



**331 CLAIR ROAD EAST, GUELPH
NOISE IMPACT ASSESSMENT**

Prepared for:

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Table of Contents

1.0 INTRODUCTION	1.1
2.0 NOISE CRITERIA	2.1
3.0 NOISE SOURCES AND PARAMETERS	3.1
4.0 METHODOLOGY AND RESULTS	4.2
5.0 DISCUSSION/ABATEMENT MEASURES	5.1
6.0 CONCLUSIONS AND RECOMMENDATIONS	6.1

List of Appendices

Appendix A	Site Plan (Prepared by GSP Group Inc.)
Appendix B	MOE Guidelines (Excerpts)
Appendix C	Noise Assessment Location Plan Noise Assessment Typical Section
Appendix D	Stamson Computer Output – Noise Calculations

List of Figures

Following Page

FIGURE 1	SITE LOCATION PLAN.....	1.1
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List of Tables

Page

TABLE 1	TRAFFIC VOLUME PROJECTIONS	3.1
TABLE 2	SUMMARY OF MAXIMUM FUTURE OUTDOOR NOISE LEVELS AND MITIGATION MEASURES.....	4.2

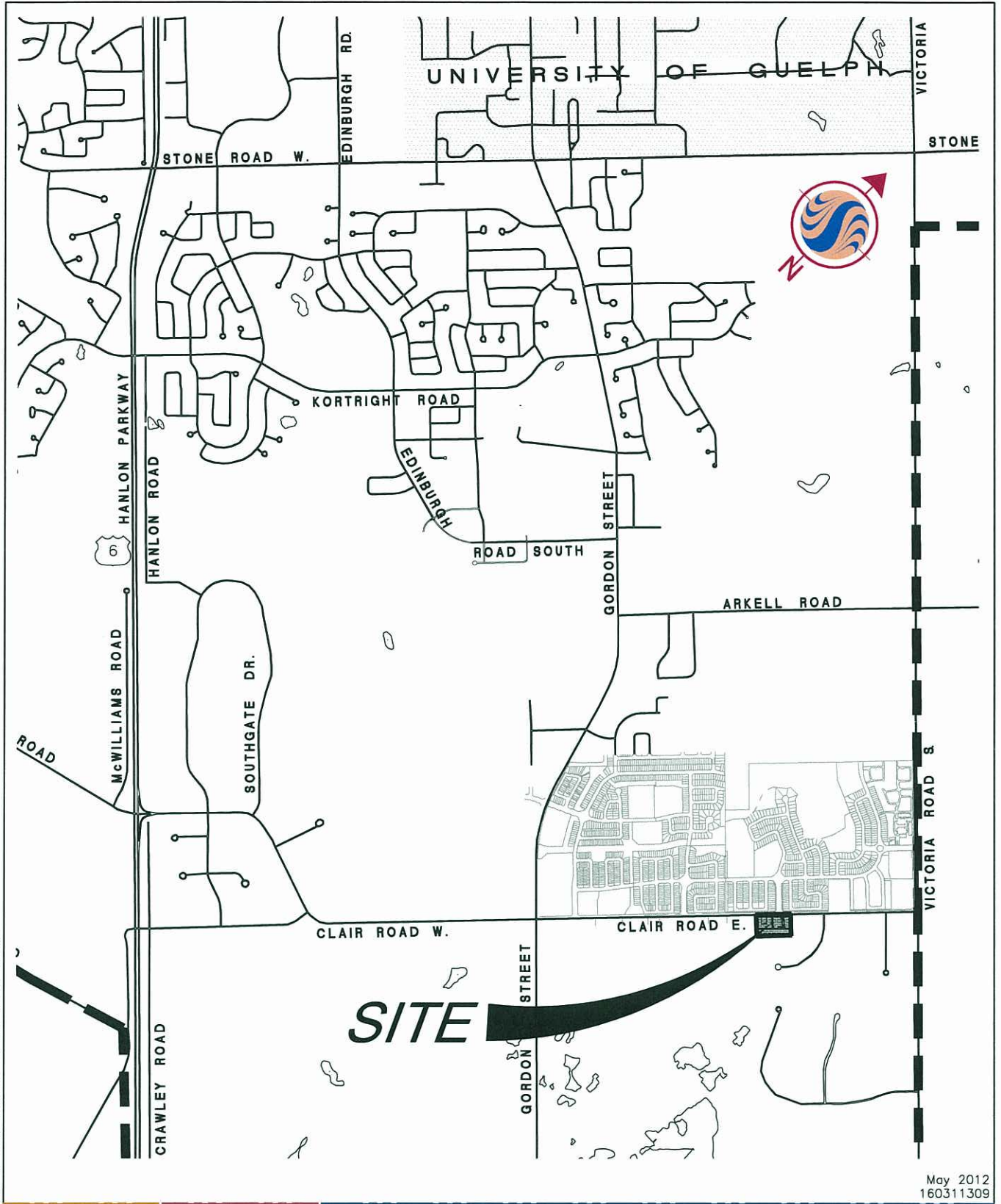
1.0 Introduction

This report has been prepared to address the effects of traffic noise from Clair Road East on the proposed development at 331 Clair Road East, in the City of Guelph, in support of Official Plan Amendment and Zone Change Applications. The subject property is an approximate 1.70 ha parcel of land located south of the existing Westminster Woods development, as illustrated in Figure 1.

The proposed development consists of 60 townhouse units, a stormwater management facility, parking area, and amenity area, along with the existing dwelling. A Site Plan for the proposed development has been prepared by GSP Group and forms the basis for the noise impact assessment. The Site Plan is shown in Appendix 'A'.

This report assesses the effects of future noise levels due to road traffic from Clair Road East on the proposed development. Stantec Consulting Ltd. has been retained by the Owner, Acorn Developments, to prepare this examination for submission to the City of Guelph, recommending any necessary noise abatement measures to meet Ministry of the Environment requirements with respect to road traffic noise.

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May 2012
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ACORN DEVELOPMENTS
331 CLAIR ROAD EAST
GUELPH, ONTARIO

Figure No.

1.0

Title

LOCATION PLAN

2.0 Noise Criteria

Noise is recognized as a pollutant in the Environment Protection Act, as it can adversely affect many human activities. To protect the health and welfare of occupants of new homes in Ontario, noise concerns are to be considered in the planning of any new development, preferably at the earliest stages.

In land use planning, although elimination or control of the pollution source is usually a primary objective, there are general limits to what is practical and technically possible. This is particularly applicable to noise impacts. The Ministry of the Environment has authority to assess noise impacts from road and rail sources adjacent to new residential development.

Relevant Ministry of the Environment (M.O.E.) sound level limits corresponding to residential developments located in the vicinity of major roadway noise sources, are:

- 55 dBA (Leq) during daytime (7:00 AM to 11:00 PM) hours as measured in the “outdoor living areas” (O.L.A.: min. 56 m² per each single family unit and 37 m² per each condominium/townhouse unit, level assessed 3 m from the building face, 1.5 m from the ground), and
- 50 dBA (Leq) during nighttime (11:00 PM to 7:00 AM) hours as measured outside the closest possible bedroom window located (4.5 m above the ground for 2-storey buildings)

These values are the normally allowed maximum limits, beyond which abatement measures are recommended and are in conformance with the latest Ministry guidelines. Supplementary and supporting information with respect to noise guidelines and implementation is contained in M.O.E. documents, including publication LU-131, “Noise Assessment Criteria in Land Use Planning” as well as its Annex and Requirements Appendices (excerpts contained in Appendix ‘B’).

3.0 Noise Sources and Parameters

Clair Road East has been identified as the only road traffic noise source of concern. Clair Road East lies within a 33.0m wide road allowance with its centerline located 12.5m from the north edge of the right-of-way. It has a posted speed limit of 60 km/h within the study area and is under the jurisdiction of the City of Guelph.

Traffic volumes, expressed as Average Annual Daily Traffic (AADT) are based on the 2031 modeled traffic counts at the intersection of Clair Road East and Victoria Road, completed by the City of Guelph. The 10-year forecast (2022) AADT values were provided by Gwen Zhang of the City of Guelph. The percentage of medium and heavy trucks are based on percentages from counts performed in 2008, and were also provided by the City of Guelph.

Traffic projections, in vehicles per day, and additional relevant data for locations adjacent the subject area are summarized in Table 1.

Table 1: Traffic Volume Projections

Roadway	Traffic Type	2022 Forecast
Clair Road East (west of Victoria Road)	AADT	10,000
	% Medium Trucks	4.6%
	% Heavy Trucks	2.7%

The traffic volumes were split 90% for the day time period (7:00 AM – 11:00 PM hrs) and 10% for the nighttime period (11:00 PM – 7:00 AM hrs) in accordance with the M.O.E. guidelines for “arterial roads”.

The prediction of road traffic noise levels is based on the one hour Leq (equivalent sound energy level), measured in ‘A’-weighted decibels (dBA).

Other than those included above, no other appreciable noise sources affecting the subject area have been identified by the author or by any of the parties or agencies involved.

4.0 Methodology and Results

In compliance with Ministry guidelines, future (10-year, year 2022) noise levels from road traffic have been calculated using the M.O.E.'s Stamson 5.0 computer model, with site-specific parameters (from the Noise Assessment Location Plan found in Appendix 'C') and traffic data referred to in Section 3.0. Key representative locations for assessment at sensitive receivers have been shown on the plan and are based on the proximity and exposure to the various noise sources.

Noise level calculations for these representative locations are enclosed in Appendix 'D'. Resultant noise levels as well as recommended mitigation measures have been summarized in Table 2.

**TABLE 2
Summary of Maximum Future Outdoor Noise Levels and Mitigation Measures**

Location	Average Road Grade	Source - Receiver Distance (m) Day (Outdoor)/ Day (Indoor)/ Night	Source	# of Rows of Houses/ % Coverage Daytime (O.L.A.)	Unmitigated Noise Levels Due to Road Traffic (dBA) ¹			Minimum Setback from Property Line/ROW Req'd to Avoid Noise Barrier (m)	Minimum Rear-yard/ Setback from Property Line/ROW Req'd to Avoid Noise Warning Clause (m)	Barrier / Additional Setback Feasible	Resultant Noise Levels			Exceeds Criteria By			Warning Clause	Mandatory Forced Air Ventilation	Mandatory Central Air Conditioning	Building Component Design
					Day-time O.L.A.	(Living Room Window) Day-time	Nighttime (Bedroom Window)				Day	Day-time (Living Room Window)	Night	Day	Day-time (Living Room Window)	Night				
A U51	1%	25/25/25	Clair Road East	0	61	61	55	8	36	Yes ¹	59	61	55	4	6	5	Types B & C	Yes	No	No
B U46	1%	56/56/56	Clair Road East	0	55	55	50	8	36	Yes ¹	54	54	50	0	0	0	None	No	No	No
C U52	1%	25/25/25	Clair Road East	0	61	61	55	8	36	Yes ²	59	61	55	4	6	5	Types B & C	Yes	No	No
D U57	1%	56/56/56	Clair Road East	0	55	55	50	8	36	Yes ²	54	54	50	0	0	0	None	No	No	No
E U1	1%	25/25/25	Clair Road East	0	61	61	55	8	36	Yes ³	59	61	55	4	6	5	Types B & C	Yes	No	No
F U6	1%	56/56/56	Clair Road East	0	55	55	50	8	36	Yes ³	54	54	50	0	0	0	None	No	No	No

Notes: All sound levels (Leq) in dBA

- (1) 1.9m high barrier, 3m in length, located adjacent to Unit 51
- (2) 1.9m high barrier, 3m in length, located adjacent to Unit 52
- (3) 1.9m high barrier, 3m in length, located adjacent to Unit 1

5.0 Discussion/Abatement Measures

Table 2 summarizes the future noise levels and recommended mitigation measures at subject locations. Predicted noise levels do not exceed applicable guidelines for the majority of the residential units within the development, with some exceptions.

Generally, noise levels exceed specified criteria on the units closest to the major noise source along Clair Road East. Units 1-5, 47-51, and 52-56 will require noise warning clauses and provision for forced-air ventilation as noise levels exceed the specified criteria during daytime (07:00 to 23:00 hours) and/or night-time hours (23:00 to 07:00 hours).

In order to provide the required noise attenuation in the OLA for Units 51, 52, and 1, a 1.9 m high noise barrier is required adjacent to the units. These barriers are to extend from the rear face of the units (abutting tight to the unit with no gaps), to 3 m behind the units, as shown on the Noise Assessment Location Plan, located in Appendix 'C'.

The additional setbacks required to avoid noise warning clauses would cause this development to be setback an unreasonable distance from the Clair Road East, and therefore, they are not practically feasible.

6.0 Conclusions and Recommendations

Based on the content of this report, we conclude:

- Noise levels from road sources at residential receivers at Units 6-46 and 57-60 in the proposed development do not exceed applicable criteria
- Outdoor noise levels at Units 1-5, and 47-56 are expected to exceed criteria, but by less than 5 dBA and therefore warning clauses should be included in pertinent Offers of Purchase/Lease/Rent
- Indoor noise levels at Units 1-5 and 47-56 are expected to exceed criteria, but by less than 10 dBA and therefore warning clauses, including a requirement for forced-air ventilation systems, should be included in pertinent offers of Purchase/Lease/Rent

The following recommendations are therefore made:

- That the City of Guelph approve of this Noise Impact Assessment as it pertains to clearing the applicable conditions of approval, and that the following clauses be contained in the registered Subdivision Agreement:

1) The owner agrees to implement the report entitled, "331 Clair Road East, Guelph, Noise Impact Assessment dated May 2012", and further agrees:

- (i) For Units 1-5 and 47-56 the following clause be included in the Offers of Purchase and/or Rental Agreements:

"Due to the proximity to Clair Road East, projected noise levels on this property exceed the Noise Level Objectives approved by the City of Guelph and may cause concern to some individuals. Moreover, the dwelling must be/have been fitted with a forced-air ducted heating system suitably sized and designed to permit the future installation of a central air conditioning system by the occupants".

Stantec

331 CLAIR ROAD EAST, GUELPH

NOISE IMPACT ASSESSMENT

Conclusions and Recommendations

This report has been prepared for, and is submitted with the intention of, obtaining approval from the City of Guelph.

All of which is respectfully submitted;

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Attachment



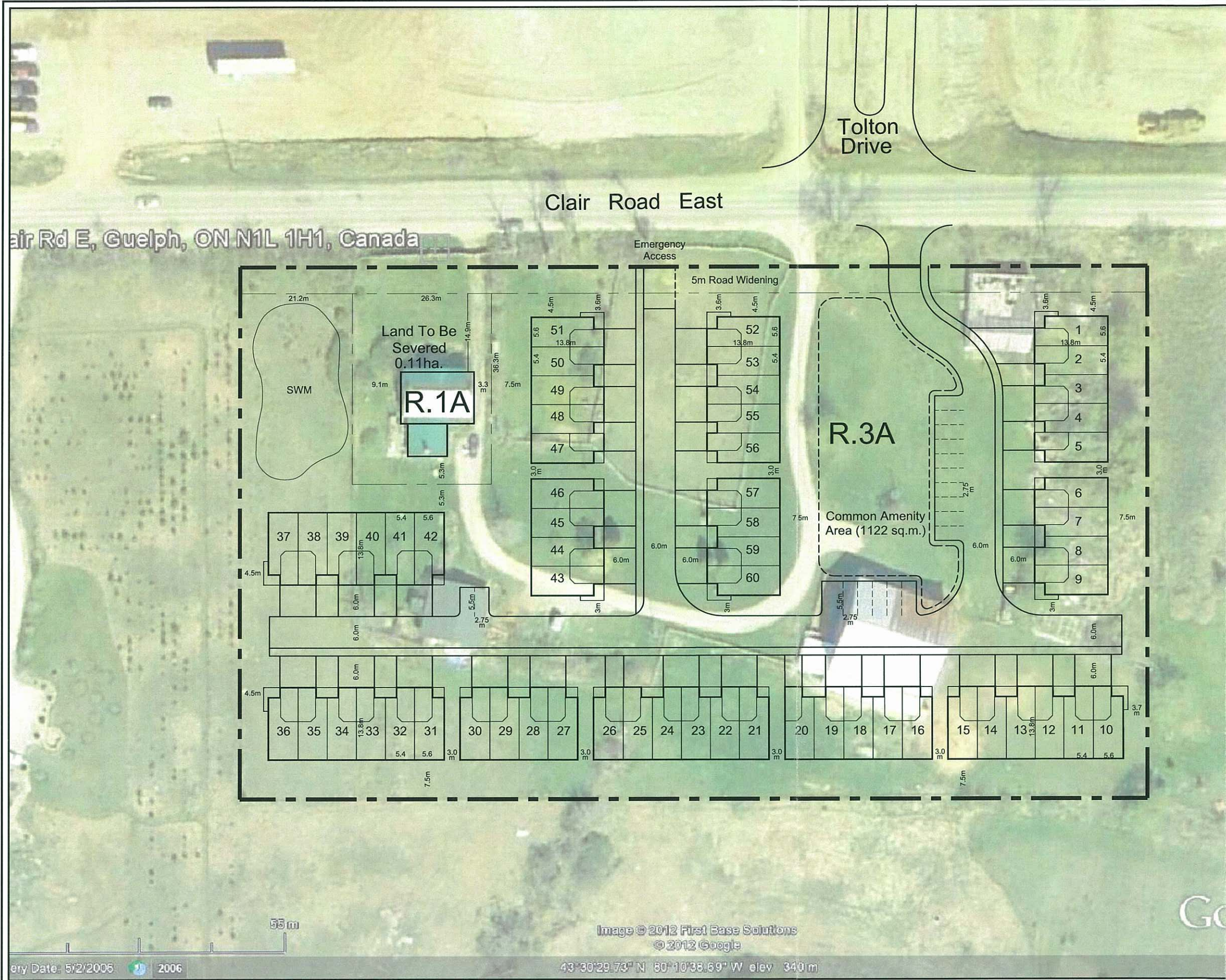
APPENDIX A

Site Plan (as prepared by GSP Group Inc.)

Preliminary Development Concept 1

331 Clair Road East, Guelph

Proposed Zoning: R.3A Townhouse Zone,
 R.1A Single Detached Zone,
 Retained Lands: 1.55ha.
 No. Of Units: 60
 Max. Density Permitted: 37.5u.p.h. (58 units)
 Density Provided: 38.7u.p.h.
 Visitor's Parking Required: 12 spaces
 Visitor's Parking Provided: 18 spaces
 Common Amenity Area Required: 300sq.m.
 Common Amenity Area Provided: 1122sq.m.



Scale 1:750
 May 8, 2012
 Project No. 12030
 Drawn By: S.L





APPENDIX B

Ministry Documents - Excerpts

- The proposed lands are within 500 m from a freeway right-of-way, 250 m from a provincial highway, or 100 m from the right-of-ways of other roads;
- The proposed lands are within 500 m from a Principal Main Railway Line, 250 m from a Secondary Main Railway Line, or 100 m from other railway lines.

4.3 NOISE FROM STATIONARY SOURCES

The category of stationary noise sources includes individual equipment and extended facilities such as industrial facilities, aggregate extraction facilities, sewage treatment facilities, ancillary transportation facilities and commercial facilities, see Annex to LU-131, Reference [1]. Feasibility as well as detailed noise studies are generally required whenever the proposed lands are within the influence area of a stationary noise source. The extent of the influence area is case specific, depending on factors such as the type and scale of the stationary source, intervening topography and intervening land uses. In general, it is in the interest of the proponent to perform a feasibility study.

5. ROAD NOISE CONTROL MEASURES

5.1 OUTDOOR LIVING AREAS

The sound level, L_{eq} , is determined using the ORNAMENT, Reference [2], prediction method during the daytime hours of 0700-2300. If the sound level, L_{eq} , in the Outdoor Living Area is less than or equal to 55 dBA, no control measures are required.

If the sound level, L_{eq} , in the Outdoor Living Area is greater than 55 dBA and less than or equal to 60 dBA, physical control measures may be applied to reduce the sound level to 55 dBA. If no physical measures are provided, prospective purchasers or tenants shall be informed of potential noise problems by a warning clause (Type A).

If the sound level, L_{eq} , in the Outdoor Living Area is greater than 60 dBA, control measures are required to reduce the level to 55 dBA. Only in cases where the required physical noise control measures are proven not to be technically, economically, or administratively feasible, such as contravening local by-laws, would an excess not greater than 5 dBA above the criterion (55 dBA) be acceptable with a warning clause Type B. When required, control measures should be designed to reduce the sound level to the criterion of 55 dBA.

5.1.1 Noise Barriers

If a barrier is used as a noise control measure, its height must be such that the line of sight between the source and the receiver is obstructed. It is required that the surface density of the noise barrier be a minimum of 20 kg/m². It is further required that the barrier be designed and constructed without cracks or gaps. Any gaps under the noise barrier that are necessary for drainage purposes must be minimized and localized, and must not deteriorate the acoustical performance.

5.2 PLANE OF A WINDOW - VENTILATION REQUIREMENTS

The requirements are applied within two time periods.

5.2.1 Night-time Period, 2300 - 0700 Hours

The sound level is determined through the ORNAMENT, Reference [2], prediction method at the plane of bedroom windows.

Control measures are not required if the L_{eq} (8 hour) night-time sound level in the plane of a bedroom window is less than or equal to 50 dBA. If the sound level in the plane of a bedroom window is greater than 50 dBA and less than or equal to 60 dBA, it is required to design the dwelling with a provision for future installation of central air conditioning. This requirement usually implies forced air heating with the ducts sized for central air conditioning. Warning clause Type C is also required.

If the night-time sound level in the plane of a bedroom window is greater than 60 dBA, installation of central air conditioning is mandatory with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The location and installation of the outdoor air conditioning device should comply with noise criteria of NPC-216, Reference [4], and guidelines of the Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Reference [5].

5.2.2 Day-time Period, 0700 - 2300 Hours

The sound level is determined through the ORNAMENT, Reference [2], prediction method at the plane of living/dining room windows.

Control measures are not required if the L_{eq} (16 hour) day-time sound level in the plane of a living/dining room window is less than or equal to 55 dBA. If the sound level in the plane of a living/dining room window is greater than 55 dBA and less than or equal to 65 dBA, it is required to design the dwelling with a provision for future installation of central air conditioning. This requirement usually implies forced air heating with the ducts sized for central air conditioning. Warning clause Type C is also required.

If the day-time sound level in the plane of a living/dining room window is greater than 65 dBA, installation of central air conditioning is mandatory with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The location and installation of the outdoor air conditioning device should comply with noise criteria of NPC-216, Reference [4], and guidelines of the Environmental Noise Guidelines for Installation of Residential Air Conditioning Equipment, Reference [5].

5.3 INDOOR LIVING AREAS - BUILDING COMPONENTS

The sound level, L_{eq} , during the day-time (16 hour) and night-time (8 hour) periods is determined using the ORNAMENT, Reference [2], prediction method, immediately outside the dwelling envelope.

If the night-time sound level outside the bedroom windows exceeds 60 dBA or the day-time sound level outside the living/dining area windows exceeds 65 dBA, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The acoustical performance of the building components (windows, doors and walls) must be specified.

6. RAIL NOISE CONTROL MEASURES

6.1 OUTDOOR LIVING AREAS

Whistle noise is not included in the determination of the outdoor day-time sound level. Otherwise, with the exception that the STEAM, Reference [3], prediction method is used to determine the rail traffic sound levels, all the provisions of Section 5.1 apply also to noise control requirements for rail noise.

6.2 PLANE OF A WINDOW - VENTILATION REQUIREMENTS

Whistle noise is not included in the determination of the sound level in the plane of a window. Otherwise, with the exception that the STEAM, Reference [3], prediction method is used to determine the rail traffic sound levels, all the provisions of Section 5.2 apply also to noise control requirements for rail noise.

6.3 INDOOR LIVING AREAS - BUILDING COMPONENTS

The sound level, L_{eq} , during the day-time (16 hour) and night-time (8 hour) periods is determined using the STEAM, Reference [3], prediction method immediately outside the dwelling envelope. Whistle noise is included in the determination of the sound level.

If the night-time sound level outside the bedroom windows exceeds 55 dBA or the day-time sound level outside the living/dining area windows exceeds 60 dBA, building components including windows, walls and doors, where applicable, must be designed so that the indoor sound levels comply with the noise criteria in Table 7. The acoustical performance of the building components (windows, doors and walls) must be specified.

In addition, the following requirement applies:

The exterior walls of the first row of dwellings next to the railway tracks shall be built to a minimum of EW5 (brick veneer) or equivalent construction from the foundation to the rafters when the rail traffic L_{eq} (24 hour), estimated at a location of night time receptor, is greater than 60 dBA and when the first row of dwellings are within 100 m of the tracks.

Note: EW5 is an exterior wall composed of 12.7 mm gypsum board, vapour barrier and 38 x 89 mm studs with 50 mm (or thicker) mineral wool or glass fibre batts in inter-stud cavities plus sheathing, 25 mm air space and 100 mm brick veneer.

7. COMBINATION OF ROAD AND RAIL NOISE

The noise impact in the OLA and in the plane of a window, and the requirements for outdoor measures, ventilation measures and warning clauses, shall be determined by combining road and rail traffic sound levels.

The assessment of the indoor sound levels and the resultant requirement for the acoustical descriptors, AIF or STC, of the building components shall be performed separately for road and rail noise. The resultant acoustical descriptors, AIF or STC, shall subsequently be combined to determine the required components.

8. AIRCRAFT NOISE CONTROL MEASURES

The noise impact from aircraft is assessed using the NEF/NEP contour maps. The NEF/NEP contour values are approved by Transport Canada for various airports in Canada.

If the receptor location is within the NEF/NEP contours of 25 and 30, it is required to design the dwelling with a provision for central air conditioning. This requirement usually implies forced air heating with the ducts sized for future installation of central air conditioning. In addition, building components including windows, doors, walls and ceiling/roof must be designed to achieve the indoor sound level criteria. Warning clause C is also required.

If the receptor location is within the NEF/NEP contours of 30 and 35, central air conditioning is mandatory with a warning clauses Type B and D. In addition, building components including windows, doors, walls and ceiling/roof must be designed to achieve the indoor sound level criteria.

9. **COMBINATION OF ROAD, RAIL AND AIRCRAFT NOISE**

The noise impact in the OLA and in the plane of a window, and the requirements for outdoor measures, ventilation measures and warning clauses, shall be determined separately for surface transportation and aircraft noise. Surface transportation impact shall be performed by combining road and rail traffic sound levels.

The assessment of the indoor sound levels, and the requirements for the acoustical performance of building components, shall be performed separately for road noise, rail noise and aircraft noise. The resultant acoustical descriptors, such as AIF or STC, shall be subsequently combined to determine the overall acoustical descriptor. Selection of the required components shall be based on the overall descriptor.

10. **CONTROL MEASURES FOR STATIONARY SOURCES**

The assessment of noise impact produced by stationary sources and any resultant control measures is more complex than that of transportation sources. The following is a brief and simplified summary of the requirements. Annex to Publication LU-131, Reference [1], provides additional details.

The sound level, L_{90} (1 hour), at a point of reception is determined during day-time and night-time hours either through prediction methods or from measurements. If the sound level in any given hour exceeds the applicable criteria, summarized in Table 7, control measures are required.

When control measures are required, they are expected to reduce the sound level to the applicable criteria at all the points of reception within the proposed development. The noise impact may be controlled at the source or at the receptor; typically, the available control measures consist of noise barriers, erected on the property of the sensitive land use, or "at-the-source" control measures such as silencers, mufflers or enclosures. Preferably, the control should be implemented at the source in order to reduce the noise emissions.

Warning clauses that are used in place of physical control measures to identify an excess over the Ministry criteria are not acceptable. Warning clause (Type E) for stationary sources may identify a potential concern due to the juxtaposition of the facility but must not be utilized to justify an excess over the criteria.

11. **STATIONARY AND TRANSPORTATION SOURCES**

The required control measures for transportation and stationary sources should be evaluated separately for day-time and night-time periods. The final selection of control measures should ensure the compliance with the applicable sound level criteria of this document.

12. **CENTRAL AIR CONDITIONING**

Central air conditioning is required in order to ensure that the windows may remain closed. The ventilation system must provide temperature and humidity control and must not generate sound levels that exceed the applicable indoor sound level criteria.

In the majority of situations, particularly for single family dwellings, central air conditioning is the only ventilation system that satisfies the above conditions. However, in high and medium density residential developments, other forms of mechanical ventilation may be available. Ventilation methods other than central air conditioning are acceptable for high and medium density residential developments, subject to the following conditions:

- (a) the noise produced by the proposed ventilation system complies with the indoor noise criteria of Table 7. In practice, this condition usually implies that window air conditioning units are not acceptable;

- (b) the ventilation system complies with all national, provincial or municipal standards and codes;
- (c) the ventilation system is designed by a Professional Engineer expert in heating and ventilation;
- (d) the ventilation system enables the windows and exterior doors to remain closed.

13. PROVISION FOR CENTRAL AIR CONDITIONING

Provision for central air conditioning is required in order to allow central air conditioning to be installed in the future, and enable windows to remain closed.

In the majority of situations, particularly for single family dwellings, provision for central air conditioning implies forced air heating with the ducts sized for the future installation of central air conditioning. However, in high and medium density residential developments, other forms of heating and mechanical ventilation may be available. Ventilation methods other than forced air heating and central conditioning are acceptable for high and medium density residential developments, subject to the conditions outlined in Section 12. The main condition is that the noise produced by the proposed ventilation system complies with the indoor noise criteria of Table 7. In practice, this condition implies that window air conditioning units are not acceptable.

14. WARNING CLAUSES

14.1 TRANSPORTATION SOURCES

The following warning clauses may be used individually or in combination:

TYPE A:

"Purchasers/tenants are advised that sound levels due to increasing road (rail) (air) traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment's noise criteria."

TYPE B:

"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 (rail) (air) traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment's noise criteria."

TYPE C:

"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 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's noise criteria. (Note: The location and installation of the outdoor air conditioning device should be done so as to comply with noise criteria of MOE Publication NPC-216, Residential Air Conditioning Devices and thus minimize the noise impacts both on and in the immediate vicinity of the subject property.)"

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 Municipality's and the Ministry of the Environment's noise criteria."

14.2 STATIONARY SOURCES

TYPE E:

"Purchasers are advised that due to the proximity of the adjacent industry (facility) (utility), sound levels from the industry (facility) (utility) may at times be audible."

 15. VERIFICATION OF NOISE CONTROL MEASURES

Implementation of noise control measures should be verified (certified) by a qualified individual, preferably a Professional Engineer with experience in environmental acoustics.

 16. SUMMARY OF MINIMUM NOISE CONTROL AND VENTILATION REQUIREMENTS FOR ROAD, RAIL AND AIRCRAFT NOISE

TABLE 1
COMBINATION OF ROAD AND RAIL NOISE, DAY-TIME (0700 - 2300)
OUTDOOR, VENTILATION AND WARNING CLAUSE REQUIREMENTS

ASSESSMENT LOCATION	L_{eq} (16 hr) (dBA)	VENTILATION REQUIREMENTS	OUTDOOR CONTROL MEASURES	WARNING CLAUSE
OUTDOOR LIVING AREA (OLA)	Less than or equal to 55 dBA	N/A	None required	Not required
	Greater than 55 dBA to less than or equal to 60 dBA	N/A	Control measures (barriers) not required but should be considered	Required if resultant L_{eq} exceeds 55 dBA Type A
	Greater than 60 dBA	N/A	Control measures (barriers) required to reduce the L_{eq} to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible	Required if resultant L_{eq} exceeds 55 dBA Type B
PLANE OF LIVING ROOM WINDOW	Greater than 50 dBA to less than or equal to 55 dBA	None required	N/A	Not required
	Greater than 55 dBA to less than or equal to 65 dBA	Forced air heating with provision for central air conditioning	N/A	Required Type C
	Greater than 65 dBA	Central air conditioning	N/A	Required Type D

TABLE 2
COMBINATION OF ROAD AND RAIL NOISE, NIGHT-TIME (2300 - 0700)
VENTILATION AND WARNING CLAUSE REQUIREMENTS

ASSESSMENT LOCATION	L_{eq} (8 hr) (dBA)	VENTILATION REQUIREMENTS	WARNING CLAUSE
PLANE OF BEDROOM WINDOW	Greater than 50 dBA to less or equal to 60 dBA	Forced air heating with provision for central air conditioning	Required Type C
	Greater than 60 dBA	Central air conditioning	Required Type D

TABLE 3
ROAD AND RAIL NOISE, DAY-TIME (0700 - 2300)
BUILDING COMPONENT REQUIREMENTS

ASSESSMENT LOCATION		L_{eq} (16 hr)	BUILDING COMPONENT REQUIREMENTS
PLANE OF LIVING ROOM WINDOW	ROAD	Less than or equal to 65 dBA	Building compliant with the Ontario Building Code
		Greater than 65 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria
	RAIL	Less than or equal to 60 dBA	Building compliant with the Ontario Building Code
		Greater than 60 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria

TABLE 4
ROAD AND RAIL NOISE, NIGHT-TIME (2300 - 0700)
BUILDING COMPONENT REQUIREMENTS

ASSESSMENT LOCATION		L_{eq} (8 hr)	BUILDING COMPONENT REQUIREMENTS
PLANE OF BEDROOM WINDOW	ROAD	Less than or equal to 60 dBA	Building compliant with the Ontario Building Code
		Greater than 60 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria
	RAIL	Less than or equal to 55 dBA	Building compliant with the Ontario Building Code
		Greater than 55 dBA	Building components (walls, windows, etc.) must be designed to achieve indoor sound level criteria

encourage development of sensitive land uses adjacent to industrial facilities and such planning is contrary to this Ministry's land use compatibility policies.

A.2.1.6 Predictable Worst Case Impact

The assessment of noise impact requires the determination of the "predictable worst case" impact. The "predictable worst case" impact assessment should establish the largest noise excess produced by the source over the applicable limit. The assessment should reflect a planned and predictable mode of operation based on routine activities that occur within the scope of the stationary source.

It is important to emphasize that the "predictable worst case" impact does not necessarily mean that the sound level of the source is highest; it means that the excess over the limit is largest. For example, the excess over the applicable limit at night may be larger even if the day-time sound level produced by the source is higher.

A.2.2 ROAD TRAFFIC NOISE

The assessment of road traffic noise impact is evaluated by prediction using statistically averaged road traffic information, the higher of the AADT (Annual Average Daily Traffic) or SADT (Summer Average Daily Traffic). The prediction method for road traffic noise, recommended by this Ministry, is a method entitled ORNAMENT, Ontario Road Noise Analysis Method for Environment and Transportation, published in 1989, Reference [3], and the descriptors are the 24-hour equivalent sound level, $L_{eq}(24)$ for freeways, and the 16-hour day-time and the 8-hour night-time equivalent sound levels, $L_{eq}(16)$ and $L_{eq}(8)$, for other roads.

In order to comply with the Ministry's guidelines, the predicted noise level is to be assessed in an Outdoor Living Area, such as a rear yard or a patio, and in Indoor Living Areas, such as bedrooms and living rooms. Where the noise impact exceeds the applicable criteria, warning clauses and mitigation measures such as site planning, architectural design, noise barriers, special building components and/or central air conditioning may be necessary. No noise control measures are required if the sound level estimated in the Outdoor Living Area is 55 dBA or less during the day-time and 50 dBA or less in the plane of bedroom windows during the night-time.

A.2.3 RAIL TRAFFIC NOISE

The assessment of rail traffic noise impact is performed using a prediction method entitled STEAM, Sound from Trains Environmental Analysis Method, published in 1990, Reference [4]. The descriptors used in the assessment are the 16-hour day-time and the 8-hour night-time equivalent sound levels, $L_{eq}(16)$ and $L_{eq}(8)$.

The impact of railway traffic noise and the requirement for control measures are assessed similarly to the road traffic noise. The noise level is to be assessed in an Outdoor Living Area, such as a rear yard or a patio, and in Indoor Living Areas, such as bedrooms and living rooms, and compared with the Ministry's guidelines. No noise control measures are required if the sound level estimated in the Outdoor Living Area is 55 dBA or less during the day-time and 50 dBA or less in the plane of bedroom windows during the night-time.

The outdoor noise impact is assessed in the Outdoor Living Area during day-time hours, 07:00 to 23:00, considering a combination of only two sources of rail traffic noise, namely the locomotive and the wheel-rail interaction. Whistle noise is not included in the outdoor noise impact assessment. The indoor noise impact is assessed in sleeping quarters during night-time hours, 23:00 to 07:00, and in living rooms or similar areas during day-time hours, 07:00 to 23:00. The assessment must consider the combination of all three railway noise sources, i.e. locomotive, wheel-rail and whistle.

The characteristic of railway noise is its high pass-by sound level for short periods and a major low frequency component produced by the operation of the diesel locomotive. This special character of the sound needs to be taken into account, particularly when assessing the indoor sound levels. Consequently, in order to account for

- Flexibility may be used in assessing the noise impact from a stationary source that exceeds the sound level criteria in the plane of a window, given in Tables 6 and 7 of Section 4.5. The Ministry may accept a marginal excess not exceeding 5 dB;
- In some cases, the maximum hourly sound level produced by the stationary source is lower than the long term average of the background sound level, but is higher than the lowest hourly background sound level. In addition, the operation of the stationary source is intermittent so that the potential of the maximum hourly stationary source sound level coinciding with lowest background hourly sound is very low. In such cases, the Ministry may allow a certain latitude in assessing the impact of the stationary source and accept a marginal excess over the sound level criteria;
- The Ministry may use some flexibility in assessing the impact from a stationary source that operates for only a very limited period of time within a year. For example, if the operation produces a noise impact within a period of only one or two weeks in one year, the Ministry may accept a marginal excess.

A.3.2 CRITERIA FOR TRANSPORTATION NOISE SOURCES

The sound level criteria for transportation sources are based on sociological surveys of large numbers of people and represent what is considered to be the onset of significant degradation of the noise environment relative to the expectations of the general population. The outdoor sound level criteria represent the beginning of a significant interference with normal conversation. The indoor sound level criteria reflect potential commencement of sleep interference; they also ensure a comfortable indoor living environment.

Transportation noise in general and road traffic noise in particular is the main contributor to the environmental noise climate in Class 1 Areas. Despite the prevalence of road traffic noise in a community, people exposed to it develop a tolerance of the noise because they recognize the usefulness of this mode of transportation.

A.3.2.1 Application of Criteria

The transportation noise criteria apply to the development of noise sensitive land uses affected by noise produced by road, rail and aircraft traffic. Recognizing the variation of human response to transportation noise and, at the same time, the possible difficulties of implementing noise control measures in some situations, the Ministry allows a certain flexibility in the transportation sound level criteria in the Outdoor Living Areas. The application and the allowable flexibility of the criteria is described below.

In case of a marginal excess over the criteria, the prospective occupants of the new land use should be notified by means of a warning clause. This clause should be included in the Agreements of Purchase and Sale, and incorporated into the Development Agreements which are registered on title of the property.

(a) Road and Rail

Reference [1] provides assessment details. If the day-time sound level in the Outdoor Living Area is 55 dBA or less and the night-time level in the plane of bedroom windows is 50 dBA or less, no further assessment is required.

Where it can be clearly demonstrated that it is not technically feasible to achieve the Ministry's outdoor sound level criterion for road and rail traffic, a tolerance not more than 5 dB above the stated criteria may be allowed, providing the prospective occupants of the new land use are notified by means of a warning clause. The tolerance, and the accompanying warning clause, is only allowable in conjunction with the sound levels in the Outdoor Living Area; the tolerance is not allowable for the indoor sound level criteria.

(b) Aircraft

Policy 1.1.3 g) of Reference [13] states:

3.1 ROAD AND RAIL TRAFFIC
3.1.1 Sound Levels

The sound levels from road and/or rail transportation at the site of a proposed noise sensitive land use shall be established using methods included in References [3] and [4]. Further details are in Section A.2 of the Annex.

3.1.2 Day-time Outdoor Sound Level Criterion

Table 1 gives the equivalent sound level (L_{eq}) criterion in the selected Outdoor Living Area. The criterion applies to the entire day-time period from 07:00 to 23:00. Section A.3.2.1 of the Annex describes the application of the criteria and the use of warning clauses.

TABLE 1
Sound Level Criterion for Outdoor Living Areas
Road and Rail

Time Period	L_{eq} (16) (dBA)
16 hr, 07:00 - 23:00	55

3.1.3 Indoor Sound Level Criteria

Table 2 gives the equivalent sound level (L_{eq}) criteria and the applicable time periods for the indicated types of indoor space. The specified sound level criteria are minimum requirements and apply to the indicated indoor spaces with the windows and doors closed.

TABLE 2
Indoor Sound Level Criteria
Road and Rail

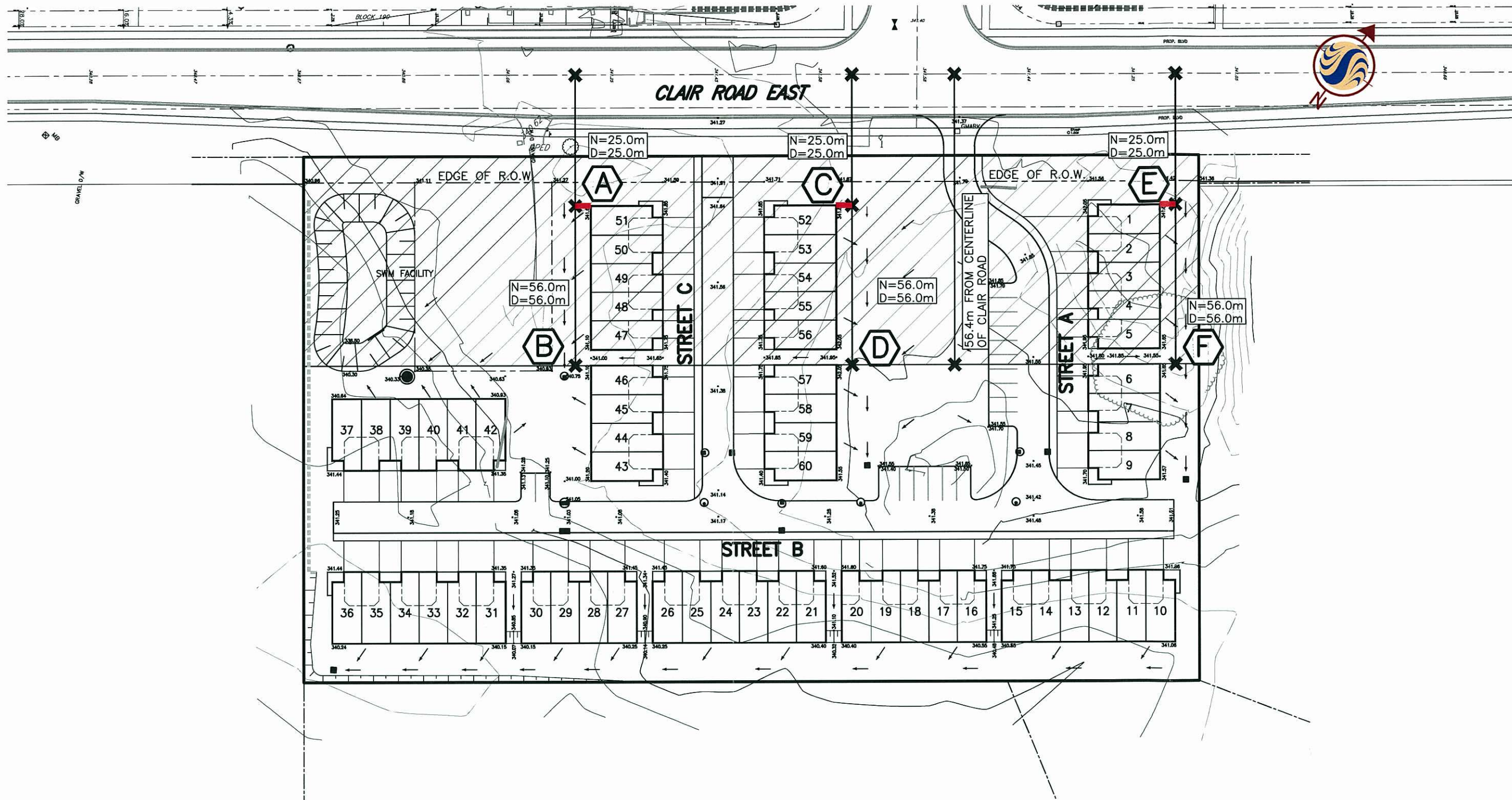
Type of Space	L_{eq} (Time Period) (dBA)	
	Road	Rail
Living/dining areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, etc. (Time period: 16 hr, 07:00 - 23:00)	45	40
Sleeping quarters (Time period: 8 hr, 23:00 - 07:00)	40	35

3.2 AIR TRAFFIC
3.2.1 Noise Impact

Policy 1.1.3 g) of Reference [13] establishes the applicable criterion. The noise impact on the proposed noise sensitive land use is determined based on the location of the noise sensitive land use with respect to the official Noise Exposure Forecast/Noise Exposure Projection (NEF/NEP) contours. These NEF/NEP contours are specified on a list of current contour maps available from the Ministry of Municipal Affairs and Housing. The more restrictive of the NEF and NEP contours apply. Further details are in Annex Section A.2.4 and Section A.3.2.1.

APPENDIX C

Noise Assessment Location Plan
Noise Assessment Typical Section



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 5/30/2012 3:00:05 PM By: Brown, Kevin

May, 2012
 160311309

ORIGINAL SHEET - ANSI B



Stantec

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 49 Frederick Street
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 www.stantec.com

- Legend**
- SOURCE/RECIEVER
 - ASSESSMENT LOCATION
 - LIMITS REQUIRING NOISE WARNING
CLAUSE FROM CLAIR ROAD
 - PROPOSED 1.9m HIGH NOISE BARRIER
(3.0m BARRIER LENGTH)

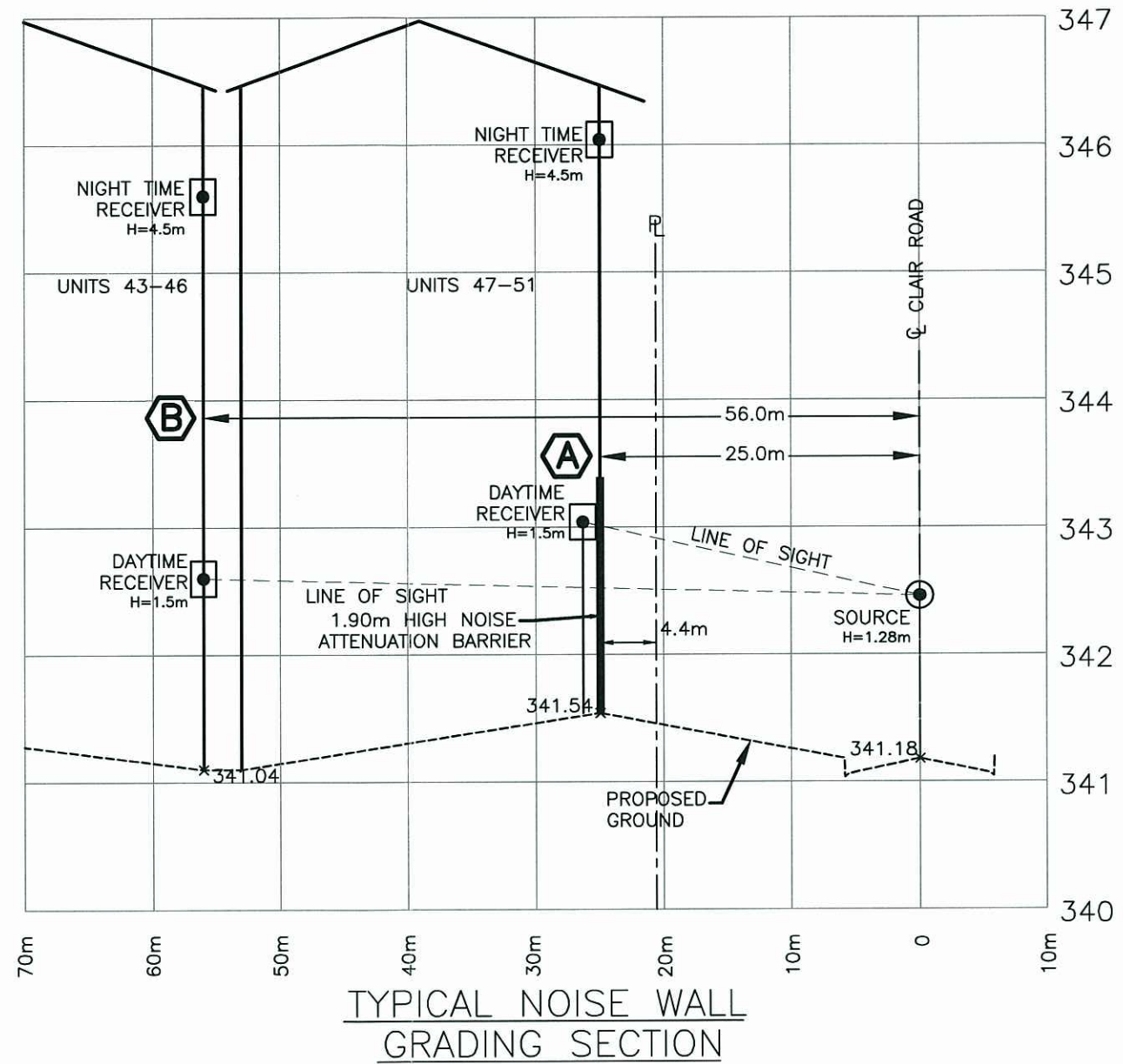
SOURCE RECEIVER DISTANCE:
 N= NIGHT TIME
 D= DAY TIME



Client/Project
 ACORN DEVELOPMENTS
 331 CLAIR ROAD EAST
 Guelph, ON

Figure No.
 N-1

Title
**NOISE ASSESSMENT
 LOCATION PLAN**



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5/30/2012 3:02:28 PM By: Brown, Kevin

May, 2012
160311309

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Legend



Client/Project
ACORN DEVELOPMENTS
331 CLAIR ROAD EAST
Guelph, ON

Figure No.
N-2

Title
**NOISE ASSESSMENT
TYPICAL SECTION**

APPENDIX D

Stamson Computer Output – Noise Calculations

Filename: un.te Time Period: Day/Night 16/8 hours
Description: Units 1, 51, and 52 Unmitigated Noise Level

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

Car traffic volume : 8343/927 veh/TimePeriod *
Medium truck volume : 414/46 veh/TimePeriod *
Heavy truck volume : 243/27 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 4.60
Heavy Truck % of Total Volume : 2.70
Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 25.00 / 25.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

ROAD (0.00 + 61.27 + 0.00) = 61.27 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.66 66.41 0.00 -3.68 -1.46 0.00 0.00 0.00 61.27

Segment Leq : 61.27 dBA

Total Leq All Segments: 61.27 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

ROAD (0.00 + 55.07 + 0.00) = 55.07 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.58 59.88 0.00 -3.50 -1.31 0.00 0.00 0.00 55.07

Segment Leq : 55.07 dBA

Total Leq All Segments: 55.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.27
(NIGHT): 55.07

Filename: dis.te Time Period: Day/Night 16/8 hours
Description: Distance Required for No Noise Warning Clause

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

Car traffic volume : 8343/927 veh/TimePeriod *
Medium truck volume : 414/46 veh/TimePeriod *
Heavy truck volume : 243/27 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 4.60
Heavy Truck % of Total Volume : 2.70
Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 56.40 / 56.40 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

ROAD (0.00 + 55.41 + 0.00) = 55.41 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.66 66.41 0.00 -9.55 -1.46 0.00 0.00 0.00 55.41

Segment Leq : 55.41 dBA

Total Leq All Segments: 55.41 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

ROAD (0.00 + 49.50 + 0.00) = 49.50 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.58 59.88 0.00 -9.07 -1.31 0.00 0.00 0.00 49.50

Segment Leq : 49.50 dBA

Total Leq All Segments: 49.50 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.41
(NIGHT): 49.50

Filename: nb.te Time Period: Day/Night 16/8 hours
Description: Distance Required to Avoid Noise Barrier

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

Car traffic volume : 8343/927 veh/TimePeriod *
Medium truck volume : 414/46 veh/TimePeriod *
Heavy truck volume : 243/27 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 1 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 4.60
Heavy Truck % of Total Volume : 2.70
Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 28.20 / 28.20 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

ROAD (0.00 + 60.40 + 0.00) = 60.40 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.66 66.41 0.00 -4.55 -1.46 0.00 0.00 0.00 60.40

Segment Leq : 60.40 dBA

Total Leq All Segments: 60.40 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

ROAD (0.00 + 54.24 + 0.00) = 54.24 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 90 0.58 59.88 0.00 -4.32 -1.31 0.00 0.00 0.00 54.24

Segment Leq : 54.24 dBA

Total Leq All Segments: 54.24 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.40
(NIGHT): 54.24

MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: u51.te Time Period: Day/Night 16/8 hours
 Description: Unit 51 - with 1.9m High Noise Barrier

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

 Car traffic volume : 8343/927 veh/TimePeriod *
 Medium truck volume : 414/46 veh/TimePeriod *
 Heavy truck volume : 243/27 veh/TimePeriod *
 Posted speed limit : 60 km/h
 Road gradient : 1 %
 Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
 Percentage of Annual Growth : 0.00
 Number of Years of Growth : 0.00
 Medium Truck % of Total Volume : 4.60
 Heavy Truck % of Total Volume : 2.70
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 25.00 / 25.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
 Barrier height : 1.90 m
 Barrier receiver distance : 0.01 / 0.01 m
 Source elevation : 341.18 m
 Receiver elevation : 341.54 m
 Barrier elevation : 341.54 m
 Reference angle : 0.00

Results segment # 1: Clair Road (day)

 Source height = 1.28 m

Barrier height for grazing incidence

 Source ! Receiver ! Barrier ! Elevation of
 Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)
 -----+-----+-----+-----
 1.28 ! 1.50 ! 1.50 ! 343.04

ROAD (58.26 + 47.94 + 0.00) = 58.65 dBA
 Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

 -90 0 0.66 66.41 0.00 -3.68 -4.47 0.00 0.00 0.00 58.26

 0 90 0.55 66.41 0.00 -3.44 -4.28 0.00 0.00 -10.74 47.94

Segment Leq : 58.65 dBA

Total Leq All Segments: 58.65 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

-----+-----+-----+-----
1.28 ! 4.50 ! 4.50 ! 346.04

ROAD (52.06 + 52.06 + 0.00) = 55.07 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----
-90 0 0.58 59.88 0.00 -3.50 -4.32 0.00 0.00 0.00 52.06

0 90 0.46 59.88 0.00 -3.24 -4.12 0.00 0.00 -0.03 52.49*

0 90 0.58 59.88 0.00 -3.50 -4.32 0.00 0.00 0.00 52.06
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----

* Bright Zone !

Segment Leq : 55.07 dBA

Total Leq All Segments: 55.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.65
(NIGHT): 55.07

Filename: u46.te Time Period: Day/Night 16/8 hours
 Description: Unit 46 - with 1.9m High Noise Barrier

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

Car traffic volume : 8343/927 veh/TimePeriod *
 Medium truck volume : 414/46 veh/TimePeriod *
 Heavy truck volume : 243/27 veh/TimePeriod *
 Posted speed limit : 60 km/h
 Road gradient : 1 %
 Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
 Percentage of Annual Growth : 0.00
 Number of Years of Growth : 0.00
 Medium Truck % of Total Volume : 4.60
 Heavy Truck % of Total Volume : 2.70
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 56.00 / 56.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
 Barrier height : 1.90 m
 Barrier receiver distance : 31.00 / 31.00 m
 Source elevation : 341.18 m
 Receiver elevation : 341.04 m
 Barrier elevation : 341.54 m
 Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	1.50	0.96	342.50

ROAD (52.45 + 47.29 + 0.00) = 53.60 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90	0	0.66	66.41	0.00	-9.50	-4.47	0.00	0.00	0.00	52.45
0	90	0.55	66.41	0.00	-8.88	-4.28	0.00	0.00	-5.96	47.29

Segment Leq : 53.60 dBA

Total Leq All Segments: 53.60 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	4.50	2.30	343.84

ROAD (46.54 + 46.54 + 0.00) = 49.55 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.58	59.88	0.00	-9.02	-4.32	0.00	0.00	0.00	46.54
0	90	0.46	59.88	0.00	-8.37	-4.12	0.00	0.00	-4.80	42.59*
0	90	0.58	59.88	0.00	-9.02	-4.32	0.00	0.00	0.00	46.54

* Bright Zone !

Segment Leq : 49.55 dBA

Total Leq All Segments: 49.55 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.60
(NIGHT): 49.55

Filename: u52.te Time Period: Day/Night 16/8 hours
 Description: Unit 52 - with 1.9m High Noise Barrier

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

Car traffic volume : 8343/927 veh/TimePeriod *
 Medium truck volume : 414/46 veh/TimePeriod *
 Heavy truck volume : 243/27 veh/TimePeriod *
 Posted speed limit : 60 km/h
 Road gradient : 1 %
 Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
 Percentage of Annual Growth : 0.00
 Number of Years of Growth : 0.00
 Medium Truck % of Total Volume : 4.60
 Heavy Truck % of Total Volume : 2.70
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 25.00 / 25.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
 Barrier height : 1.90 m
 Barrier receiver distance : 0.01 / 0.01 m
 Source elevation : 341.58 m
 Receiver elevation : 341.79 m
 Barrier elevation : 341.79 m
 Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	1.50	1.50	343.29

ROAD (58.26 + 47.96 + 0.00) = 58.65 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.66	66.41	0.00	-3.68	-4.47	0.00	0.00	0.00	58.26
0	90	0.55	66.41	0.00	-3.44	-4.28	0.00	0.00	-10.73	47.96

Segment Leq : 58.65 dBA

Total Leq All Segments: 58.65 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	4.50	4.50	346.29

ROAD (52.06 + 52.06 + 0.00) = 55.07 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.58	59.88	0.00	-3.50	-4.32	0.00	0.00	0.00	52.06
0	90	0.46	59.88	0.00	-3.24	-4.12	0.00	0.00	-0.03	52.49*
0	90	0.58	59.88	0.00	-3.50	-4.32	0.00	0.00	0.00	52.06

* Bright Zone !

Segment Leq : 55.07 dBA

Total Leq All Segments: 55.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.65
(NIGHT): 55.07

Filename: u57.te Time Period: Day/Night 16/8 hours
 Description: Unit 57 - with 1.9m High Noise Barrier

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

Car traffic volume : 8343/927 veh/TimePeriod *
 Medium truck volume : 414/46 veh/TimePeriod *
 Heavy truck volume : 243/27 veh/TimePeriod *
 Posted speed limit : 60 km/h
 Road gradient : 1 %
 Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
 Percentage of Annual Growth : 0.00
 Number of Years of Growth : 0.00
 Medium Truck % of Total Volume : 4.60
 Heavy Truck % of Total Volume : 2.70
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 56.00 / 56.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
 Barrier height : 1.90 m
 Barrier receiver distance : 31.00 / 31.00 m
 Source elevation : 341.58 m
 Receiver elevation : 341.99 m
 Barrier elevation : 341.79 m
 Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
 Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

1.28 ! 1.50 ! 1.35 ! 343.14

ROAD (52.45 + 47.90 + 0.00) = 53.75 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 0 0.66 66.41 0.00 -9.50 -4.47 0.00 0.00 0.00 52.45

0 90 0.55 66.41 0.00 -8.88 -4.28 0.00 0.00 -5.35 47.90

Segment Leq : 53.75 dBA

Total Leq All Segments: 53.75 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	4.50	2.69	344.48

ROAD (46.54 + 46.54 + 0.00) = 49.55 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.58	59.88	0.00	-9.02	-4.32	0.00	0.00	0.00	46.54
0	90	0.46	59.88	0.00	-8.37	-4.12	0.00	0.00	-4.16	43.24*
0	90	0.58	59.88	0.00	-9.02	-4.32	0.00	0.00	0.00	46.54

* Bright Zone !

Segment Leq : 49.55 dBA

Total Leq All Segments: 49.55 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.75
(NIGHT): 49.55

Filename: u1.te Time Period: Day/Night 16/8 hours
 Description: Unit 1 - with 1.9m High Noise Barrier

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

Car traffic volume : 8343/927 veh/TimePeriod *
 Medium truck volume : 414/46 veh/TimePeriod *
 Heavy truck volume : 243/27 veh/TimePeriod *
 Posted speed limit : 60 km/h
 Road gradient : 1 %
 Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
 Percentage of Annual Growth : 0.00
 Number of Years of Growth : 0.00
 Medium Truck % of Total Volume : 4.60
 Heavy Truck % of Total Volume : 2.70
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 25.00 / 25.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
 Barrier height : 1.90 m
 Barrier receiver distance : 0.01 / 0.01 m
 Source elevation : 341.17 m
 Receiver elevation : 341.54 m
 Barrier elevation : 341.54 m
 Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	1.50	1.50	343.04

ROAD (58.26 + 47.94 + 0.00) = 58.65 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.66	66.41	0.00	-3.68	-4.47	0.00	0.00	0.00	58.26
0	90	0.55	66.41	0.00	-3.44	-4.28	0.00	0.00	-10.75	47.94

Segment Leq : 58.65 dBA

Total Leq All Segments: 58.65 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	4.50	4.50	346.04

ROAD (52.06 + 52.06 + 0.00) = 55.07 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.58	59.88	0.00	-3.50	-4.32	0.00	0.00	0.00	52.06
0	90	0.46	59.88	0.00	-3.24	-4.12	0.00	0.00	-0.03	52.48*
0	90	0.58	59.88	0.00	-3.50	-4.32	0.00	0.00	0.00	52.06

* Bright Zone !

Segment Leq : 55.07 dBA

Total Leq All Segments: 55.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.65
(NIGHT): 55.07

Filename: u6.te Time Period: Day/Night 16/8 hours
 Description: Unit 6 - with 1.9m High Noise Barrier

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

Car traffic volume : 8343/927 veh/TimePeriod *
 Medium truck volume : 414/46 veh/TimePeriod *
 Heavy truck volume : 243/27 veh/TimePeriod *
 Posted speed limit : 60 km/h
 Road gradient : 1 %
 Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 10000
 Percentage of Annual Growth : 0.00
 Number of Years of Growth : 0.00
 Medium Truck % of Total Volume : 4.60
 Heavy Truck % of Total Volume : 2.70
 Day (16 hrs) % of Total Volume : 90.00

Data for Segment # 1: Clair Road (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 : 56.00 / 56.00 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 0.00 deg Angle2 : 90.00 deg
 Barrier height : 1.90 m
 Barrier receiver distance : 31.00 / 31.00 m
 Source elevation : 341.17 m
 Receiver elevation : 341.59 m
 Barrier elevation : 341.54 m
 Reference angle : 0.00

Results segment # 1: Clair Road (day)

Source height = 1.28 m

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
 Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

1.28 ! 1.50 ! 1.20 ! 342.74

ROAD (52.45 + 47.69 + 0.00) = 53.70 dBA

Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq

-90 0 0.66 66.41 0.00 -9.50 -4.47 0.00 0.00 0.00 52.45

0 90 0.55 66.41 0.00 -8.88 -4.28 0.00 0.00 -5.56 47.69

Segment Leq : 53.70 dBA

Total Leq All Segments: 53.70 dBA

Results segment # 1: Clair Road (night)

Source height = 1.28 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.28	4.50	2.54	344.08

ROAD (46.54 + 46.54 + 0.00) = 49.55 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	0	0.58	59.88	0.00	-9.02	-4.32	0.00	0.00	0.00	46.54
0	90	0.46	59.88	0.00	-8.37	-4.12	0.00	0.00	-4.48	42.92*
0	90	0.58	59.88	0.00	-9.02	-4.32	0.00	0.00	0.00	46.54

* Bright Zone !

Segment Leq : 49.55 dBA

Total Leq All Segments: 49.55 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.70
(NIGHT): 49.55