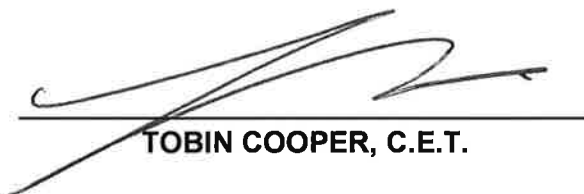


**NOISE AND VIBRATION IMPACT STUDY
HANLEY PARK NORTH SUBDIVISION
CITY OF BELLEVILLE**

FOR

MACAULAY SHIOMI HOWSON

BY



TOBIN COOPER, C.E.T.

CHECKED BY



JOHN E. COULTER, B.A.Sc., P.ENG.



**J.E. COULTER ASSOCIATES LIMITED
1210 SHEPPARD AVENUE EAST, SUITE 211
TORONTO, ONTARIO
M2K 1E3**

November 1, 2019

TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	DESCRIPTION OF SITE	1
3.0	NOISE SOURCES.....	1
3.1	CNR Railway – Kingston Subdivision	1
3.2	CP Railway – Belleville Subdivision	2
3.2	Airport Parkway West	2
4.0	NOISE CRITERIA (Transportation Sources)	2
5.0	RAILWAY CRITERIA.....	3
6.0	VIBRATION CRITERIA.....	3
7.0	PROJECTED EXTERIOR SOUND LEVELS	3
8.0	AIR CONDITIONING AND WARNING CLAUSE REQUIREMENTS.....	4
9.0	EXTERIOR NOISE CONTROL MEASURES.....	4
9.1	Acoustic Fence Requirements	5
10.0	FAÇADE COMPONENTS	5
11.0	RECOMMENDATIONS.....	6

LIST OF TABLES

Table 1:	CNR Railway Kingston Subdivision Current Traffic Volume	1
Table 2:	CPR Railway Belleville Subdivision Current Traffic Volume	2
Table 3:	Road Traffic Volumes	2
Table 4:	Projected Road and Rail Sound Levels Without Barrier	3

APPENDICES

APPENDIX A: FIGURES

APPENDIX B: CALCULATIONS

APPENDIX C: WARNING CLAUSES

APPENDIX D: NOISE CRITERIA

APPENDIX E: REFERENCES

1.0 INTRODUCTION

At the request of Macaulay Shiomi Howson, J.E. COULTER ASSOCIATES LIMITED has reviewed the site plan for the proposed Hanley Park North Subdivision in the City of Belleville (see Figure #1 in Appendix A). This analysis is based on the Draft Plan of Subdivision dated November 8, 2018.

The purpose of this report is to identify the sources of noise that may have an impact on the proposed development and to provide recommendations to reduce these levels to within MECP guidelines, should measures be required. The noise criteria for transportation sources are found in MECP's *NPC-300* and are listed in Appendix D.

2.0 DESCRIPTION OF SITE

This site is loosely bounded to the north by Airport Parkway West and the CN rail corridor; CP rail to the south; Elmwood Drive to the east; and Haig Road to the west. When complete, the proposed development will consist of 112 fully detached homes and 59 town homes (see Key Plan – Figure #1 in Appendix A).

3.0 NOISE SOURCES

The main sources of transportation noise at the proposed site are the CN Rail Kingston Subdivision 700m to the south and the CP Rail corridor 350m to the north and, to a much lesser extent, Airport Pkwy West 400m to the north. The internal subdivision roads will carry light traffic volumes too small to affect the results and are not incorporated into the calculations.

3.1 CNR Railway – Kingston Subdivision

The Kingston Subdivision is classified as a principal mainline and is the main rail corridor between Montreal and Toronto. The train movements, types and speeds for this area, provided by CN Rail on May 16, 2019, are listed in Table 1, below.

Time	Train Type	# of Trains	# of Cars	# of Engines	Average Speed M.P.H.
Daytime (0700–2300)	Freight	1	140	4	60
	Way Freight	3	25	4	60
	Passenger	7	10	2	65
Nighttime (2300–0700)	Freight	29	140	4	60
	Way Freight	5	25	4	60
	Passenger	11	10	2	65

Notes:

1. Whistling does not normally occur near this development and has not been incorporated into the noise calculations.
2. The railway data have been projected to 2029 using a 2.5% increase over 10 years.

3.2 CP Railway – Belleville Subdivision

The CP Belleville Subdivision is classified as a Principal Main Line and is the main rail corridor between Montreal and Toronto. The train movements, types and speeds, provided by CP rail on April 29, 2019, are listed in Table 1, below.

Time	Train Type	# of Trains	# of Cars	# of Engines	Average Speed M.P.H.
Eastbound (0700–2300)	Freight	7	211	4	60
Westbound (2300–0700)	Freight	3	211	4	60

3.2 Airport Parkway West

Based on traffic data provided by the City of Belleville, Airport Parkway West carries the following traffic volumes:

Roadway	24hr. AADT	Cars	Trucks	Heavy Trucks	Posted Speed Limit
Airport Parkway West	1738	1764	2.9	6.4	80km/hr.

Note: These data, provided by the City of Belleville, were recorded September 25 to 27, 2018. These volumes were forecasted by 10 years after construction completion. The Medium/Heavy Truck split was derived from the data collected from College Street.

The source data above were projected to 2029 with an assumed 2.0% increase per year and a 90/10 daytime/nighttime traffic volume split.

4.0 NOISE CRITERIA (Transportation Sources)

The Ministry of the Environment's noise criterion for private outdoor areas is 55 dBA L_{eq} daytime. The Ministry, however, does allow up to a maximum of 5 dB in excess (i.e., 60 dBA L_{eq}), provided a warning clause is inserted into the *Agreement of Purchase or Sale* and the subdivision agreement. In the case where the sound level is greater than 60 dB L_{eq} daytime, mitigation measures (usually noise barriers of suitable heights) are required to attenuate the sound levels to 60 dB L_{eq} or less. For residential buildings, the Ministry's ventilation requirements are based on the sound level at the exterior building façade. Air conditioning is required prior to occupancy when the sound level is greater than 60 dB L_{eq} at exterior bedroom windows at nighttime, or when it is greater than 65 dB L_{eq} at exterior living room windows during the daytime. Forced air ventilation with provision for future air conditioning is required when the nighttime sound level at bedroom windows is above 50 and below 60 dB L_{eq} , or when the daytime sound level at the living room window is greater than 55 and less than 65 dB L_{eq} . For

those residences that require provision for future air conditioning, there must also be a warning clause inserted into the *Agreement of Purchase and Sale*.

5.0 RAILWAY CRITERIA

CN Rail has requested that the first row of homes adjacent to the R-O-W, regardless of the sound level, have brick veneering. The Railway's criteria are applicable to new developments located within 300m of their R-O-W. The Kingston Subdivision tracks are situated a minimum of approximately 300m north of the proposed residential units. A berm is not required due to the large distance from the railway corridor.

6.0 VIBRATION CRITERIA

The Ministry of the Environment has not established requirements for ground-borne vibration. However, the rail company requests that for dwellings within 75m of the railway rights-of-way, ground-borne vibration should not be in excess of 0.14mm/sec. between 4 Hz and 200 Hz. If in excess, vibration isolation measures are required to ensure that vibration in the living areas does not exceed 0.14mm/sec. on and above the first floor of the dwelling. This development is to be 300m or more from the railway corridors and is not subject to vibration from this distance.

No further mention of railway vibration will be made in this report.

7.0 PROJECTED EXTERIOR SOUND LEVELS

The following table summarizes the exterior L_{eq} sound levels at various locations, exposed fully or partially to CN Rail and Bath Road. The sound levels were computed using the Ministry's model *STEAM (STAMSON Version 5.03)*. Details of the sound level calculations are provided in Appendix B.

Location	Daytime			Nighttime		
	Airport Parkway West	Railway	Total without barriers	Airport Parkway West	Railway	Total without barriers
Lot 6	--	44	44	- -	61	61
Lot 41	--	50	50	- -	50	50
Lot 114	34	52	52	30	60	60
Lot 116	38	51	51	33	64	64

Notes:

1. All daytime calculations are based on a 1.5m high receiver in the OLA (Outdoor Living Area).
2. All nighttime calculations are based on a 4.5m high receiver.
3. It has been assumed there are no train whistles as the nearby at-grade rail crossings are equipped with signals.

It is apparent from the above table that ventilation, exterior façade upgrades, and exterior barriers will be required for several residences in this development.

8.0 AIR CONDITIONING AND WARNING CLAUSE REQUIREMENTS

The Ministry of the Environment, Conservation and Parks requires a warning clause and the installation of air conditioning prior to occupancy in cases where the sound levels at the plane of the living room window exceed 65 dBA in the daytime and 60 dBA at the plane of the bedroom window in the nighttime. This ventilation upgrade and Warning Clause A are applicable to the following lots (see Appendix C: Warning Clauses):

Lots: 1 to 13 and 114 to 121.

Note: Air conditioners should not exceed a sound rating of 7.6bels.

Forced air heating with provisions for the future installation of air conditioning and Warning Clause B are required by the MECF when the exterior sound level during the daytime is greater than 55 dB L_{eq} and less than 65 dB L_{eq} , and greater than 50 dBA and less than 60 dBA during the nighttime. This is applicable to the following lots (see Appendix C: Warning Clauses):

Lots: 14 to 42, 110 to 113, and Blocks 104 to 109.

Warning Clause C should be inserted into the *Agreement of Purchase and Sale* for all lots that have acoustic barriers installed on them. This warning clause inclusion is applicable to the following areas:

Lots: 1 to 13 and 114 to 121.

CN Rail has requested that all homes being built within 300m of its R-O-W have its warning clause, Warning Clause D, inserted into the *Agreement of Purchase and Sale*. This is applicable to Lots 110 to 121 (see Appendix C: Warning Clauses).

9.0 EXTERIOR NOISE CONTROL MEASURES

Exterior noise control measures are recommended for this site, as the outdoor living areas are more than 4.0m deep. The current railway traffic pattern indicates that there are several lots requiring treatment.

The following barriers are needed for this development:

- a) A minimum 2.2m high acoustic barrier should be constructed along the northern property line of Lots 114 to 121 of the OLA (Outdoor Living Area). The barrier should start on the southeast corner of Lot 114 and extend north to the southeast corner of Lot 116. The barrier should then extend west to the west property line of Lot 121, wrap south for 4m and then terminate.
- b) An acoustic barrier should be constructed to protect the outdoor living areas of Lots 1 to 13. This 2.2m high acoustic fence should start at the northwest corner of Lot 1, extend east and trace the north/northeast property line south to the north edge of Lot 14, then terminate.

All barrier configurations that terminate beyond the rear façades of residential structures may alternatively be terminated at the rear façades with gates. All gates in these barriers will have to be of an acoustic quality.

The sound levels and barrier geometries indicated above are similar to those implemented in similar developments in the province of Ontario.

9.1 Acoustic Fence Requirements

All acoustical barriers (fence and/or earth berming) must be solid. Any gaps at the base of the acoustic fence must be minimized and localized so as not to significantly affect the acoustical performance of the fence. MECP requires that all acoustical fences have a minimum surface density of 20 kg/m² (4 lbs./ft.²). This density requirement is more than is needed acoustically, but the more robust construction will ensure the prolonged life of the fence.

All acoustic barriers can be constructed of any combination of berm and fencing, as long as the total required barrier height is achieved.

10.0 FAÇADE COMPONENTS

To reduce the interior sound levels to 35 dB L_{eq} nighttime from road and rail noise in the north-facing bedroom areas, and to 40 dB L_{eq} daytime in the living rooms, special exterior façade treatments are needed. This conclusion is based on a window area that is 25% of the floor area. CN Rail insists on brick veneering or equivalent for the first row of housing adjacent to its railway corridor. The façade facing away from the noise source need not be so treated. An exterior façade configuration that would meet the MECP requirement is as follows:

- a) 12.7mm gypsum board, vapour barrier
38 x 39mm studs
39mm mineral wool or glass fibre batts in the inter-stud cavities sheathing
25mm air space and 100mm brick veneer.

Alternatively the following non-brick veneering exterior configuration can be used to meet the CN criterion.

- b) 2 layers of 15mm gypsum board, vapour barrier
38 x 140mm studs
Resilient channel
140mm (or thicker) mineral wool or glass fibre batts in the inter-stud cavities
2 layers of 13mm OSB or exterior drywall
Vinyl or aluminum siding.

These configurations permit the interior sound levels to remain below the criterion. This façade upgrade is applicable to Lots 114 to 121.

Based on a 25% window area, it is anticipated the following window configuration will be required for the first row of this development, Lots 114 to 121. All sleeping areas on the north, east and west façades will require a minimum of STC 36 operable and STC 39 fixed windows. A window configuration that would meet this standard would be 6(25)6L; that is, 6mm glass, a

25mm air gap and 6mm laminated glass. This upgraded window type is necessary due to the high level of rail activity during the nighttime on the CN Corridor.

Slightly upgraded glazing requirements are appropriate for Lots 1 to 13 with northern exposure. These lots will require a minimum of STC 32 operable and STC 34 fixed windows for the sleeping areas with north, east, and west exposures.

STC 34 windows can be constructed with a 6(13)6 configuration; that is, 6mm glass, 13mm air space and 6mm glass. An STC 32 window can be built with 5 or 6mm glass, 12mm air space, and 4mm glass.

It is expected the balance of lots in this development can be constructed with minimum OBC construction.

Once building designs have been finalized, it is recommended an acoustic consultant conduct a review to ensure the MECP interior sound level criteria are being met.

11.0 RECOMMENDATIONS

To meet the requirements of CN Rail and the MECP, the following noise mitigation measures are proposed:

1. The insertion of Warning Clause A into the *Agreement of Purchase and Sale* and the installation of air conditioning is required for Lots 1 to 13 and Lots 114 to 121, as the daytime and/or nighttime sound levels exceed the applicable MECP criteria (see Appendix C: Warning Clauses).

Note: Air conditioners should not exceed a sound rating of 7.6bels.

2. The balance of units within this subdivision should be provided with forced air heating and the inclusion of Warning Clause B into the *Agreement of Purchase and Sale* as the nighttime sound levels exceed the applicable MECP criteria (see Appendix C: Warning Clauses).
3. CN Rail has requested that brick veneering (STC 55) or its acoustical equivalent be applied from the top of the foundation wall up to the soffits, for the first row of houses (Lots 114 to 121) for all surfaces not facing away from the tracks. This is applicable to the north, east, and west façades of this development (see Section 10, above, for details).
4. It is recommended the following window configurations be incorporated into the construction of homes on Lots 114 to 121. All sleeping areas on the north, east, and west façades will require a minimum of STC 36 operable and STC 39 fixed windows. Upper bedrooms on the north, east, and west façades will require STC 32 operable and STC 34 fixed windows (see section 11 above). The balance of lots in this development can be provided with minimum OBC glazing (see section 10 above).
5. As the façade components have been determined based on theoretical conditions, it is recommended an acoustic consultant conduct a review once building designs have been finalized.

6. It is recommended acoustic barriers be constructed in the following areas:
 - a) A minimum 2.2m high acoustic barrier should be constructed along the northern property line of Lots 114 to 121 of the OLA (Outdoor Living Area). The barrier should start on the southeast corner of Lot 114 and extend north to the southeast corner of Lot 116. The barrier should then extend west to the west property line of Lot 121, wrap south for 4m and then terminate. Any gates that are to be used to access this area should be of an acoustic quality similar to the fences.
 - b) An acoustic barrier should be constructed to protect the outdoor living areas of Lots 1 to 13. This 2.2m high acoustic fence should start at the northwest corner of Lot 1, extend east and trace the north/northeast property line south to the north edge of Lot 14, then terminate.
7. It is recommended Warning Clause C be inserted into the *Agreement of Purchase and Sale* for all lots that have acoustic barriers installed on them. This warning clause inclusion is applicable to Lots 1 to 13 and 114 to 121.
8. It is recommended the CN Rail Warning Clause be inserted into all *Agreements of Purchase and Sale* of the homes in this development. CN requests this insertion for all homes being built within 300m of its R-O-W (see Appendix C: Warning Clauses). This is applicable to Lots 110 to 121.

APPENDIX A: FIGURES

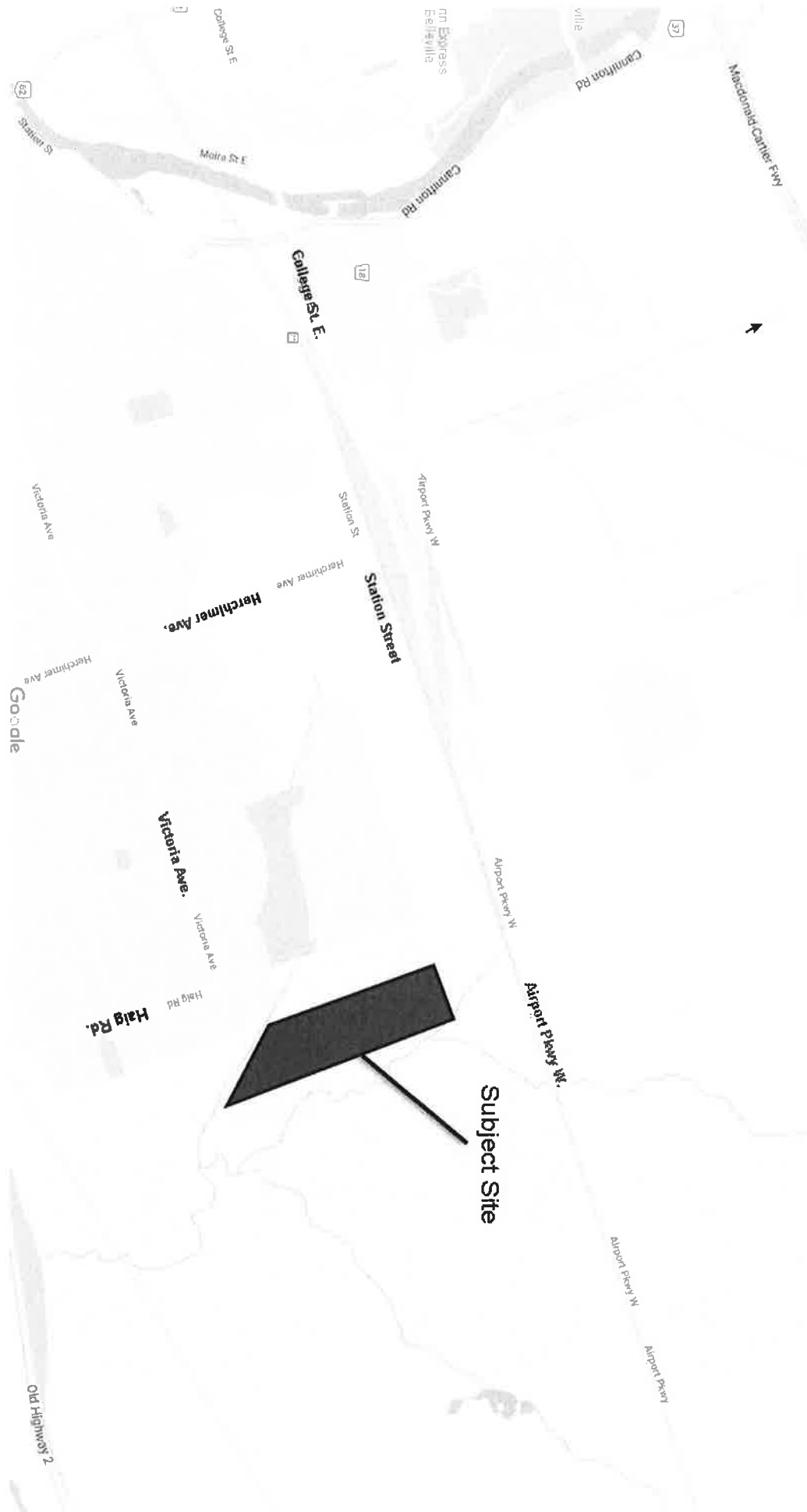
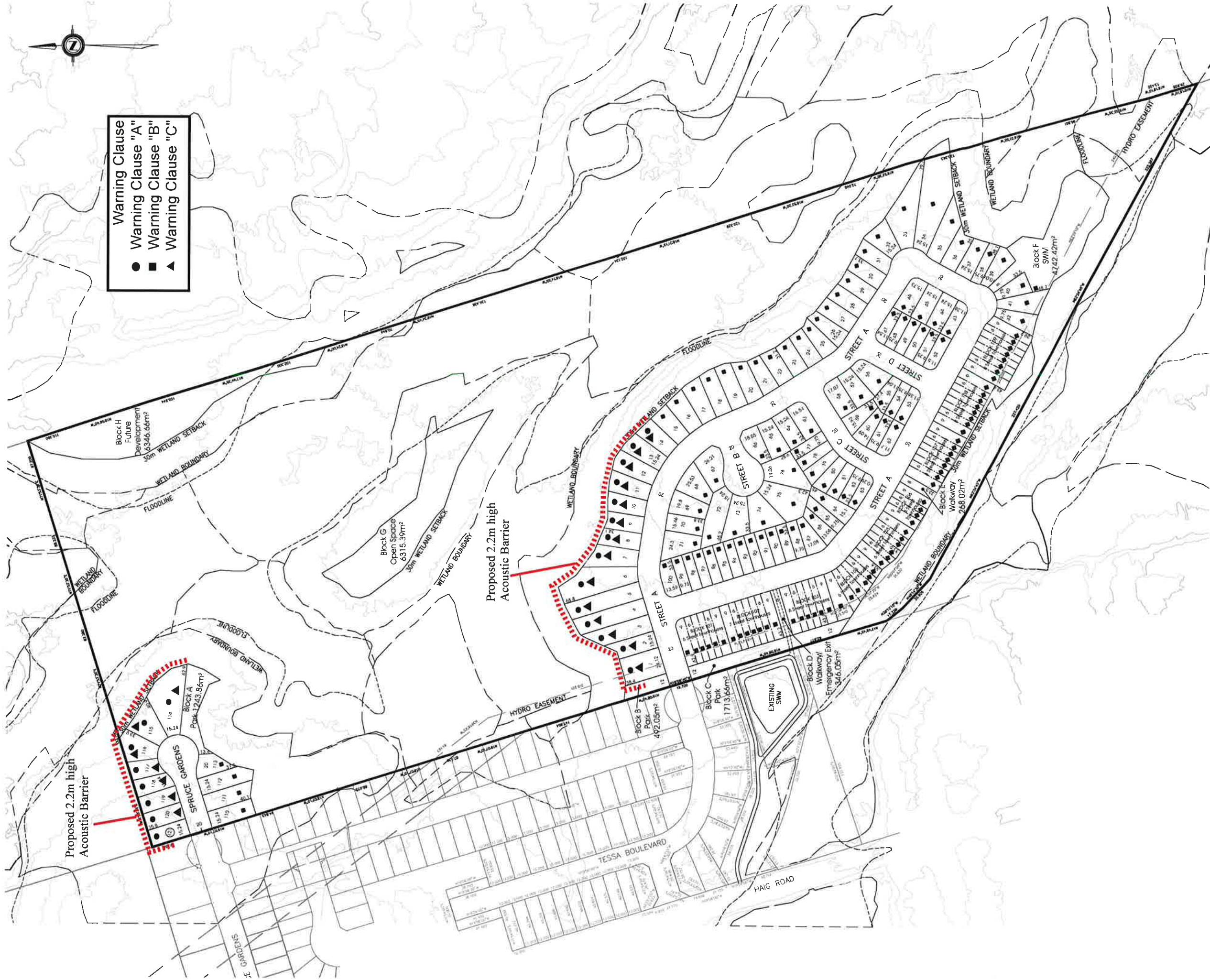


Figure #1
Key Plan



Figure #2
Hanley Park Site
Plan



- Warning Clause
- Warning Clause "A"
 - Warning Clause "B"
 - ▲ Warning Clause "C"

Figure #3
 Hanley Park
 Barrier Locations and
 Warning Clauses

APPENDIX B: CALCULATIONS



800 - 1290 Central Parkway West
Mississauga, Ontario
Canada L5C 4R3

T 905 803 3429
E josie_tomei@cpr.ca

April 29, 2019

Via email: hpatlik@jecoulterassoc.com

Howard Patlik
J.E. Coulter Associates Limited
1210 Sheppard Ave. East
North York, ON M2K 1E3

Dear Sir/Madam:

**Re: Rail Traffic Volumes, CP Mileage 93.72, Belleville Subdivision,
Wilkie Street, Belleville**

This is in reference to your request for rail traffic data in the vicinity of Wilkie Street in the City of Belleville. The study area is located at mile 93.72 of our Belleville Subdivision, which is classified as a Principal Main line.

The information requested is as follows:

1. Number of freight trains between 0700 & 2300: 7
Number of freight trains between 2300 & 0700: 3
2. Maximum cars per train freight: 211
3. Number of locomotives per train: 2 (4 max.)
4. Maximum permissible train speed: 60 mph
5. The whistle signal is prohibited approaching public grade crossings from the east up to Wilkie Street, and then is sounded at grade crossings west of Wilkie Street. Please note, the whistle may be sounded if deemed necessary by the train crew for safety reasons at any time.
6. There is 1 main line track with continuously welded rail.

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

Yours truly,

Josie Tomei SR/WA
Specialist Real Estate Sales & Acquisitions – Ontario

Date: 2019/05/16

Project Number: KNG – 199.43 – Belleville Rd, Napanee ON

Dear Howard:

Re: Train Traffic Data – CN Kingston Subdivision near Belleville Rd in Napanee, ON

The following is provided in response to Howard's 2019/04/29 request for information regarding rail traffic in the vicinity of Belleville Rd in Napanee at approximately Mile 199.43 on CN's Kingston Subdivision.

Typical daily traffic volumes are recorded below. However, traffic volumes may fluctuate due to overall economic conditions, varying traffic demands, weather conditions, track maintenance programs, statutory holidays and traffic detours that when required may be heavy although temporary. For the purpose of noise and vibration reports, train volumes must be escalated by 2.5% per annum for a 10-year period.

Typical daily traffic volumes at this site location are as follows:

*Maximum train speed is given in Miles per Hour

	0700-2300			
Type of Train	Volumes	Max.Consist	Max. Speed	Max. Power
Freight	1	140	60	4
Way Freight	3	25	60	4
Passenger	7	10	65	2

	2300-0700			
Type of Train	Volumes	Max.Consist	Max. Speed	Max. Power
Freight	29	140	60	4
Way Freight	5	25	60	4
Passenger	11	10	65	2

The volumes recorded reflect westbound and eastbound freight and passenger operations on CN's Kingston Subdivision.

Except where anti-whistling bylaws are in effect, engine-warning whistles and bells are normally sounded at all at-grade crossings. There is one (1) at-grade crossing in the immediate vicinity of the study area at Mile 199.68 Belleville Rd. Anti-whistling bylaws are in effect at this crossing. Please note that engine warning whistles may be sounded in cases of emergency, as a safety and or warning precaution at station locations and pedestrian crossings and occasionally for operating requirements.

With respect to equipment restrictions, the gross weight of the heaviest permissible car is 286,000 lbs.

The double mainline track is considered to be continuously welded rail throughout the study area.

Ontario Traffic, Inc.
 17705 Leslie St., Unit 6
 Newmarket, Ontario L3Y 3E3
 Tel: (905) 898-7711 Fax: (905) 898-3664

Site Code: 1
 Station ID: V7N/51
 Airport Pkwy east of College St E

Date Start: 25-Sep-18
 Date End: 27-Sep-18

Start Time	24-Sep-18		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	*	*	7	8	7	8	10	7	*	*	*	*	*	*	10	7
01:00	*	*	4	7	4	3	11	4	*	*	*	*	*	*	9	4
02:00	*	*	9	3	9	5	9	5	*	*	*	*	*	*	7	6
03:00	*	*	14	3	14	7	4	5	*	*	*	*	*	*	4	9
04:00	*	*	7	2	5	7	5	9	*	*	*	*	*	*	5	7
05:00	*	*	14	13	26	29	21	23	*	*	*	*	*	*	16	26
06:00	*	*	37	31	72	91	49	70	*	*	*	*	*	*	39	78
07:00	*	*	87	94	110	94	88	140	*	*	*	*	*	*	90	129
08:00	*	*	85	84	139	84	73	128	*	*	*	*	*	*	81	131
09:00	*	*	92	117	108	123	121	121	*	*	*	*	*	*	108	117
10:00	*	*	110	135	107	105	130	108	*	*	*	*	*	*	125	107
11:00	*	*	144	133	122	138	135	118	*	*	*	*	*	*	137	126
12:00 PM	*	*	138	141	139	141	141	124	*	*	*	*	*	*	140	135
01:00	*	*	103	122	120	124	147	129	*	*	*	*	*	*	124	124
02:00	*	*	128	126	108	142	137	143	*	*	*	*	*	*	130	131
03:00	*	*	180	163	102	138	193	145	*	*	*	*	*	*	179	128
04:00	*	*	149	179	130	147	201	151	*	*	*	*	*	*	176	143
05:00	*	*	164	182	112	98	194	102	*	*	*	*	*	*	180	104
06:00	*	*	101	98	90	95	122	93	*	*	*	*	*	*	107	93
07:00	*	*	104	116	77	70	116	57	*	*	*	*	*	*	112	68
08:00	*	*	66	72	55	55	78	53	*	*	*	*	*	*	72	54
09:00	*	*	50	48	35	32	61	35	*	*	*	*	*	*	53	34
10:00	*	*	30	32	19	26	44	31	*	*	*	*	*	*	35	25
11:00	*	*	38	46	15	15	36	16	*	*	*	*	*	*	40	15
Lane Day	0	0	1863	1955	1725	1861	2120	1817	0	0	0	0	0	0	1979	1801
			3588	3816	3937	3816	3937	3780							3780	
AM Peak	11:00	08:00	10:00	11:00	07:00	11:00	11:00	07:00							11:00	08:00
Vol.	144	139	135	138	140	135	140	131							137	131
PM Peak	15:00	12:00	17:00	16:00	16:00	16:00	16:00	16:00							17:00	16:00
Vol.	180	139	182	147	151	201	151	151							180	143

Comb. Total 0 3588 3816 3937 3780

ADT ADT 2,238 AADT 2,238

Airport PKWY
Traffic Volumes

Ontario Traffic Inc.
 17705 Leslie St., Unit 6
 Newmarket, Ontario L3Y 3E3
 Tel: (905) 878-7711 Fax: (905) 898-3664

Site Code: 21
 Station ID: C74
 College St east of Airport Pkwy

Date Start: 04-Dec-12
 Date End: 06-Dec-12

EB, WB Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl		6 Axle		>6 Axl		Total
											Multi	Multi	Multi	Multi			
12/06/12	0	51	17	0	0	0	0	7	7	3	0	0	0	0	1	86	
01:00	0	26	11	0	0	0	0	7	11	3	0	0	0	0	0	58	
02:00	0	40	8	0	2	1	0	5	6	2	0	0	0	0	0	64	
03:00	0	44	11	0	3	0	0	2	4	0	0	0	0	0	0	64	
04:00	0	120	22	0	3	1	0	0	3	1	0	0	0	0	0	150	
05:00	1	304	64	0	2	0	1	2	4	0	0	0	1	0	0	379	
06:00	1	404	74	1	4	2	1	4	4	0	4	1	1	0	0	500	
07:00	1	463	97	1	4	3	0	3	3	5	2	0	0	1	1	583	
08:00	1	283	101	0	8	3	0	6	11	4	0	0	1	2	2	420	
09:00	1	193	89	0	10	5	1	12	13	2	1	0	0	0	2	329	
10:00	0	149	70	2	7	3	1	7	13	7	0	1	1	1	1	261	
11:00	0	183	61	0	14	6	0	8	14	0	0	0	0	0	1	288	
12 PM	0	261	72	1	11	3	1	7	10	3	1	1	1	4	4	375	
13:00	0	264	94	0	8	4	0	5	13	5	0	0	1	2	2	396	
14:00	2	391	91	0	9	4	1	8	24	5	0	0	1	2	2	538	
15:00	0	430	127	0	8	7	1	8	10	1	0	0	1	3	3	596	
16:00	0	268	94	0	7	5	1	9	9	2	0	0	0	3	3	398	
17:00	2	269	74	0	6	2	0	4	11	2	1	0	0	1	1	372	
18:00	0	215	30	0	2	1	0	6	14	1	0	0	0	0	0	269	
19:00	1	166	39	0	1	1	0	3	5	0	0	0	0	0	0	216	
20:00	0	72	11	0	1	0	0	4	5	2	0	0	0	0	0	95	
21:00	0	59	16	0	1	1	0	3	6	2	0	0	0	0	0	88	
22:00	1	159	23	0	0	3	0	6	7	2	1	0	0	1	1	203	
23:00	0	134	29	0	0	0	1	2	11	5	0	0	0	0	1	183	
Day Total	11	4948	1325	5	111	55	9	128	218	57	11	8	25	8	25	6911	
Percent	0.2%	71.6%	19.2%	0.1%	1.6%	0.8%	0.1%	1.9%	3.2%	0.8%	0.2%	0.1%	0.4%	0.1%	0.4%		
AM Peak	05:00	07:00	08:00	10:00	11:00	11:00	05:00	09:00	11:00	10:00	06:00	05:00	08:00	07:00	07:00		
Vol.	1	463	101	2	14	6	1	12	14	7	4	1	2	2	2	583	
PM Peak	14:00	15:00	15:00	12:00	12:00	15:00	12:00	16:00	14:00	13:00	12:00	12:00	12:00	12:00	12:00	15:00	
Vol.	2	430	127	1	11	7	1	9	24	5	1	1	4	4	4	596	
Grand Total	45	14501	4168	40	355	192	13	367	691	135	33	28	59	28	59	20627	
Percent	0.2%	70.3%	20.2%	0.2%	1.7%	0.9%	0.1%	1.8%	3.3%	0.7%	0.2%	0.1%	0.3%	0.1%	0.3%		

Rail data, segment # 1: CN Rail (day/night)

Train Type	! Trains	! Speed (km/h)	! # loc /Train	! # Cars /Train	! Eng type	! Cont weld
* 1. Freight	1.2/35.4	96.0	4.0	140.0	Diesel	No
* 2. Way Freight	3.7/6.1	96.0	4.0	25.0	Diesel	No
* 3. Passenger	8.5/13.4	110.0	2.0	10.0	Diesel	No

* The identified number of trains have been adjusted for future growth using the following parameters:

Train type: No Name	! Unadj. Trains	! Annual % Increase	! Years of Growth
1. Freight	1.0/29.0	2.00	10.00
2. Way Freight	3.0/5.0	2.00	10.00
3. Passenger	7.0/11.0	2.00	10.00

Data for Segment # 1: CN Rail (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 500.00 / 500.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 No Whistle
 Reference angle : 0.00

Results segment # 1: CN Rail (day)

LOCOMOTIVE (0.00 + 41.93 + 0.00) = 41.93 dBA
 Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
 0 90 0.58 70.41 -24.14 -4.34 0.00 0.00 0.00 41.93

WHEEL (0.00 + 35.33 + 0.00) = 35.33 dBA
 Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
 0 90 0.66 65.07 -25.28 -4.47 0.00 0.00 0.00 35.33

Segment Leq : 42.79 dBA
 Total Leq All Segments: 42.79 dBA

Results segment # 1: CN Rail (night)

LOCOMOTIVE (0.00 + 56.14 + 0.00) = 56.14 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.50	83.08	-22.77	-4.18	0.00	0.00	0.00	56.14

WHEEL (0.00 + 50.64 + 0.00) = 50.64 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.60	79.38	-24.37	-4.37	0.00	0.00	0.00	50.64

Segment Leq : 57.22 dBA

Total Leq All Segments: 57.22 dBA

Road data, segment # 1: Airport PKW (day/night)

Car traffic volume	:	17294/1922	veh/TimePeriod	*
Medium truck volume	:	553/61	veh/TimePeriod	*
Heavy truck volume	:	1220/136	veh/TimePeriod	*
Posted speed limit	:	60	km/h	
Road gradient	:	0	%	
Road pavement	:	1	(Typical asphalt or concrete)	

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT)	:	17380
Percentage of Annual Growth	:	2.00
Number of Years of Growth	:	10.00
Medium Truck % of Total Volume	:	2.90
Heavy Truck % of Total Volume	:	6.40
Day (16 hrs) % of Total Volume	:	90.00

Data for Segment # 1: Airport PKW (day/night)

Angle1	Angle2	:	0.00 deg	90.00 deg
Wood depth	:	0	(No woods.)	
No of house rows	:	0 / 0		
Surface	:	1	(Absorptive ground surface)	
Receiver source distance	:	500.00 / 500.00	m	
Receiver height	:	1.50 / 4.50	m	
Topography	:	1	(Flat/gentle slope; no barrier)	
Reference angle	:	0.00		

Results segment # 1: Airport PKW (day)

Source height = 1.59 m

ROAD (0.00 + 41.85 + 0.00) = 41.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	71.55	0.00	-25.24	-4.46	0.00	0.00	0.00	41.85

Segment Leq : 41.85 dBA

Total Leq All Segments: 41.85 dBA

Results segment # 1: Airport PKW (night)

Source height = 1.59 m

ROAD (0.00 + 36.85 + 0.00) = 36.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.57	65.03	0.00	-23.87	-4.31	0.00	0.00	0.00	36.85

Segment Leq : 36.85 dBA

Total Leq All Segments: 36.85 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 45.36
(NIGHT) : 57.26

Rail data, segment # 1: CN Rail (day/night)

Train Type	Trains	Speed (km/h)	# loc /Train	# Cars /Train	Eng type	Cont weld
1. Freight	7.0/29.0	96.0	4.0	140.0	Diesel	No
2. Way Freight	3.0/5.0	96.0	4.0	25.0	Diesel	No
3. Passenger	7.0/11.0	110.0	2.0	10.0	Diesel	No

Data for Segment # 1: CN Rail (day/night)

Angle1	Angle2	:	0.00 deg	90.00 deg
Wood depth	:	0	(No woods.)	
No of house rows	:	0 / 0		
Surface	:	1	(Absorptive ground surface)	
Receiver source distance	:	297.00 / 297.00 m		
Receiver height	:	1.50 / 4.50 m		
Topography	:	1	(Flat/gentle slope; no barrier)	
No Whistle				
Reference angle	:	0.00		

Results segment # 1: CN Rail (day)

LOCOMOTIVE (0.00 + 48.92 + 0.00) = 48.92 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.58	73.82	-20.55	-4.34	0.00	0.00	0.00	48.92

WHEEL (0.00 + 43.78 + 0.00) = 43.78 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	69.77	-21.52	-4.47	0.00	0.00	0.00	43.78

Segment Leq : 50.08 dBA
 Total Leq All Segments: 50.08 dBA

Results segment # 1: CN Rail (night)

LOCOMOTIVE (0.00 + 58.65 + 0.00) = 58.65 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.50	82.21	-19.39	-4.18	0.00	0.00	0.00	58.65

WHEEL (0.00 + 53.40 + 0.00) = 53.40 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.60	78.51	-20.75	-4.37	0.00	0.00	0.00	53.40

Segment Leq : 59.78 dBA
 Total Leq All Segments: 59.78 dBA

Road data, segment # 1: Airport PKWY (day/night)

Car traffic volume : 17640/1960 veh/TimePeriod *
Medium truck volume : 564/63 veh/TimePeriod *
Heavy truck volume : 1245/138 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 17380
Percentage of Annual Growth : 2.00
Number of Years of Growth : 11.00
Medium Truck % of Total Volume : 2.90
Heavy Truck % of Total Volume : 6.40
Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Airport PKWY (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 341.00 / 341.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Airport PKWY (day)

Source height = 1.59 m

ROAD (0.00 + 44.69 + 0.00) = 44.69 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.66	71.64	0.00	-22.48	-4.46	0.00	0.00	0.00	44.69

Segment Leq : 44.69 dBA

Total Leq All Segments: 44.69 dBA

Results segment # 1: Airport PKWY (night)

Source height = 1.59 m

ROAD (0.00 + 39.53 + 0.00) = 39.53 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.57	65.10	0.00	-21.26	-4.31	0.00	0.00	0.00	39.53

Segment Leq : 39.53 dBA

Total Leq All Segments: 39.53 dBA

TOTAL Leq FROM ALL SOURCES (DAY) : 51.18
(NIGHT) : 59.82

Rail data, segment # 1: CN Rail (day/night)

Train Type	Trains	Speed (km/h)	# loc /Train	# Cars /Train	Eng type	Cont weld
* 1. Freight	1.2/35.4	96.0	4.0	140.0	Diesel	No
* 2. Way Freight	3.7/6.1	96.0	4.0	25.0	Diesel	No
* 3. Passenger	8.5/13.4	110.0	2.0	10.0	Diesel	No

* The identified number of trains have been adjusted for future growth using the following parameters:

Train type: No Name	Unadj. Trains	Annual % Increase	Years of Growth
1. Freight	1.0/29.0	2.00	10.00
2. Way Freight	3.0/5.0	2.00	10.00
3. Passenger	7.0/11.0	2.00	10.00

Data for Segment # 1: CN Rail (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 268.00 / 268.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 No Whistle
 Reference angle : 0.00

Results segment # 1: CN Rail (day)

LOCOMOTIVE (0.00 + 49.24 + 0.00) = 49.24 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.58	70.41	-19.84	-1.33	0.00	0.00	0.00	49.24

WHEEL (0.00 + 42.83 + 0.00) = 42.83 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	65.07	-20.78	-1.46	0.00	0.00	0.00	42.83

Segment Leq : 50.13 dBA

Total Leq All Segments: 50.13 dBA

Results segment # 1: CN Rail (night)

LOCOMOTIVE (0.00 + 63.20 + 0.00) = 63.20 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.50	83.08	-18.72	-1.17	0.00	0.00	0.00	63.20

WHEEL (0.00 + 57.99 + 0.00) = 57.99 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	79.38	-20.03	-1.35	0.00	0.00	0.00	57.99

Segment Leq : 64.34 dBA

Total Leq All Segments: 64.34 dBA

Road data, segment # 1: Airport PKWY (day/night)

Car traffic volume : 17640/1960 veh/TimePeriod *

Medium truck volume : 564/63 veh/TimePeriod *

Heavy truck volume : 1245/138 veh/TimePeriod *

Posted speed limit : 60 km/h

Road gradient : 0 %

Road pavement : 1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 17380

Percentage of Annual Growth : 2.00

Number of Years of Growth : 11.00

Medium Truck % of Total Volume : 2.90

Heavy Truck % of Total Volume : 6.40

Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Airport PKWY (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg

Wood depth : 0 (No woods.)

No of house rows : 0 / 0

Surface : 1 (Absorptive ground surface)

Receiver source distance : 313.00 / 313.00 m

Receiver height : 1.50 / 4.50 m

Topography : 1 (Flat/gentle slope; no barrier)

Reference angle : 0.00

Results segment # 1: Airport PKWY (day)

Source height = 1.59 m

ROAD (0.00 + 48.32 + 0.00) = 48.32 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	71.64	0.00	-21.87	-1.45	0.00	0.00	0.00	48.32

Segment Leq : 48.32 dBA

Total Leq All Segments: 48.32 dBA

Results segment # 1: Airport PKWY (night)

Source height = 1.59 m

ROAD (0.00 + 43.13 + 0.00) = 43.13 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	65.10	0.00	-20.68	-1.30	0.00	0.00	0.00	43.13

Segment Leq : 43.13 dBA

Total Leq All Segments: 43.13 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 52.33
(NIGHT): 64.37

APPENDIX C: WARNING CLAUSES

Warning Clause A

"This dwelling unit has been supplied with central air-conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the Municipality's and the Ministry of the Environment, Conservation and Parks' noise criteria."

Warning Clause B

"This dwelling unit has been fitted with a forced air heating system and the ducting, etc. was sized to accommodate central air conditioning. Installation of central air conditioning by the occupant will allow the windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the Municipality's and the Ministry of the Environment, Conservation and Parks' noise criteria.

Note: Locate the outdoor air-conditioning device in a noise insensitive area to minimize the noise impacts in the immediate vicinity of the subject property."

Warning Clause C

"That the acoustical berm and/or barrier as installed shall be maintained, repaired or replaced by the owner. Any maintenance repair or replacement shall be with the same material, to the same standards, and having the same colour and appearance of the original."

Warning Clause D

CN Railway Warning Clause

The Owner shall insert in all offers of sale and purchase or lease and register on title to the land the following clause:

"Canadian National Railway Company or its assigns or successors in interest has or have a right of way within 300m 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 residences in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwellings(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 right-of-way."

APPENDIX D: NOISE CRITERIA

The noise study will be based on the following criteria for residential units as required by the Ministry of the Environment, Conservation and Parks and the Railway:

Time Periods	Receiver Locations	Sound Level dBA L_{eq}
0700–2300	Outdoor Recreational Areas	55
2300–0700	Bedroom Windows (Outside)	50
0700–2300 2300–0700	Bedroom (Indoor)	35
0700–2300 2300–0700	Living and Dining Rooms (Indoor)	40

L_{eq} (Definition)

The L_{eq} is defined as the mean energy of the sound level averaged over the measurement period. It can be considered as the continuous steady noise level which would have the same acoustic energy as the real fluctuating noise measured over the same period of time.

APPENDIX E: REFERENCES

1. Ministry of the Environment's *STAMSON* Computer Programme (*Version 5.03*) for the IBM PC.
2. Ministry of the Environment "Noise Assessment Criteria in Land Use Planning. Publication *LU-131*", October 1995.
3. Quirt, D.J., "Controlling Sound Transmission into Buildings", National Research Council, *Building Practice Note 56*.