July 21, 2021

Dave Simpson
Edwardsburgh Developments Inc
434-300 Earl Grey Drive
Kanata, ON K2T 1C1

Dear: Mr. Simpson

Re: Noise Barrier Requirement
Lockmasters Meadow, Cardinal
GW File No.: 21-139 – Cover Letter

This letter describes the results of the rail noise study for Lockmasters Meadow in terms of the necessity of a noise barrier. Gradient Wind carried out this noise study using architectural drawings provided by David Simpson, railway traffic info purchased from CN, and MECP's STAMSON software using STEAM (Sound from Trains Environmental Analysis Method) to determine railway noise impact on the study site. The result of the noise study concluded that noise levels in the outdoor living areas of the proposed development do not require a berm or noise barrier, however, Warning Clauses will be required in all Lease, Purchase, and Sale agreements.

Should you have any questions, or wish to discuss our findings further, please call me at (613) 784-0537, or contact us by e-mail.

Sincerely,

Gradient Wind Engineering Inc.

Caleb Alexander, B.Eng.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File 21-139-Cover Letter

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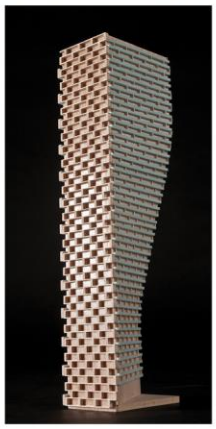
ENGINEERS & SCIENTISTS

RAIL NOISE ASSESSMENT

Lockmasters Meadow
Cardinal, Ontario

Report: 21-139-Rail Noise



July 21, 2021

PREPARED FOR

Edwardsburgh Developments Ltd
434-300 Earl Grey Drive
Kanata, ON K2T 1C1

PREPARED BY

Caleb Alexander, B.Eng., Junior Environmental Scientist
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EXECUTIVE SUMMARY

This report describes a rail noise assessment performed for a proposed residential development located off Shanly Road in Cardinal, Ontario. The development comprises of 93 single-family lots. A CN railway corridor approximately 175m northwest is the major noise source for the development. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP); (ii) noise level criteria as specified by the MECP NPC-300 guidelines; (iii) rail traffic volumes corresponding to data obtained from CN; and (iv) draft site plans dated November 2020.

The results of the current analysis indicate that noise levels will range between 55 and 59 dBA during the daytime period (07:00-23:00) and between 55 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e., 59 dBA) occurs in the backyards of the development's northernmost row of houses, which are nearest and most exposed to the CN railway.

The noise levels predicted due to railway traffic exceed the criteria listed in Section 4.2 for building components at certain houses, therefore, upgraded building components will be required as displayed in Figure 4. Noise levels at the outdoor living areas (OLA) reach 59 dBA, since they fall below 60 dBA no mitigation is required for these areas. However, since noise levels are above 55 dBA a Type A Warning Clause is required on Lease, Purchase and Sale Agreements as specified in Figure 4.

Results of the calculations indicate that some buildings in the development experience noise levels at the Plane of Window which exceed 55 dBA. These buildings will require central air conditioning which will allow occupants to keep windows closed and maintain a comfortable living environment. Additionally, Type D Warning Clauses will also be required in all Lease, Purchase and Sale Agreements as summarized in Section 6. A CN specific Warning Clause is also required on all buildings due to the proposed development's proximity to the CN railway.

With respect to stationary noise impacts from the buildings on the surroundings and the building itself, since the development comprises of single-family homes no rooftop HVAC equipment is expected therefore no stationary noise impacts are expected.

The surroundings of the site includes residential buildings and farm fields. As such, there are no significant existing stationary noise sources impacting the site.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Edwardsburgh Developments Inc. to undertake a rail noise assessment for the proposed residential development located off Shanly Road in Cardinal, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local train traffic.

This assessment is based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP)[1] guidelines. Noise calculations were based on draft site plans dated November 2020, with future rail traffic volumes corresponding to data obtained from CN.

2. TERMS OF REFERENCE

The focus of this rail noise assessment is a proposed residential development located off Shanly Road in Cardinal, ON. The development is directly south of an existing CN railway. The development will comprise of 93 2-storey single-family lots.

The source of rail noise is the CN railway directly north of the proposed development. Shanly Road is located directly east of the proposed development, however, traffic volumes on this roadway are low enough to neglect it as a noise source.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study building produced by rail traffic, and (ii) determine whether exterior noise levels exceed the allowable limits specified by the MECP Noise Control Guidelines – NPC-300 as outlined in Section 4.2 of this report.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source

[1] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Pri nter for Ontario, Toronto, 2013

or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Rail Noise

4.2.1 Criteria for Rail Traffic Noise

For rail traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The NPC-300 guidelines specify that the recommended indoor noise limit ranges (that are relevant to this study) are 40 and 35 dBA for living rooms, and sleeping quarters, respectively, as listed in Table 1. However, to account for deficiencies in building construction and to control peak noise, these levels should be targeted toward 37, and 32 dBA.

TABLE 1: INDOOR SOUND LEVEL CRITERIA

Type of Space	Time Period	L_{eq} (dBA)
General offices, reception areas, retail stores, etc.	07:00 – 23:00	45
Living/dining/den areas of **residences**, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	40
Sleeping quarters of hotels/motels	23:00 – 07:00	40
Sleeping quarters of **residences**, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	35

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[2]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[3]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning. Where noise levels exceed 60 dBA daytime and 55 dBA nighttime, building components will require higher levels of sound attenuation[4].

The sound level criterion for outdoor living areas (OLA) is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation should be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion. When noise levels at the OLA exceed 60 dBA mitigation must be provided.

4.2.2 Railway Traffic Volumes

The CN Railway line is located to the north of the development, as shown in Figure 1. This railway line serves 3 train types: freight, way freight, and passenger trains. NPC-300 dictates that noise calculations should consider future sound levels based on a railway's classification at the mature state of development. As a result, the ultimate AADT volumes are based on train count data provided by CN Railway (dated July of 2021), with a 2.5% growth rate applied for 10 years from the date of the project (2021). Table 2 summarizes the railway traffic values used for each railway segment, the number of cars, the maximum speed and the number of locomotives included in this assessment.

[2] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[3] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[4] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

TABLE 2: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Train Type	Projected 2031 Traffic Volumes	Speed Limit (km/h)	Number of Locomotives	Number of Cars
Freight	15/9*	89	4	140
Way Freight	1/0*	89	4	25
Passenger	14/0*	105	2	10

* Projected 2031 AADT daytime/nighttime rail traffic volumes

4.2.3 Theoretical Transportation Noise Predictions

Calculations were performed in MECP's STAMSON software using STEAM (Sound from Trains Environmental Analysis Method) to determine railway noise impact on the study site. Calculations were performed by treating the rail segment as a line sources of noise, and by using existing building locations as noise barriers. In addition to the railway traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- The ground surface was modelled as absorptive where grass and foliage (soft ground) are present, and as reflective where pavement and concrete are present (hard ground).
- Noise receptors were strategically placed at four (4) locations at the façades as Plane of Window (POW) receptors at the highest levels of the buildings.
- Buildings were assumed to be 2-storeys tall with a height of 6 m.
- Two (2) receptor location were chosen as OLA receptors located in backyards.
- The location of the receptors are illustrated in Figure 2.
- Whistle events were considered 1700 metres away to the west of the study site.
- Rail lines were taken as welded.
- Railway is assumed to be 3 m above grade since it crosses over the road on a bridge near the study site.

5. TRANSPORTATION NOISE RESULTS

5.1 Transportation Noise Levels

The results of the transportation noise calculations are summarized in Table 3 below. The results of the current analysis indicate that noise levels will range between 55 and 59 dBA during the daytime period (07:00-23:00) and between 55 and 58 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e., 59 dBA) occurs in the backyard of the row of houses which are closest to the CN railway.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Receptor Height Above Grade/Roof (m)	Receptor Location	Railway Noise Level (dBA)	
			Day	Night
R1	4.5	POW – North Façade – 2nd North Row	57	57
R2	4.5	POW – North Façade – West Row	58	58
R3	4.5	POW – North Façade – 1st North Row	58	58
R4	4.5	POW – East Façade – 1st North Row	55	55
R5	1.5	OLA – Backyard – 1st North Row	59	N/A*
R6	1.5	OLA – Backyard – West Row	55	N/A*

*Nighttime noise levels are not considered as per NPC-300

5.2 Noise Control Measures

The noise levels predicted due to rail traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.3, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels). Detailed STC calculations will be required to be completed prior to building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 4):

- **Bedroom Windows**

(i) Bedroom windows facing north, as specified in Figure 4, will require a minimum STC of 26.

- **Living Room Windows**

(ii) Living room windows facing north, as specified in Figure 4, will require a minimum STC of 21.

- **Exterior Walls**

(i) Exterior wall components on north façades will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[5].

The STC requirements apply to windows, doors, spandrel panels and curtainwall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a window/wall system is used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have specified an example window configuration, however several manufacturers and various combinations of window components, such as those proposed, will offer the necessary sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

[5] J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the noise study indicate that noise levels at certain houses exceed 55 dBA during the nighttime period (23:00-7:00), therefore, building components with a higher Sound Transmission Class (STC) rating will be required. Noise levels at certain outdoor living areas (OLA) exceed 55 dBA which will require a Warning Clause on all Lease, Purchase and Sale Agreements, as specified in Figure 4.

Results of the calculations also indicate that certain buildings in the development will require forced air heating with provisions for central air conditioning which will allow occupants to keep windows closed and maintain a comfortable living environment at the occupant's discretion, as specified in Figure 4. The following Warning Clauses will also be required to be placed on Lease, Purchase and Sale Agreements, as summarized below:

Type D

> *"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."*

Type A

> *"Purchasers/tenants are advised that sound levels due to increasing rail traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and the Ministry of the Environment"*

In addition to NPC-300 Warning Clauses the following CN Railway Warning Clause will be required in all Lease, Purchase and Sale Agreements:

CN Warning Clause:

> *"Warning: Canadian National Railway Company or its assigns or successors in interest has or have a rights-of-way within 300 metres from the land the subject hereof. There may be alterations to or expansions of the railway facilities on such rights-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). CNR will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way."

Off-site stationary noise impacts are not expected to be an issue since houses in the proposed development will not have rooftop HVAC equipment.

The immediate surroundings of the site include residential buildings and farm fields. As such, there are no significant existing stationary noise sources impacting the site.

This concludes rail noise assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

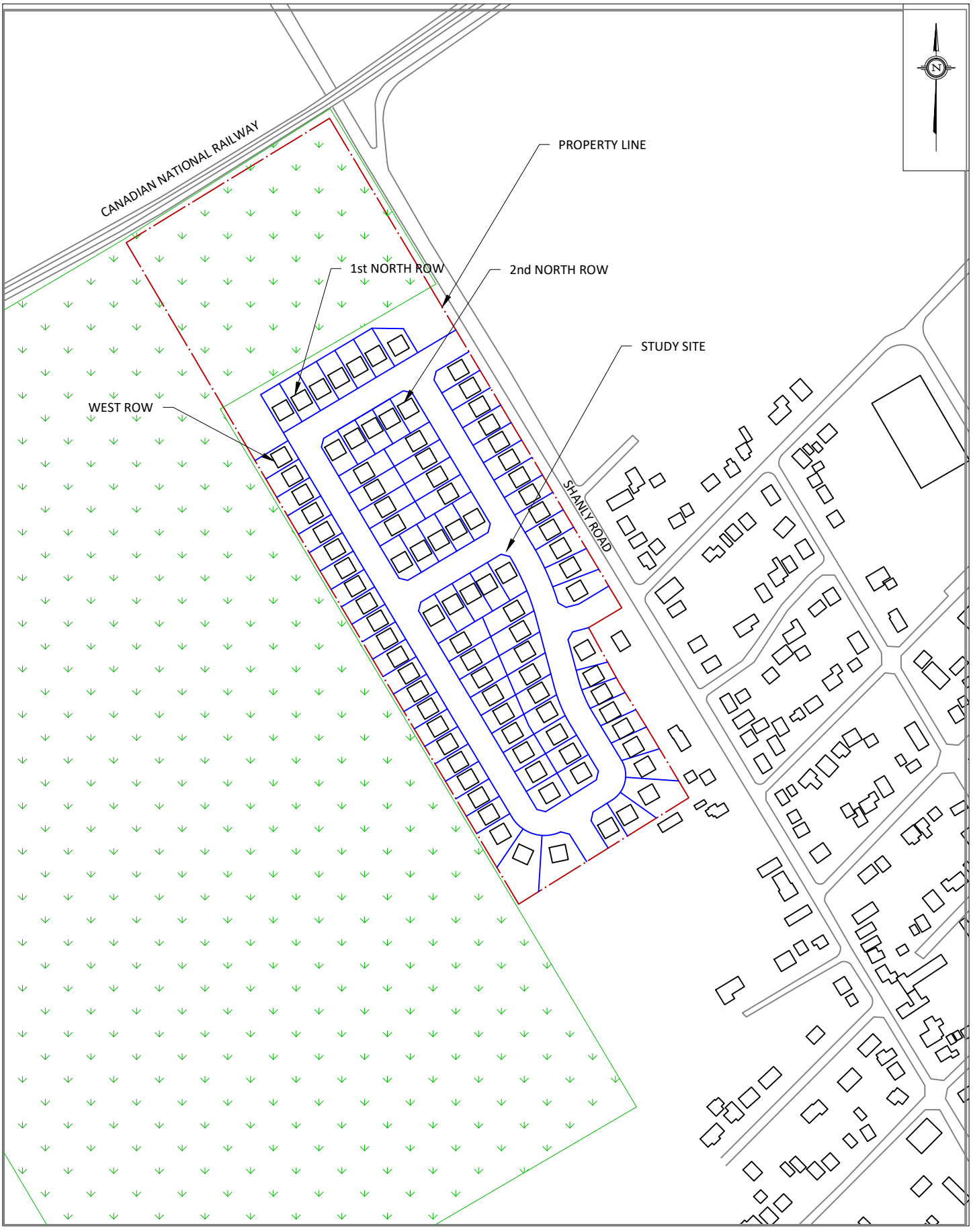
Sincerely,

Gradient Wind Engineering Inc.

Caleb Alexander, B.Eng.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File 21-139-Rail Noise



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PROJECT	LOCKMASTER'S MEADOW, OTTAWA RAIL NOISE ASSESSMENT
SCALE	1:4000 (APPROX.)
DRAWING NO.	21-139-1
DATE	JULY 13, 2021
DRAWN BY	C.A.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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PROJECT	LOCKMASTER'S MEADOW, OTTAWA RAIL NOISE ASSESSMENT		DESCRIPTION
SCALE	1:2000 (APPROX.)	DRAWING NO.	21-139-2
DATE	JULY 13, 2021	DRAWN BY	C.A.

FIGURE 2:
RECEPTOR LOCATIONS

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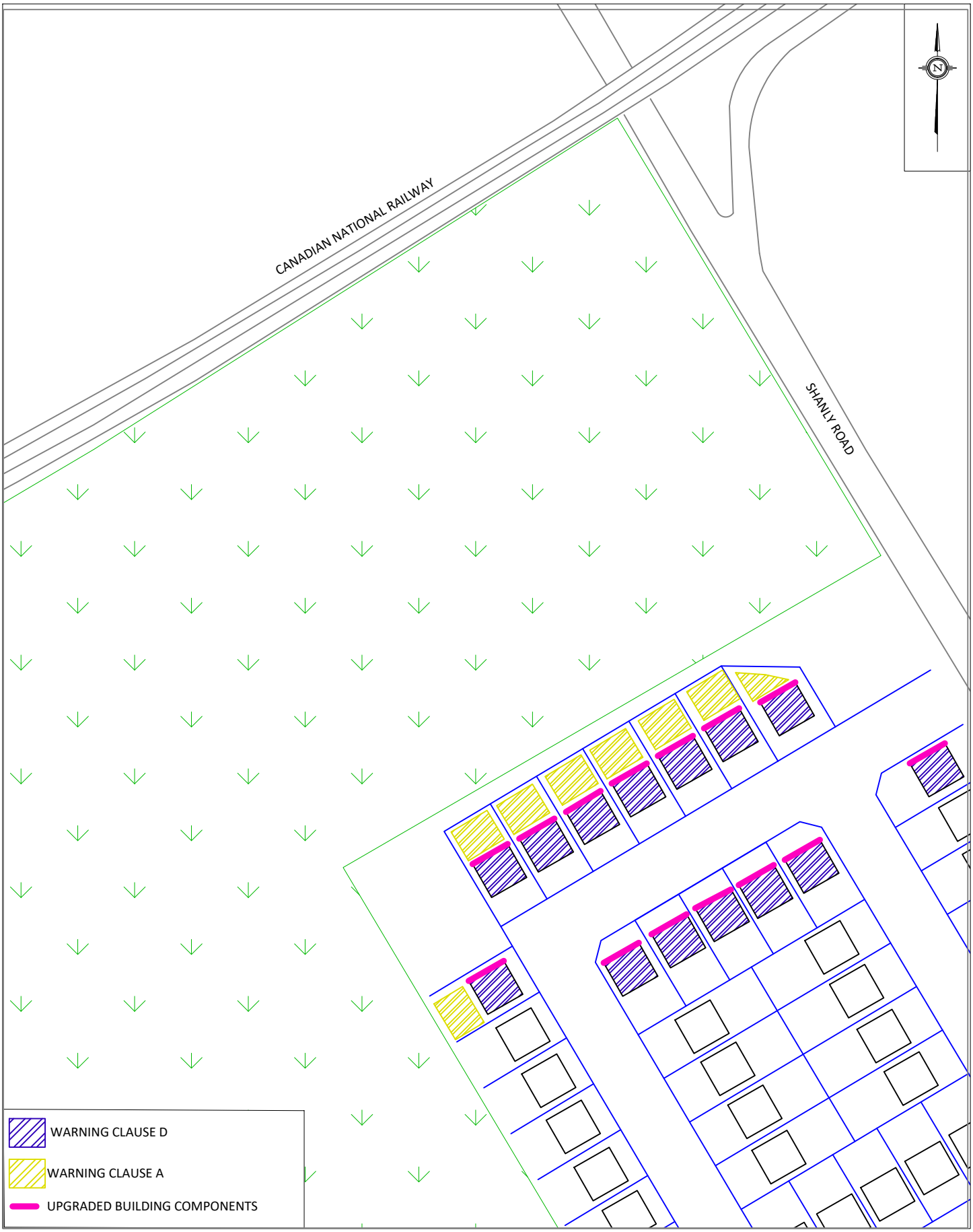
PROJECT	LOCKMASTER'S MEADOW, OTTAWA RAIL NOISE ASSESSMENT
SCALE	1:2000 (APPROX.)
DRAWING NO.	21-139-3
DATE	JULY 13, 2021
DRAWN BY	C.A.

DESCRIPTION

FIGURE 3:
RECEPTORS 1-6



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127 WALGREEN ROAD, OTTAWA, ON
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PROJECT	LOCKMASTER'S MEADOW, OTTAWA RAIL NOISE ASSESSMENT		DESCRIPTION
SCALE	1:2000 (APPROX.)	DRAWING NO.	21-139-4
DATE	JULY 14, 2021	DRAWN BY	C.A.

FIGURE 4:
UPGRADED BUILDING COMPONENTS AND WARNING CLAUSES