HGC ENGINEERING

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Noise Feasibility Study
Proposed Residential Development
231 - 249 Reach Street
Uxbridge, Ontario

Prepared for:

Arya Investments Corp/Venetian Group
220 Duncan Mill Rd., Ste 401
Toronto, ON M3B 3J5

Prepared by

Waqas Sajid, BASc, EIT

and

Sheeba Paul, MEng, PEng

February 22, 2018

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1 INTRODUCTION AND SUMMARY

HGC Engineering was retained by Arya Investments Corp/Venetian Group to conduct a Noise Feasibility Study for a proposed residential development to be located at 231-249 Reach Street in the Township of Uxbridge, Regional Municipality of Durham, Ontario. The study is required by the municipality as part of the planning and approvals process.

The primary source of noise is road traffic from Reach Street. Ultimate annual daily traffic data was obtained from the Region of Durham for Reach Street. The predicted sound levels were compared to the guidelines of the Ministry of Environment and Climate Change (MOECC) and the Region of Durham.

The results of this study indicate that with suitable noise control measures integrated into the design of buildings, it is feasible to achieve the indoor MOECC guideline sound levels. Physical mitigation in the form of acoustic barriers will be required for the closest flanking rear yards to Reach Street. Forced air ventilation with ductwork sized for the future installation of central conditioning by the occupant will be required for the units flanking onto Reach Street and units fronting onto Reach Street. Building constructions meeting the minimum requirements of the Ontario Building Code will provide sufficient acoustical insulation for the indoor spaces for all units in the development. Warning clauses are also recommended to inform future owners and tenants of the road traffic noise impacts.

2 SITE DESCRIPTION AND NOISE SOURCES

Figure 1 is a key plan indicating the location of the proposed development. The proposed development is to be located at 231 – 249 Reach Street, in the Township of Uxbridge, Ontario. Figure 2 shows the proposed site plan prepared by Hunt Design Associates Inc., dated December 2017. Figure 2 also indicates the prediction locations [A] to [I]. The proposed development will consist of 61 townhouse units and bungalow units.

The acoustical environment surrounding the site is urban in nature. The primary source of sound is road traffic on Reach Street. Reach Street currently consists of two lanes (one lane in each direction). Most of the lands surrounding the subject site are existing residential homes. To the south of the subject site there is a golf course. During the site visit, noise was not audible from the golf course. There are no other significant sources of noise within 500 m of the subject site.

3 SOUND LEVEL CRITERIA

3.1 Traffic Noise

Guidelines for acceptable levels of road traffic noise impacting residential developments are given in the MOECC publication NPC-300, “Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning” Part C release date October 21, 2013, and are listed in Table I below. The values in Table I are energy equivalent (average) sound levels [L_{EQ}] in units of A-weighted decibels [dBA].

Table I: MOECC Road Traffic Noise Criteria (dBA)

Area	Daytime L_{EQ} (16 hour) Road	Night-time L_{EQ} (8 hour) Road
Outdoor Living Areas	55 dBA	--
Inside Living/Dining Rooms	45 dBA	45 dBA
Inside Bedrooms	45 dBA	40 dBA

Daytime refers to the period between 07:00 and 23:00. Nighttime refers to the period between 23:00

and 07:00. The term “outdoor living area” (OLA) is used in reference to an outdoor patio, a backyard, a terrace, or other area where passive recreation is expected to occur. Balconies that are less than 4 m in depth are not considered to be outdoor living areas under MOECC guidelines.

The guidelines in the MOECC publication allow the sound level in an Outdoor Living Area to be exceeded by up to 5 dBA, without mitigation, if warning clauses are placed in the property agreements, offers of purchase and sale and tenancy agreements to the property. Where OLA sound levels exceed 60 dBA, physical mitigation is required to reduce the OLA sound level to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible.

A central air conditioning system as an alternative means of ventilation to open windows is required for dwellings where nighttime sound levels outside bedroom windows will exceed 60 dBA or daytime sound levels outside living/dining room windows will exceed 65 dBA. Forced-air ventilation with ducts sized to accommodate the future installation of air conditioning is required when nighttime sound levels at bedroom windows will be in the range of 51 to 60 dBA or when daytime sound levels at living/dining room windows will be in the range of 56 to 65 dBA.

If the nighttime sound level outside the bedroom windows exceeds 60 dBA or the daytime sound level outside the living/dining room windows exceeds 65 dBA due to road traffic, 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 I. Warning clauses to notify future residents of possible excesses are also required when nighttime sound levels exceed 50 dBA at the plane of the bedroom window due to road traffic.

4 TRAFFIC NOISE ASSESSMENT

4.1 Road Traffic Data

Traffic data for Reach Street was obtained from the Region of Durham in the form of Ultimate Average Annual Daily Traffic (AADT) values, and is provided in Appendix A. A commercial vehicle percentage of 10% was split into 6% heavy trucks and 4% medium trucks. A day/night split of 90/10% was used. A speed limit of 50 km/h posted near the subject site was used in the analysis. Table II summarizes the traffic volume data used in this study.

Table II: Ultimate Road Traffic Data

Road Name		Cars	Medium Trucks	Heavy Trucks	Total
Reach Street	Daytime	8 100	360	540	9 000
	Nighttime	900	40	60	1 000
	Total	**9 000**	**400**	**600**	**10 000**

4.2 Road Traffic Noise Predictions

To assess the levels of road traffic noise which will impact the study area in the future, sound level predictions were made using STAMSON version 5.04, a computer algorithm developed by the MOECC. Sample STAMSON output is included in Appendix B.

Predictions of the traffic sound levels were made at various locations around the proposed residential development. Sound levels were predicted in the plane of living/dining room and bedroom windows during daytime and nighttime hours to investigate ventilation requirements. Sound levels were also predicted in the rear yard OLAs to determine acoustic barrier requirements.Table III summarizes the predicted sound levels at the proposed development.

Table III: Predicted Future Sound Levels, L_{EQ} [dBA], Without Mitigation

Prediction Location	Description	Daytime – in OLA $L_{EQ(16)}$	Daytime – at Façade $L_{EQ(16)}$	Nighttime – at Facade $L_{EQ(8)}$
[A]	Rear Lane Townhomes "Block 10" fronting onto Reach Street	+	64	57
[B]	West End, First Bungalow unit "Block 1" flanking onto Reach Street	61	64	57
[C]	East End First Bungalow Unit "Block 7" flanking onto Reach Street	58	64	57
[D]	West End, Second Bungalow unit "Block 1"	58	59	53
[E]	West End, Fourth Bungalow unit "Block 1"	<55	56	<50
[F]	East End, First Bungalow unit "Block 6"	--	<55	<50
[G]	West End, First Bungalow unit "Block 2"	<55	<55	<50
[H]	East End, Fourth Bungalow unit "Block 7" flanking onto Reach Street	<55	<55	<50
[I]	East End, Third Bungalow unit "Block 7" flanking onto Reach Street	<55	56	<50

Note: + Small courtyards have been provided on the shielded side of the units which are to be considered the OLAs. The predicted sound level is less than 55 dBA.

5 DISCUSSION AND RECOMMENDATIONS

The sound level predictions indicate that the future traffic sound levels will exceed MOECC guidelines at various units closest to Reach Street. Recommendations to address these excesses are discussed below.

5.1 Outdoor Living Areas

There are small courtyards located on the shielded side of the Blocks fronting onto Reach Street. These courtyards are well shielded and are expected to have sound levels that are less than 55 dBA.

The predicted sound level in the rear yard of the first bungalow unit flanking onto Reach Street (prediction location [B]) will be 61 dBA, 6 dBA in excess of MOECC's limit of 55 dBA. Physical mitigation is required. To achieve 55 dBA, an acoustic barrier of 2.1 m in height is recommended. Alternatively, an acoustic barrier 2.0 m height will achieve 56 dBA.

The predicted sound level at prediction location [D], the second rear yard from Reach Street, will be 58 dBA. This is 3 dBA in excess of the MOECC's limit of 55 dBA. Once mitigation is installed at prediction location [A], the sound level at prediction location [D] will be reduced to less than 55 dBA. Physical mitigation is not required for the rear yard at prediction location [D]).

The predicted sound level in the rear yard of the first bungalow unit flanking onto Reach Street (prediction location [C]) will be 58 dBA, 3 dBA in excess of MOECC's limit of 55 dBA. Physical mitigation is recommended for this rear yard. To achieve 55 dBA, an acoustic barrier of 2.0 m in height is recommended.

Figure 3 shows the approximate location and the extent of the required acoustic barriers.

As a general note, 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/m^2. 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 Indoor Living Areas

Provision for Future Installation of Central Air Conditioning

The predicted daytime sound level outside the plane of living/dining room window for the rear lane townhomes flanking onto Reach Street (prediction location [A]) and units with some exposure to Reach Street (prediction locations [B], [C], [D], [E], [I]) will be between 55 dBA and 65 dBA and nighttime sound levels are between 51 dBA to 60 dBA. To address these excesses, the MOECC guidelines recommend that these units be equipped with forced air ventilation systems with ductwork sized for the future installation of central air conditioning by the occupant. Window or through-the-wall air conditioning units are not recommended because of the noise they produce and because the units penetrate through the exterior wall which degrades the overall sound insulating proprieties of the envelope. The location, installation and sound ratings of the outdoor air conditioning devices should minimize noise impacts and comply with the criteria of MOECC publication NPC-216, Residential Air Conditioning Devices. Figure 3 shows the ventilation requirements.

All remaining units will have daytime sound levels less than 55 dBA and less than 50 dBA during nighttime. These dwellings have no specific ventilation requirements.

5.3 Building Façade Constructions

The predicted sound levels at all units in the development will be less than 65 dBA during the daytime and less than 60 dBA during the nighttime. Thus, any exterior wall and double glazed window construction meeting the minimum requirements of the Ontario Building Code (OBC) will provide adequate sound insulation.

5.4 Warning Clauses

The MOECC guidelines recommend that warning clauses be included in the property and tenancy agreements and offers of purchase and sale for all units with anticipated road traffic sound level excesses. Examples are provided below.

Suggested wording for future dwellings with sound level excesses.

Type A:

> Purchasers/tenants are advised that sound levels due to increasing road may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the noise criteria of the Municipality and the Ministry of the Environment.

Suggested wording for future dwellings with daytime OLA sound levels exceeding the MOECC criteria by 6 dB or more, for which physical mitigation has been provided is given below.

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 traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the criteria of the Municipality and the Ministry of the Environment.

Suitable wording for future dwellings requiring forced air ventilation systems is given below.

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 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 minimize the noise impacts and comply with criteria of MOECC publication NPC-216, Residential Air Conditioning Devices.)

These sample clauses are provided by the MOECC as examples and can be modified by the Municipality as required.

6 SUMMARY OF RECOMMENDATIONS

The following list and Table IV summarizes the recommendations made in this report.

1. Acoustic barriers are recommended for the rear yards of the closest bungalow units to Reach Street (prediction location [B] and [C]).

2. Forced air ventilation systems with ductwork sized for future installation of central air conditioning systems by the occupant will be required for rear lane townhouse units flanking onto Reach Street (prediction location [A]) and bungalow units with some exposure to Reach Street (prediction locations [B], [C], [D], [E], [I]). The location, installation and sound ratings of the air conditioning devices should comply with NPC-216, Residential air Conditioning Devices.

3. Warning clauses should be included in the property and tenancy agreements and offers of purchase and sale to inform future owners and tenants of the property of the road traffic noise impacts.

4. A detailed noise study is required when detailed grading information is available to refine the acoustic barrier heights for the lots with flanking exposure to Reach Street.

Table IV: Summary of Noise Control Requirements and Noise Warning Clauses

Prediction Location	Block No.	Description	Acoustic Barrier	Ventilation Requirements *	Warning Clause	Upgraded Building Constructions Required
[A]	10 - 12	Rear Lane Townhomes fronting onto Reach Street	--	Forced Air	A, C	OBC
[B]	End unit, Blk 1	First Bungalow unit "Block 1" flanking onto Reach Street	✓	Forced Air	A, B, C	OBC
[C]	End unit, Blk 7	First Bungalow Unit "Block 7" flanking onto Reach Street	✓	Forced Air	A, B, C	OBC
[D]	Remaining unit in Blk 1	West End, Second Bungalow unit "Block 1"	--	Forced Air	A, C	OBC
[E]	Remaining unit in Blk 1	West End, Fourth Bungalow unit "Block 1"	--	Forced Air	A, C	OBC
[F]	Block 6	East End, First Bungalow unit "Block 6"	--	--	--	OBC
[G]	Block 2	West End, First Bungalow unit "Block 2"	--	--	--	OBC
[H]	Remaining units in Blk 1	East End, Fourth Bungalow unit "Block 7" flanking onto Reach Street	--	--	--	OBC
[I]	Remaining units in Blk 1	East End, Fourth Bungalow unit "Block 7" flanking onto Reach Street	--	Forced Air	A, C	OBC

Note: (All units not included in the Table have no specific acoustic requirements)
* The location, installation and sound rating of the air conditioning condensers must be compliant with MOECC Guideline NPC-216.
OBC – meets the minimum requirements of the Ontario Building Code.

6.1 Implementation

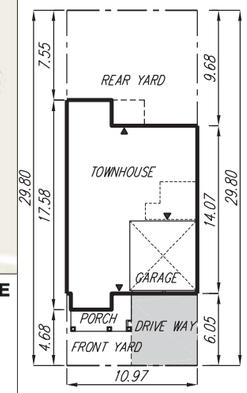
To ensure that the noise control recommendations outlined above are fully implemented, it is recommended that:

1) Prior to the issuance of occupancy permits for this development, the Municipality's building inspector or a Professional Engineer qualified to provide acoustical engineering services in the province of Ontario should certify that the noise control measures for the dwellings units have been properly incorporated, installed and constructed.

Figure 1: Key Plan

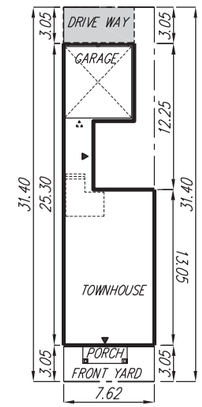
KEY MAP - NOT TO SCALE

TYPE 'A' (BLOCK 1-7)



1-1/2 STOREY BUNGALOW TOWNHOUSE
11.0m X 29.8m
MAX. +/- 2265 SQ.FT.

TYPE 'E' (BLOCK 8-12)



1-1/2 STOREY REAR LANE TOWNHOUSE
7.62 m X 31.40 m
MAX. +/- 2150 SQ.FT.

SCHEME 'E5'

1. SITE AREA:

Total area = 3.59 ha (8.87 acre)

1.1. Wood lot area = 0.13 ha

1.2. LSRCA = 0.82 ha

1.3. Net area = 2.64 ha (6.52 acre)

2. NUMBER OF UNITS:

TYPE 'A', 11.0 m BUNGALOW TOWNHOUSE,	1-1/2 STOREY	= 29 UNITS
TYPE 'E', 7.6 m REAR LANE TOWNHOUSE,	1-1/2 STOREY	= 32 UNITS
TOTAL		= 61 UNITS

3. DENSITY: (NET AREA)

61 UNITS / 6.52 ACRE = 9.36 UNITS PER ACRE

61 UNITS / 2.64 HECTARE= 23.11 UNITS PER HECTARE

4. PARKING:

PARKING REQUIRED: 2.0 PER UNIT // 0.5 VISITOR SPACE			
	#UNITS	RES. SPACES	VISITOR. SPACES
TYPE 'A'	29	58	15
TYPE 'E'	32	64	16
PARKING PROVIDED:			
	#UNITS	RES. SPACES	VISITOR. SPACES
TYPE 'A'	29	58	58 (ON DRIVEWAY)
TYPE 'E'	32	64	16 (ON STREET)
TOTAL PARKING PROVIDED		196 (3.21 / UNIT)	

5. AREA BALANCE OF LSRCA LINE AND WOOD LOT:

DEFINITION	AREA		LEGEND
AREA OF ENCROACHMENT LSRCA LINE AND WOOD LOT (TAKEN)	-570.53 sqm	-6108.84 sq.ft.	
AREA OF CONSERVED WOOD LOT	1157.52 sqm	12459.44 sq.ft.	
AREA OF ADDITIONAL LANDS OUTSIDE OF LSRCA TO BE CONVEYED TO LSRCA (GIVEN)	+577.74sqm	+6218.74 sq.ft.	
RESULT (EXTRA COMPENSATION)	+7.21 sqm	+109.9 sq.ft.	

LEGEND:

	SERVICING EASEMENT
	OBSOLETE REAR YARD BOUNDARY
	PROPOSED REAR YARD BOUNDARY
	LSRCA LINE (TO BE CONFIRMED)
	STAKE LINE
	FIRE ROUTE
	PROPERTY LINE
	GROUND PARKING SPACE

SITE PLAN

SCALE: 1:1000

Figure 2: Proposed Site Plan with Prediction Locations

HUNT DESIGN ASSOCIATES INC.
www.huntdesign.ca

VENETIAN GROUP - 217049

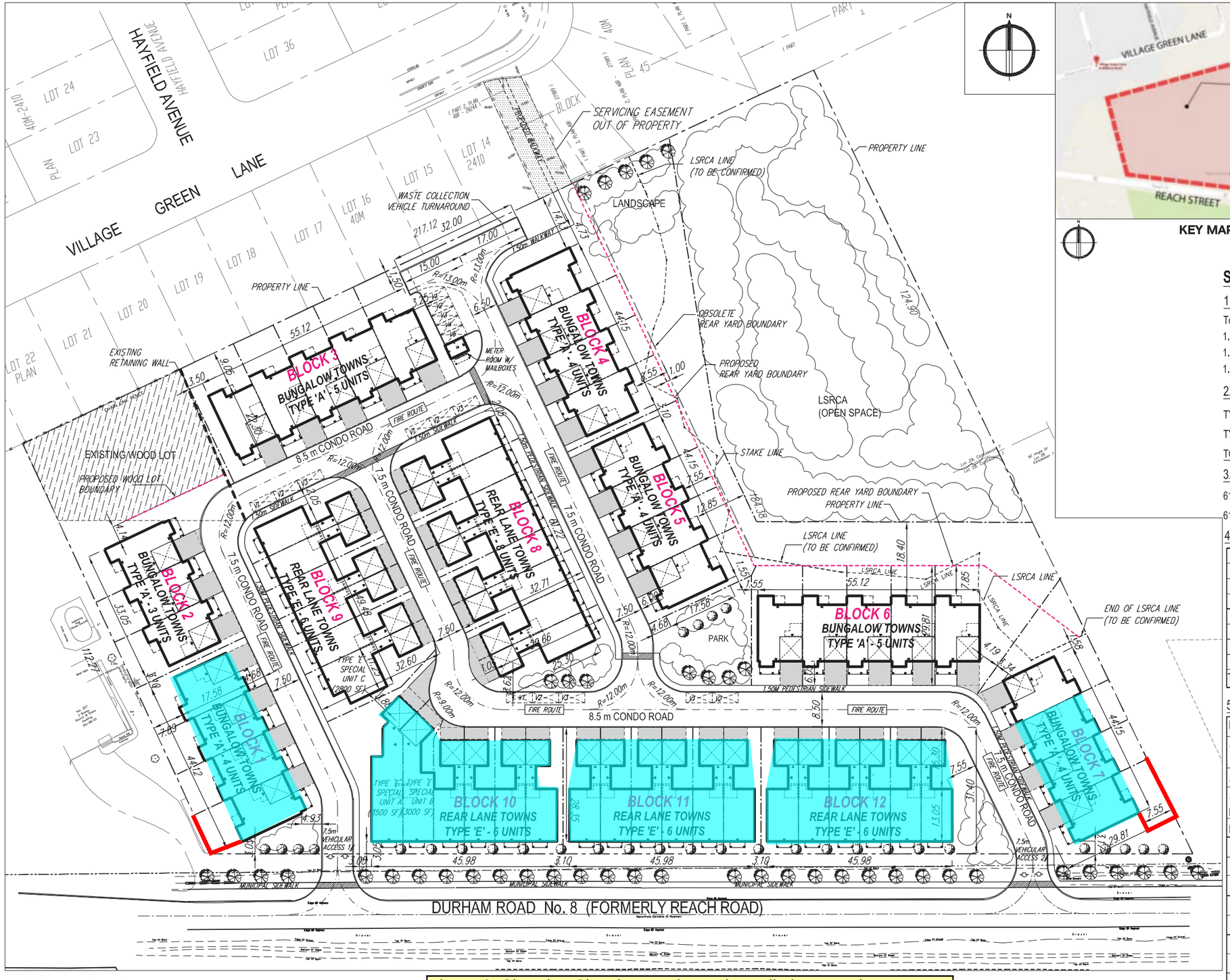
REACH STREET, UXBRIDGE, ONTARIO

8966 Woodbine Ave, Markham, ON L3R 0J7 ■ T 905.737.5133 ■ F 905.737.7326 ■ DEC.20, 2017 ■ JZ ■

SITE PLAN-SCHEME E5

SCALE = 1:1000

217049DSP01-SCHEME E5



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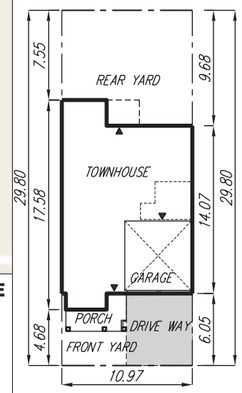

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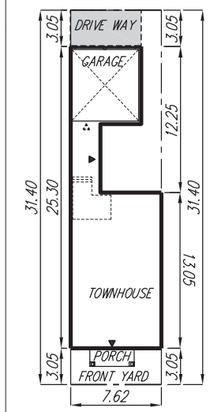

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	PROPOSED REAR YARD BOUNDARY
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	STAKE LINE
	FIRE ROUTE
	PROPERTY LINE
	GROUND PARKING SPACE

SITE PLAN

SCALE: 1:1000

Forced Air

Acoustic Barrier

Figure 3: Site Plan Showing Barrier and Ventilation Requirements

HUNT DESIGN ASSOCIATES INC.
www.huntdesign.ca

VENETIAN GROUP - 217049

REACH STREET, UXBRIDGE, ONTARIO

SITE PLAN-SCHEME E5

SCALE = 1:1000

8966 Woodbine Ave, Markham, ON L3R 0J7 ■ T 905.737.5133 ■ F 905.737.7326 ■ DEC.20, 2017 ■ JZ ■ 217049DSP01-SCHEME E5

APPENDIX A

Road Traffic Data

Planning and Economic Development Department

Planning Division

605 ROSSLAND RD. E.
4TH FLOOR
P.O. BOX 623
WHITBY, ON L1N 6A3
CANADA
905-668-7711
1-800-372-1102
Fax: 905-666-6208
E-Mail: planning@durham.ca

www.durham.ca

Brian Bridgeman, MCIP, RPP
Commissioner of Planning and Economic Development

The Regional Municipality of Durham

ROAD SEGMENT TRAFFIC FORECASTS FOR NOISE ANALYSES

This information is to be used as the basis for assessing the potential impacts of noise, generated by traffic on Provincial Highways and arterial roads, on proposed land uses that are sensitive (e.g., residential subdivisions). Arterial roads include existing and future Type A, B and C, as designated in the Durham Regional Official Plan.

Noise assessment reports recommend specific measures to be integrated into the design of sensitive developments to reduce road noise impacts to acceptable levels.

Provided For:

Name / Name of Firm: Waqas Sajid, HGC Engineering

Address: 2000 Argentia Rd., Plaza One, Suite 203, Mississauga, ON

Telephone: (905) 826-4044 Fax:

Location of Proposal:

241 and 245 Reach Street

Municipality: Uxbridge Lot(s): Concession:

Durham Region File No. (if available):

Name of Property Owner (if available):

Date Request Received: November-08-17 Received By: Chris Leitch

Date Forecast Sent: November-09-17

Name of Road Segment	Forecasted AADT*	No. of Lanes	% of Trucks	Heavy : Medium Truck Ratio		Speed (km/h)
Reach Street, west of Lake Ridge Road	10,000	2	10	60	40	50
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0

* Average Annual Daily Traffic. Forecast based on ultimate development according to the Durham Regional Official Plan.

Sheeba Paul

From: Michael Blake <Michael.Blake@Durham.ca>
Sent: November-18-13 9:19 AM
To: Sheeba Paul
Subject: RE: road traffic data request (241 Reach Street, Uxbridge)

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Sheeba,

Yes, it appears that this site is within the urban area and the speed limit is 50 kph.

Thanks,

Mike

From: Sheeba Paul [mailto:spaul@hgcengineering.com]
Sent: November 17, 2013 9:28 PM
To: Michael Blake
Subject: RE: road traffic data request (241 Reach Street, Uxbridge)

Hello Michael,

We received the attached data from you for Reach Street in Uxbridge. I went to the site today and noticed that the posted speed limit is 50 kph and not 80 kph. There are many houses fronting onto Reach Street.

Could you check the data again and resend?

Thank you.

Ms. Sheeba Paul, MEng, PEng
HGC Engineering **NOISE | VIBRATION | ACOUSTICS**
Howe Gastmeier Chapnik Limited
t: 905.826.4044

From: Michael Blake [mailto:Michael.Blake@Durham.ca]
Sent: October-17-13 3:03 PM
To: Sheeba Paul
Subject: RE: road traffic data request

Hi Sheeba,

Here is our traffic forecast for Reach Road in Uxbridge.

Thanks,

Mike

APPENDIX B

Sample Stamson Calculations

```
STAMSON 5.0        NORMAL REPORT        Date: 22-02-2018 15:48:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: a.te                 Time Period: Day/Night 16/8 hours
Description:  Daytime and nighttime sound levels at prediction location
[A], Rear Lane Townhomes “Block 10” fronting onto Reach Street

Road data, segment # 1: Reach Street (day/night)
-----------------------------------------------
Car traffic volume  :  8100/900   veh/TimePeriod  *
Medium truck volume :   360/40    veh/TimePeriod  *
Heavy truck volume  :   540/60    veh/TimePeriod  *
Posted speed limit  :    50 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):  10000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :  10.00
    Medium Truck % of Total Volume     :   4.00
    Heavy Truck  % of Total Volume     :   6.00
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: Reach Street (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  :  19.00 / 19.00  m
Receiver height           :   3.00 / 3.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Reach Street (day)
---------------------------------------

Source height = 1.57 m

ROAD (0.00 + 63.76 + 0.00) = 63.76 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
---
   -90     90   0.61  66.80   0.00  -1.66  -1.38   0.00   0.00   0.00
63.76
-------------------------------------------------------------------------
---

Segment Leq : 63.76 dBA

Total Leq All Segments: 63.76 dBA
```

```
Results segment # 1: Reach Street (night)
----------------------------------------

Source height = 1.57 m

ROAD (0.00 + 57.23 + 0.00) = 57.23 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
---
   -90     90   0.61  60.27   0.00  -1.66  -1.38   0.00   0.00   0.00
57.23
-------------------------------------------------------------------------
---

Segment Leq : 57.23 dBA

Total Leq All Segments: 57.23 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.76
                           (NIGHT): 57.23
```

```
STAMSON 5.0        NORMAL REPORT        Date: 22-02-2018 15:49:48
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: bola.te              Time Period: 16 hours
Description:  Daytime sound levels at prediction location [B], OLA with
exposure to Reach Street, with mitigation

Road data, segment # 1: Reach Street
----------------------------------
Car traffic volume  :  8100 veh/TimePeriod  *
Medium truck volume :   360 veh/TimePeriod  *
Heavy truck volume  :   540 veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: Reach Street
----------------------------------
Angle1   Angle2           : -90.00 deg   55.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  25.00 m
Receiver height           :   1.50 m
Topography                :      2       (Flat/gentle slope; with
barrier)
Barrier angle1            : -90.00 deg   Angle2 : 55.00 deg
Barrier height            :   2.10 m
Barrier receiver distance :   7.00 m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: Reach Street
----------------------------------

Source height = 1.57 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.57 !        1.50 !        1.52 !         1.52

ROAD (0.00 + 55.44 + 0.00) = 55.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
---
   -90     55   0.53  66.80   0.00  -3.40  -1.83   0.00   0.00  -6.13
55.44
```

```
--------------------------------------------------------------------------------
---

Segment Leq : 55.44 dBA

Total Leq All Segments: 55.44 dBA

TOTAL Leq FROM ALL SOURCES:       55.44
```