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Noise Impact Assessment

CTM Design Services Ltd.

Shell Canada Gas Station
1440 Prince of Wales Drive Ottawa

Prepared For:

Ms. Amina Oyakhilome
CTM Design Services Ltd.

Prepared By:

Mr. Hossein Mehravaran, P.L.(Eng.), Ph.D., INCE
Mr. James Farquharson, C.E.T., INCE

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Sound Advice • Sound Delivery

Executive Summary

CTM Design Services Ltd. (CTM) wanted to determine the environmental noise impact of the proposed Shell Canada Limited (Shell) Gas Station at 1440 Prince of Wales Drive in the City of Ottawa, Ontario. The assessment was commissioned in response to the feedback received from the City of Ottawa on August 3, 2023 on the Proposed Site Plan Control Application – 1440 Prince of Wales. CTM retained the services of FDI Acoustics to complete a Noise Impact Assessment for the proposed development to determine compliance with the Exclusion Limit Values of the Environmental Noise Guideline NPC-300 prepared by Ontario Ministry of the Environment (NPC-300)[1], City of Ottawa Environmental Noise Control Guidelines (ENCG)[2], and City of Ottawa Noise By-Law No. 2017 – 255[3]. The assessment also provides the foundation to develop noise control measures for the equipment and operations assessed should the predicted sound levels exceed the Exclusion Limit Values of NPC-300 and ENCG.

Octave band sound pressure levels related to the significant noise sources identified with the proposed gas station equipment operations were assigned from a combination of manufacturer's data, FDI Acoustics' sound pressure level measurement library, or values were calculated following schemes as presented in texts[4,5]. Following accepted acoustic evaluation practices, the sound pressure level data was used to calculate octave band sound power level values for the significant noise sources associated with the proposed gas station operations. The sound power levels were entered in the Softnoise GmbH Predictor™ Type 7810 noise propagation modelling software. The environmental noise propagation computer model calculates the sound level contribution of the gas station operations at the most impacted and interest reception points following the requirements of the ENCG and NPC-300. The nearest residences are east of the development site.

Executive Summary (continued)

Table ES-1 presents the results of the modeling along with the exclusion limit values for the receiver locations at the most impacted floor.

Table ES-1
Predicted Sound Levels
Shell Gas Station 1440 Prince of Wales Drive Ottawa

Receiver Location & Sound Level Description	07:00 – 23:00 Sound Level (L_{eq} dBA)	23:00 – 07:00 Sound Level (L_{eq} dBA)
Plane of Window of Noise Sensitive Spaces		
R1 (1435 Prince of Wales Dr Ottawa, ON) – 4th Floor	**46.7**	**44.8**
R2 (9-955 Dynes Rd #55, Ottawa, ON) – 2nd Floor	**34.5**	**31.2**
R3 (2-960 Debra Ave, Ottawa, ON) – 1st Floor	**35.9**	**26.3**
R4 (913 Meadowlands Dr, Ottawa, ON) – 1st Floor	**40.0**	**31.9**
R5 (894 Meadowlands Dr Ottawa ON) – 1st Floor	**44.6**	**39.4**
R6 (1485 Prince of Wales Dr, Ottawa, ON) – 1st Floor	**35.8**	**31.9**
Exclusion Limit Values of One-Hour Equivalent Sound Level / Class 1 Area (Noise Sensitive Space)	**50.0**	**45.0**

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The results of the environmental noise propagation model indicate the predicted sound levels from the proposed Shell Gas Station comply with the daytime and nighttime of the exclusion limit values of ENCG and NPC-300 at the assessed receivers.

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Scope of Work

CTM Design Services Ltd. (CTM) wanted to determine the environmental noise impact of the proposed Shell Canada Limited (Shell) Gas Station at 1440 Prince of Wales Drive in the City of Ottawa, Ontario. The assessment was commissioned in response to the feedback received from the City of Ottawa on August 3, 2023 on the Proposed Site Plan Control Application – 1440 Prince of Wales. CTM retained the services of FDI Acoustics to complete a Noise Impact Assessment for the proposed development to determine compliance with the Exclusion Limit Values of the Environmental Noise Guideline NPC-300 prepared by Ontario Ministry of the Environment (NPC-300)[1], City of Ottawa Environmental Noise Control Guidelines (ENCG)[2], and City of Ottawa Noise By-Law No. 2017 – 255[3]. The assessment also provides the foundation to develop noise control measures for the equipment and operations assessed should the predicted sound levels exceed the Exclusion Limit Values of NPC-300 and ENCG.

Method

Octave band sound pressure levels related to the significant noise sources identified with the proposed gas station equipment operations were assigned from a combination of manufacturer's data, FDI Acoustics' sound pressure level measurement library, or values were calculated following schemes as presented in texts[4,5]. Following accepted acoustic evaluation practices, the sound pressure level data was used to calculate octave band sound power level values for the significant noise sources associated with the proposed gas station operations. Plans for the development were provided by CTM. The development area information supplied by CTM was supplemented with information from government and commercial sources. This information formed the input for an environmental noise propagation computer model that calculates the sound level contribution of the gas station at the noise sensitive zones near the gas station development site.

The results of the model are presented as the individual component sound levels of the proposed gas station equipment, the overall gas station facility sound level contribution, the predicted sound levels for the receiver locations under assessment, and a study area noise contour map. The results are reviewed with the predicted sound levels compared with the applicable exclusion limit values to determine compliance. Should the results exceed either the daytime or nighttime exclusion limit values; noise control measures may be developed and evaluated within the noise propagation model. The predicted sound level contribution for each noise control measure after implementation may be reported for the point of interest. Acoustical specifications related to the recommendations are included in the report.

Environmental Noise Regulation Criteria

Noise By-Law No. 2017 - 255, a By-Law of the City of Ottawa respecting noise whereas it is in the public interest to reduce the noise level in the City of Ottawa, to preserve, protect and promote public health, safety, welfare and peace and quiet of the inhabitants of the city. In this by-law there are several definitions, sound level limits, prohibitions, enforcements, and exemptions as follows:

Noise By-Law No. 2017 – 255, Definitions Section 1:

> "Point of reception" means any point on the premises of a person where sound or vibration originating from other than those premises are received.

Noise By-Law No. 2017 – 255, Sound Reproduction or Amplification Devices Section 4:

(1) No person shall operate or use or cause to be operated or used any sound reproduction device between 2300 hours of one day and 0700 hours of the next day so as to disturb the peace and comfort of,
   a. any person in any dwelling house, apartment house, hotel or other type of residence; or
   b. any owner or operator of a business in his or her place of business.

(2) Despite subsection (1), no person shall operate or use or cause to be operated or used any sound reproduction device so as to disturb the peace and comfort of:
   a. any person in any dwelling house, apartment house, hotel or other type of residence before 0900 hours on any Saturday; or
   b. any person in any dwelling house, apartment house, hotel or other type of residence before 1200 hours on any Sunday or statutory or public holiday; or
   c. any owner or operator of a business in his or her place of business before 0900 hours on any Saturday; or
   d. any owner or operator of a business in his or her place of business before 1200 hours on any Sunday or statutory or public holiday.

(6) No person shall operate or use or cause to be operated or used any sound reproduction device originating from or in connection with the operation of any commercial establishment between 0700 hours and 2300 hours of the same day, the noise from which sound reproduction device when measured in any business, dwelling house, apartment house, hotel or any other type of residence has an equivalent sound level (Leq) greater than 45 dB(A).

(7) No person shall operate or cause to be operated or used any sound reproduction device between 0700 hours and 2300 hours of the same day, the noise from which sound reproduction device has an equivalent sound level (Leq) greater than 55 dB(A) when measured outside of the business, dwelling house, apartment house, hotel or other residence, at or inside the property line of the business owner or person whose peace and comfort has been disturbed.

Environmental Noise Regulation Criteria (continued)

(10) Assessment of noise complaints may be undertaken at the point of reception of the noise for the purposes of confirming a violation.

Noise By-Law No. 2017 – 255, Air Conditioners, Heat Pumps, Compressors, Chillers, Cooling Towers and Similar Devices Section 5:

> No person shall use or operate or cause to be used or operated any air conditioner, heat pump, compressor, condenser, chiller, cooling tower or similar device, the noise from which has a level greater than 50 dB(A) when measured at the point of reception.

Noise By-Law No. 2017 – 255, Exhaust Fan, Exhaust System, Intake Fan Generators, Commercial Dryers and Similar Devices Section 6 Subsection (1):

(1) No person shall use or operate or cause to be used or operated any exhaust fan, exhaust system, intake fan, generators, dryer in a commercial car wash or similar device which includes combustion exhaust of a high efficiency furnace, the noise from which has a level greater than 50 dB(A) when measured at the point of reception.

Noise By-Law No. 2017 – 255, Deliveries Section 11 Subsection (1):

(1) No person shall cause or permit the delivery of any goods, wares, merchandise or commodities from any vehicle to the owner, lessee, tenant or occupier of any premises between the hours of 2300 hours of one day and 0700 hours of the next day and which delivery disturbs or tends to disturb the quiet, peace, rest, enjoyment, comfort or convenience of the neighbourhood or of persons in the vicinity.

Noise By-Law No. 2017 – 255, Loading and Unloading Section 12 Subsection (1):

(1) No person shall cause or permit the loading or unloading of any transport truck, moving van or motor vehicle between 2300 hours of one day and 0700 hours of the next day so as to make or cause noises that disturb, or tend to disturb the quiet, peace, rest, enjoyment, comfort or convenience of the neighbourhood or of persons in the vicinity.

Noise By-Law No. 2017 – 255, Idling Motor Vehicles Section 16 Subsection (1):

(1) No person shall operate or permit the operation of an engine or motor in, or on, any motor vehicle or item of attached auxiliary equipment for a continuous period exceeding five (5) minutes while such vehicle is stationary.

Noise By-Law No. 2017 – 255, Enforcement Section 26:

> This by-law shall be enforced by the Chief of Police or by the By-law Officers of the City.

Environmental Noise Regulation Criteria (continued)

The Environmental Noise Control Guidelines (ENCG), Introduction and Glossary, prepared for Planning and Growth Management by City of Ottawa, January 2016, are an important tool for the implementation of the City's environmental noise policies contained in the Official Plan. These Guidelines are to be used by city staff and the development and consulting industries when dealing with issues involving all sources of environmental noise in the land use and transportation planning and development processes. The ENCG Guideline set sound level limit for outdoor and indoor for transportation and stationary sources as follow:

> Part 1: Environmental Noise Control Guidelines for Land Use Planning, Section 3.0 Stationary Sources of Noise:
>
> This section applies to new development in proximity to existing stationary sources of noise and to development of new stationary noise sources in proximity to noise sensitive land uses. Stationary sources of noise, either fixed or mobile, represent the combined sound and vibration levels emitted beyond the property boundary. Stationary source noise can be generated by individual or multiple sources (facilities). Examples of individual noise sources include generators, fans and commercial air conditioners. Examples of facilities include manufacturing facilities, car dealerships and vehicle maintenance facilities, snow disposal sites, car washes and transit stations. Some sources of noise are excluded from the definition of a stationary noise source by the province; these include: construction activities, gas stations, music concerts and festivals, and individual retail stores where goods are not frequently delivered.
>
> The impact of stationary noise on the community is largely dependent on its location in the city. Within the Provincial guidelines there are four separate community class areas which are defined by their ambient sound level and described in Table 3.0: Area Classes for Definition of Stationary Noise Ambient Sound Level.
>
> Part 1: Environmental Noise Control Guidelines for Land Use Planning, Section 3.0 Stationary Sources of Noise, Table 3.0 Area Classes for Definition of Stationary Noise Ambient Sound Level / Class 1 Area:
>
> Means an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as "urban hum." Within the City Class 1 areas generally include all of the urban area as well as lands in proximity to Employment Lands and the 416/417 corridor.

Environmental Noise Regulation Criteria (continued)

> Part 1: Environmental Noise Control Guidelines for Land Use Planning, Section 3.1 When a Study is Required for Stationary Noise:
>
> Noise impacts from proposed equipment and facilities that are expanded or intensified are considered by the Province during the approval processes under the Environmental Protection Act. Whether or not an updated or new approval is required from the Province, the City may request that a Noise Study or Acoustical Audit be prepared and that a certification of final construction be submitted.
>
> Part 4: Technical Requirements for Environmental Noise Control Studies and Implementation, Section 3.0 Study Requirements:
>
> Environmental noise studies should be prepared as early as possible in the application process. In most cases the Official Plan requires the study as part of a complete application under the Planning Act. The reason that the study is required early in the process is because the outcome of the study is intended to contribute directly to site design and consequent decisions of committee, council and staff on the planning application. As with other technical studies prepared in support of an application, pre-consultation with the City is required. At the pre-consultation phase the source(s) and receptors of noise will be defined by the applicant and the City will indicate the level of study.

The Point of reception applies to impact assessments of stationary sources, means any location on a noise sensitive land use where noise from a stationary source is received. Noise sensitive land uses may have one or more points of reception. The following locations are points of reception:

(1) Location outdoors within 30 metres of a façade of a dwelling, at a height of 1.5 metres above ground, typically in backyards and rear yard terraces or patios. If the dwelling is a high-rise multi-unit building, the location should be confined to a common outdoor amenity area.
(2) Location on balconies and elevated terraces (e.g., rooftops) provided they are the only outdoor living area for the occupant, have a minimum depth of 4 metres, and are not enclosed.
(3) Location within 30 metres of a portion of property that is used as a campsite or campground, at a height of 1.5 metres above ground.
(4) Location in the centre of any window on a noise sensitive space of a dwelling or a building used for a noise sensitive institutional purpose or a noise sensitive commercial purpose; the location should be a minimum of 1.5 metres above ground for a first storey window, a minimum of 4.5 metres above ground for a second storey window, a minimum of 7.5 metres above ground for a third storey window, and the height of the vertical midpoint of the nearest and most exposed storey for a high-rise multi-unit building.

Environmental Noise Regulation Criteria (continued)

The following are examples of locations that are not considered to be points of reception:

(1) Outdoor locations associated with a noise sensitive institutional purpose or a noise sensitive commercial purpose.
(2) Inoperable (fixed or sealed) window as defined in part a of this guideline; and
(3) Plane of a window of an enclosed noise buffer. Note that the planes of a window on the façade of a dwelling in the enclosed noise buffer are considered to be points of reception in accordance with paragraph 4 above.

Noise Sensitive Land Use means a land use that is sensitive to noise, whether inside and/or outside the building and that must be planned and/or designed using appropriate land use compatibility principles. Examples of sensitive land uses:

- Residential developments.
- Seasonal residential developments.
- Hospitals, nursing/retirement homes, schools, day-care centres.
- Other land uses that may contain outdoor and/or outdoor areas/spaces where an intruding noise may create an adverse effect.

In general, a noise-sensitive land use could be any type of land use where environmental noise is likely to cause an adverse effect or material discomfort whether inside or outside of a building.

The Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning, Publication NPC-300 (NPC-300) prepared by the Ontario Ministry of the Environment (MOE), August 2013 is within the scope of this study.

The gas station development considered to be in a Class 1 Area of the City. Although it is not considered a stationary source by the Guidelines definitions Ontario NPC-300 and Ottawa ENCG, the gas station development includes sources such as a roof top mounted heating unit/air conditioner, exhaust fans, idling vehicles, and delivery trucks which are defined in Noise By-Law No. 2017 – 255, Ontario NPC-300 and Ottawa ENCG.

Environmental Noise Regulation Criteria (continued)

Environmental Noise Control Guidelines for Land Use Planning Part 1 of Ottawa ENCG, Section 3.2 Applicable Guidelines for Stationary Noise, Table 3.2a of the Guidelines for Stationary Noise – Steady and Varying Sound for Class 1 Area defined as the exclusion limit values. The values presented in Table 1 are sourced from NPC-300.

Table 1
Exclusion Limit Values of One-Hour Equivalent Sound Level (NPC-300 Class 1 Area)
Shell Gas Station 1440 Prince of Wales Drive Ottawa

Time of Day / Class 1 Area	Outdoor Point of Reception One-Hour Sound Level Leq (dBA)	Plane of Window One-Hour Sound Level Leq (dBA)
Daytime 07:00 – 19:00	50	50
Evening 19:00 – 23:00	50	50
Nighttime 23:00 – 07:00	-	45

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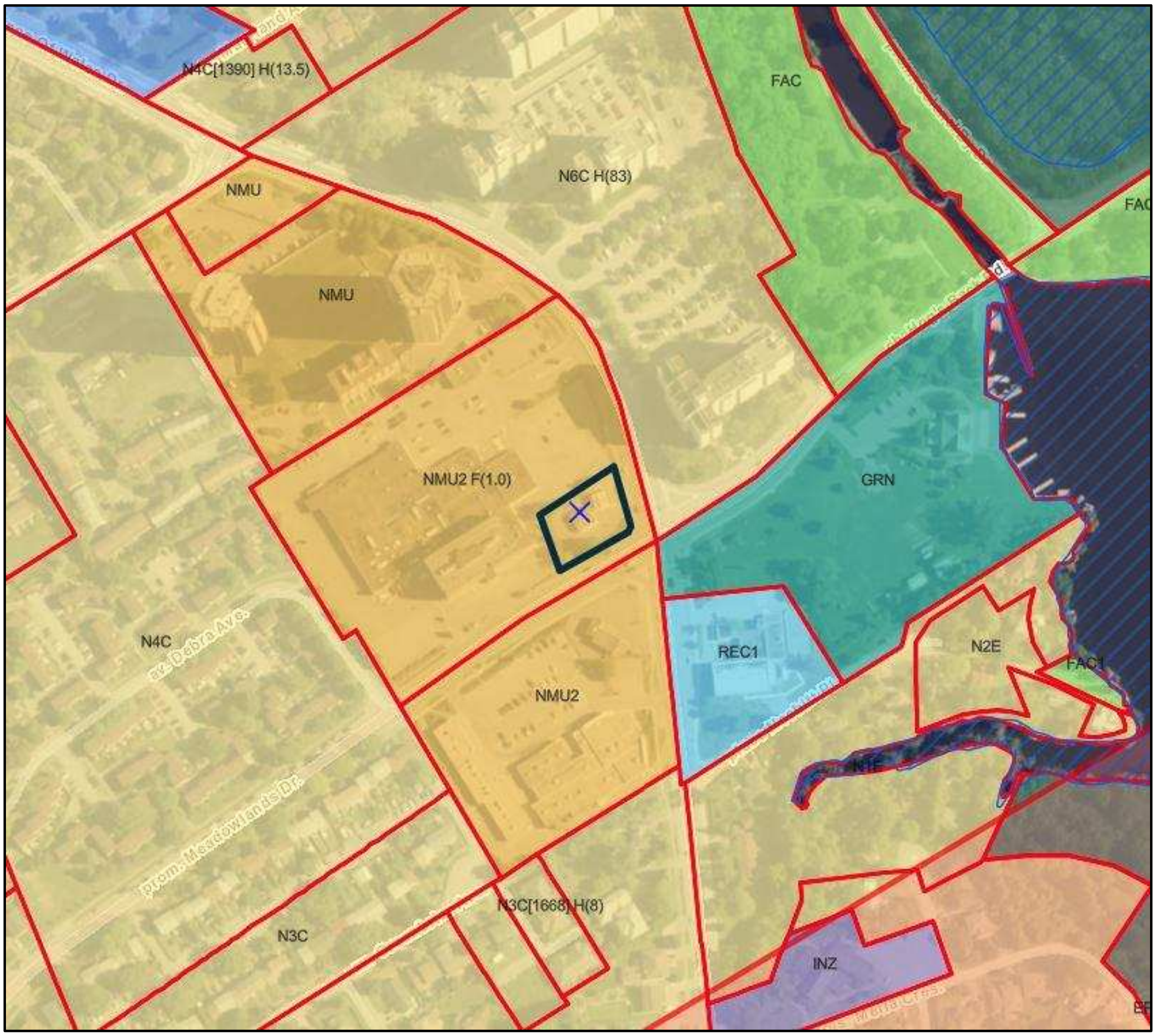
FDI Acoustics following a conservative approach considers the Table 1 sound level limits as appropriate for this assessment. The gas station may be described as a multi-source development in support of the choice to apply the sound level limits in Table 1.

Figure 1 presents the City of Ottawa Zoning By-Law No. 2008-250 (May 2024) map as it applies to the noise study area. The City of Ottawa Zoning Map designates the Shell Gas Station as a “GM15 F (1.0)” zone (Mixed Use – Commercial Zones I) for existing Zoning and “NMU2 F (1.0)” zone (Neighbourhood Mixed-Use Zone) for Draft 1 new Zoning By-law. The other study area zones shown in Figure 1 designated “N6C H (83)” represent the Neighbourhood Zone area east of the development. The high-rise building is considered Residential Zone (R5B H (83) in the existing Zoning By-law and is considered a noise sensitive land use. The other noise sensitive land use areas are shown in Figure 1 and designated “N4C” represent a Neighbourhood Zone area west of the development. These residential buildings are considered Residential Zone (R3A) in existing Zoning By-law and thus a noise sensitive land use.

Environmental Noise Regulation Criteria (continued)

Figure 1
City of Ottawa New Zoning By-Law Map Draft 1
Shell Gas Station 1440 Prince of Wales Drive Ottawa



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Study Area

The proposed Shell Gas Station is located at 1440 Prince of Wales Drive in Ottawa, Ontario. The proposed building on site housing the convenience store associated with the development will be situated parallel to the east property line of the site and is east of the existing convenience store. The proposed overhead fuel pump canopy will be situated parallel to the west property line of the site and is west of the proposed convenience store location. The nearest or most impacted residences designated noise sensitive receivers are located to the east of the gas station property at 1435 Prince of Wales Drive, a high-rise building known as the Prince of Wales Complex. A non-residential property at 885 Rideauview is a corporate centre and 1430 Rideauview is a shopping mall. These properties border the west and northwest side of the gas station property. Available information describes the topography of the area as flat and the landscape as urban with a mix of paved surfaces, asphalt, lawn, and trees.

Figure 2 and the report cover (Google Earth image) present maps of the study area and site plan drawing indicating the location of the Shell site, residential units in the area, and other area features. Appendix A presents a larger higher resolution copy of Figure 2 and the study area map indicating the location of the proposed gas station, existing structures, and the assessed residences.

Figure 2
Site Plan Map
Shell Gas Station 1440 Prince of Wales Drive Ottawa

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Description of Equipment

The proposed gas station pump island canopy is located near the west side and the proposed convenience store building and is at the east side of development site. The significant noise sources associated with the gas station development include the rooftop mounted heating and air conditioning unit (RTU) on the roof of the convenience store building, idling vehicles along the north side of the site awaiting entry to the gas station or waiting in the parking stalls in front of the proposed convenience store, an idling delivery truck (fuel and goods deliveries). In collaboration with CTM FDI Acoustics has assumed the convenience store rooftop unit is a Trane 5 ton Precedent model RTU or equivalent. FDI Acoustics has assumed the convenience store building will include two exhaust fans. FDI Acoustics has also assumed the potential for the development to include a customer use vacuum cleaner and a tire inflator air compressor near the convenience store building. FDI Acoustics has assumed that the vacuum cleaner and tire inflator air compressor will be in operation during the day and evening periods from 07:00 to 23:00 for a total of 4 hours of operation per day. The rooftop unit and exhaust fans area assumed to operate continuously during daytime and nighttime period although actual operations may be less. The assessment also considers five vehicles idling during the day and evening from 07:00 to 23:00 and three vehicles idling continuously during the nighttime period from 23:00 to 07:00. The deliveries are assumed to occur daily during the daytime and evening periods (07:00 to 23:00) with the vehicles idling for 30 minutes per day.

Source Sound Power Levels

FDI Acoustics completed calculations to determine octave band sound power level values for the significant noise sources associated with the equipment. Completion of the calculations followed accepted techniques and practices for the determination of sound power levels from sound pressure levels for large machinery. The sound power values presented in Table 2 are order-ranked from highest to lowest by the overall sum (dBA) per source group.

Table 2
Source Sound Power Levels
Shell Gas Station 1440 Prince of Wales Drive Ottawa

Sound Source Description	Sound Power Level (dBA re: 10^{-12} W)									
	Octave Band Frequency (Hertz)									Sum (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Vacuum Cleaner										
Vacuum Cleaner	32.6	44.4	64.2	73.7	86.3	86.6	90.9	87.5	82.5	94.6
Rooftop Air Conditioners Unit (RTU) / 5 Ton										
Rooftop Air Conditioners Unit	45.6	58.8	69.9	75.4	81.8	83.0	80.2	74.1	65.9	87.2
Exhaust Fan										
Exhaust Fan	43.6	56.8	64.9	66.4	67.8	69.0	66.2	62.1	56.9	74.5
Gas Station Tire Inflator Air Compressor										
Air Compressor Sum	35.2	62.0	64.1	69.9	73.6	75.6	73.9	72.2	69.0	81.0
Vehicle @ Idle										
Vehicle @ Idle	55.2	62.4	69.6	71.9	74.8	77.6	77.4	71.8	64.6	82.7
Delivery Truck @ Idle / Gas / Goods										
Delivery Truck @ Idle	55.6	79.9	82.2	97.2	95.3	94.8	94.2	88.4	77.0	101.8

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Noise Propagation Model

The Predictor™ 7810 v2024, an environmental noise assessment software package from Softnoise GmbH was employed to determine the environmental noise impact of the equipment. The noise prediction program completes complex sound propagation calculations that include the effects of the environment, terrain, and topography. The algorithms used by the model are consistent with international standards, including International Organization for Standardization (ISO) *9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere* [6], *Part 2: General method of calculation* [7,8], *Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1* [9].

The calculated individual source sound power level complete with information regarding the facility location, equipment layout and the reception locations were entered in the model. The propagation algorithms of ISO 9613 consider a downwind condition from each noise source to each receiver. The ISO 9613 method claims to couple the downwind condition with a mild temperature inversion. The ground absorption coefficient ranges between 0.0 – 1.0 where a value of 0.0 (the lowest) depicts reflective (hard) ground with a value of 1.0 (the highest) depicting porous (absorptive) ground. The model was structured to reflect favourable conditions for the propagation of sound from the source to the receiver locations.

Table 3 lists the modelled environmental parameters of the noise propagation model.

Table 3
Noise Model Environmental Parameters
Shell Gas Station 1440 Prince of Wales Drive Ottawa

Environmental Parameter	Model Input Value
Ground Attenuation (between development & receiver)	0 (suitable value for concrete and asphalt)
Ground Attenuation (Lawn)	1 (suitable value for vegetation and porous ground)
Receiver Height Above Ground	1.5m (1st floor), 4.5m (2nd floor)
Relative Humidity	70%
Temperature	+15°C
Wind Conditions	1 to 5 m/s (default ISO 9613 – moderate inversion condition, downwind in all directions)
Topography	CDEM (Canadian Digital Elevation Model) 30m x 43m height points

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Results

Table 4 presents the overall predicted sound pressure level and the source sound pressure level contributions as dBA values for the most impacted receiver locations at the 5th floor of the window plane for Residence 1 (R1) at 1435 Prince of Wales Dr, Ottawa, ON. This high-rise complex is at the east of the proposed gas station site. The source sound level contribution values are order ranked by the "A" weighted contribution level.

Table 4
Order Ranked Sound Pressure Levels
Most Impacted Residence (R1)
Shell Gas Station 1440 Prince of Wales Drive Ottawa

Source Description	Source Sound Level Contribution (dBA)
Rooftop Air Conditioners Unit	41.4
Delivery Truck @ Idle (Gas)	39.8
Vehicle #1	38.1
Vehicle #2	36.8
Vehicle #3	35.9
Vehicle #4	35.5
Vehicle #5	32.8
Gas Station Tire Inflator Air Compressor	30.1
Exhaust Fan #2	29.0
Vacuum Cleaner	25.3
Exhaust Fan #1	16.9
Predicted Facility Contribution Sum (Day and Evening)	**46.7**
Predicted Facility Contribution Sum (Night)	**44.8**

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Note: Sound Pressure level values below the reference level of 20 microPascals are indicated by a negative sign preceding the value

Order ranked sound pressure levels (Table 4) at a distant point of reception may differ from the equipment order ranked sound power levels (Table 2). This can occur due to the frequency composition of each noise source, the physical height of the noise source above the ground, acoustical shielding at the site or the topography between the site and the receiver.

Appendix B presents two noise contour maps overlaid on the site plan and study area. The first depicts the gas station sound level contributions during daytime from 07:00 to 23:00. The second noise contour map depicts the gas station sound level contributions during night from 23:00 to 07:00. The sound levels depicted in the noise contour maps were calculated at the 1.5 metre receiver height.

Discussion of Results

Table 5 presents the overall predicted sound level contribution values from the proposed gas station operations and the exclusion limit values for the locations assessed at the most impacted floor. The development sound level contributions are used for determining compliance with the applicable exclusion limit values.

Table 5
Predicted Sound Levels
Shell Gas Station 1440 Prince of Wales Drive Ottawa

Receiver Location & Sound Level Description	07:00 – 23:00 Sound Level (L_{eq} dBA)	23:00 – 07:00 Sound Level (L_{eq} dBA)
Plane of Window of Noise Sensitive Spaces		
R1 (1435 Prince of Wales Dr Ottawa, ON) – 4th Floor	46.7	44.8
R2 (9-955 Dynes Rd #55, Ottawa, ON) – 2nd Floor	34.5	31.2
R3 (2-960 Debra Ave, Ottawa, ON) – 1st Floor	35.9	26.3
R4 (913 Meadowlands Dr, Ottawa, ON) – 1st Floor	40.0	31.9
R5 (894 Meadowlands Dr Ottawa ON) – 1st Floor	44.6	39.4
R6 (1485 Prince of Wales Dr, Ottawa, ON) – 1st Floor	35.8	31.9
Exclusion Limit Values of One-Hour Equivalent Sound Level / Class 1 Area (Noise Sensitive Space)	**50.0**	**45.0**

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A comparison of the predicted sound levels with the daytime and nighttime exclusion limit values indicates the proposed Shell Gas Station is predicted to comply with the daytime and nighttime exclusion limit values of ENCG and NPC-300 at all receivers assessed.

Conclusion

The results of the environmental noise propagation model indicate the predicted sound levels from the proposed Shell Gas Station comply with the daytime and nighttime of the exclusion limit values of ENCG and NPC-300 at the assessed receivers.

Glossary

Ambient Sound Level — All noises that exist in an area and are not related to a facility covered by the applicable regulation. Ambient noise includes sound from other industrial noise not subject to either regulation for example; transportation sources, animals and nature.

A-weighted sound level — The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear.

C-weighted sound level — The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weightings sound level (i.e., measured with the C-weightings) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low frequency content of complex sound environments.

Calibration — A procedure used for the adjustment of a sound level meter using a reference source of a known sound pressure level and frequency. Calibration must take place before and after the sound level measurements.

Comprehensive Sound Level (CSL) — The measured sound level that is a composite of different airborne sounds from many sources both far away and near the point of measurement as measured during a valid comprehensive sound survey. The CSL does include industrial components and must be measured with them, but it should exclude abnormal noise events.

Daytime — Defined as the hours from 07:00 to 22:00 or as defined by the applicable regulation.

dB (decibel) or dBZ — The decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit. A decibel is one tenth of a bel (B). A reference pressure of 20 microPascals (µPa) is used because sounds in air at a frequency of 1000 Hz and with a pressure of 20 microPascals (µPa) can just barely be heard by most people.

dBA — The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response.

See dB and A-weighted sound level.

dBC — The decibel (dB) sound pressure level is adjusted to include the low frequency end of the spectrum. Although less consistent with human hearing than dBA, dBC can be used to discern the impact of low frequency sound emissions from industrial operations.

Energy equivalent sound level (L_{eq})	The L_{eq} is a single-number average, A-weighted sound level that represents cumulative acoustical energy as measured over a specified time interval. This interval should be specified in brackets following the L_{eq} (e.g.: L_{eq} (9) is a nine-hour L_{eq}).
ISO 9613-2:1996	Acoustics- Attenuation of sound during propagation outdoors- Part 2: General method of calculation (International Organization for Standardization)
L_{eq}	See Energy equivalent sound level.
Nighttime	Defined as the hours from 22:00 to 07:00 or as defined by the applicable regulation.
Noise	Generally understood as unwanted sound.
Octave	A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. The octave band has a centre frequency that is double the centre frequency of the octave band preceding it.
1/3 Octave	The 1/3 octave band analysis provides a finer breakdown of sound distribution as a function of frequency.
Representative conditions	Those conditions typical for an area and/or the nature of a complaint. Sound levels must be taken only when representative conditions exist; this may necessitate a survey of extensive duration (two or more consecutive nights).
Sound monitoring survey	The measurement and recording of sound levels and pertinent related information over a given time period.
Sound level meter	An instrument designed and calibrated to respond to sound and to give objective, reproducible measurements of sound pressure levels. It normally has several features that enable its frequency response and averaging times to be changed.
Sound pressure level	A measurement of the local pressure deviation from the ambient (average, or equilibrium) pressure caused by a sound wave.
Sound power level	Expressed in decibels (dB), it is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to a reference sound power level, typically 10^{-12} watts.
Spectrum	A wide range or sequence of frequencies.
Windscreen	A specialized piece of porous sponge that fits over the microphone to reduce the noise generated by the wind blowing across the microphone.

Appendix A – Site Plan and Study Area Map

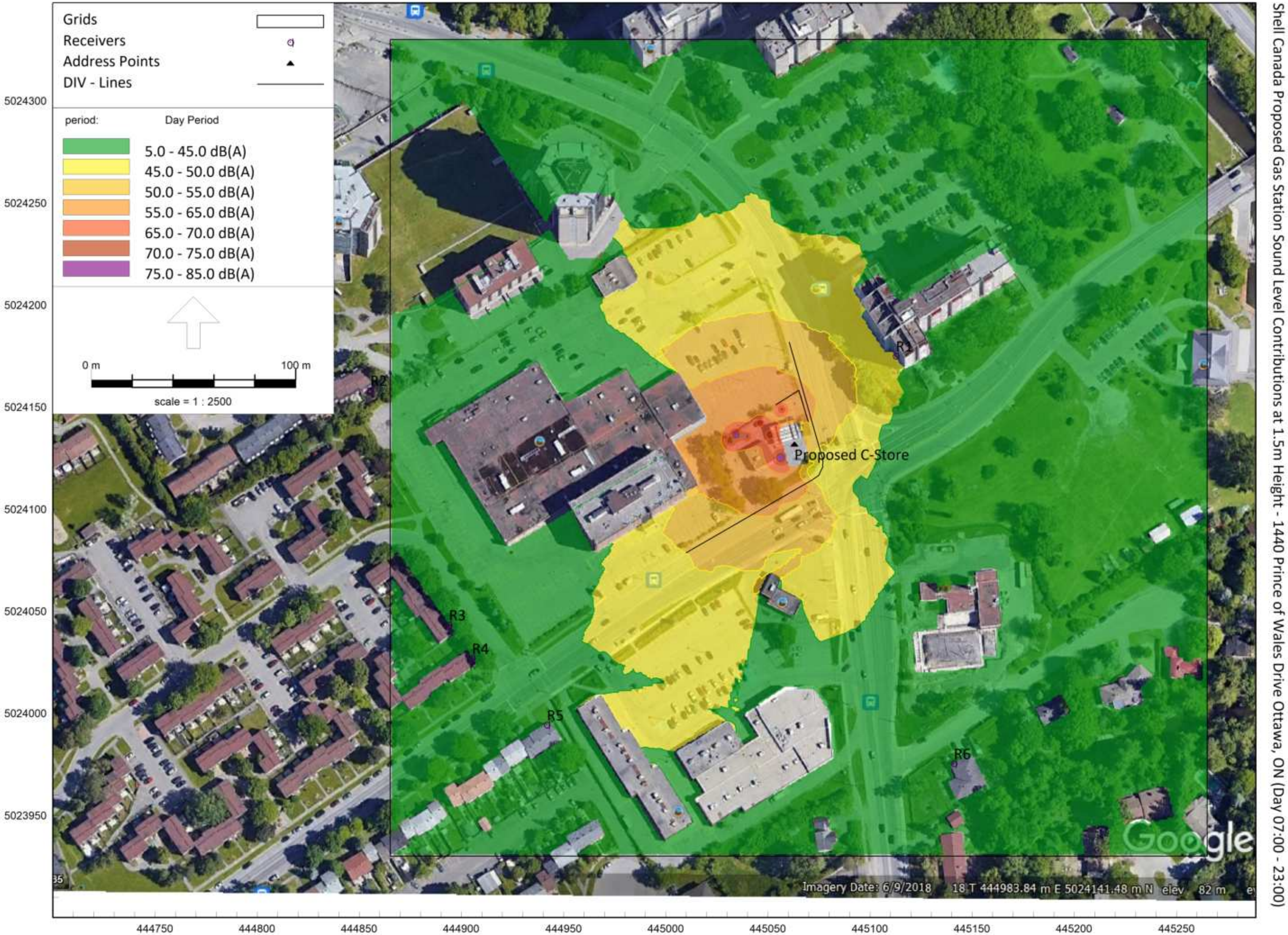
Shell Canada Proposed Gas Station Site Plan - 1440 Prince of Wales Drive Ottawa, ON

ISO 9613, [Proposed Shell Gas Station - Site Plan] , Predictor V2024 Licensed to FDI Acoustics Inc., Canada

Shell Canada Proposed Gas Station Study Area Map & Receivers - 1440 Prince of Wales Drive Ottawa, ON

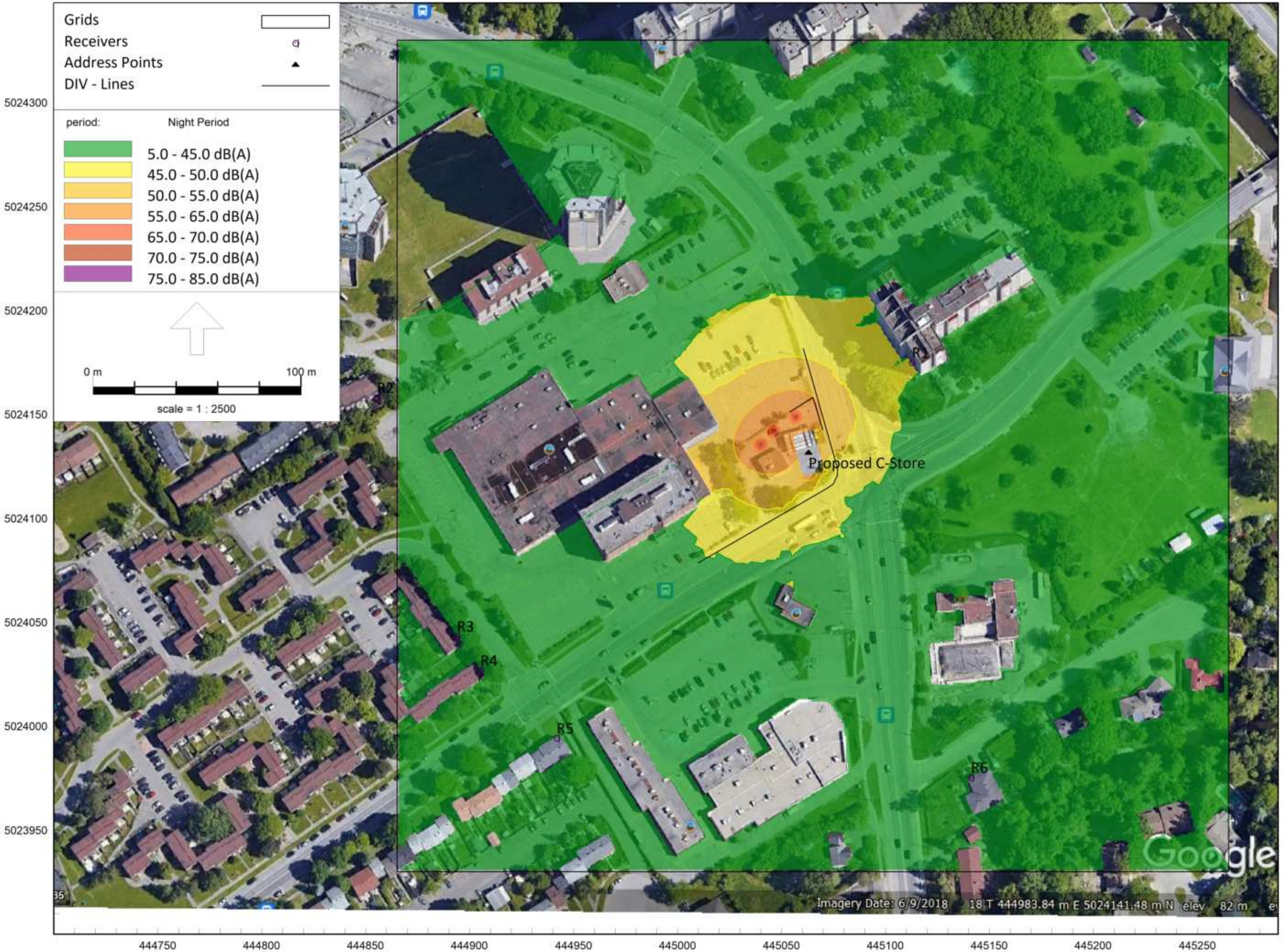
ISO 9613, [Proposed Shell Gas Station - Study Area Map] , Predictor V2024 Licensed to FDI Acoustics Inc., Canada

Appendix B – Noise Contour Maps (Day & Night)



ISO 9613, [Proposed Shell Gas Station - Noise Contour Map] , Predictor V2024 Licensed to FDI Acoustics Inc., Canada

Shell Canada Proposed Gas Station Sound Level Contributions at 1.5m Height - 1440 Prince of Wales Drive Ottawa, ON (Night 23:00 - 07:00)



ISO 9613, [Proposed Shell Gas Station - Noise Contour Map] , Predictor V2024 Licensed to FDI Acoustics Inc., Canada

Appendix C – References

1. Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning, Publication (NPC-300) prepared by Ontario Ministry of the Environment (MOE), August 2013.
2. Environmental Noise Control Guidelines (ENCG), Introduction and Glossary, prepared for Planning and Growth Management by City of Ottawa, January 2016.
3. City of Ottawa, Noise By-Law No. 2017 - 255, Effective Date, September 30, 2017.
4. Crocker, M.J., Handbook of Noise and Vibration Control, John Wiley & Sons. New York, NY, 2007.
5. Bies, D.A. and Hansen, C.H., Engineering Noise Control Theory and Practice, Third Edition, Spon Press. New York, NY, 2003.
6. International Organization for Standardization (ISO 9613-1), Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere, Approved 1993.
7. International Organization for Standardization (ISO 9613-2), Attenuation of sound during propagation outdoors - Part 2: General method of calculation, Approved 1996.
8. International Organization for Standardization (ISO 1996-2:2007), Description, measurement, and assessment of environmental noise - Part 2: Determination of environmental noise levels, Approved 2007 (Revises ISO 1996-2:1987 Acoustics – Description and measurement of environmental noise – Part 2: Acquisition of data pertinent to land use).
9. International Organization for Standardization (ISO/TR 17534-3), Acoustics – Software for the calculation of sound outdoors – Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1, Approved 2015.