. Applicable for low and medium density developments: Provision for future installation of air-conditioning, warning clause "Type C".
2. Applicable for high density developments: Installation of air-conditioning to allow for windows and doors to remain closed, warning clause "Type D".
3. 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 remained closed, warning clause "Type D".
4. Brick veneer of masonry equivalent for the first row of housing or adjacent façades with exposure to railway line.

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

Receptor	Receptor Level Daytime L _{EQ} , 16hr(dBA)	Sound Level Limit Daytime L _{EQ} , 16hr (dBA)	Exceeds Limits?
OLA1-First Row Townhouse	62	55	Yes
OLA2-Second Row Townhouse	54	55	No

3.3 Rail Vibration Assessment

The CP guidelines provide a vibration limit of 0.14 mm/s RMS, between 4 and 200 Hz, for railway-induced ground vibration at residential dwellings within 75 m of a rail corridor. The 0.14 mm/s limit is based on the limit for human perception of vibration which is around 0.1 mm/s. RAC suggests vibration measurements should be conducted for proposed dwelling units that are within 75 m of the rail right-of-way.

Based on the preliminary design drawings; the first row of townhouses, the second row of houses and the senior condominium are within the 75 m setback as shown in **Figure 3**, thus vibration monitoring was completed.

Vibration measurements were completed along the CP industrial spur line, to the south of the tracks, from May 27th, 2021 to June 14th, 2021. A motion-sensitive camera was installed along with one triaxial vibration sensor at 25 m, and two uniaxial vibration sensors at 50 m and 75 m south of the closest rail track. Several freight train pass-bys were captured with vibration levels from different train pass-bys summarized in **Figure 4**. Although it is expected that measurements completed south of the track would be similar to the measured conditions to the north, this should be confirmed through site-specific measurements at the final locations of the proposed buildings prior to site plan approval.

One extreme exceedance event can be seen in **Figure 4** for the 25- and 50-meter sensors however this event was found to be unrelated to a train and was likely caused by human interference with the sensors. In two cases, vibration levels at 50 meters were above 0.2 mm/s RMS, however this was not a frequent occurrence.

The CN guidelines identify levels over 0.2 mm/s RMS to be a significant problem for frequent events such as rapid transit. Residential annoyance for infrequent events such as commuter rail starts around 0.5 mm/s RMS. The levels measured at 25 m exceed both annoyance thresholds. The measured vibration levels are not a concern for building damage, which typically is a concern at levels of 5 mm/s Peak Particle Velocity (PPV) and above.

Exceedances of the CN guidelines occur rarely at 50 meters, and do not occur at 75 meters, based on the data collected. Vibration propagation calculations were completed to approximate the setback distance where the CP vibration limit would be met. It is expected that buildings within approximately 40 meters of the rail line may experience vibration levels at or above 0.14 mm/s. The first row of townhouses closest to the rail line falls within this area of influence. Recommendations are provided in Section 3.4.2 to reduce vibration intrusion for these buildings.

3.4 Recommendations

The following section outlines the required control measures to achieve compatibility between the proposed development and the rail activity.

3.4.1 Rail Noise

3.4.1.1 Façade Recommendations

Due to the elevated rail sound levels in the area, acoustical design of the façade components including spandrel, window glazing, and exterior doors, are recommended to be specified for the proposed development.

To assess the development's feasibility, preliminary window glazing, and exterior door sound isolation requirements were determined. These were based on following assumptions:

- Typical residential living room:
 - Glazing 60% of façade, Door: 20% of façade
 - 55% Façade to floor area Ratio
- Typical residential bedroom:
 - Glazing 80% of façade, Door: N/A

- 81% Façade to floor area Ratio
- Acoustical character of rooms: High absorption finishes/furniture for bedrooms and intermediate absorption finishes/furniture for living rooms.

Based on the predicted plane of window sound levels and the assumptions listed above, recommendations for the minimum sound insulation ratings for the building components were determined using the National Research Council of Canada “BPN-56 method” (NRCC, 1985). The reported results are in terms of Sound Transmission Class (STC) ratings as summarized in **Table 4**.

Table 4: Recommended Façade Component Minimum Sound Insulation Rating

Portion of Development	Façade Sound Level Daytime(dBA)	Façade Sound Level Nighttime(dBA)	Window Glazing	Exterior Door	Façade Wall
First Row Townhouse	61	60	STC 31	STC 28	STC 50 (Note 2)
Senior Condominium	58	58	STC 29	STC 28	STC 50 (Note 2)

Notes:

1. “OBC” denotes that the noise insulation design is not required to be specified. Building envelope assemblies meeting the minimum Ontario Building Code (OBC) requirements will also exhibit sufficient noise reduction to meet the interior sound level criteria.
2. Exterior walls to include a minimum brick veneer or masonry equivalent for the façade with exposure to the railway line.

For the first row of townhouse and the senior condominium, windows that achieve a minimum of STC 31 are required. Window and door STC specification should be confirmed by an acoustical engineer once interior layouts are determined. Windows with STC ratings meeting these requirements (up to STC 43) are commercially available; therefore, indoor sound level criteria can be met.

Considering the assumptions used as a basis to determine the glazing requirements, the applicable indoor transportation source sound level criteria are predicted to be achieved.

The façade construction should be reviewed during detailed design to ensure that the indoor sound level limits will be met, and that the window/door supplier is requested to provide STC laboratory test reports as part of shop drawing submittal to confirm that the glazing/door components will meet the minimum STC requirements. This review should be conducted by a qualified acoustical engineer.

3.4.1.2 Ventilation Recommendations

Due to the transportation sound levels at the plane of the façade, central air conditioning is recommended for the senior condominium 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.”**

3.4.1.3 Outdoor Living Areas

Due to exposure to transportation sources along the nearby Canadian pacific rail line, sound levels in OLAs are predicted to be elevated. The daytime average sound levels for the OLAs included in the assessment are in the range of 54-62 dBA. To reduce the transportation sound levels in OLAs to meet the applicable criteria, noise barriers are recommended.

Due to the complex nature of local topography, the barrier heights were designed with Cadna/A, a 3-D noise propagation software package which implements the ISO-9613 algorithms (ISO, 1994 and ISO, 1996). Due to the complexity of the topography, barrier heights are provided as a height above the top-of-rail to ensure the final construction achieves the reductions required.

The recommended geometry of the noise barriers are included with **Figure 6a** (to meet 55 dBA) and **Figure 6b** (to meet 60 dBA). The barrier heights are summarized in **Table 5**. Note that barrier heights provided are with respect to the height of the top-of-rail, not the ground. General guidance with respect to noise barrier design is included with **Appendix D**.

Table 5: Barrier Height Recommendations for OLAs

Receptor	Description	Predicted OLA Sound Level	Barrier Height (m) Above Rail to Meet Sound Level Criterion	
		Daytime L _{EQ} , 16hr	≤ 55 dBA ¹	≤ 60 dBA ²
OLA_01	First Row Townhouse	62 dBA	3.0 m	1.5 m ²

Notes:

1. Refer to Figure 6a for barrier geometry to meet 55 dBA.
2. Refer to Figure 6b for barrier geometry to meet 60 dBA. A warning clause "Type B" is recommended in cases where the OLA sound level is >55 dBA (to a maximum of 60 dBA).
3. If noise control measures are not provided, a warning clause "Type A" is recommended.

3.4.2 Rail Vibration

The first row of townhouses has the potential to be adversely affected by vibration from the CP rail line. The following items will reduce vibration levels for these residential lots to minimize rail vibrations from entering the dwelling units where people may perceive vibration. The following recommendations are to be revisited once the design is finalized and building construction is known, and vibration measurements at building façade locations have been completed.

- Vibration mitigation for low-rise buildings 3-storeys or less (see **Figure 5**):
 - Isolate the upper floors from the foundation wall and internal column supports using rubber pads (5-20 mm deflection under load). No rigid connections should exist between the structure above the isolation layer and below it.
 - Use hollow core concrete for 1st floor (if applicable);

- Seal the seam around the foundation wall (created by the rubber pads) that is insulated and watertight;
 - Finishing components must be attached either above or below isolation joint; and
 - Line the outside foundation walls facing the rail line and 90° to the rail line with a soft, resilient layer.
- RAC indicates that minor reductions in vibration levels (approximately 30%) can be achieved through lining of the outside of the foundation walls with a resilient layer, as a minimum. The lining must be quite soft but able to withstand the lateral soil pressures present on the foundation wall. This lining should be installed on the foundation areas facing the rail line and 90° to the rail line.
- In addition to the resilient layer, large diameter gravel backfill covered with filter fabric to prevent topsoil infiltration can also be used adjacent to the closest foundations to provide a break in the soil, and further reducing vibration levels.

Prior to the Site Plan Approval stage, tri-axial vibration measurements should be completed to the north of the track, in locations where the buildings will be closest to the rail corridor. These measurements will inform the detailed design of vibration mitigation to ensure the requirements are met.

3.4.3 Warning Clauses

Warning clauses are required to be inserted in all development agreements, offers to purchase, and agreements of Purchase and Sale or Lease of each dwelling unit.

Proximity to Railway Line: CP Warning Clause for developments that are within 300 metres of the right-of-way.

"Warning: Canadian Pacific Railway Company (CPR) or its assigns or successors in interest has or have a right-of-way within 300 metres from the land the subject hereof. There may be alterations to or expansions of the rail facilities on such right-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its operations, which expansion may affect the living environment of the residents in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwelling(s). CPR will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid right-of-way."

The following warning clause is required by the MECP for the 1st row of dwellings adjacent to the rail line (townhomes and the Senior Condominium):

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."

Npc-300 Type B: Recommended to address transportation noise in OLAs if the sound level is in the range of 56-60 dBA.

"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic (rail traffic) (air traffic) may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."

3.4.4 Industrial Spur Line Requirements

The CP and RAC guidelines outline the following minimum requirements for an industrial spur line:

- CP requires building setback of 15 m for residential dwellings. The latest plan shows building setbacks greater than 15 m which satisfies the CP requirement.
- CP also requires that a 1.83 m high chain link fence be constructed and maintained along the common property line of the railway and the development at the expense of the developer. The developer is to be aware of the necessity of including a covenant with the lands, in all deeds, obliging the purchasers of the land to maintain the fence in satisfactory condition at their expense. CP requirements are provided in **Appendix B.**

4 THE EFFECTS OF THE DEVELOPMENT ON ITS SURROUNDINGS AND ITSELF

4.1 Mixed-use Development and Senior Condominium

On-site stationary sources for the mixed-use development (A01) and the senior condominium (A05) are expected to consist of HVAC-related equipment 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 mixed-use development(A01) and the senior condominium(A05) 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. Appropriate mitigation should be included where necessary.

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.

4.2 Townhouses and Detached Residential Dwellings

On-site stationary sources for the townhouses and detached residential dwellings (A06) are expected to consist of small residential HVAC units. As per NPC-216 (MOE), air cooled condenser units should be located in a noise insensitive location. Ventilated attic roof construction must also meet OBC requirements.

The least restrictive of the following should apply to the townhouses and detached residential dwellings(A06):

- a) The general sound level limit of the air conditioning device should not exceed 5 dBA greater than a one-hour equivalent sound level (L_{EQ}) cause by road traffic at the point of reception from 07:00 to 21:00 for Class I and Class II areas. This is typically used in areas of relatively high background noise caused by road traffic.
- b) The sound level limits of the central air conditioning or through the wall air conditioning device should not exceed 50 dBA in a Class 1 area, or 45 dBA in a Class 2 area.
- c) When the air conditioning device is mandatory for noise control in the interior living space of new land use developments, the specific sound level limit should not exceed 55dBA.

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 Phase 2A Riverfront Community development located in Niagara Falls, Ontario.

Noise and vibration levels due to rail traffic are predicted to meet the applicable criteria following the implementation of control measures outlined in this report.

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

1. Installation of central air-conditioning so that all windows can remain closed.
2. The inclusion of noise warning clauses related to:
 - a. Transportation sound levels at the building façade
 - b. Proximity to railway line
3. Minimum sound isolation performance:
 - a. Suite bedroom window glazing with minimum sound isolation performance of STC 29 for the senior condominium and STC 31 for the first row of town houses.
 - b. Brick veneer or equivalent masonry construction for the townhouse facades facing the rail corridor.
4. Vibration mitigation for the first row of townhouses. Vibration levels should be confirmed through measurement during site plan approval when final building locations are known.
5. Construction of perimeter noise barriers along the outdoor amenity areas if feasible, with the applicable warning clause.

This assessment was based on assumptions regarding basic building construction, so the resulting recommendations are broad. The selection of building materials, such as windows and doors should be reviewed by an acoustical engineer prior to construction to ensure the applicable limits are met.

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. Ontario Ministry of the Environment and Energy (MOE), 1993, Publication NPC-216, Residential Air Conditioning Devices (MOE, 1993).
3. Ontario Ministry of the Environment (MOE), 1990, STEAM Sound from Trains Environmental Analysis Method, Technical Publication (MOE, 1990)
4. Ontario Ministry of the Environment (MOE) Publication Guideline D-6, “Compatibility Between Industrial Facilities and Sensitive Land Uses”, July 1995 (MOE, 1995).
5. Controlling Sound Transmission into Buildings (BPN-56), National Research Council Canada (NRCC, 1985).
6. The Railway Association of Canada (RAC), Guidelines for New Development in Proximity to Railway Operations (RAC, 2013).
7. Federal Transit Administration, U.S. Department of Transportation, Transit Noise and Vibration Impact Assessment, 2018 (FTA, 2018).
8. 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)
9. 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)



7 STATEMENT OF LIMITATIONS

This report entitled Riverfront Phase 2A was prepared by RWDI AIR Inc. ("RWDI") for GR(CAN) Investment Co. Ltd. ("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.

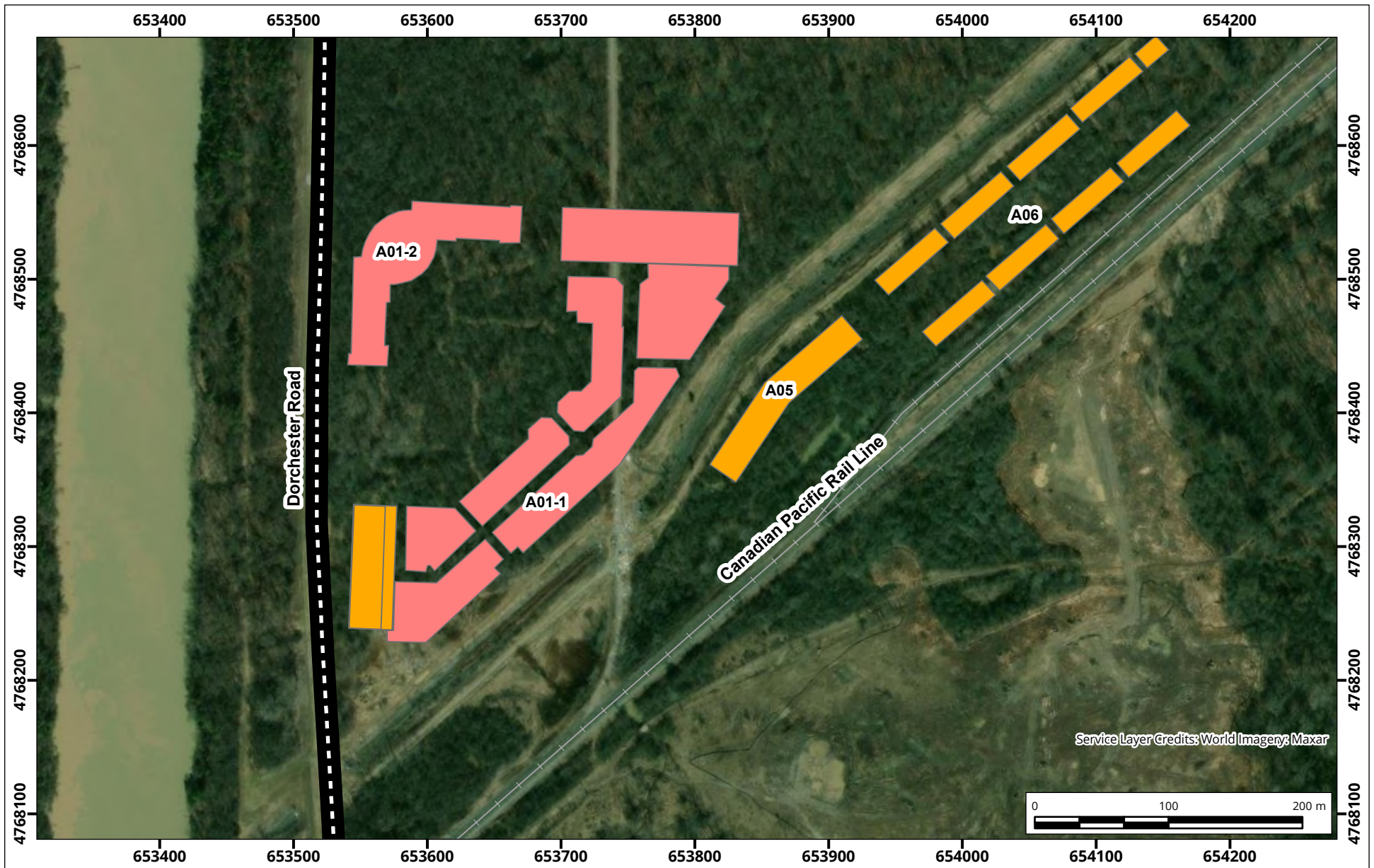
The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the 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.

A large graphic on the left side of the page. It features a blue triangular shape in the top-left corner, separated from a large, light-grey circular shape by a thin white curved line. The word 'FIGURES' is written in blue capital letters across the grey circle.

FIGURES

Map Document: \\wgdgroup\ueqph\jobs_1\2206772\03\WorkItems\20\EnvironmentalNoise\ArcGIS\Ontario\LUP ArcGIS Templates\Figures for Phase 2\2206772\03\07.aprx



Site Context Plan

Map Projection: NAD 1983 UTM Zone 17N
Riverfront Phase 2A-Niagara Falls, Ontario

True North



Project #: 2206772

Drawn by: CJ

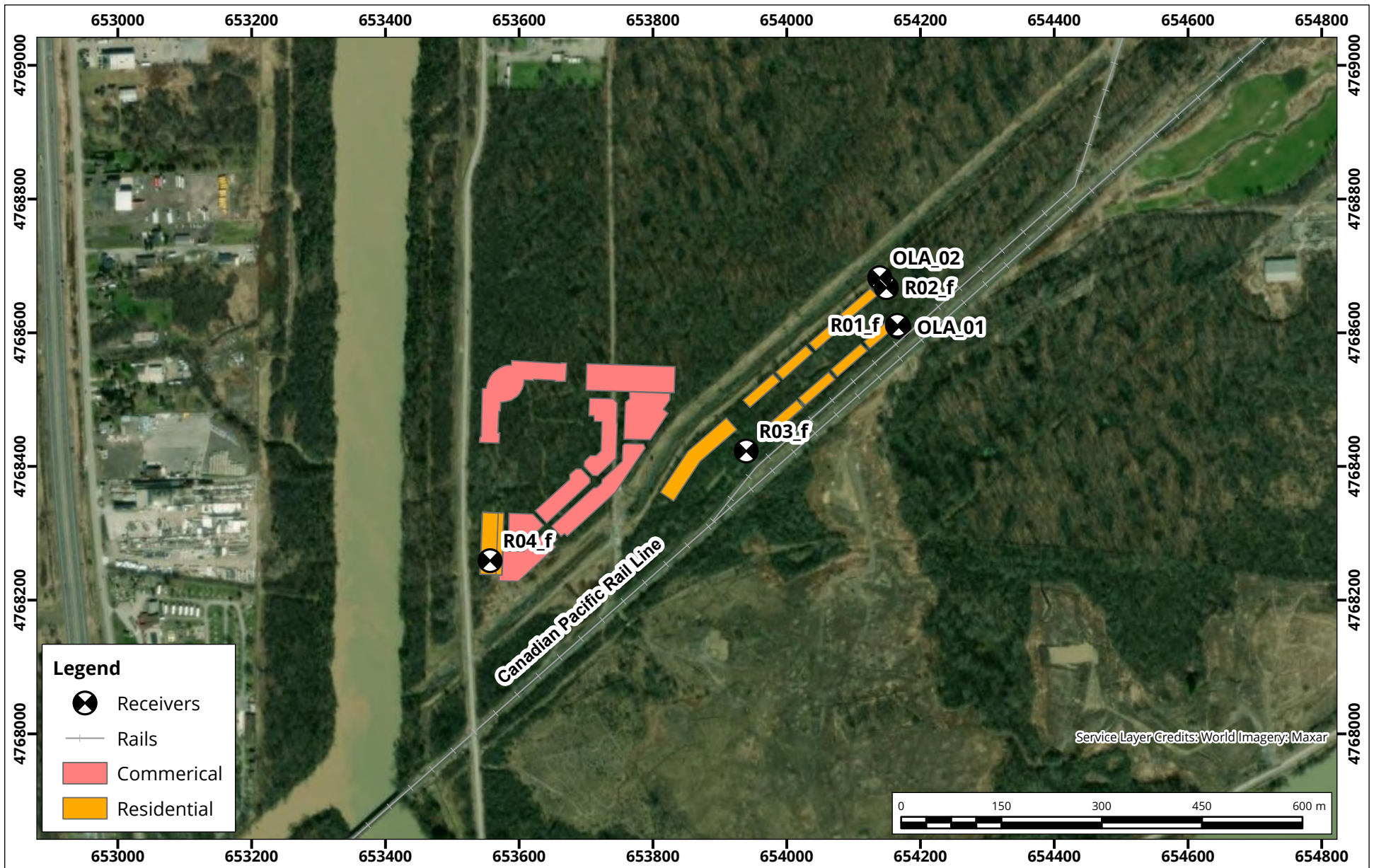
Figure: 1

Approx. Scale: 1:4,000

Date Revised: Sep 7, 2023



Map Document: \\wvdlgroup\p\ueph\jobs_1\2206772\03\WorkItems\20\Environmental\Noise\ArcGIS\Ontario\UP ArcGIS Templates\Figures for Phase 2\2206772.aprx



Location of Receptors

Map Projection: NAD 1983 UTM Zone 17N
Riverfront Phase 2A-Niagara Falls, Ontario

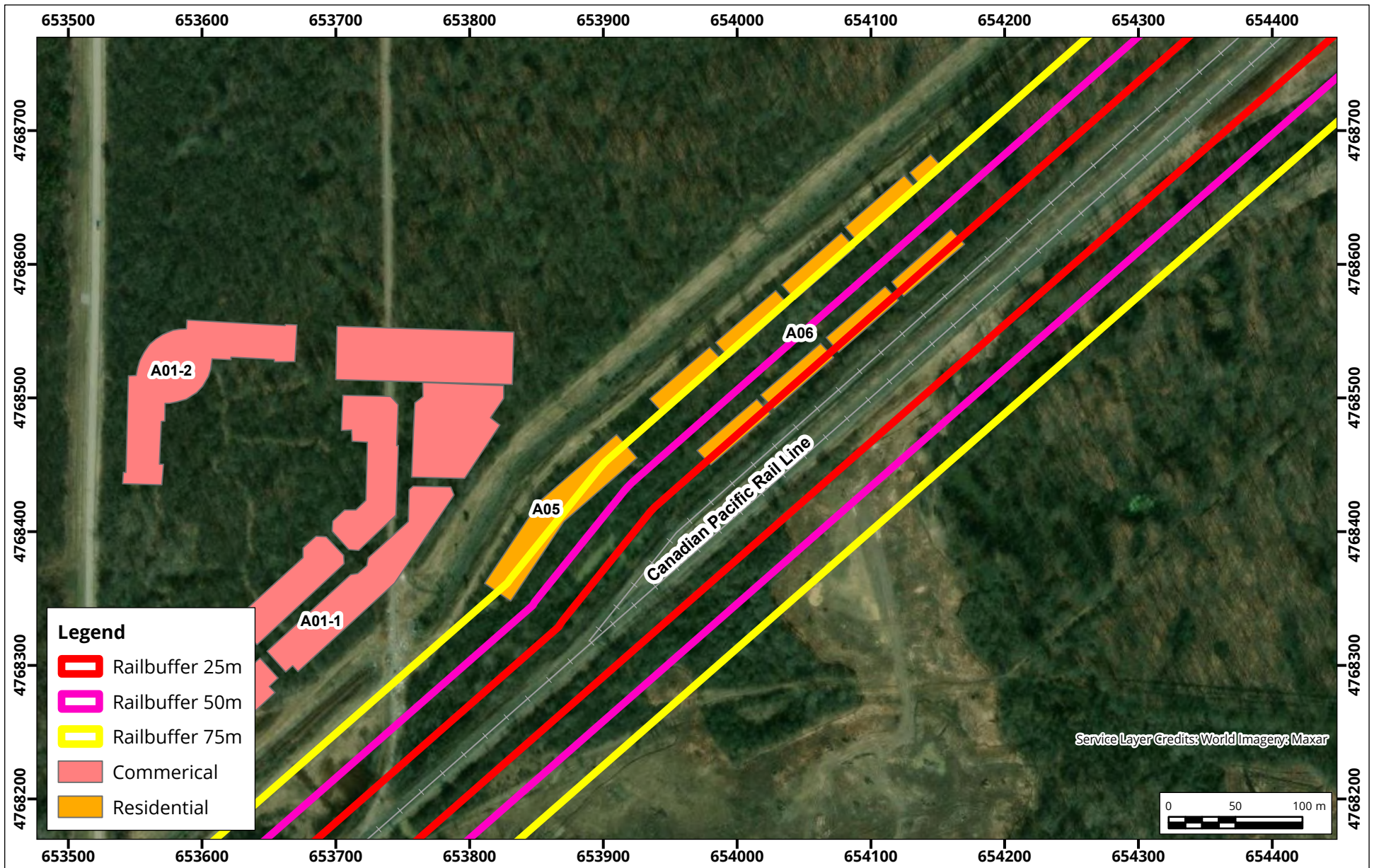


Drawn by: CJ	Figure: 2
Approx. Scale: 1:8,000	
Date Revised: Sep 7, 2023	

Project #: 2206772



Map Document: \\wgdgroup\p\ueph\j\j\2206772\03\WorkItems\20\Environmental\Noise\ArcGIS\Ontario\UP ArcGIS Templates\Figures for Phase 2\2206772.aprx



Vibration Setback limits Location of Vibration Buffer Regions

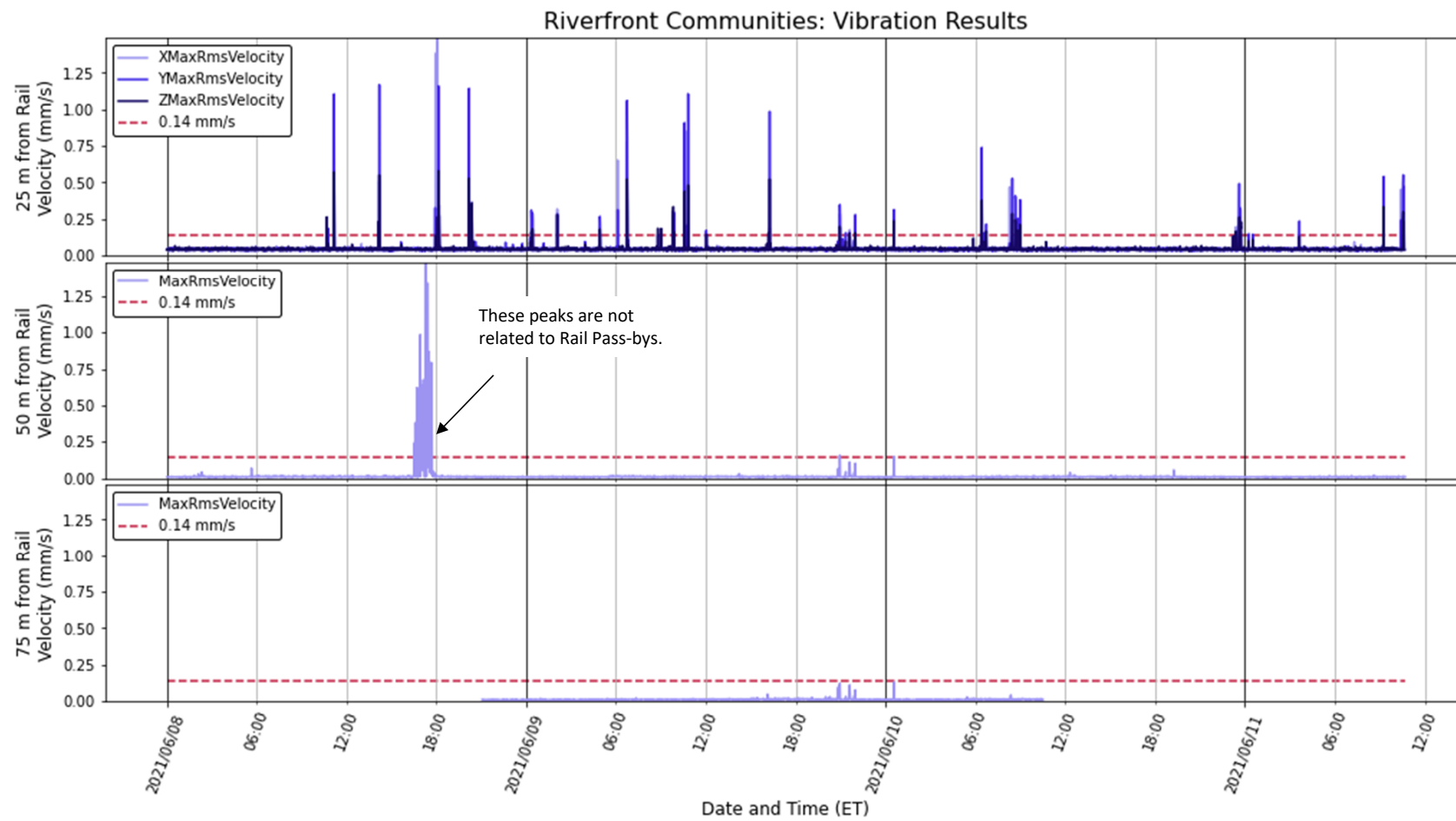
Map Projection: NAD 1983 UTM Zone 17N
Riverfront Phase 2A-Niagara Falls, Ontario



Project #: 2206772

Drawn by: CJ	Figure: 3
Approx. Scale: 1:4,000	
Date Revised: Sep 7, 2023	





Vibration Levels at Different Distances from the Rail Track

Riverfront Phase 2A-Niagara Falls, Ontario

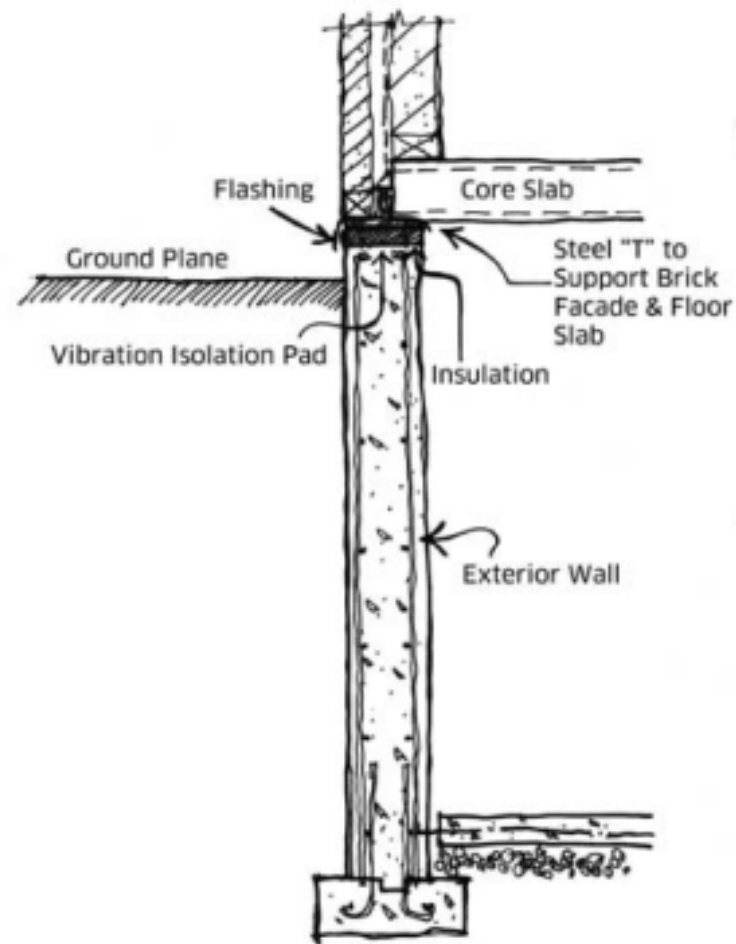
Drawn by: CJ

Figure: 4

Project #: 2206772

Date: 2023-02-07





Examples of Vibration Isolation for Low-Rise Buildings (per RAC)

Riverfront Phase 2A-Niagra Falls, Ontario

Drawn by: CJ

Figure: 5

Project #: 2206772

Date: 2023-02-03



Map Document: \\wv\group\geoph\jobs_1\2206772\03\Work\Environmental\Noise\ArcGIS\Ontario\UP ArcD5 Templates\Figures for Phase 2A\220907.aprx



Outdoor Living Areas (OLAs) Mitigation to 55 dBA Recommended Barrier Geometry and Height to meet 55 dBA

Map Projection: NAD 1983 UTM Zone 17N
Riverfront Phase 2A-Niagara Falls, Ontario



Drawn by: CJ	Figure: 6a
Approx. Scale: 1:2,500	
Date Revised: Sep 7, 2023	

Project #: 2206772



Map Document: \\wvdlgroup\geoph\jobs_1\2206772\03WorkItems\20EnvironmentalNoise\ArcGIS\Ontario\UP ArcD5 Templates\Figures for Phase 2A\220907.aprx



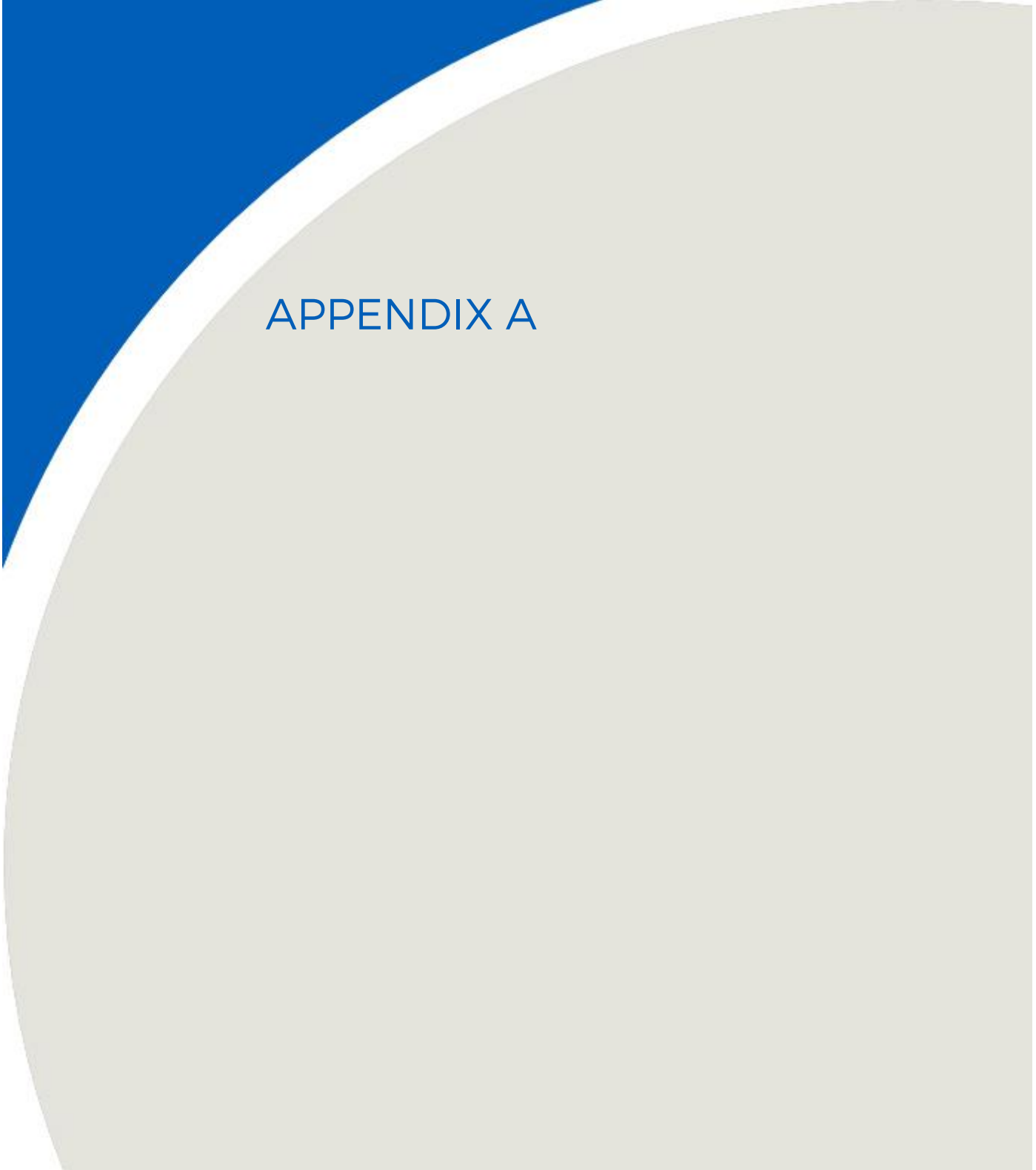
Outdoor Living Areas (OLAs) Mitigation to 60 dBA Recommended Barrier Geometry and Height to meet 60 dBA

Map Projection: NAD 1983 UTM Zone 17N
Riverfront Phase 2A-Niagara Falls, Ontario

True North
↑
Project #: 2206772

Drawn by: CJ	Figure: 6b
Approx. Scale: 1:2,500	
Date Revised: Sep 7, 2023	



The graphic for Appendix A features a large, light beige circle on the right side of the page. To its left, a blue shape, which is a quarter-circle, is partially visible, separated from the beige circle by a thin white gap. The text 'APPENDIX A' is centered in the white gap between the two shapes.

APPENDIX A

OVERALL	ZONE PROVISIONS	REQUIRED BY ZONING	PROPOSED DEVELOPMENT
	PROPERTY AREA	NA	122644 SQM
	DEVELOPABLE AREA	NA	00
	BUILDING COVERAGE	NA	LOT SPECIFIC
	BUILDING HEIGHT	NA	LOT SPECIFIC
	FRONT SETBACK	NA	LOT SPECIFIC
	SIDEBACK	NA	LOT SPECIFIC
	REAR SETBACK	NA	LOT SPECIFIC
	TYPE OF USE	NA	LOT SPECIFIC

Site Statics
1 : 50



A01	ZONE PROVISIONS	REQUIRED BY ZONING	PROPOSED DEVELOPMENT
	PROPERTY AREA	NA	48,838.43 SQM
	DEVELOPABLE AREA	NA	48,834.43 SQM
	BUILDING COVERAGE	NA	23,780.29 SQM (48.7%)
	BUILDING HEIGHT	NA	12 M
	FRONT SETBACK	NA	6M
	SIDE SETBACK	NA	4M
	REAR SETBACK	NA	4M
	TYPE OF USE	NA	COMMERICAL RETAIL, RESTAURANT, INDOOR PLAYGROUND, CONDO, PARKING STRUCTURE

A06	ZONE PROVISIONS	REQUIRED BY ZONING	PROPOSED DEVELOPMENT
	PROPERTY AREA	NA	25,978.77 SQM
	DEVELOPABLE AREA	NA	25,978.77 SQM
	BUILDING COVERAGE	NA	6,552 SQM (25.2%)
	BUILDING HEIGHT	NA	15M
	FRONT SETBACK	NA	10M
	SIDE SETBACK	NA	6M
	REAR SETBACK	NA	9M
	TYPE OF USE	NA	RESIDENTIAL TOWNHOUSE

A02	ZONE PROVISIONS	REQUIRED BY ZONING	PROPOSED DEVELOPMENT
	PROPERTY AREA	NA	15,468 SQM
	DEVELOPABLE AREA	NA	15,468 SQM
	BUILDING COVERAGE	NA	5,317.16 SQM (33.65%)
	BUILDING HEIGHT	NA	53 M
	FRONT SETBACK	NA	6M
	SIDE SETBACK	NA	6M
	REAR SETBACK	NA	6M
	TYPE OF USE	NA	HOTEL CONDO, RESIDENTIAL CONDO,
	UNITS	CONDO	180
		HOTEL CONDO	320
	PARKING	SURFACE	77
		GARAGE	253
		TOTAL	330

A05	ZONE PROVISIONS	REQUIRED BY ZONING	PROPOSED DEVELOPMENT
	PROPERTY AREA	NA	9,451 SQM
	DEVELOPABLE AREA	NA	9,451 SQM
	BUILDING COVERAGE	NA	3,070 SQM (32.7%)
	BUILDING HEIGHT	NA	26.5 M
	FRONT SETBACK	NA	6M
	SIDE SETBACK	NA	6M
	REAR SETBACK	NA	6M
	TYPE OF USE	NA	Senior Condo, Senior Care Home
	UNITS	Senior Condo	135
		Senior Care Home	132
	PARKING	SURFACE	28
		GARAGE	174
		TOTAL	202

REVISION RECORD		
No.	Description	Date

ISSUE RECORD		

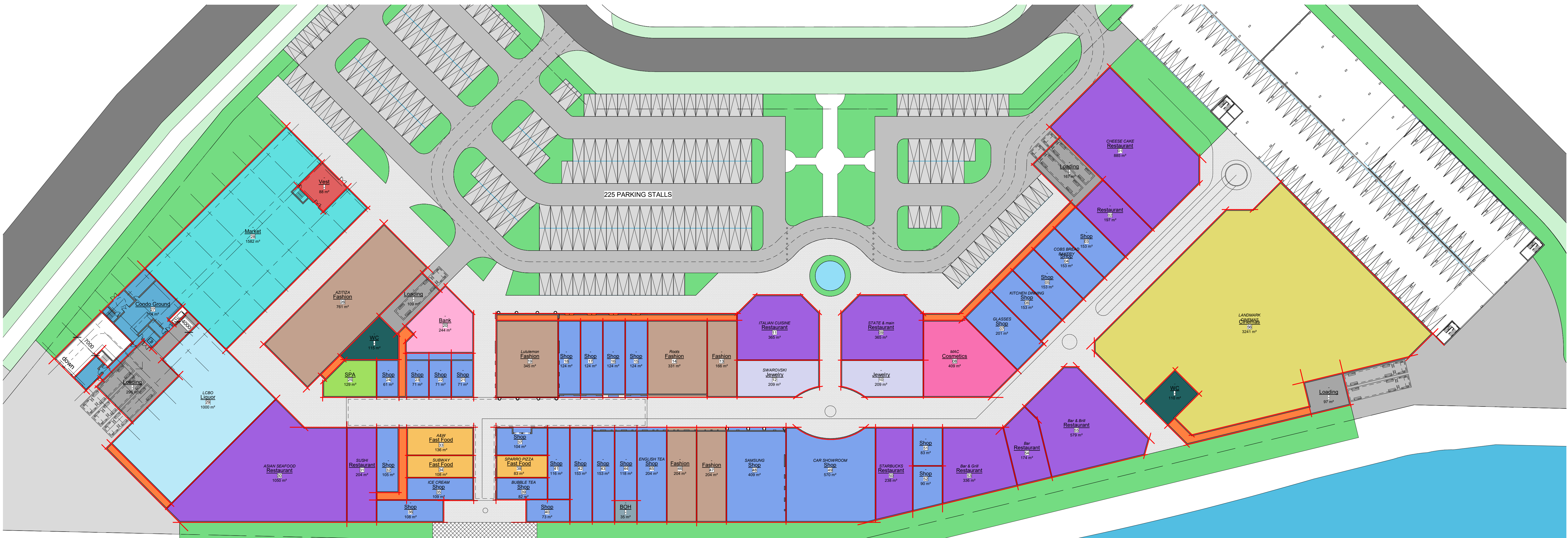
Project Name
Street
City, State Zip
for Owner

23010	As indicated	Author	Checker
PROJECT SCALE		DRAWN	REVIEWED

Overall Site Plan
A001

Note: This drawing is the property of the Architect and may not be reproduced or used without the expressed consent of the Architect. The Contractor is responsible for checking and verifying all levels and dimensions and shall report all discrepancies to the Architect and obtain clarification prior to commencing work.

8/17/2023 5:06:53 PM



1 A01 Area Plan
1 : 500

Area Schedule (Ground Level)				
Level	Number	Name	Area	Comments
Ground		Corridor	52 m²	
Ground	-	Loading	109 m²	-
Ground	-	Loading	296 m²	-
Ground	-	Loading	167 m²	-
Ground	-	WC	115 m²	-
Ground	-	Corridor	40 m²	-
Ground	-	Corridor	13 m²	-
Ground	-	Loading	97 m²	-
Ground	-	BOH	35 m²	-
Ground	-	Corridor	120 m²	-

Area Schedule (Ground Level)				
Level	Number	Name	Area	Comments
Ground	-	Corridor	97 m²	-
Ground	-	Vest	88 m²	-
Ground	-	WC	110 m²	-
Ground	-	Corridor	96 m²	-
Ground	01	Restaurant	885 m²	CHEESE CAKE
Ground	02	Restaurant	197 m²	-
Ground	03	Shop	153 m²	-
Ground	04	Shop	153 m²	COBS BREAD BAKERY
Ground	05	Shop	153 m²	-
Ground	06	Shop	153 m²	-
Ground	07	Shop	201 m²	KITCHEN DINNING
Ground	08	Shop	201 m²	GLASSES
Ground	09	Restaurant	365 m²	MAC
Ground	10	Jewelry	209 m²	STATE & main
Ground	11	Restaurant	365 m²	ITALIAN CUISINE
Ground	12	Jewelry	209 m²	SWAROVSKI
Ground	13	Fashion	166 m²	-
Ground	14	Fashion	331 m²	Roots
Ground	15	Shop	124 m²	-
Ground	16	Shop	124 m²	-
Ground	17	Shop	124 m²	-
Ground	18	Shop	124 m²	-
Ground	19	Fashion	345 m²	Lululemon
Ground	20	Bank	244 m²	-
Ground	21	Shop	71 m²	-
Ground	22	Shop	71 m²	-
Ground	23	Shop	71 m²	-
Ground	24	Shop	61 m²	-
Ground	25	SPA	129 m²	-

Area Schedule (Ground Level)				
Level	Number	Name	Area	Comments
Ground	26	Fashion	761 m²	AZITIZA
Ground	27	Condo Ground	314 m²	-
Ground	28	Market	1582 m²	-
Ground	29	Liquor	1000 m²	LCBO
Ground	30	Restaurant	1050 m²	ASIAN SEAFOOD
Ground	31	Restaurant	204 m²	SUSHI
Ground	32	Shop	105 m²	-
Ground	33	Fast Food	136 m²	A&W
Ground	34	Fast Food	108 m²	SUBWAY
Ground	35	Shop	109 m²	ICE CREAM
Ground	36	Shop	108 m²	-
Ground	37	Shop	104 m²	-
Ground	38	Fast Food	83 m²	SPARRO PIZZA
Ground	39	Shop	82 m²	BUBBLE TEA
Ground	40	Shop	73 m²	-
Ground	41	Shop	116 m²	-
Ground	42	Shop	153 m²	-
Ground	43	Shop	153 m²	-
Ground	44	Shop	118 m²	-
Ground	45	Shop	204 m²	ENGLISH TEA
Ground	46	Fashion	204 m²	-
Ground	47	Fashion	204 m²	-
Ground	48	Shop	409 m²	SAMSUNG
Ground	49	Shop	570 m²	CAR SHOWROOM
Ground	50	Restaurant	238 m²	STARBUCKS
Ground	51	Shop	83 m²	-
Ground	52	Shop	90 m²	-
Ground	53	Restaurant	336 m²	Bar & Grill
Ground	54	Restaurant	174 m²	Bar
Ground	55	Restaurant	579 m²	Bar & Brill
Ground	56	Cinemas	3241 m²	LANDMARK CINEMAS
Ground	=	Corridor	45 m²	-
Ground	71		19610 m²	

REVISION RECORD		
No.	Description	Date

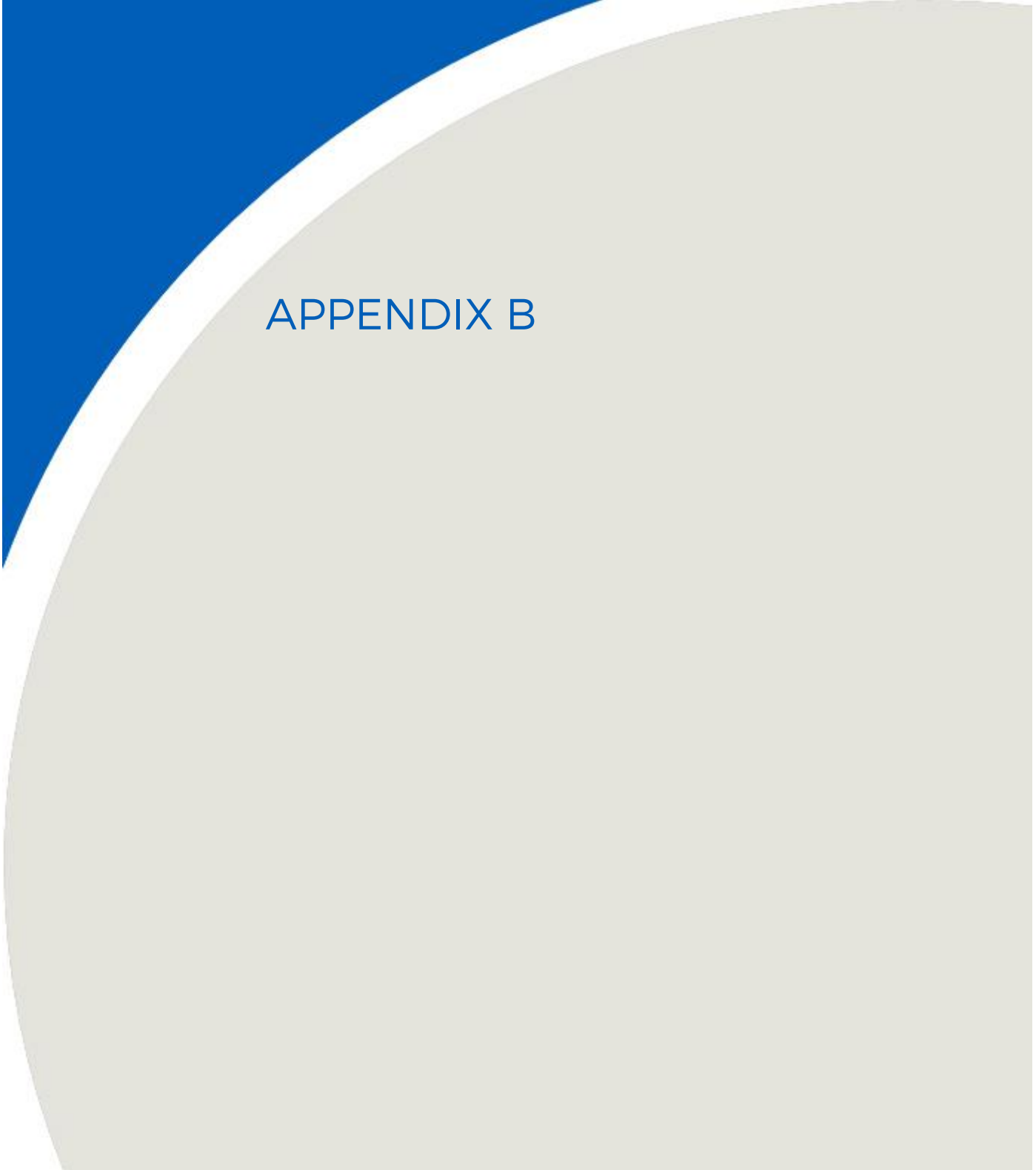
ISSUE RECORD	

	Z-SQUARE CONSULTING INC.
	2710 14th AVE, MARKHAM, ON L3R 0J1
	info@zsquareconsulting.com
	1-416-502-1616

Project Name
Street
City, State Zip
for
Owner

23010	1 : 500	Author	Checker
PROJECT SCALE		DRAWN	REVIEWED

Ground Floor Plan
A101
Note: This drawing is the property of the Architect and may not be reproduced or used without the expressed consent of the Architect. The Contractor is responsible for checking and verifying all levels and dimensions and shall report all discrepancies to the Architect and obtain clarification prior to commencing work.

The graphic for Appendix B features a large, light gray circular shape on the right side of the page. To its left, a blue triangular shape is partially visible, separated from the gray circle by a thin white curved line. The text 'APPENDIX B' is centered in the white space between these two shapes.

APPENDIX B



INDUSTRIAL SPUR LINE REQUIREMENTS

1. Setback of dwellings from the railway right-of-way to be a minimum of 15 metres. While no dwelling should be closer to the right-of-way than the specified setback, an unoccupied building, such as a garage, may be built closer.
 2. A clause should be inserted in all offers of purchase and sale or lease and in the title deed or lease of each dwelling within 300m of the railway right-of-way, warning prospective purchasers or tenants of the existence of the Railway's operating right-of-way; the possibility of alterations including the possibility that the Railway may expand its operations, which expansion may affect the living environment of the residents notwithstanding the inclusion of noise and vibration attenuating measures in the design of the subdivision and individual units, and that the Railway will not be responsible for complaints or claims arising from the use of its facilities and/or operations.
 3. Any proposed alterations to the existing drainage pattern affecting railway property must receive prior concurrence from the Railway, and be substantiated by a drainage report to be reviewed by the Railway.
 4. A 1.83 metre high chain link security fence be constructed and maintained along the common property line of the Railway and the development by the developer at his expense, and the developer is made aware of the necessity of including a covenant running with the lands, in all deeds, obliging the purchasers of the land to maintain the fence in a satisfactory condition at their expense.
 5. Any proposed utilities under or over railway property to serve the development must be approved prior to their installation and be covered by the Railway's standard agreement.
-

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:

- i. 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.
- ii. 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.
- iii. 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 Leq,16-hr 07:00h – 23:00h	Nighttime Leq,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.

Rail Layover Sites

NPC-300 provides a sound level limit for rail layover sites to be the higher of the background sound level or 55 dBA $L_{eq,1-hr}$, for any one-hour period.

Rail Vibration Criteria

An assessment of rail vibration is generally recommended for developments within 75m of a rail corridor or rail yard, and adjacent to or within a setback of 15m of a transit (subway or light-rail) rail line.

The generally accepted vibration criterion for sensitive land-uses is the threshold of perception for human exposure to vibration, being a vibration velocity level of 0.14 mm/s RMS in any one-third octave band centre frequency in the range of 4 Hz to 200 Hz.

This vibration criterion is based on a one-second exponential time-averaged maximum hold root-mean-square (RMS) vibration velocity level and is consistent with the Railway Associations of Canada (RAC, 2013) guideline, the U.S. Federal Transit Authority (FTA, 2018) criterion for residential land-uses, the Toronto Transit Commission (TTC) guidelines for the assessment of potential vibration impact of future expansion (MOEE/TTC, 1993).

Aircraft

Land-use compatibility in the vicinity of airports is addressed in Ministry of the Environment, Conservation, and Parks (MECP) Guideline NPC-300 (MOE, 2013). The guideline provides recommendations for ventilation, and noise control for different Noise Exposure Forecast (NEF) values, which would be based on NEF contour maps available from the airport authority. The NEF values can be expressed as $L_{Aeq,24hr}$ sound levels by using the expression $NEF = L_{Aeq,24hr} - 32$ dBA.

Table 5: Indoor Sound Level Criteria for Aircraft Sources

Assessment Location	Indoor Sound Level Criteria NEF ($L_{eq, 24hr}$) ¹
Living/dining/den areas of residences, hospitals, schools, nursing/retirement homes, daycare centres, etc.	NEF- 5 (37 dBA)
Sleeping quarters	NEF-0 (32 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 6** are provided to inform good-practice design objectives.

Table 6: Supplementary Indoor Sound Level Criteria for Aircraft Sources

Assessment Location	Indoor Sound Level Criteria ¹
General offices, reception areas, retail stores, etc.	NEF-15 (47 dBA)
Individual or semi-private offices, conference rooms, etc.	NEF-10 (42 dBA)
Sleeping quarters of hotels/motels, theatres, libraries, places of worship, etc.	NEF-5 (37 dBA)

Table 7: NPC-300 Sound Level Criteria for Aircraft (Outdoors)

Assessment Location	Outdoor Sound Level Criteria ¹
Outdoor areas, including OLA	NEF-30 (62 dBA)

Table 8: Ventilation, Building Component, and Warning Clauses Recommendations for Aircraft Sources

Assessment Location	Aircraft Sound Level	NPC-300 Requirements
	NEF ($L_{EQ,24-hr}$)	
Outdoors	$\geq$ NEF 30	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 clauses "Type D" and "Type B" are recommended.
	$<$ NEF 30 $\geq$ NEF 25	The sound insulation performance of building components must be specified and designed to meet the indoor sound level criteria. 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.
	$<$ NEF 25	Further assessment not required

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.

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 9**.

Table 9: NPC-300 Exclusion Limits – Continuous and Quasi-Steady Impulsive Stationary Sources (LAeq-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.
4. 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.

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}), and is summarized in **Table 10**.

Table 10: NPC-300 Exclusion Limits – Impulsive Stationary Sources (L_{LM})

Time Period	Number of Impulses in Period of One-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	60dBAI	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 11**). 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.

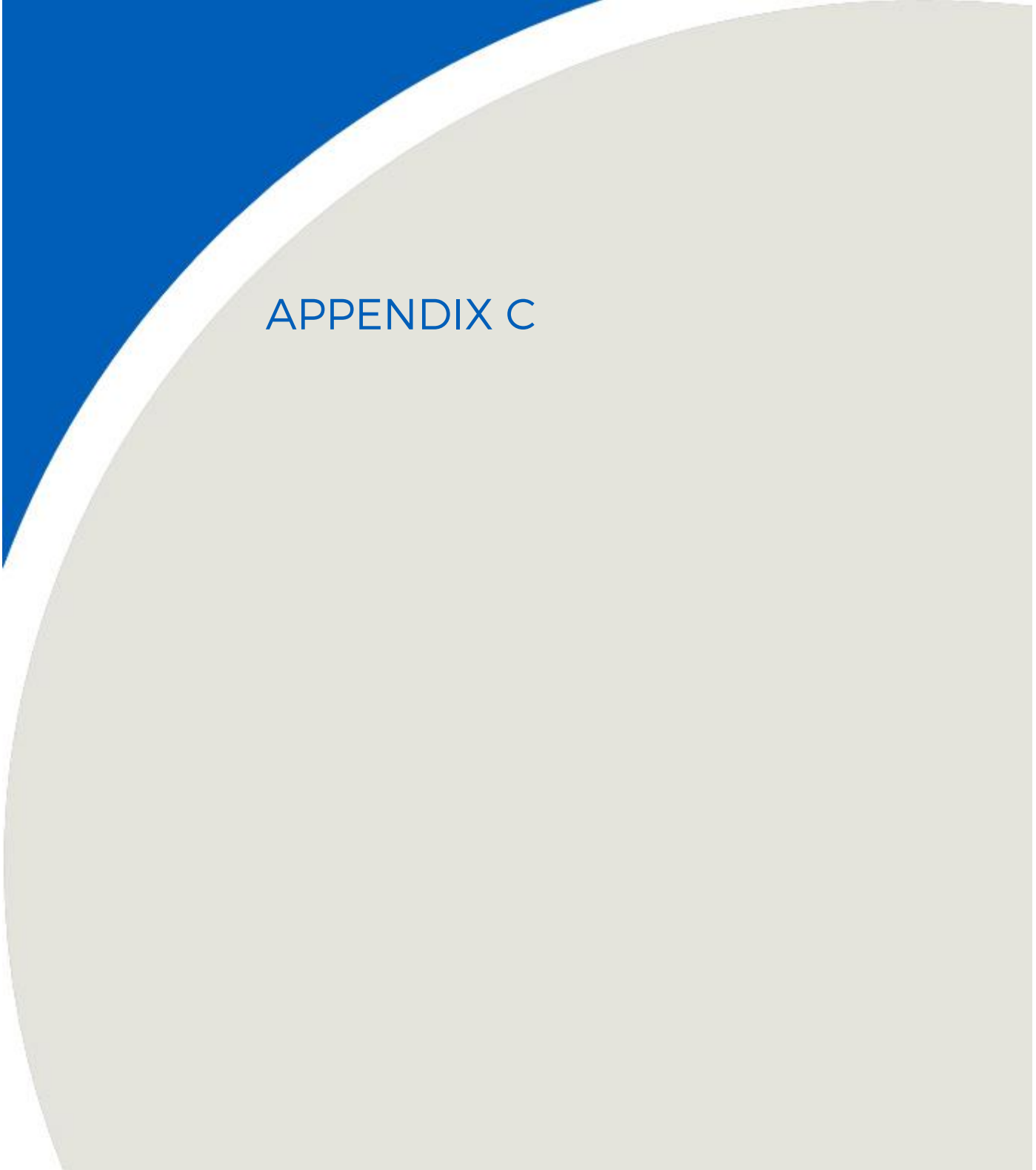
Table 11: Summary of Guideline D-6

Industry Class	Definition	Potential Influence Area	Recommended Minimum Separation Distance (property line to property line)
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

Guideline D-6 provides criteria for classifying industrial land uses, based on their outputs, scale of operations, processes, schedule and intensity of operations. **Table 12** provides the classification criteria and examples.

Table 12: 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

The graphic for Appendix C features a large, light gray circular shape on the right side of the page. On the left, a blue triangular shape is partially visible, separated from the gray circle by a thin white curved line. The text 'APPENDIX C' is centered within the gray area in a blue, sans-serif font.

APPENDIX C

Appendix C: Riverfront Community Phase 2A Air Quality Assessment
Niagara Falls, Ontario

RWDI# 2206772

Table C-1: List of Industrial and Non-Industrial Facilities Around the Proposed Development with Potential for Air Emissions

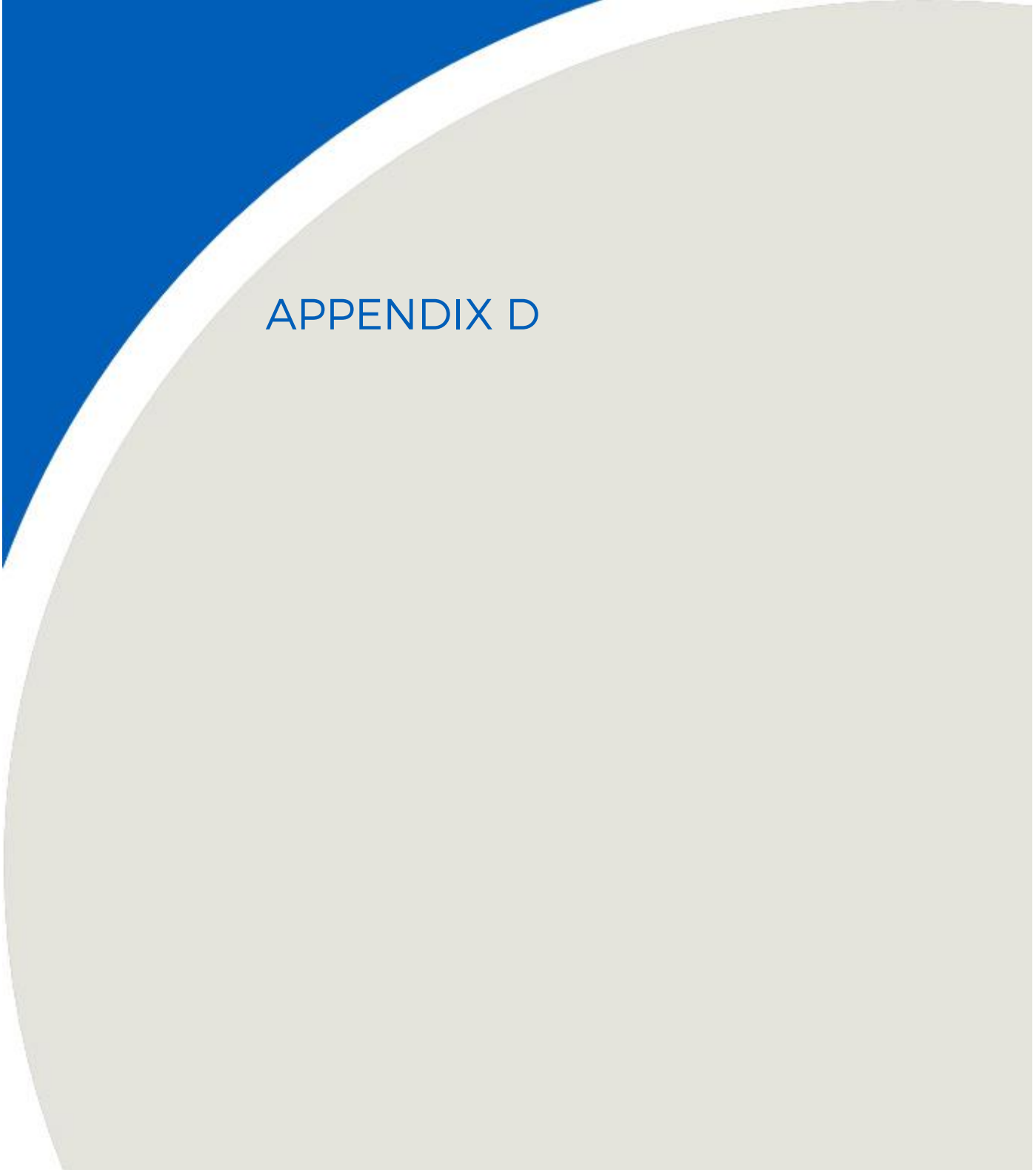
Map Icon Number	BUSINESS NAME	ADDRESS	TYPE OF APPROVAL / FACILITY / EQUIPMENT	APPROVAL / REGISTRATION NUMBER	Comment on Operations	Tall Stacks Present	Approximate Distance to Site (m)	D-6 Classification
1	Modern Mosaic Limited	8620 OAKWOOD DR	ECA-AIR	8501-53NP4J	TKL Group / Modern Mosaic Limited (https://www.tklgroup.com/services/) operates a manufacturing facility for sustainable precast concrete solutions. MECP permitted processes include operation of baghouse dust collectors to reduce air emissions from cement storage silos and concrete mixing, and one area for sandblasting operation equipped with water line and tarp enclosure to reduce emissions. The site has partially paved outdoor areas, with storage of finished concrete forms and open bins containing aggregate material; thus there is potential for fugitive dust emissions. After assessment of additional operational information received from site, this site was assigned a D-6 Classification of Class II during the air quality and noise assessment performed in support of the Thundering Waters Secondary Plan study in 2016. Based on apparent continuation of similar industrial activity, the D-6 Classification of Class II has been retained. The facility is located adjacent to a campground which is considered a sensitive receptor under D-6 classification; the subject lands are located 326m away across the Welland River, and are expected to be beyond the facility's potential influence area.	No	326	II
-	T. T. & H. Montgomery Construction (Niagara) Limited	8550 OAKWOOD DR	ECA-WASTE MANAGEMENT SYSTEMS	2721-8A8PZW	Review of satellite and street-level imagery indicates this site is permanently closed.	No	329	N/A
-	Eugene T. Willick (operating as The Chair Experts)	8230-8252 OAKWOOD DR	ECA-AIR	2324-4JJMH	This business no longer operates at this site. Review of satellite and street-level imagery suggests this site is now a Premier Truck Group facility, although this location is not included on the company website (https://www.premiertruck.com/locations.aspx). The site has unpaved outdoor areas, but no apparent storage of materials that could generate fugitive dust or odour emissions. Based on apparent current operations at this site, the facility has been assigned a D-6 Classification of Class I.	No	405	I
-	CYRO Canada Inc.	8100 DORCHESTER RD	ECA-AIR	4622-4LRL63	No longer in operation at this site.	No	427	N/A
-	Laurcoat Inc.	8100 Dorchester Rd Building "B"	ECA-AIR	5650-856LVJ	No longer in operation at this site. (https://laurcoat.com/contact)	No	427	N/A
-	WRB Sales	8100 Dorchester Rd	N/A	N/A	WRB Sales is an importer of party supplies, seasonal products, and festival items, operating a warehouse at this location. There is no evidence of industrial activity at the site, other than warehousing. This facility has been assigned a D-6 Classification of Class I.	No	427	I
2	Chemtrade Logistics Inc.	6300 OLDFIELD RD	ECA-AIR / ECA-AIR / ECA-AIR / ECA-AIR / EASR-Air Emissions	8-2016-95-006 / 8-2069-97-006 / 8-2082-89-997 / 8-2157-90-006 / 3355-9TZLBT / R-010-6111569981	Chemtrade Logistics Inc. operates a chemical storage facility at this site. MECP permitted processes include the transfer and storage of chemicals between storage tanks, railway tankers, and transport trucks with a Facility Transfer Limit specified in its most recent ECA of up to 50,000 tonnes of 93% sulphuric acid, 20,000 tonnes of 98% sulphuric acid, 15,000 tonnes of molten sulphur, and 5,000 tonnes of sulphur dioxide throughput per year. Based on review of current satellite and street-level imagery, no tall stacks are apparent and the site has mostly paved outdoor areas with no apparent storage of materials that could generate fugitive dust emissions. Thus, any emissions that may occur would be released from low-lying sources, and impacts from any air emissions are expected to be greatest in close proximity to the property line and are required to meet MECP air contaminant benchmarks at the property line and beyond. Air quality and noise impacts from this facility were assessed as part of the Thundering Waters Secondary Plan study in 2016 and operations were not expected to create significant air quality or steady-state noise impacts on the development proposed at that time. The current Phase 2 development proposal is for residential located further from Chemtrade than the previous proposal (515m vs. 145m). There is also existing residential development to the north on Oldfield road that is within 250m of Chemtrade operations. This suggests the established influence area of the facility is less than 300m, and the it has been assigned a D-6 Classification of Class II.	No	515	II
3	Lafarge Canada Inc.	6224 PROGRESS ST	ECA-AIR	4664-7S8L3G	This facility was investigated as part of a previous study, "Riverfront Community Phase 1A and 1B, Air Quality, Noise and Vibration Assessment, August 2021", and was found to be compatible with the proposed residential development of Phase 1. The Certificate of Approval originally issued to on May 29, 2009 to Centennial Concrete was amended to the current ECA on December 21, 2021 to identify that the "Best Management Practices Plan for the Control of Fugitive Dust Emissions", dated May 2021 and prepared by Lafarge Canada is in place at the facility. Based on the previous assessment for Riverfront Community Phase 1, this site has been assigned a D-6 Classification of Class II. Since Riverfront Community Phase 1 is in closer proximity to this site, it is expected that any air emissions will not impact the development proposed for Riverfront Community Phase 2.	No	719	II
-	1019537 Ontario Limited (operating as Vac-Mat Environmental)	6255 DON MURIE ST	ECA-WASTE MANAGEMENT SYSTEMS	A821129	This business is no longer in operation at this site and has been replaced by Gordon Wright, a trade contractor providing electrical and mechanical construction, service, and maintenance for industrial, commercial, and institutional sectors (https://gordonwrightltd.com/). There is no apparent industrial activity occurring at the site other than the storage of equipment and vehicles. Based on this, the site has been assigned a D-6 Classification of Class I.	No	766	I
-	The Corporation of the City of Niagara Falls	9240 MONTROSE RD	ECA-AIR	8120-72DGYB	This ECA is for one standby generator set, having an initial rating of 100 kW, to provide power for the Grassy Brook Sewage Pumping Station during emergency situations. Air emissions from this site are not expected to impact the subject lands.	No	900	I
-	CONSTANTIN SARUC	7868 OAKWOOD DR	EASR-Automotive Refinishing Facility	R-001-3110412945	This site is an automotive refinishing facility, with MECP permitted operations including one paint spray booth with a coating application rate of 2 to 3 litres per hour. Based on the type and scale of operations, this site has been assigned a D-6 Classification of Class I.	No	904	I

Appendix C: Riverfront Community Phase 2A Air Quality Assessment
Niagara Falls, Ontario

RWDI# 2206772

Table C-1: List of Industrial and Non-Industrial Facilities Around the Proposed Development with Potential for Air Emissions

Map Icon Number	BUSINESS NAME	ADDRESS	TYPE OF APPROVAL / FACILITY / EQUIPMENT	APPROVAL / REGISTRATION NUMBER	Comment on Operations	Tall Stacks Present	Approximate Distance to Site (m)	D-6 Classification
-	Marine Clean Ltd.	6220 Don Murie St	ECA-WASTE MANAGEMENT SYSTEMS / ECA-WASTE MANAGEMENT SYSTEMS	8117-8CDNGN / A820068	Review of current satellite and street-level imagery and search of publicly available information suggests this business is no longer in operation at this site. Marine Clean Ltd joined Envirosystems in 2017, and apparently was subsequently acquired by GFL but is no longer shown as a GFL operating location (https://gflenv.com/marine-clean/).	No	913	N/A
-	AIRWOOD VENTS INC	6167 DON MURIE ST	EASR-Air Emissions	R-010-3111289481	Airwood Flooring Accessories operates a manufacturing facility for hardwood floor products (https://airwood.ca/pages/about-us). MECP permitted processes include receipt of raw wood, millworking activities (cutting, sanding) and staining. Wood working and staining products are a potential emission source for particulate matter and volatile organic compounds (VOCs). There are no tall stacks apparent in satellite imagery so any emissions to air would be from low-lying point sources with impacts from these emissions expected to be greatest in close proximity to the property line and are required to meet MECP air contaminant benchmarks at the property line and beyond. Potential for noise impacts at this facility from its daytime operations was assessed in a previous study, "Riverfront Community Phase 1A and 1B, Air Quality, Noise and Vibration Assessment, August 2021" and were found to be below the daytime limit with no further action required. Based on this, the site has been assigned a D-6 Classification of Class I.	No	940	I
-	Niagara Pattern Limited	6135 DON MURIE ST	ECA-AIR	5857-8AFRRE	Niagara Pattern Limited no longer has operations at this site (https://www.niagarapattern.com/default.html). The facility has moved to 6537 Kister Road, Niagara Falls, which is beyond the study area of this assessment.	No	986	N/A
-	Riverfront Community Sewage Pumping Station (Proposed)	Street "E" and Chippawa Parkway	N/A	N/A	The potential for odour impacts from the proposed Riverfront Community Sewage Pumping Station on the Phase 1 residential development was investigated as part of the previous study, "Riverfront Community Phase 1A and 1B, Air Quality, Noise and Vibration Assessment, August 2021". Odour mitigation was recommended at the pumping station to reduce impacts on nearby sensitive receptors. Since the Phase 2 development is over 730m from the pumping station, mitigation measures to reduce odour impacts in proximity to the pumping station would effectively address any potential concerns for the Phase 2 development.	No	730	II

The graphic for Appendix D features a large, light gray circular shape on the right side of the page. To its left, a blue triangular shape is partially visible, separated from the gray circle by a thin white curved line. The text 'APPENDIX D' is centered in the white space between these two shapes.

APPENDIX D

Nghi Nguyen

From: Gene Chartier <gchartier@ptsl.com>
Sent: Thursday, January 14, 2016 9:45 AM
To: Melissa Annett; Lorelei Jones
Subject: FW: Rail Traffic Data - Montrose Subdivision, Niagara Falls

FYI ...

Gene Chartier, M.A.Sc., P.Eng., FITE
Vice-President



Paradigm Transportation Solutions Limited
p: 416.479.9684 x501
m: 416.300.7858

From: Josie Tomei [mailto:Josie_Tomei@cpr.ca]
Sent: January-14-16 9:39 AM
To: Gene Chartier
Subject: Rail Traffic Data - Montrose Subdivision, Niagara Falls

Hi Gene,
I refer to your recent request for rail traffic data for a noise study in the vicinity of the Montrose Subdivision in Niagara Falls, mileage 4.0 to 5.35. Please note that the Montrose Subdivision is classified as an industrial spur.

The information requested is as follows:

1. Number of freight trains 0700 to 2300: 10
Number of freight trains 2300 to 0700: 5
2. Average number of cars per train: 8
Maximum cars per train: 19
3. Number of Locomotives per train: 2 average
4. Type of Trains: freight
5. Maximum speed : 25 mph, normal speed is 15 mph
6. There are grade crossings at Biggar Road, Grassy Brook Road and Montrose Road, however whistling is prohibited at these locations. Please note, the whistle signal may be used in any dangerous situation when suitable warning is required.

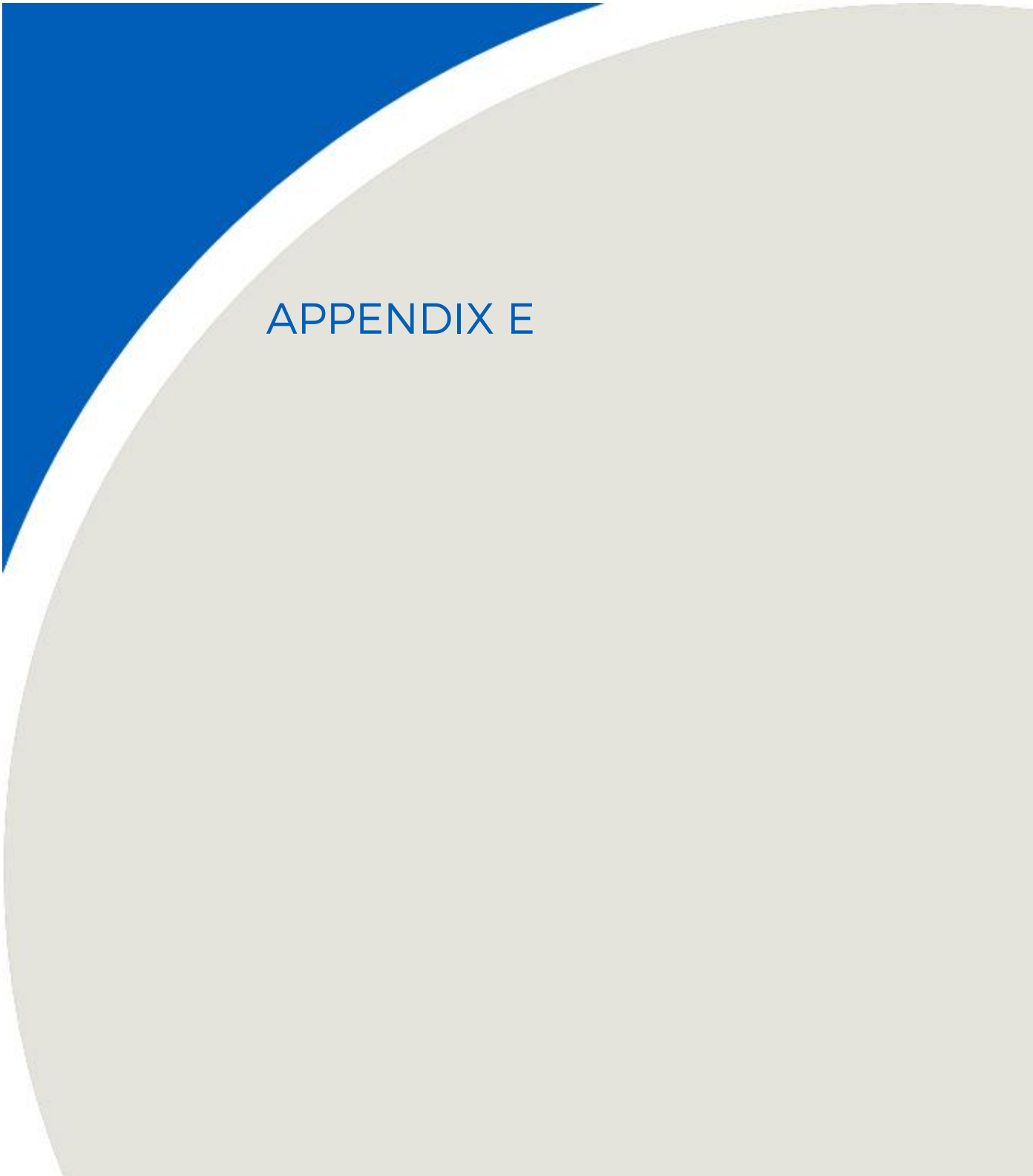
The information provided is based on rail traffic over the past month to date. Variations of the above may exist on a day-to-day basis. Specific measurements may also vary significantly depending on customer needs

Josie Tomei | Specialist Real Estate Sales & Acquisitions | 1290 Central Parkway West, Suite 800, Mississauga, ON L5C 4R3

905-803-3429 CP

----- IMPORTANT NOTICE - AVIS IMPORTANT ----- Computer viruses can be transmitted via email. Recipient should check this email and any attachments for the presence of viruses. Sender and sender company accept no liability for any damage caused by any virus transmitted by this email. This email transmission and any accompanying attachments contain confidential information intended only for the use of the individual or entity named above. Any dissemination, distribution, copying or action taken in reliance on the contents of this email by anyone other than the intended recipient is strictly prohibited. If you have received this email in error please immediately delete it and notify sender at the above email address. Le courrier electronique peut etre porteur de virus informatiques. Le destinataire doit donc passer le present courriel et les pieces qui y sont jointes au detecteur de virus. L'expediteur et son employeur declinent toute responsabilite pour les dommages causes par un virus contenu dans le courriel. Le present message et les pieces qui y sont jointes contiennent des renseignements confidentiels destines uniquement a la personne ou a l'organisme nomme ci-dessus. Toute diffusion, distribution, reproduction ou utilisation comme reference du contenu du message par une autre personne que le destinataire est formellement interdite. Si vous avez recu ce courriel par erreur, veuillez le detruire immediatement et en informer l'expediteur a l'adresse ci-dessus. ----- IMPORTANT NOTICE - AVIS IMPORTANT -----

This e-mail and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this e-mail in error please notify the sender immediately. Please note that any views or opinions presented in this e-mail are solely those of the author and do not necessarily represent those of Paradigm Transportation Solutions Limited. Finally, the recipient should check this e-mail and any attachments for the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this e-mail.

The graphic for Appendix E features a large, light beige circular shape on the right side of the page. To its left, a blue triangular shape is partially visible, separated from the beige circle by a thin white curved line. The text 'APPENDIX E' is centered within the beige area in a blue, sans-serif font.

APPENDIX E



STEAM Night

Sound from Trains Environmental Analysis Method (Ontario)

Job No. 2206772
Job Name Riverfront Phase 2

Scenario Traffic Grown from 2016

TIME PERIOD T: 8 hrs

Use this method for Diesel and Electrically powered heavy trains, including:

- Freight Trains and freight switchers
- VIA Passenger trains

TRAIN TYPE DEFINITIONS

1	2	3	4	5	6	7	8
Train Type	Type Name	Loco Type (Diesel / Electric)	Rail Type (CWR / Jointed)	# Locos (Per Train)	# Cars (Per Train)	Speed (km/h)	Use Whistle?
1	Montrose Max	D	J	2	19	40	N

DIESEL / ELECTRIC HEAVY RAIL

Façade

RAIL CHARACTERISTICS

Name	Component	Train Type	Train Name	No. of Trains of this Type	Effective No. of Units		Speed (km/h)	Source Height (m)
					Locos	Cars		
R1-Close Townhouse	Locomotive	1	Montrose Max	7	14.0	n/a	40.0	4.0
	Wheel-Rail				n/a	133.0		0.5
	Whistle				n/a	n/a		4.0
R2-Second row House	Locomotive	1	Montrose Max	7	14.0	n/a	40.0	4.0
	Wheel-Rail				n/a	133.0		0.5
	Whistle				n/a	n/a		4.0
R3-Retirement care building North	Locomotive	1	Montrose Max	7	14.0	n/a	40.0	4.0
	Wheel-Rail				n/a	133.0		0.5
	Whistle				n/a	n/a		4.0
R4-Retirement care building South	Locomotive	1	Montrose Max	7	14.0	n/a	40.0	4.0
	Wheel-Rail				n/a	133.0		0.5
	Whistle				n/a	n/a		4.0
R5-Condominium	Locomotive	1	Montrose Max	7	14.0	n/a	40.0	4.0
	Wheel-Rail				n/a	133.0		0.5
	Whistle				n/a	n/a		4.0

SOURCE-RECEIVER-TOPOGRAPHY CHARACTERISTICS

Source-Receiver Distance (m)	Ground Type (1-Hard, 2-Soft)	Topo-graphy Type	Rail Viewable Angle		Rail Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Ground Elevation Change (m)		
			⊙ ₁	⊙ ₂				Elevation Change e (m)	Hor. Dist a (m)	Hor. Dist b (m)
40.0	1	B	-90	90	0.0	4.5	0.0	3.0	22.0	18.0
92.0	1	B	-90	-43	0.0	4.5	0.0	3.0	22.0	70.0
80.0	1	B	-90	90	0.0	4.5	0.0	3.0	22.0	58.0
63.0	1	B	-90	90	0.0	1.5	0.0	3.0	22.0	41.0
160.0	1	B	-90	90	0.0	4.5	0.0	3.0	22.0	138.0

MODELLING RESULTS

Component	L _{ref} (dBA)	Distance Adj. A _d (dBA)	Finite Segment Adj. A _f (dBA)	Track Type Adjust?	Woods Adj. A _w (dBA)	Total Component L _{eq} (dBA)	Total Segment L _{eq} (dBA)
Loco	63.5	-4.3	0.1	n/a	-	59.3	60
Wheel	57.7		0.0	0.0		53.5	
Whistle	-		-	n/a		0.0	
Loco	63.5	-7.9	-5.8	n/a	-	49.8	51
Wheel	57.7		0.0	0.0		44.0	
Whistle	-		-	n/a		0.0	
Loco	63.1	-7.3	0.1	n/a	-	55.9	57
Wheel	57.7		0.0	0.0		50.5	
Whistle	-		-	n/a		0.0	
Loco	63.1	-6.2	0.1	n/a	-	56.9	58
Wheel	57.7		0.0	0.0		51.5	
Whistle	-		-	n/a		0.0	
Loco	63.5	-10.3	0.1	n/a	-	53.3	54
Wheel	57.7		0.0	0.0		47.5	
Whistle	-		-	n/a		0.0	