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ENVIRONMENTAL NOISE IMPACT STUDY

"2294-2300 QUEENSWAY DRIVE"

City of Burlington
Municipality of Halton Region

Prepared for:

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Oct 23, 2020
PROVINCE OF ONTARIO

REVISED OCTOBER 2020

Our File No: 19-1199

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1.0 INTRODUCTION

dBA Acoustical Consulting Inc. has been retained to conduct a noise impact study on behalf of Waggy Inc. for the proposed "2294-2300 Queensway Drive" townhouse development, located in Burlington, ON.

The purpose of the study is to determine the noise impact from the QEW and Queensway Drive vehicular traffic and area stationary noises that may impact the proposed residential development, as required for RZ/OPA/ Subdivision application approval for the City of Burlington. Proposed for the site are (4) four Blocks of residential dwellings consisting of a total of 24, twenty-four (3) three storey townhouse units. Block 4 consisting of 8, three storey back-to-back townhouse units with rooftop terraces.

This study will detail noise impact relative to the site plan and recommend noise control measures necessary (if applicable) to meet MOE Publication NPC-300 entitled "Stationary & Transportation Sources-Approval & Planning guidelines while satisfying the planning requirements of the City of Burlington, MTO, and the Region of Halton. CN Rail Warning Clauses are not required as the tracks are more than 300m from the proposed site. There are no Stationary noise impacts in the general area that would impact the site development.

Vibration is not considered as there are no heavy industrial operations in the proposed development. Aircraft is not a concern as the development is located outside the NEF 25 contour of the area. The CN Rail is located 320m north of the proposed development site. Due to extensive noise levels from the QEW, the major roadway, distance separation, and shielding from the QEW, CN Rail will have no acoustical impact on the proposed site. See attached Figure 1.

2.0 SITE DESCRIPTION

The proposed site property north façades are located (30m) on the south side of the Queensway Drive and approximately 122m south of the QEW (HWY 403). To the east is Guelph Line located approximately 650m from the proposed development site. Located on Queensway Drive to the west are existing commercial properties and to the east are residential properties.

The QEW is partially shielded by existing earth berms to the west and the angle to which the QEW turns at Brant Street. The earth berm to the west of the proposed development site has an average height of 5-6m above the development site grade elevations. Queensway Drive traffic is considered in this report and the traffic volumes are low compared to the AADT of the QEW. The site plan attached has included the required MTO 14m setback from the QEW road allowance. Site Plan is attached in Figure 2.

The QEW is an 8-lane highway and is the main noise source located approximately122m north from the building façade of the proposed development. The QEW has a posed speed of 100 km/hr. and runs east to west from the proposed site. The QEW has been separated into two segments for distances. The earth berms of the QEW to the west of the proposed site provides shielding of traffic due to the elevation difference. The posted QEW speed limit is 100 km/hr.

Queensway Drive is a 2-lane roadway and located approximately 30m from the north front facades of Block 1 and Block 4 of the proposed residential development. The posted speed for Queensway Drive is 50 km/hr.

3.0 NOISE IMPACT ASSESSMENT

3.1 NOISE CRITERIA

The Ministry of Environment (MOE) specifies limits for road noise relative to new residential developments.

The MOE Publication NPC-300 entitled "Stationary & Transportation Sources-Approval & Planning, specifies the criteria, summarized as follows:

TABLE1- Road Traffic Sound Levels Limits	
Time Period	**Leq (dBA)**
07:00 – 23:00 (16 hr.)	55 Outdoor Living area
07:00 – 23:00 (16 hr.)	55 Plane of Window
23:00 – 07:00 (8 hr.)	50 Plane of Bedroom window

The OLA refers to an outdoor terrace or other area where outdoor passive recreation is expected. Noise levels are calculated at the upper storey bedroom window to represent nighttime (23:00-0700) periods.

Where noise levels estimated at the first-floor window (POW) are equal to or less than the values listed in Table 1, no noise control measures are required. Where noise levels exceed Table 1 values, the following action is required:

TABLE 2 –Noise Control Requirements		
Time Period	**Noise Level Leq (dBA)**	**Action Required**
07:00 - 23:00 Daytime (OLA)	56 to 60	Warning Clause Type "A"
	> 60	Barrier & Warning Clause Type "B"
07:00 – 23:00 Daytime (POW)	>55	Provision for A/C, Warning Clause "C"
	>65	Central A/C, Warning Clause "D"
	>65	Building Component Specification
23:00 to 07:00 Nighttime (POW)	> 50	Provision for A/C and Warning Clause Type "C"
	> 60	Building Component Specification
	> 60	Central Air and Warning Clause Type "D"

Where nighttime noise levels exceed 60 dBA, building components must be designed to meet Table 3 indoor sound level limits.

TABLE 3 - Indoor Road Sound Levels Limits	
Indoor Location	**Leq (dBA)**
	Road
Living/Dining/ Bedroom 7:00 – 23:00	45
Living/Dining/ Bedroom 23:00 - 07:00	40

3.2 ROAD NOISE

Predicted road traffic noise levels were calculated for both the QEW and Queensway Drive, the major road noise sources in the area. Road traffic volumes for Queensway Drive AADT 2015 (Annual Average Daily Traffic) were sourced by the City of Burlington 2016 AADT Map Traffic Data. (See Appendix "A"). The current QEW road traffic volumes AADT 2016 (Annual Average Daily Traffic) were sourced by the MTO website. See Appendix "A"

The MOE computer program STAMSON version 5.04 was used to carry out prediction calculations (See Appendix "A"). Traffic data is summarized in Table 4. The daytime/nighttime volume ratios relative to QEW is calculated using a 66/33 split and the MTO require the noise levels be calculated over a 24-hour period.

The QEW, an 8-lane roadway, has a maximum posted speed for all vehicles of 100 km/hr. The percentage of annual growth for the QEW was figured at 2.0% over 13 years. The AADT (Annual Average Daily Traffic) volumes were used considered the worst-case scenario.

QEW Truck volumes were factored at 8% medium and 12% heavy of the total vehicle volumes Table 5A summarizes the "free field" traffic noise prediction results, modeled at 6 receptor locations representative of the 1st and 3rd floor north facades, 1st and 3rd floor west and east facades as well as the rear yard outdoor amenity area proposed for Block 2throughout the proposed development. (See Figure 3 Receptor Locations).

The daytime/nighttime volume ratio relative to Queensway Drive, is calculated using an 90/10 split, as required by the MOE. The percentage of annual growth was figured at 2.0% over 14 years, volumes used are reflective of the worst-case scenario. Truck volumes were factored at 2.0% medium and 1.5% heavy of the total vehicle volumes for Queensway Drive. Table 5 summarizes the "free field" traffic noise prediction results, modeled at 6 receptor locations.

TABLE 4 – Future Road Traffic Volumes

QEW	AADT 209694 Vehicles		
	Cars	Medium Trucks	Heavy Trucks
East Bound	55921	5592	8388
West Bound	55921	5592	8388
Queensway Drive	**AADT 10750 Vehicles**		
	Cars	Medium Trucks	Heavy Trucks
Day	9433	97	145
Night	1048	11	16

The following Table 5A summarizes the QEW "free field" traffic noise prediction results, modeled at six receptor locations represents the north façade, east and west façades, and the OLA within the proposed development. (see Figure 3 Receptor Locations).

TABLE 5A – Predicted Combined Queensway Drive & QEW (East/West) Future Traffic Noise (dBA)

Location	07:00 – 23:00	23:00 – 07:00
R1- Blocks 1 & 4 (QEW)	63(1)	63(1)
R2- Blocks 1 & 4 (QEW)	70(2)	70(2)
R3- Blocks 1 & 4 (QEW) East & West Facades	63(1)	63(1)
R4- Blocks 1 & 4 (QEW) East & West Facades	62(2)	62(2)
R5- Block 1 – Ground Floor OLA (3M Noise Wall)	55(1)	NA
R6- Block 2 – Ground Floor OLA	49(1)	NA

(1) 2.0m receiver height (2) 7.0m receiver height

The following Table 5B summarizes Queensway Drive "free field" traffic noise prediction results, modeled at one receptor location represents the north façade of Blocks 1 & 4 of the proposed development. Road surface was considered reflective source and is considered the worst-case scenario for Queensway Drive traffic noise.

TABLE 5B – Predicted Queensway Drive Future Traffic Noise (dBA)		
Location	**07:00 – 23:00**	**23:00 – 07:00**
R1- Blocks 1 & 4 (Queensway Dr)	61 (1)	54 (2)

(1) 2.0m receiver height (2) 7.0m receiver height

The following Table 5C summarizes the "Combined" QEW & Queensway Drive traffic noise prediction results, modeled at six receptor locations represents the north façade, east and west façades and Block 1 rear yard OLA, within the proposed development. Traffic noise level from Queensway Drive & the QEW are combined in the following Table 5C. Traffic noise from Queensway Drive is below 10dba from the QEW traffic noise therefore; the QEW traffic noise is the predominant traffic noise source and Queensway Drive has little acoustical impact on the proposed development.

TABLE 5C – Combined QEW & Queensway Drive Future Traffic Noise (dBA)		
Location	**07:00 – 23:00**	**23:00 – 07:00**
R1- Blocks 1 & 4 (QEW)	70 (1)	70 (1)
R2- Blocks 1 & 4 (QEW)	72 (2)	72 (2)
R3- Blocks 1 & 4 (QEW) East & West Facades	67 (1)	67 (1)
R4- Blocks 1 & 4 (QEW) East & West Facades	69 (2)	69 (2)
R5- Block 3 (QEW) North Facades	66 (1)	66 (1)
R6- Blocks 3 (QEW) North Facades	67 (2)	67 (2)

(1) 2.0m receiver height (2) 7.0m receiver height

4.0 RECOMMENDATIONS - NOISE CONTROL

4.1 OUTDOOR NOISE LEVELS

Calculated road noise levels exceed the 55 dBA daytime criteria outlined in Table 1. The proposed development includes outdoor amenity spaces for the east Block 1 and a 3.0m noise barrier is required to mitigate the noise levels within the MOE noise criteria. Building 4 has proposed rooftop terraces that are less than 4m in depth. The rooftop terraces are less than 4.0m in depth and not considered an outdoor amenity space as defined by the MOE, and as such no noise mitigation is required. Although the rooftop terrace is not considered an Outdoor Amenity Area (OLA) sound levels due to increasing road traffic will 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. It is a standard recommendation that either safety glass guard railing or equivalent be considered for these rooftop terraces. dBA further recommends a specific Warning Clause be inserted into all Offers and Agreements of Purchase and Sale or Lease of the units in Block 4 addressing the noise levels from the QEW.

In compliance with MOE guidelines, a noise barrier must have a minimum surface density of 20kg/m^2 and be designed and constructed without cracks or gaps. Any gaps under the noise barrier that are necessary for drainage purposes must be minimized (2") and localized and must not deteriorate acoustical performance. (See Figure 4, Noise Barrier Location)

4.2 INDOOR NOISE LEVELS

Calculated nighttime road noise levels at the Plane of Window (POW) exceed the 50 dBA criteria outlined in Table 1 for indoor spaces for all residential units.

Specific building components (walls, windows, doors etc.) are required and confirmed using the STC (Sound Transmission Class) method and are summarized in Table 6 following, with minimum window, door and wall construction specified throughout the development. The STC values are calculated for each room type, based on window to floor ratios of 80%. Whereas the interior room details were not made available during report writing, the STC values must be confirmed once they are considered prior to the building permit issuance. The STC ratings for the walls and windows must ensure that all interior bedrooms and living rooms will achieve the indoor noise levels as noted in Table 3.

TABLE 6 – Recommended Door, Wall, and Window Construction

LOCATION	STC Rating Windows Estimated To Be Used	Wall	Door Construction
All Blocks			
Bedroom	**34**	**EW3**	**D4-sd**
Living room	**34**	**EW3**	**D4-sd**

5.0 VENTILATION / WARNING CLAUSES

Ventilation and warning clause requirements are required for this project as noted in the following Table 7 following. It is recommended that the appropriate warning clauses be inserted into all Offers and Agreements of Purchase and Sale or Lease.

TABLE 7 - Ventilation and Warning Clause Requirements

LOCATION	VENTILATION	WARNING CLAUSE
All Residential Units for All Blocks	Central Air Conditioning	Type "B" and "D"
All Residential Units for Block 4	Central Air Conditioning	Type "A" "B" and "D"

The following are the required warning clauses.

TYPE A: (Block 4)

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

TYPE B: (All Blocks)

"Purchasers/tenants are advised that despite the inclusion of noise control features (Central Air Conditioning Units) in the development and within the buildings units, sound levels due to increasing road traffic (QEW) 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 D: (All Blocks)

"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."

It should be noted that any central air conditioner unit should not be installed in the front yard or front entrance of any residential dwelling. Consideration for rooftop locations of central air conditioning units should be considered if possible.

6.0 SUMMARY OF RECOMMENDATIONS

The following noise control measures are required for this development:

- Table 6 recommends acoustically tested windows, walls, in Section 4.2 to ensure MOE compliance.
- Appropriate ventilation requirements and warning clauses are inserted into all Offers and Agreements of Purchase and Sale or Lease (Section 5, Table 7).
- 3.0m Noise Barrier required for east Block 1 as noted in Figure 4.
- A letter from the Window supplier to conform STC value for windows will be installed to achieve all interior noise levels noted in Table 2.

It is recommended that a Qualified Acoustical Consultant certify that the required noise control measures have been incorporated into the builder's plans, prior to issuance of a building permit.

Prior to issuance of an occupancy permit, it is recommended the Qualified Acoustical Consultant certify that the approved noise control measures have been property installed.

7.0 CONCLUSIONS

dBA Acoustical Consulting Inc. has conducted a noise impact study on behalf of Waggy Inc. for the proposed "2294-2300 Queensway Drive" townhouse development, located in Burlington, ON. The purpose of the study determined the noise impact from the QEW and Queensway Drive vehicular traffic and area stationary noise that may impact the proposed residential development, as required for RZ/OPA/ Subdivision application approval for the City of Burlington.

This noise study detailed noise impact relative to the site plan and recommend noise control measures necessary (Section 6) to meet MOE Publication NPC-300 entitled "Stationary & Transportation Sources-Approval & Planning guidelines while satisfying the planning requirements of the City of Burlington, MTO, and the Region of Halton.

FIGURE 1
SITE LOCATION

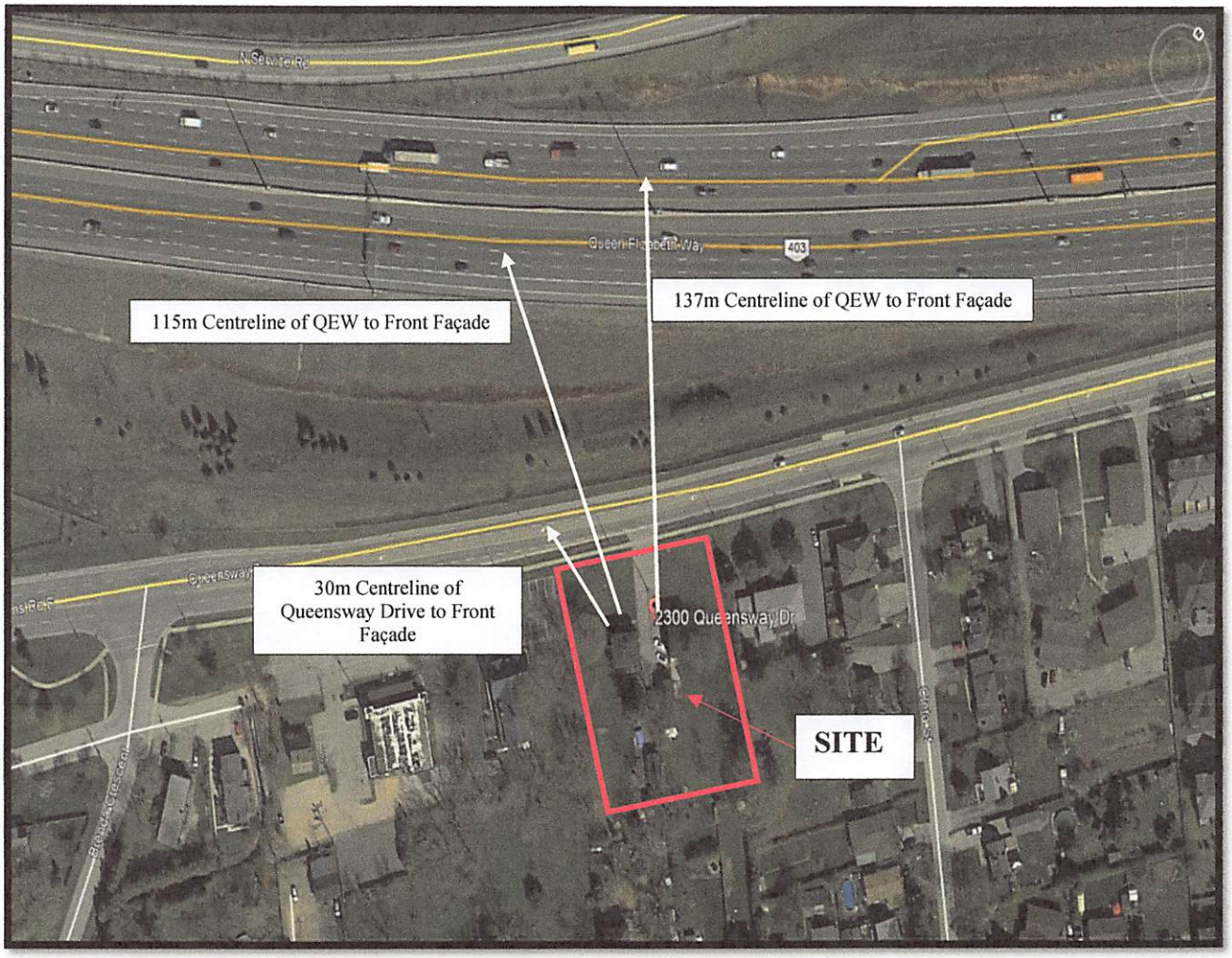


FIGURE 2
SITE PLAN

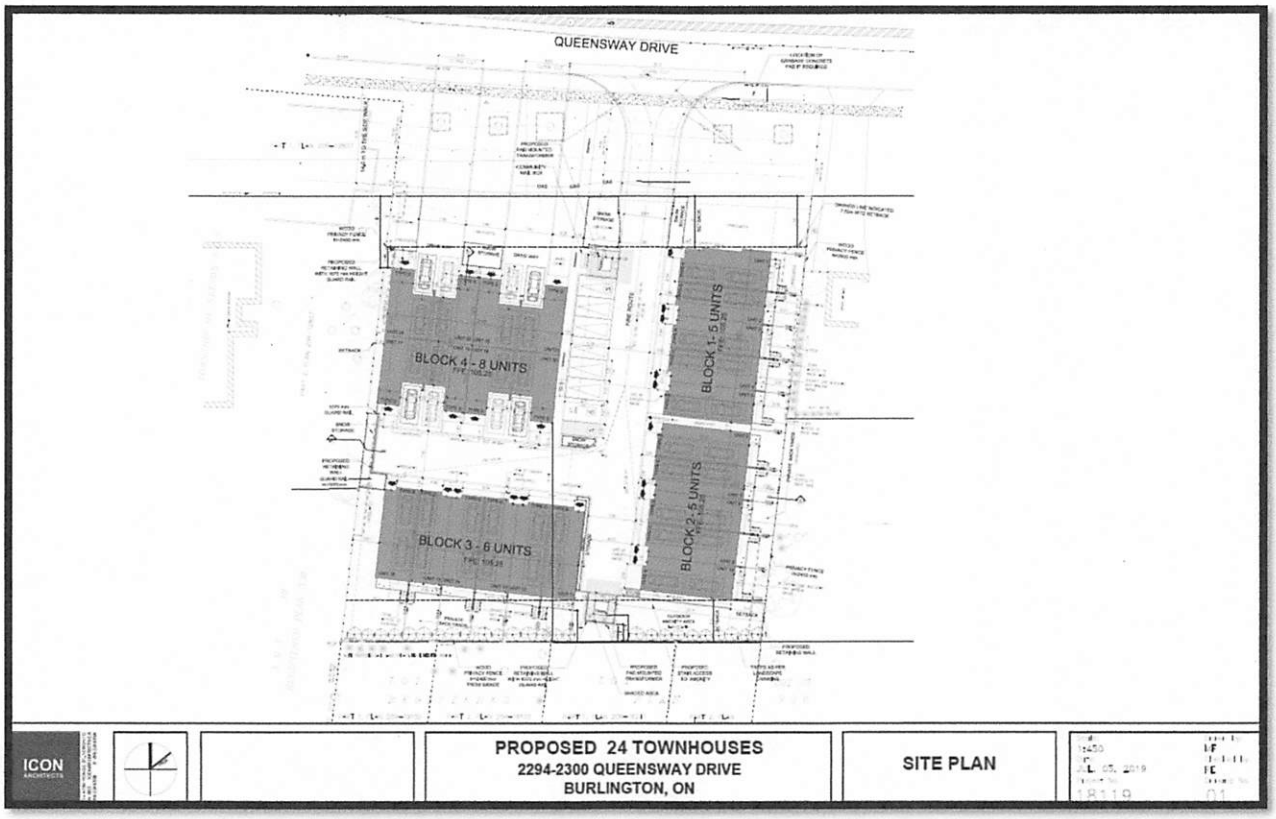


FIGURE 3
RECEPTOR LOCATIONS



R1 – Block 1 & Block 4 – First Floor

R2 – Block 1 & Block 4 – Top Floor

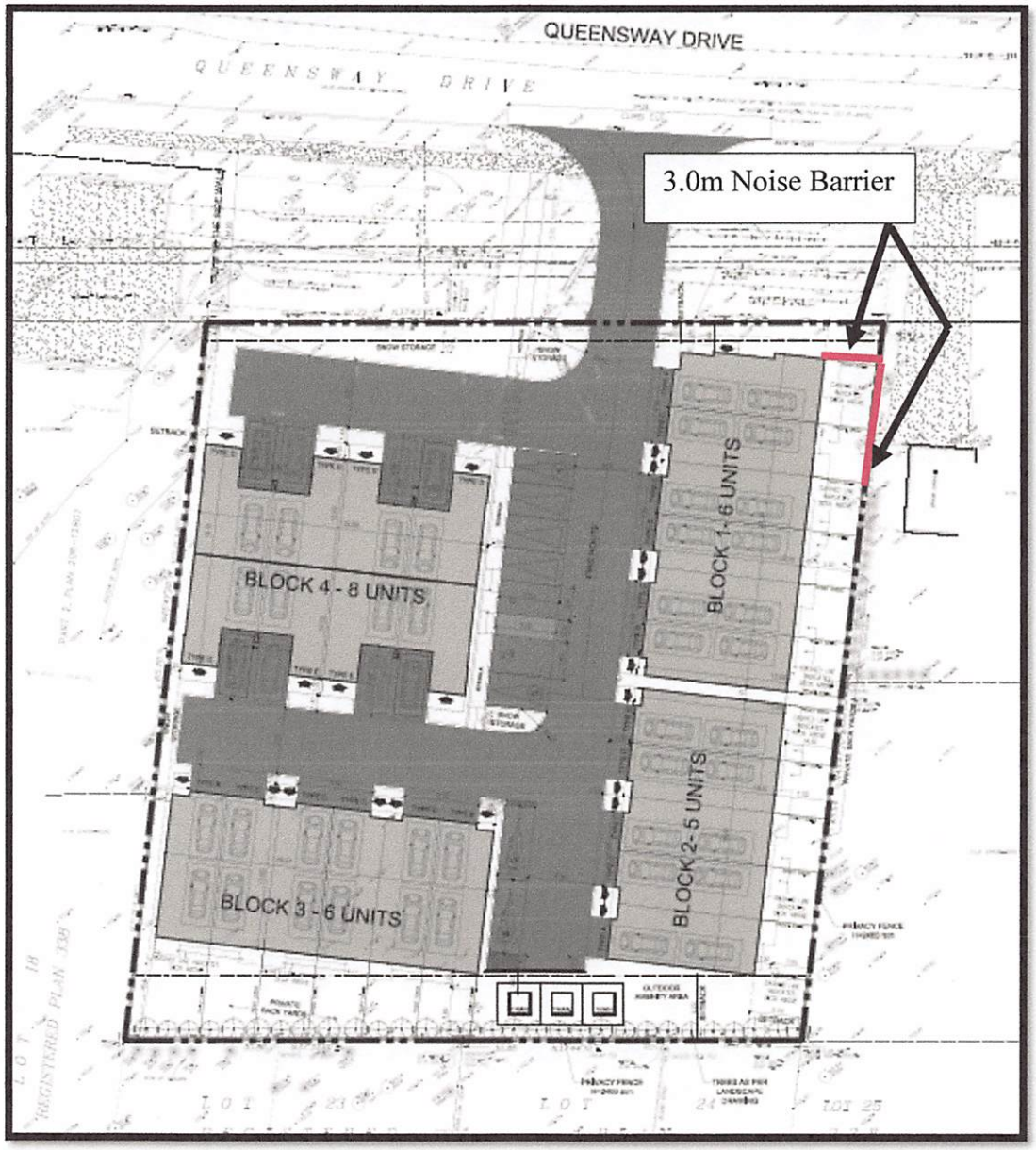
R3 – Block 1 & Block 4 – East & West Facades First Floor

R4 – Block 1 & Block 4 – East & West Facades Top Floor

R5 – Block 1 - Ground Floor OLA

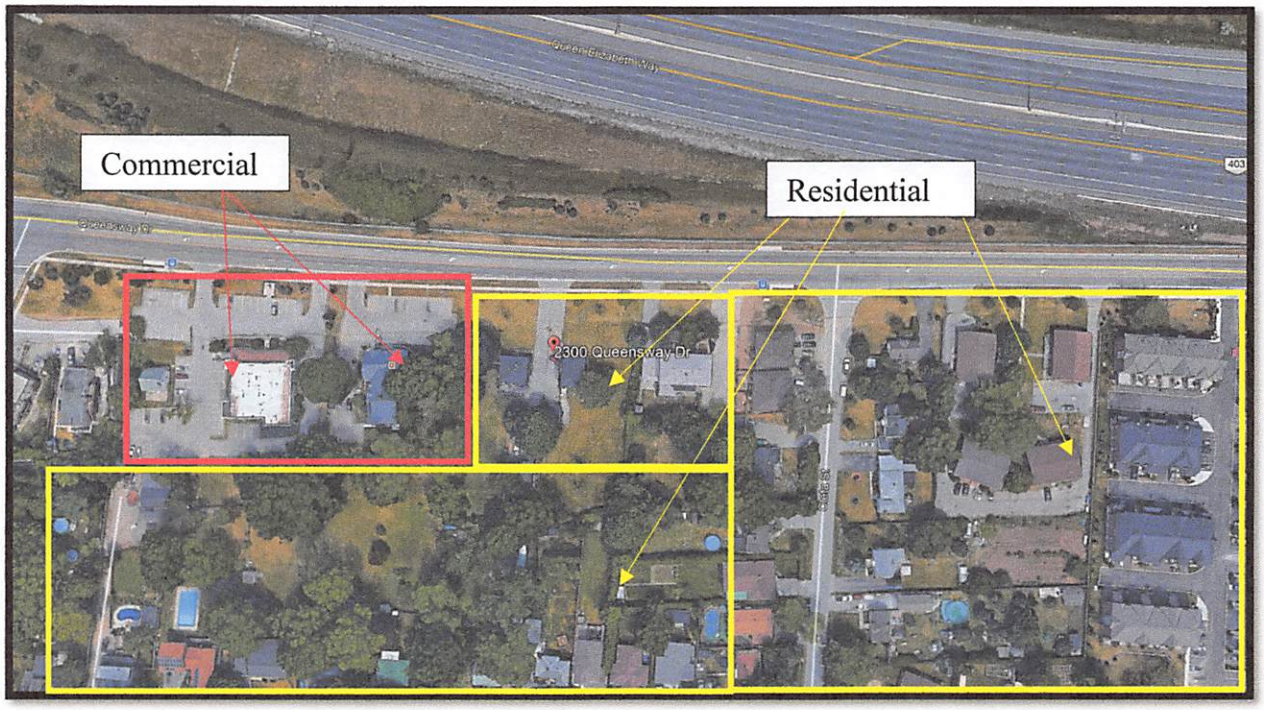
R6 – Block 2 - Ground Floor OLA

FIGURE 4
NOISE BARRIER LOCATIONS



APPENDIX "A"

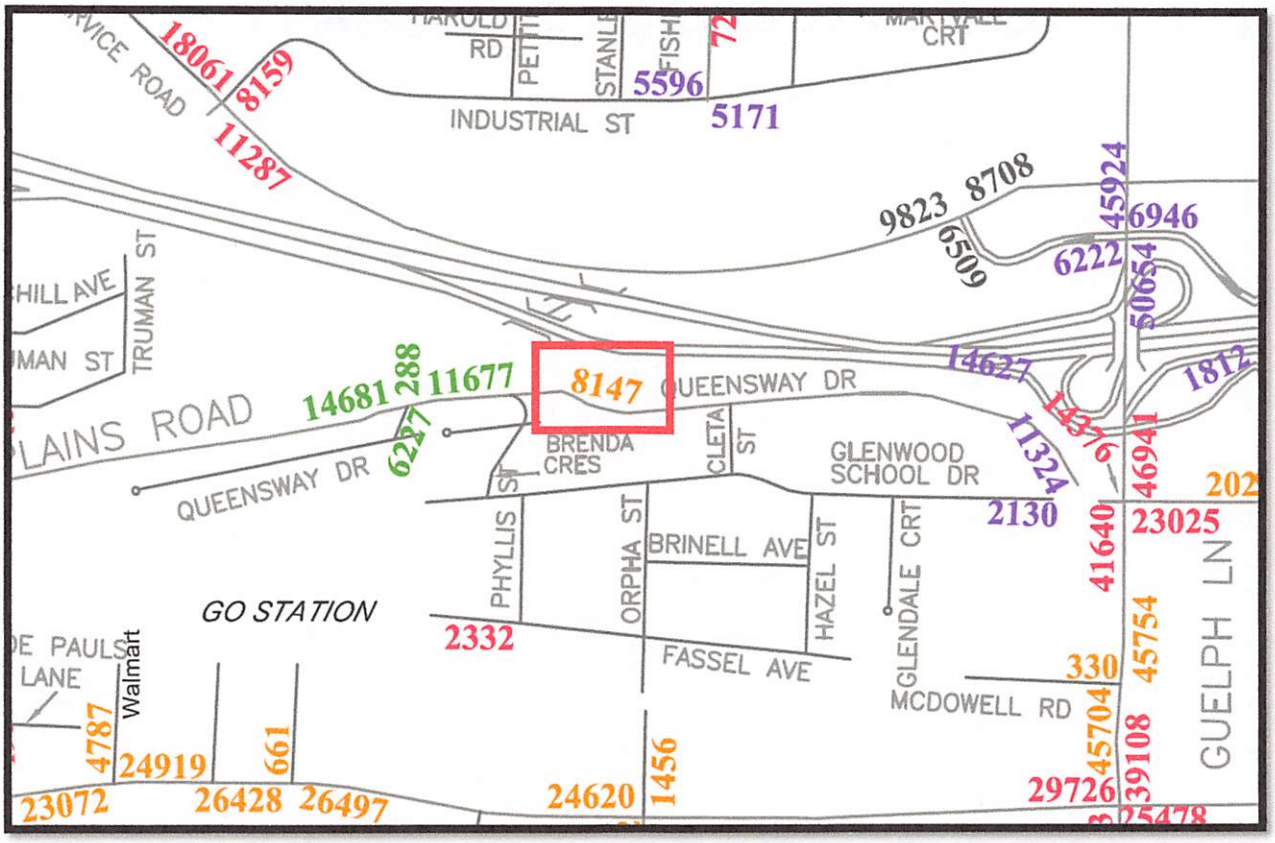
AREA CONCEPT



2016 QEW TRAFFIC DATA

Highway	Location Description From	Location Description To	Dist. (KM)	2016 AADT
QEW	FORT ERIE-GODERICH ST-PEACE BRIDGE PLAZA	CENTRAL AV IC	0.2	14,600
QEW	CENTRAL AV IC	CONCESSION RD IC-1	0.9	18,700
QEW	CONCESSION RD IC-1	THOMPSON RD IC-2	1.0	15,500
QEW	THOMPSON RD IC-2	GILMORE RD IC-5	2.4	17,700
QEW	GILMORE RD IC-5	BOWEN RD IC-7	2.0	24,200
QEW	BOWEN RD IC-7	NETHERBY RD IC-12 NIAGARA FALLS LTS	5.5	25,700
QEW	NETHERBY RD IC-12 NIAGARA FALLS LTS	SODOM RD IC-16	3.2	22,000
QEW	SODOM RD IC-16	LYONS CREEK RD IC-21	6.6	29,000
QEW	LYONS CREEK RD IC-21	MCLEOD RD IC-27	4.4	36,700
QEW	MCLEOD RD IC-27	HWY 420 IC-30	2.9	45,100
QEW	HWY 420 IC-30	THOROLD STONE RD IC-32	2.0	70,400
QEW	THOROLD STONE RD IC-32	MOUNTAIN RD IC-34	2.5	67,400
QEW	MOUNTAIN RD IC-34	HWY 405(WBL)IC-37	2.4	71,000
QEW	HWY 405(WBL)IC-37	GLENDALE AV IC-38	1.3	88,100
QEW	GLENDALE AV IC-38	NIAGARA ST SERVICE RDS	4.8	90,500
QEW	NIAGARA ST SERVICE RDS	NIAGARA ST IC-44	1.2	78,600
QEW	NIAGARA ST IC-44	LAKE ST IC-46	1.6	81,900
QEW	LAKE ST IC-46	ONTARIO ST IC-47	1.3	117,000
QEW	ONTARIO ST IC-47	MARTINDALE RD IC-48	0.7	97,400
QEW	MARTINDALE RD IC-48	HWY 406 IC-49	0.7	74,400
QEW	HWY 406 IC-49	SEVENTH ST IC-51	1.9	97,100
QEW	SEVENTH ST IC-51	JORDAN RD IC-55	4.3	98,100
QEW	JORDAN RD IC-55	VICTORIA AV IC-57	2.8	104,300
QEW	VICTORIA AV IC-57	ONTARIO ST IC-64	6.7	105,100
QEW	ONTARIO ST IC-64	BARTLETT AV IC-68	3.8	99,800
QEW	BARTLETT AV IC-68	MAPLE AV IC-71	2.5	99,300
QEW	MAPLE AV IC-71	CASABLANCA BV IC-74	3.6	107,100
QEW	CASABLANCA BV IC-74	FIFTY RD IC-78	3.5	112,300
QEW	FIFTY RD IC-78	FRUITLAND RD IC-83	5.1	120,300
QEW	FRUITLAND RD IC-83	HAMILTON 20 IC 88-CENTENNIAL PKWY	5.2	119,000
QEW	HAMILTON 20 IC 88-CENTENNIAL PKWY	BURLINGTON ST IC-89	1.6	130,000
QEW	BURLINGTON ST IC-89	EASTPORT RD IC-93 (7189)	4.0	135,000
QEW	EASTPORT RD IC-93 (7189)	HAMILTON HARBOUR ENTRANCE	0.9	149,400
QEW	HAMILTON HARBOUR ENTRANCE	NORTH SHORE BLVD IC 97	2.3	271,300
QEW	NORTH SHORE BLVD IC 97	FAIRVIEW ST IC-99	2.3	161,300
QEW	FAIRVIEW ST IC-99	HWY 403/407 IC-100	1.0	172,900
QEW	HWY 403/407 IC-100	BRANT ST IC 101	0.8	164,300
QEW	BRANT ST IC 101	GUELPH LINE IC-102	1.8	162,100
QEW	GUELPH LINE IC-102	WALKERS LINE IC-105	2.0	195,000
QEW	WALKERS LINE IC-105	APPLEBY LINE IC-107	2.0	190,000
QEW	APPLEBY LINE IC-107	BURLOAK DR IC-109	1.0	195,000

CITY OF BURLINGTON
QUEENSWAY DRIVE TRAFFIC DATA



2016 AADT MAP

LAST REVISION:
JULY 2017

CITY OF Burlington

NOT TO SCALE

Reproduction of this map is prohibited without express permission of the Burlington Transportation Services Department.

Note: The volumes shown are the two-way annual average daily traffic (24 hour period).

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STAMPSON CALCULATIONS

```
STAMSON 5.04        SUMMARY REPORT        Date: 21-10-2020 14:58:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: QuenR1nw.te          Time Period: 24 hours
Description: R1- Blocks 1 & 4 North Facade Facing QEW Free Field (First Floor)
                                        TOTAL Leq FROM ALL SOURCES:      59.07

Road data, segment # 1: QEW Eastbound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QEW Eastbound
-----------------------------------
Angle1   Angle2          : -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 115.00 m
Receiver height          :   2.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           : -90.00 deg   Angle2 : 90.00 deg
Barrier height           : 114.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 109.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 109.00 m
Reference angle          :   0.00

Road data, segment # 2: QEW WestBound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QEW WestBound
-----------------------------------
Angle1   Angle2          : -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 137.00 m
Receiver height          :   2.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           : -90.00 deg   Angle2 : 90.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 108.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 108.00 m
Reference angle          :   0.00

Result summary
--------------
                   !  source  !   Road   !  Total
                   !  height  !   Leq    !   Leq
                   !    (m)   !  (dBA)   !  (dBA)
-------------------+---------+---------+---------
 1.Qew Eastbound   !     1.86 !    54.86 !    54.86
 2.QEW WestBound   !     1.86 !    57.00 !    57.00
-------------------+---------+---------+---------
                     Total                 59.07 dBA
```

```
STAMSON 5.04        SUMMARY REPORT        Date: 02-06-2019 20:40:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R1Queens.te          Time Period: Day/Night 16/8 hours
Description: R1- Queensway Free Field Block 4 North Facade
                              TOTAL Leq FROM ALL SOURCES     (DAY): 61.01
                                                             (NIGHT): 54.47
Road data, segment # 1: Queensway Dr (day/night)
-----------------------------------------------
Car traffic volume  :  9433/1048  veh/TimePeriod  *
Medium truck volume :    97/11    veh/TimePeriod  *
Heavy truck volume  :   145/16    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):   8147
    Percentage of Annual Growth        :   2.00
    Number of Years of Growth          :  14.00
    Medium Truck % of Total Volume     :   1.00
    Heavy Truck  % of Total Volume     :   1.50
    Day (16 hrs) % of Total Volume     :  90.00

Data for Segment # 1: Queensway Dr (day/night)
-----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  14.00 / 14.00  m
Receiver height           :   2.00 / 7.00   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Result summary (day)
--------------------
                    !  source  !   Road   !  Total
                    !  height  !   Leq    !   Leq
                    !   (m)    !  (dBA)   !  (dBA)
--------------------+---------+---------+---------
 1.Queensway Dr     !     1.11 !    61.01 !    61.01
--------------------+---------+---------+---------
                      Total                 61.01 dBA
Result summary (night)
----------------------
                    !  source  !   Road   !  Total
                    !  height  !   Leq    !   Leq
                    !   (m)    !  (dBA)   !  (dBA)
--------------------+---------+---------+---------
 1.Queensway Dr     !     1.10 !    54.47 !    54.47
--------------------+---------+---------+---------
                      Total                 54.47 dBA
```

```
STAMSON 5.04        SUMMARY REPORT        Date: 22-10-2020 16:13:17
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: quenr2nw.te          Time Period: 24 hours
Description: R2- Blocks 1 & 4 North Facade Facing QEW Free Field (Top Floor)

                                                TOTAL Leq FROM ALL SOURCES:      69.63
Road data, segment # 1: QEW Eastbound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QEW Eastbound
-----------------------------------
Angle1   Angle2          : -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 115.00 m
Receiver height          :   7.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           : -90.00 deg   Angle2 : 0.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 109.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 109.00 m
Reference angle          :   0.00

Road data, segment # 2: QEW WestBound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QEW WestBound
-----------------------------------
Angle1   Angle2          : -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 137.00 m
Receiver height          :   7.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           : -90.00 deg   Angle2 : 0.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 108.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 108.00 m
Reference angle          :   0.00

Result summary
--------------
                  !  source  !   Road    !  Total
                  !  height  !   Leq     !   Leq
                  !    (m)   !  (dBA)    !  (dBA)
------------------+---------+---------+---------
 1.Qew Eastbound  !     1.86 !    67.06 !    67.06
 2.QEW WestBound  !     1.86 !    66.14 !    66.14
------------------+---------+---------+---------
                    Total                 69.63 dBA
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STAMSON 5.04        SUMMARY REPORT        Date: 22-10-2020 16:30:12
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: quenr3nw.te          Time Period: 24 hours
Description: R3- Blocks 1 & 4 East & West Facade Facing QEW Free Field (First Floor)
                                                TOTAL Leq FROM ALL SOURCES:      57.28

Road data, segment # 1: QEW Eastbound
-------------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QEW Eastbound
-----------------------------------
Angle1   Angle2           :  -0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 115.00 m
Receiver height           :   2.00 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :   0.00 deg   Angle2 : 90.00 deg
Barrier height            :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation          : 109.00 m
Receiver elevation        : 102.00 m
Barrier elevation         : 109.00 m
Reference angle           :   0.00

Road data, segment # 2: QEW WestBound
-------------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QEW WestBound
-----------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 137.00 m
Receiver height           :   2.00 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation          : 108.00 m
Receiver elevation        : 102.00 m
Barrier elevation         : 108.00 m
Reference angle           :   0.00

Result summary
--------------
                   !  source  !   Road   !  Total
                   !  height  !   Leq    !   Leq
                   !    (m)   !  (dBA)   !  (dBA)
-------------------+---------+---------+---------
 1.Qew Eastbound   !     1.86 !    54.49 !    54.49
 2.QEW WestBound   !     1.86 !    54.03 !    54.03
-------------------+---------+---------+---------
                     Total                 57.28 dBA
```

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STAMSON 5.04        SUMMARY REPORT        Date: 22-10-2020 19:35:11
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: quenr5nw.te          Time Period: 24 hours
Description: R4- Blocks 1 & 4 East & West Facade Facing QEW Free Field (TOP Floor)
                                TOTAL Leq FROM ALL SOURCES:       62.03

Road data, segment # 1: QEW Eastbound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QEW Eastbound
-----------------------------------
Angle1   Angle2          :  -0.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 115.00 m
Receiver height          :   7.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           :  -0.00 deg   Angle2 : 90.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 109.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 109.00 m
Reference angle          :   0.00

Road data, segment # 2: QEW WestBound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QEW WestBound
-----------------------------------
Angle1   Angle2          :  -0.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 137.00 m
Receiver height          :   7.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           :  -0.00 deg   Angle2 : 90.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 108.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 108.00 m
Reference angle          :   0.00

Result summary
--------------
                   !  source  !   Road   !  Total
                   !  height  !   Leq    !   Leq
                   !    (m)   !  (dBA)   !  (dBA)
-------------------+---------+---------+---------
 1.Qew Eastbound   !     1.86 !    58.98 !    58.98
 2.QEW WestBound   !     1.86 !    59.05 !    59.05
-------------------+---------+---------+---------
                     Total                 62.03 dBA
```

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STAMSON 5.04        SUMMARY REPORT        Date: 22-10-2020 18:11:39
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: quenr5nw.te          Time Period: 24 hours
Description: R5- Block 1 OLA East Ground Floor OLA 3.0m Barrier
                                   TOTAL Leq FROM ALL SOURCES:   55.14

Road data, segment # 1: QEW Eastbound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QEW Eastbound
-----------------------------------
Angle1   Angle2          :  -90.00 deg   90.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 115.00 m
Receiver height          :   2.00 m
Topography               :      2      (Flat/gentle slope; with barrier)
Barrier angle1           :   0.00 deg   Angle2 : 90.00 deg
Barrier height           :   3.00 m
Barrier receiver distance :  3.00 m
Source elevation         : 109.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 109.00 m
Reference angle          :   0.00

Road data, segment # 2: QEW WestBound
-----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QEW WestBound
-----------------------------------
Angle1   Angle2          : -90.00 deg   0.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 137.00 m
Receiver height          :   2.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           : -90.00 deg   Angle2 : 0.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 108.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 108.00 m
Reference angle          :   0.00

Result summary
--------------
                  !  source  !   Road   !  Total
                  !  height  !   Leq    !   Leq
                  !    (m)   !  (dBA)   !  (dBA)
------------------+---------+---------+---------
 1.Qew Eastbound  !     1.86 !    48.67 !    48.67
 2.QEW WestBound  !     1.86 !    54.03 !    54.03
------------------+---------+---------+---------
                    Total                 55.14 dBA
```

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STAMSON 5.04        SUMMARY REPORT        Date: 22-10-2020 19:35:19
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: quenr7nw.te          Time Period: 24 hours
Description: R6- Above Grade Level OLA
                                   TOTAL Leq FROM ALL SOURCES:       48.79
Road data, segment # 1: QEW Eastbound
----------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 1: QEW Eastbound
----------------------------------
Angle1   Angle2          :  -0.00 deg   20.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 170.00 m
Receiver height          :   5.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           :  -0.00 deg   Angle2 : 20.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 109.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 109.00 m
Reference angle          :   0.00

Road data, segment # 2: QEW WestBound
-------------------------------------
Car traffic volume  : 83877 veh/TimePeriod  *
Medium truck volume :  8388 veh/TimePeriod  *
Heavy truck volume  : 12582 veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

Data for Segment # 2: QEW WestBound
----------------------------------
Angle1   Angle2          :  -0.00 deg   20.00 deg
Wood depth               :      0       (No woods.)
No of house rows         :      0
Surface                  :      1       (Absorptive ground surface)
Receiver source distance : 189.00 m
Receiver height          :   5.00 m
Topography               :      2       (Flat/gentle slope; with barrier)
Barrier angle1           :  -0.00 deg   Angle2 : 20.00 deg
Barrier height           :   6.00 m
Barrier receiver distance :  47.00 m
Source elevation         : 108.00 m
Receiver elevation       : 102.00 m
Barrier elevation        : 108.00 m
Reference angle          :   0.00

Result summary
--------------

                  !  source  !   Road   !  Total
                  !  height  !   Leq    !   Leq
                  !   (m)    !  (dBA)   !  (dBA)
--------------------+---------+---------+---------
 1.Qew Eastbound    !     1.86 !    45.55 !    45.55
 2.QEW WestBound    !     1.86 !    46.00 !    46.00
--------------------+---------+---------+---------
                     Total                  48.79 dBA
```

EXTERIOR WALL STC RATINGS

EXTERIOR WALL STC RATINGS

Wall Configuration	EW1	EW2	EW3	EW4	EW1R	EW2R	EW3R	EW5	EW4R	EW6	EW7 EW5R	EW8
STC Rating	**38**	**40**	**43**	**46**	**47**	**48**	**49**	**54**	**55**	**57**	**58**	**62**

Source: National Research Council, Division of Building Research

NOTES:

1 The common structure of walls EW1 to EW5 is composed of 12.7mm gypsum board, vapour barrier and 38x89 mm studs with 50 mm (or thicker) mineral wool or glass fibre batts in inter-stud cavities.

- EW1 denotes the common structure, plus sheathing, plus wood siding or metal siding and fibre backer board
- EW2 denotes the common structure, plus rigid insulation (25 to 30 mm), and wood siding or metal siding and fibre backer board.
- EW3 denotes simulated mansard with the common structure, plus sheathing, 28 X89 mm framing, sheathing and asphalt roofing material
- EW4 denotes the common structure, plus sheathing and 20 mm stucco.
- EW5 denotes the common structure, plus sheathing, 25 mm air space, 100mm brick veneer.
- EW6 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25 to 50 mm), 100 mm back-up block 100 mm face brick.
- EW7 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25 to 50 mm), 140mm back-up block, 100 mm face brick.
- EW8 denotes exterior wall composed of 12.7 mm gypsum board, rigid insulation (25 to 50 mm), 200 mm concrete.

2 R signifies the mounting of the interior gypsum board on resilient clips.

3 An exterior wall conforming to rainscreen design principles and composed of 12.7 mm gypsum board, 100 mm concrete block, rigid insulation (25 to 50 mm), 25 mm air space, and 100 mm brick veneer has the same STC as EW6.

4 An exterior wall described in EW1 with the addition of rigid insulation (25 to 50 mm) between the sheathing and the external finish has the same STC as EW2.