APPENDIX O:
NOISE IMPACT ASSESSMENT REPORT

July 5, 2023

Prepared for:

Ministry of Transportation Ontario
Capital Planning and Program
Development East
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Noise Impact Assessment Report

Highway 401 Planning Study, Brockville, from 2 km West of Stewart Boulevard to 750 m East of North Augusta Road (GWP 4003-19-00)

File: 165001160

Sign-off Page

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Executive Summary

The Ontario Ministry of Transportation (MTO) is undertaking the Preliminary Design and Class Environmental Assessment (Class EA) for an approximate length of 4.5 kilometers (km) along Highway 401 in Brockville, from 2 km west of Stewart Boulevard to 750 meters (m) east of North Augusta Road (GWP 4003-19-00). The purpose of the Class EA study is to develop a plan for the rehabilitation and/or replacement of five (5) structures; determine the long-term plans for the Stewart Boulevard and North Augusta Road interchanges and establish the footprint for interim six-lanes and ultimate eight-lanes of Highway 401 within the City of Brockville. This noise impact assessment report was prepared to assess the potential changes in traffic noise associated with the proposed reconfiguration of the study area interchanges and future footprint of Highway 401. In addition, the purpose of this assessment was to determine the potential noise impact at nearby noise sensitive areas (NSAs) associated with the project, and to investigate the feasibility of noise mitigation (if needed) in accordance with the MTO Environmental Guide for Noise (MTO 2022).

The following two scenarios were considered for this noise assessment:

1. Interim Project footprint: Highway 401 upgrade from 4 lanes to 6 lanes and the reconfiguration of the Stewart Boulevard and North Augusta Road interchanges with future traffic data for the horizon year 2032.

2. Ultimate Project footprint: Highway 401 upgrade from 6 lanes to 8 lanes and the minor adjustments to ramps required at the interchanges at Stewart Boulevard and North Augusta Road with future traffic for horizon year 2042.

The horizon years 2032 and 2042 were selected for the purpose of the analysis and they do not represent the actual timing of the highway improvements.

To determine the Project noise impact, a comparison was made for predicted future noise levels with the Project (Future Build) and without the Project (Future No-build) for both interim and ultimate Project footprint scenarios. Where predicted Future Build noise levels increased more than 5 dB over Future No-build and/or exceed 65 dBA, mitigation was investigated. Mitigation was investigated for technical, economic and administrative feasibility.

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Fifteen (15) NSAs, including three (3) proposed developments were identified from a review of aerial imagery, the City of Brockville development information, and the Air Quality Assessment Report for the Project (Stantec 2023). Thirty-two (32) representative receptors were selected from these NSAs for consideration within this noise assessment. The selected receptors from the existing NSAs are those that have an outdoor living area (OLA). The receptors identified in the Air Quality Assessment without an OLA are excluded from this assessment.

For the purpose of this road traffic noise impact assessment, the Traffic Noise Model (TNM, version 3.1) developed by the United States Federal Highway Administration (FHWA) as recommended by the MTO was used.

At receptor R14, an increase in sound levels of up to 2.6 dB for the interim Project footprint and up to 2.9 dB for the ultimate Project footprint was predicted, and both levels are within the 5 dB MTO limit. Predicted Future Build noise levels exceeded the MTO level above which mitigation feasibility is investigated (65 dBA) at three (3) receptors (R18, R28 and R29) for future interim Project footprint, and at seven (7) receptors (R04, R11, R19, R30, R28, R29 and R32) for future ultimate Project footprint. Noise mitigation was investigated only for the existing receptors. Mitigation for the proposed future development (R04) was not investigated as it is expected to be incorporated in the design of the future development and would fall under the responsibility of the developer.

Considering the nature of the Project, alignment adjustments as a mitigation option were not considered. In addition, adjustments to pavement type were also not considered as a mitigation measure as asphalt is being used for this Project. Only noise barriers were considered for Project noise mitigation.

The relocated noise barrier ENB1 (between Stewart Boulevard and Ormond Street) will be constructed to current MTO standards and is expected to be 5 m high. Therefore, 5 m high noise wall is considered for the ultimate footprint scenario in this assessment.

Two (2) new noise barriers (NB1 and NB2) and an upgrade of the existing noise barrier (ENB2) were investigated for noise mitigation for the Project. Although one of the noise barriers (NB2) considered met the criteria for technical feasibility, it did not meet the criteria for economic feasibility. The remaining noise barriers did not meet technical feasibility criteria. Therefore, noise barriers are not recommended for this project.

Construction noise for the Project was assessed in accordance with the applicable Ministry of the Environment, Conservation and Parks (MECP) Publication NPC-115 (MECP 1977) and NPC-118 (MECP 1982) for construction and the City of Brockville Noise By-Law (No. 076-2-21), a By-Law to Control Noise in the City of Brockville (Brockville 2021).

The typical sound levels for most of the construction equipment are within the MECP and City noise limits. However, there is potential for higher sound levels than the permissible limits for some equipment. Once equipment and construction schedules are finalized, the equipment noise data should be reviewed during the detailed design stage to confirm that noise emissions are within the applicable limits. If the sound levels are higher than the limits, noise control options may be required. Methods to minimize construction noise impacts should be included in the Construction Code of Practice

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Acronyms / Abbreviations

AADT	Annual Average Daily Traffic
dB	decibel
dBA	decibel, A-weighted
DFC	Dense Friction Course Pavement
EA	Environmental Assessment
ENB	Existing Noise Barrier
Km	Kilometre
km/h	kilometres per hour
m	metres
m^2	square metres
MECP	Ontario Ministry of the Environment, Conservation and Parks
MTO	Ontario Ministry of Transportation
NB	Noise Barrier
NPC	Noise Pollution Control
NSAs	Noise Sensitive Areas

OLA	Outdoor Living Area
TNM	Traffic Noise Model
US FWHA	United States Federal Highway Administration

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A-weighting	The weighting network used to account for changes in level sensitivity as a function of frequency. The A-weighting network de-emphasizes the high (i.e., 6.3 kHz and above) and low (i.e., below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an effort to simulate the relative response of the human ear. See also: frequency weighting.
decibel (dB)	A logarithmic quantity of any measured physical parameter and commonly used in the measurement of sound. The decibel (dB) provides the possibility of representing a large span of sound levels in a simplified manner. The difference between the sound pressures for virtual silence versus a loud sound is a factor of 1:1,000,000 or more, therefore, it is less cumbersome to use a small range of equivalent values: 0 to 130 dB. It is used for both sound pressure level as well as sound power level.
energy equivalent sound level	An energy-average sound level (L_{eq}) over a specified period that would have the same sound energy as the actual (i.e., time varying) sound over the same period. It represents the average sound pressure level encountered for the period. The period is often added as a suffix to the label (i.e., L_{eq} (24) for the 24-hour equivalent sound level).
frequency	The number of times per second that the sine wave of sound repeats itself. It can be expressed in cycles per second, or Hertz (Hz). Frequency equals speed of sound/wavelength.

Glossary

frequency weighting (A, B, and C-Weighting)	A method used to account for changes in sensitivity as a function of frequency. Three standard weighting networks, A, B, and C are used to account for different responses to sound pressure levels. Note: The absence of frequency weighting is referred to as linear response or unweighted response. Most commonly used weighting is A-Weighting (see also A-weighting).
noise	Unwanted sound.
Point of Reception or Receptor	A noise-sensitive receptor (also referred as noise sensitive area in this report) such as a residence, campground, daycare, school, church, or hospital as defined in Ontario Ministry of the Environment, Conservation and Parks Publication NPC-300.
sound level	Generally, sound level refers to the weighted sound pressure level obtained by frequency weighting, usually A-weighted for the purpose of approval in Ontario and expressed in decibels.
sound power level	The total sound energy radiated by a source per unit time. The unit of measurement is the watt. The acoustical power radiated from a given sound source as related to a reference power level (i.e., typically 1E -12 watts, or 1 picowatt) and expressed as decibels. A sound power level of 1 watt = 120 decibels relative to a reference level of 1 picowatt.
sound pressure level	Logarithmic ratio of the root-mean-square of the sound pressure to the sound pressure at the threshold of human hearing (i.e., 20 micro-pascals).

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sound spectrum	The amplitude of sound within a range of frequencies/frequency bands and usually referred to by the center frequency of that band. It is given by a set of numbers that describe the amplitude of sound at each frequency band.
study area	The spatial extent where there is potential for noise and vibration effects on the environment as a result of the Project.
weighting	Adjustment of sound level data to reflect receptor sensitivities. A weighting is used to refer to average human hearing as a function of frequency. The A-weighting network de-emphasizes the high (i.e., 6,300 Hz and above) and low (i.e., below 1,000 Hz) frequencies, and emphasizes the frequencies between 1,000 Hz and 6,300 Hz, to simulate the relative response of human hearing. C Weighting is linear over the mid frequency range from 200 Hz to 1,600 Hz, and de-emphasizes the low (i.e., below 200 Hz) and high (i.e., above 1,600 Hz) frequencies.

1.0 Introduction

The Ontario Ministry of Transportation (MTO) is undertaking the Preliminary Design and Class Environmental Assessment (Class EA) for an approximate length of 4.5 kilometers (km) along Highway 401 in Brockville, from 2 km west of Stewart Boulevard to 750 metres (m) east of North Augusta Road (GWP 4003-19-00). The purpose of the Class EA study is to develop a plan for the rehabilitation and/or replacement of five (5) structures; determine the long-term plans for the Stewart Boulevard and North Augusta Road interchanges and establish the footprint for interim six-lanes and ultimate eight-lanes of Highway 401 within the City of Brockville.

This noise impact assessment report was prepared to support the Class EA for the proposed reconfigured interchanges as well as the future interim (6 lanes) and ultimate (8 lanes) Highway 401 improvements. The purpose of this assessment was to assess the Project noise impact at nearby noise sensitive areas (NSAs) and investigate noise mitigation, if needed, in accordance with the MTO Environmental Guide for Noise (MTO 2022). The noise impact was assessed by comparing predicted future noise levels with the Project (Future Build) and without the Project (Future No-build) and was done for both Interim and Ultimate project footprint scenarios.

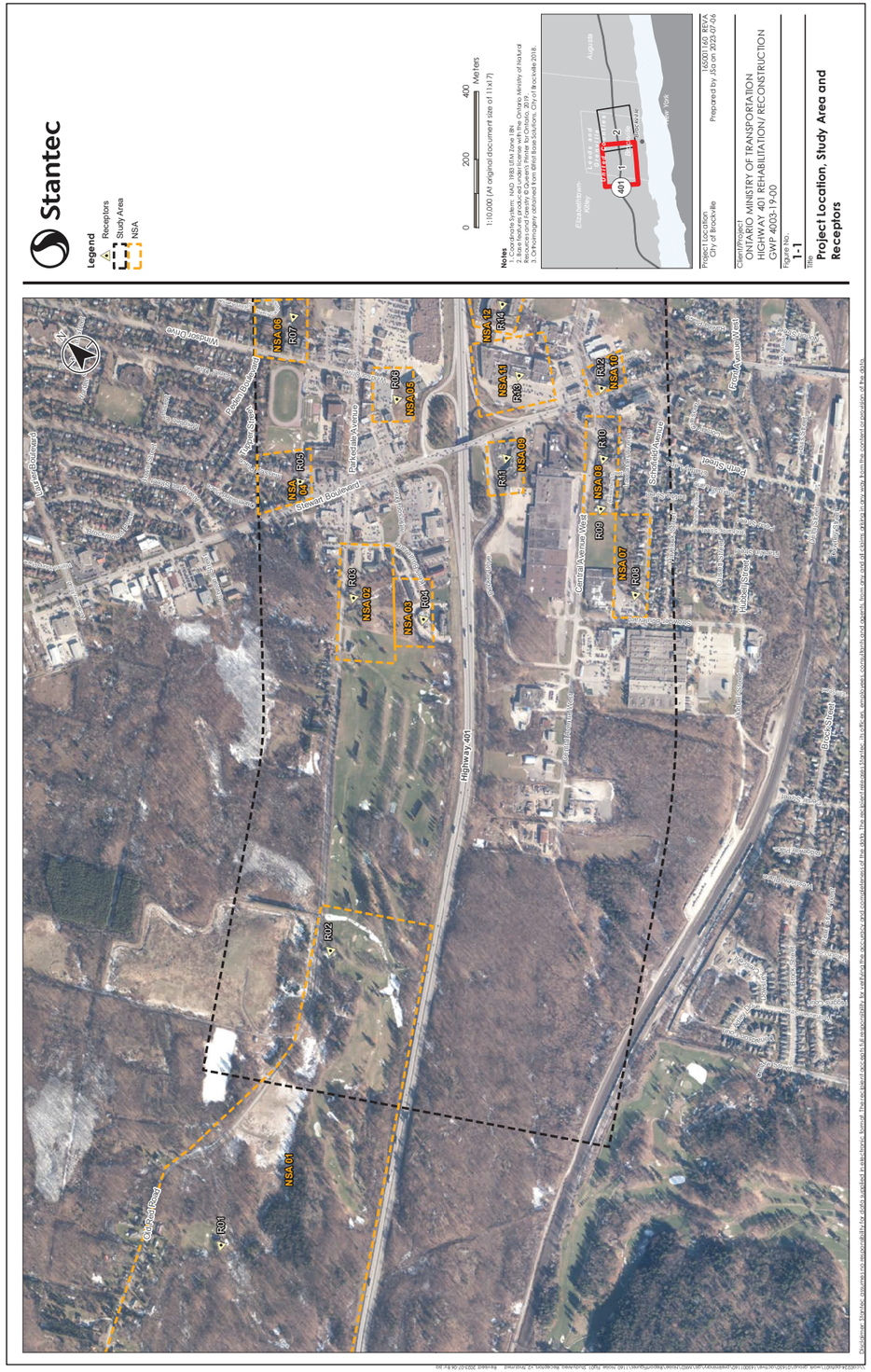
The following two future scenarios were considered for this noise assessment:

1. Interim Project footprint: Highway 401 upgrade from 4 lanes to 6 lanes and the reconfiguration of the interchanges Stewart Boulevard and North Augusta Road with future traffic data for the horizon year 2032.

2. Ultimate Project footprint: Highway 401 upgrade from 6 lanes to 8 lanes and the minor adjustments to ramps required at the interchanges at Stewart Boulevard and North Augusta Road with future traffic for the horizon year 2042.

The horizon years 2032 and 2042 were selected for analysis and do not represent the actual timing of the highway improvements or configuration of the interchanges.

The Study Area encompasses areas where noise sensitive areas may be impacted from the Project. In accordance with the MTO Environmental Guide for Noise (MTO Guide), the Study Area for this noise impact assessment was determined using a perpendicular distance of 600 m from the closest edge of the Project pavement and a 100 m distance from the ends of the Project pavement. A map of the Study Area along with the Project location is shown in Figure 1.1 and 1.2.



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2.0 Project Description

The existing footprint of Highway 401, from 2 km west of Stewart Boulevard to 750 m east of North Augusta Road, currently has a total of four travelled lanes (two in each travel direction). The Project will include an interim roadway expansion from four travel lanes to six lanes (three lanes in each travel direction) and to ultimately eight lanes (four lanes in each travel direction).

Both Stewart Boulevard and North Augusta Road interchanges are four-lane bridges (two lanes in each travel direction) serving traffic northbound and southbound over Highway 401. Currently, there are four on-ramps (two in the eastbound direction and two in the westbound direction) to Highway 401, accessible to traffic travelling northbound or southbound on Stewart Boulevard. Traffic travelling on Highway 401 eastbound or westbound can access Stewart Boulevard via two off-ramps. Traffic exiting the highway from either travel direction approach a signalized intersection on Stewart Boulevard. Similarly, there is one off-ramp for eastbound traffic on Highway 401 to North Augusta Road and one off-ramp for westbound traffic that exits to a signalized intersection on Parkdale Avenue.

The Project will include a reconfiguration of Stewart Boulevard interchange to a single point urban intersection consisting of a replacement bridge (4 lanes, 2 in each travel direction), two off-ramps and two on-ramps. Traffic will approach a single signalized intersection on Stewart Boulevard.

The reconfiguration of the North Augusta Road interchange will include building a new road structure over Highway 401, slightly shifted towards east of the existing North Augusta Road crossing. The new interchange will consist of 4 lanes (2 in each travel direction), two off-ramps and three on-ramps. There will be no signalized intersection on North Augusta Road.

Relocation of existing noise wall (ENB1) located between Stewart Boulevard and North Augusta Road to farther south is expected as part of the Project.

For the purposes of this study, noise impacts for the Project were evaluated for the interim build (2032) and ultimate build (2042) scenarios. The years 2032 and 2042 were selected for analysis purpose only and do not represent the actual timing of the highway improvements or reconfiguration of the interchanges.

The preferred design plan for the Project is provided in Appendix A.

3.0 Applicable Guidelines

The applicable noise guidelines for this project are the MTO Environmental Guide for Noise (MTO 2022),the Ministry of the Environment, Conservation, Parks (MECP) Publication NPC-115 (MECP 1977) and NPC-118 (MECP 1982), and the City of Brockville Noise By-Law (No. 076-2-21), a By-Law to Control Noise in the City of Brockville (Brockville 2021).

3.1 Operational Noise Guidelines

In accordance with the MTO Guide, the Project noise impact is assessed by making a comparison of the predicted future noise level with the Project (Future Build) and without the Project (Future No-build). Where predicted Future Build noise levels increase more than 5 dB over Future No-build, mitigation measures are to be investigated. Additionally, mitigation measures are to be investigated where Future Build noise levels equal or exceed 65 dBA.

According to the MTO Guide requirements, mitigation measures should be restricted to within the MTO lands. For the mitigation to be implemented, it must be technically, economically, and administratively feasible. For the noise mitigation measure(s) to be considered technically feasible, it (they) must provide a minimum 5 dB noise level reduction averaged over the first row of receptors[1].

Once a mitigation option is deemed technically feasible, it must then be evaluated for economic feasibility. For the noise mitigation measure(s) to be considered economically feasible, its cost-benefit ratio should be within the range of what the MTO typically spends per benefitted receptor. The current MTO cost-benefit ratio limit is $120,000 per residence for the noise mitigation measure to be economically feasible. The cost-benefit ratio is calculated as the estimated cost of the noise mitigation divided by the number of benefitted receptors; a benefitted receptor is one which gets at least a 5 dB noise reduction from the investigated mitigation measure.

[1] First Row Receptors, as defined in the MTO Guide means the line of adjacent receptors closest to the highway, usually running parallel to each other. In some cases where the first-row receptors do not run parallel to a highway, first-row receptors are interpreted to be adjacent receptors where noise level differences are imperceptible (within 3 dB) from the receptor experiencing the highest noise levels.

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Administrative feasibility is assessed by determining the ability to locate the noise mitigation on lands within public ownership (e.g., provincial or municipal right-of-way), within project constraints.

When noise barriers are rebuilt or relocated, they should be designed and constructed to current MTO standards. Therefore, the noise barrier being relocated with the Project, designated ENB1 between Stewart Boulevard and Ormond Street, is expected to be 5 m high, and a technical or economic feasibility is not required, per MTO Guide.

Noise assessments should be based on a minimum 10-year future horizon year traffic data from the date of completion of the project, per MTO Guide

As per the MTO Guide, $L_{eq\ (24h)}$ sound levels are used to assess impacts from freeways (400-series major highways).

3.2 Construction Noise Guidelines

The MTO is legally exempt from the requirements of municipal noise by-laws and will not be required to apply for by-law exemptions and permits. However, MTO recognizes that construction noise can have impacts on communities and will frequently communicate with the municipalities to work within the spirit of the municipal noise by-laws. MTO will make reasonable attempts, including public notification and mitigation measures, to reduce construction noise impact.

The relevant local noise by-laws and applicable criteria are discussed in the following subsections.

3.2.1 Local Noise Control By-Law

The proposed Project is located under the City of Brockville. The City of Brockville Noise By-Law (No. 076-2-21is applicable for the Project. The City By-Law prohibits the operation of any construction equipment in connection with construction from from 19:00 hours one day to 07:00 hours next day, except until 09:00 hours on Saturdays, and all day on Sundays and statutory holidays.

The By-Law also restricts construction equipment sound level at the point of reception to 85 dBA.

3.2.2 MECP Construction Noise Guideline

The MECP stipulates limits on noise emissions from individual pieces of equipment, rather than for overall construction noise. In the presence of persistent noise complaints, sound emission standards for the various types of construction equipment used on the project should be verified. The specified limits contained in MECP Publication NPC-115 (MECP 1977) and NPC-118 (MECP 1982) are summarized in Table 3.1.

Table 3.1: Construction Noise Emission Limits (NPC-115 and NPC-118)

Type of Unit	Maximum Allowed Sound Pressure Level a (dBA)	**Distance at Which Sound Levels are Measured (m)**
Excavation Equipment Under 75 kW Capacity b	83	15
Excavation Equipment with 75 kW or Greater Capacity b	85	15
Pneumatic Equipment c	85	7
Portable Compressors	76	7
Track Drills	100	15
Heavy Vehicles with Governed Diesel Engines	95	15

Notes:

[a] Maximum permissible sound levels presented here are for equipment manufactured after Jan 1, 1981

[b] Excavation equipment includes bulldozers, backhoes, front end loaders, graders, excavators, steam rollers and other equipment capable of being used for similar applications

[c] Pneumatic equipment includes pavement breakers

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4.0 Noise Sensitive Areas and Receptors

As per the MTO Guide, there are two types of noise sensitive areas (NSAs) considered for the noise impact assessment: Traditional NSAs and Special Land Use NSAs.

Traditional NSAs include the following land uses, with an outdoor living area[2] (OLA) associated with them:

- Private homes
- Townhouses
- Multiple unit buildings (e.g., such as apartments with OLAs for use by all occupants)
- Hospitals, nursing homes for the aged, where there are OLAs for the patients/residents

Special Land Use NSAs include the following land use areas:

- Educational facilities and day care centres, where there are OLAs for students
- Campgrounds that provide overnight accommodation
- Hotels/motels where there are OLAs for visitors (e.g., swimming pool area)
- Community centres with OLAs (e.g., outdoor basketball courts)
- Municipal parks (excluding golf courses and trails)
- Places of worship with OLA

Where a freeway/highway improvement is planned, Special Land Use NSAs are only considered if they are located next to a Traditional NSA.

Fifteen (15) NSAs, including three (3) proposed developments were identified from a review of aerial imagery, the City of Brockville development information, and the Air Quality Assessment Report for the Project (Stantec 2023). Thirty-two (32) representative receptors were chosen from these NSAs in this noise assessment. The receptors identified for the existing NSAs have associated outdoor living areas (OLAs). The receptors identified in the Air Quality Assessment without an OLA are excluded from this assessment. The receptors representing the OLA of the NSAs are included in

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[2] Outdoor Living Area (OLA) means an area at ground level, adjacent to an NSA, intended and designed for the enjoyment of the outdoor environment.

this analysis and have been modelled consistent with the MTO Guide, at 1.5 m above the existing ground surface and 3 m from the dwelling wall, typically located in the backyard.

The details of the proposed developments received from the City of Brockville are attached as Appendix B.

The receptors considered for the assessment are listed in Table 4.1 and are also shown in Figure 1.1.

Table 4.1: Representative Receptors

Receptor ID [a]	Description	UTM Coordinates Zone 18		NSA
		Easting (m)	Northing (m)	
NSA01_R01	Residence on Old Red Road	442156	4937592	NSA01
NSA01_R02	Residence on Old Red Road	443005	4937958	NSA01
NSA02_R03	Residence on Parkdale Avenue	443799	4938635	NSA02
NSA03_R04	Development at 7829 Kent Boulevard	443897	4938435	NSA03
NSA04_R05	Residence on Massey Place	443943	4938985	NSA04
NSA05_R06	Proposed Hotel at 325 Stewart Boulevard	444310	4938939	NSA05
NSA06_R07	Residence on Steacy Gardens	444275	4939326	NSA06
NSA07_R08	Residence on Schofield Avenue	444379	4938035	NSA07
NSA08_R09	Residence on Alexander Street	444493	4938277	NSA08
NSA08_R10	Residence on Alexander Street	444607	4938374	NSA08
NSA09_R11	Days Inn on Stewart Boulevard	444402	4938599	NSA09
NSA10_R12	Residence at Central Avenue	444750	4938527	NSA10
NSA11_R13	Development at 125 Stewart Boulevard	444608	4938727	NSA11
NSA12_R14	Residential Building on Balmoral Place	444727	4938911	NSA12
NSA13_R15	Residence on Willow Place	444859	4939122	NSA13
NSA13_R16	Residence on Brookview Place	444994	4939250	NSA13
NSA13_R17	Residence on Ormond Street	445181	4939466	NSA13

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Receptor ID [a]	Description	UTM Coordinates Zone 18		NSA
		Easting (m)	Northing (m)	
NSA13_R18	Residence on Sussex Place	445414	4939645	NSA13
NSA13_R19	Residence on Salisbury Avenue	445511	4939744	NSA13
NSA13_R20	Residence on Salisbury Avenue	445564	4939788	NSA13
NSA13_R21	Residence on Salisbury Avenue	445600	4939799	NSA13
NSA13_R22	Residence on Sevenoaks Avenue	445639	4939733	NSA13
NSA14_R23	Residence on Manor Drive	445780	4939721	NSA14
NSA14_R24	Residence on Manor Drive	445787	4939824	NSA14
NSA14_R25	Residence on Manor Drive	445782	4939906	NSA14
NSA14_R26	Residence on Baker Place	445795	4940045	NSA14
NSA14_R27	Residence on Oxford Crescent	446277	4940538	NSA14
NSA15_R28	Residence on Oxford Avenue	446123	4940609	NSA15
NSA15_R29	Residence on Oxford Avenue	446104	4940643	NSA15
NSA15_R30	Residence on Oxford Avenue	446094	4940664	NSA15
NSA15_R31	Residence on North Augusta Road	446032	4940813	NSA15
NSA15_R32	Residence on Concession 2 Road	446220	4940764	NSA15

5.0 Road Traffic Data

This section of the report discusses the road traffic considered for assessing noise impacts from the proposed future interim and ultimate footprints for Highway 401, and reconfiguration of Stewart Boulevard and North Augusta Road interchanges.

The future Annual Average Daily Traffic (AADT) for Highway 401, Stewart Boulevard, North Augusta Road and ramps were provided by the traffic team (CIMA+ 2022) for the horizon years 2032 and 2042. The No-Build traffic data was only provided for year 2032 and is used for both interim and ultimate Project footprint scenarios in this assessment. The future AADT used in the assessment for highway, ramps and crossroads are summarized in Table 5.1.

Table 5.1: Traffic Data

Road and Segment	Direction [a]	2032 AADT	2042 AADT	Heavy / Medium Truck [b] %	Traffic Speed Limit (km/h)
Highway 401 – West of Stewart Boulevard [c, d, e]	Both EB and WB	43,229	53,215	27/5	100/110
Highway 401 – Between Stewart Boulevard and North Augusta Road [c, d, e]	Both EB and WB	46,854	57,678	27/5	100/110
Highway 401 – East of North Augusta Road [c, d, e]	Both EB and WB	50,898	62,656	27/5	100/110
Stewart Boulevard	Both NB and SB	24,114	26,637	8/5	50
Stewart Boulevard On-Ramp - Existing	EB-NB	980	-	8/5	40
Stewart Boulevard On-Ramp - Existing	EB-SB	1,425	-	8/5	30
Stewart Boulevard On-Ramp - Existing	WB-NB	524	-	8/5	30
Stewart Boulevard On-Ramp - Existing	WB-SB	1,127	-	8/5	30
Stewart Boulevard On-Ramp - Proposed	EB	2,406	1,651	8/5	40/50[f]
Stewart Boulevard On-Ramp - Proposed	WB	2,682	1,824	8/5	40/50[f]
Stewart Boulevard Off-Ramp	EB	2,192	2,421	8/5	40
Stewart Boulevard Off-Ramp	WB	2,682	2,962	8/5	30
North Augusta Road	Both NB and SB	13,330	14,725	8/5	50
North Augusta Road On-Ramp - Existing	EB-NB	1,183	-	8/5	50
North Augusta Road On-Ramp - Existing	EB-SB	1,070	-	8/5	30
North Augusta Road On-Ramp - Existing	WB	1,578	-	8/5	40
North Augusta Road On-Ramp - Proposed	EB	2,254	2,489	8/5	50
North Augusta Road On-Ramp - Proposed	WB-NB	568	627	8/5	40
North Augusta Road On-Ramp - Proposed	WB-SB	1,010	1,115	8/5	50
North Augusta Road Off-Ramp	EB	1,228	1,357	8/5	40
North Augusta Road Off-Ramp	WB	2,209	2,440	8/5	30

Notes:

[a] EB – Eastbound, WB – Westbound, NB – Northbound and SB – Southbound.

[b] The truck % for the highway were provided by the traffic team, and that for the crossroads and ramps were estimated based on the MTO Guide.

[c] Four lanes with a traffic speed of 100 km/hr are considered for Highway 401 interim No-Build scenario.

[d] Six lanes with a traffic speed of 100 km/hr are considered for Highway 401 interim Build and ultimate No-Build scenarios.

[e] Eight lanes with a traffic speed of 110 km/hr are considered for Highway 401 ultimate Build scenario.

[f] Traffic speed of 40 km/h used for branches to the north and southbound, and 50 km/h for the combined lines.

6.0 Operation Noise Assessment

The methodology and noise model used for the assessment are discussed under this section. The modelling results are also summarized and the investigation of mitigation where needed are discussed under this section.

6.1 Assessment Methodology

The assessment predicts road traffic noise levels for the Future No-build and Future Build scenarios for the 2032 horizon year (interim Project footprint) and Future Build for the 2042 horizon year (ultimate Project footprint). Highway 401 is upgraded from 4 lanes to 6 lanes for the interim footprint and the future traffic data for the horizon year of 2032 is considered for the assessment. In the ultimate Project footprint, the highway is upgraded from 6 lanes to 8 lanes for a future traffic for the horizon year of 2042. The traffic data discussed in Section 5 and summarized in Table 5.1 is used for this assessment.

The MTO Environmental Guide for Noise (MTO 2022) recommends the latest version of the US FHWA Traffic Noise Model (FHWA TNM©). The MTO Guide refers to the MECP NPC-306 guideline for assessing road traffic noise assessment. The recently published "*Methods to Determine Sound Levels Due to Road and Rail Traffic* - NPC-306", dated February 2020 which is currently in draft from MECP (MECP 2020) also recommends using TNM for modelling traffic noise from road traffic. The NPC-306 guideline stipulates that proponents use the most current noise prediction methods available when determining sound levels caused by road and rail traffic.

The most current version of the FHWA Traffic Noise Model (TNM v3.1) was used for this noise impact assessment. The road traffic noise model considers the following inputs:

- Annual Average Daily Traffic (AADT)
- Commercial vehicle percentages including heavy and medium trucks
- Vehicle speed
- Shielding from intervening ground
- Pavement type
- Elevation profiles for the existing and new/modified roadways

Existing noise barriers south of Highway 401 between Stewart Boulevard and North Augusta Road, and east of North Augusta Road were included in the modelling. The noise barriers located between Stewart Boulevard and North Augusta Road (ENB1 and ENB2) are 4 m high, and the barrier located east of North Augusta Road (ENB3) is 5 m high. These barrier heights are used for No-Build and interim Build scenarios. Since the existing noise barrier ENB1 will be relocated, it is modelled at a 5 m high for the ultimate Project footprint scenario (as per MTO policy on relocating noise barriers). The locations of the existing noise barriers are shown in Figure 1.1 and 6.2.

6.2 Future Noise Impacts

As per the MTO Guide, $L_{eq\ (24h)}$ sound levels are used to assess impacts from the highway. The noise impact from the Project was assessed by comparing "Future Build" noise impact (with the Project) with "Future No-Build" impact (without the Project). The assessment was completed for the interim and ultimate scenarios with the traffic data for the horizon years 2032 and 2042 respectively. The Project noise assessment was conducted by comparing "Future Build" sound levels with "Future No-Build" sound levels and is presented in Table 6.1 and Table 6.2 for both scenarios. These tables also identify the need for noise mitigation.

Table 6.1: Predicted Future Sound Levels for Interim Project Footprint (2032)

Receptor ID	Number of Receptors Represented	Future No-Build Sound Levels (dBA)	Future Build Sound Levels (dBA)	Is Future Build Sound Level ≥ 65dBA?	Increase in Sound Levels (dB) [a]	Predicted Increase Greater than 5 dB?	Should Mitigation be Investigated?
NSA01_R01	13	53.9	54.0	No	0.0	No	No
NSA01_R02	2	55.0	55.0	No	0.0	No	No
NSA02_R03	3	59.9	59.8	No	-0.1	No	No
NSA03_R04	1	64.8	64.9	No	0.1	No	No
NSA04_R05	10	60.5	60.3	No	-0.2	No	No
NSA05_R06	1	63.3	62.9	No	-0.4	No	No
NSA06_R07	10	58.4	58.2	No	-0.2	No	No
NSA07_R08	15	57.0	56.9	No	-0.1	No	No
NSA08_R09	7	58.6	58.3	No	-0.3	No	No
NSA08_R10	10	59.0	58.7	No	-0.4	No	No
NSA09_R11	1	65.4	64.9	No	-0.6	No	No
NSA10_R12	5	64.1	64.0	No	-0.1	No	No
NSA11_R13	1	65.1	63.7	No	-1.4	No	No
NSA12_R14	1	55.9	58.5	No	2.6	No	No
NSA13_R15	17	61.3	61.5	No	0.2	No	No
NSA13_R16	16	58.7	58.1	No	-0.6	No	No
NSA13_R17	18	60.6	59.8	No	-0.7	No	No
NSA13_R18 [b]	15	64.2	65.8	Yes	1.7	No	Yes

Receptor ID	Number of Receptors Represented	Future No-Build Sound Levels (dBA)	Future Build Sound Levels (dBA)	Is Future Build Sound Level ≥ 65dBA?	Increase in Sound Levels (dB) [a]	Predicted Increase Greater than 5 dB?	Should Mitigation be Investigated?
NSA13_R19	5	63.6	63.9	No	0.3	No	No
NSA13_R20	3	61.4	61.7	No	0.3	No	No
NSA13_R21	3	60.3	60.2	No	-0.1	No	No
NSA13_R22	10	62.4	61.6	No	-0.8	No	No
NSA14_R23	8	62.0	61.2	No	-0.9	No	No
NSA14_R24	8	62.7	60.0	No	-2.6	No	No
NSA14_R25	11	63.1	58.7	No	-4.3	No	No
NSA14_R26	31	59.1	59.1	No	0.1	No	No
NSA14_R27	12	59.2	59.2	No	0.0	No	No
NSA15_R28 [c]	1	69.7	69.6	Yes	-0.1	No	Yes
NSA15_R29 [c]	1	66.2	66.0	Yes	-0.2	No	Yes
NSA15_R30	1	64.1	64.2	No	0.1	No	No
NSA15_R31	1	60.4	60.4	No	0.0	No	No
NSA15_R32	3	63.8	63.6	No	-0.1	No	No

Notes:

[a] For the receptors with negative values for increase in sound levels, ramps will be farther away from the receptor for the future build footprint, hence less noise impacts are expected.

[b] Mitigation is not investigated for this receptor since the sound level for the ultimate Project footprint scenario with relocated noise barrier (ENB1) is expected to be within the MTO limit.

[c] Mitigation is investigated for these receptors.

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Table 6.2: Predicted Future Sound Levels for Ultimate Project Footprint (2042)

Receptor ID	Number of Receptors Represented	Future No-Build Sound Levels (dBA)	Future Build Sound Levels (dBA)	Is Future Build Sound Level ≥ 65dBA?	Increase in Sound Levels (dB) [a]	Predicted Increase Greater than 5 dB?	Should Mitigation be Investigated?
NSA01_R01	13	53.9	55.5	No	1.6	No	No
NSA01_R02	2	55.0	56.2	No	1.2	No	No
NSA02_R03	3	59.9	61.2	No	1.3	No	No
NSA03_R04 [b]	1	64.8	66.2	Yes	1.4	No	Yes
NSA04_R05	10	60.5	61.3	No	0.8	No	No
NSA05_R06	1	63.3	64.3	No	1.0	No	No
NSA06_R07	10	58.4	59.6	No	1.2	No	No
NSA07_R08	15	57.0	57.3	No	0.3	No	No
NSA08_R09	7	58.6	58.3	No	-0.3	No	No
NSA08_R10	10	59.0	59.2	No	0.2	No	No
NSA09_R11 [c]	1	65.4	65.7	Yes	0.3	No	Yes
NSA10_R12	5	64.1	64.5	No	0.4	No	No
NSA11_R13	1	65.1	64.8	No	-0.3	No	No
NSA12_R14	1	55.9	58.8	No	2.9	No	No
NSA13_R15	17	61.3	61.2	No	-0.1	No	No
NSA13_R16	16	58.7	58.2	No	-0.5	No	No
NSA13_R17	18	60.6	60.0	No	-0.6	No	No
NSA13_R18	15	64.2	64.9	No	0.7	No	No

Receptor ID	Number of Receptors Represented	Future No-Build Sound Levels (dBA)	Future Build Sound Levels (dBA)	Is Future Build Sound Level ≥ 65dBA?	Increase in Sound Levels (dB) [a]	Predicted Increase Greater than 5 dB?	Should Mitigation be Investigated?
NSA13_R19 [c]	5	63.6	65.2	Yes	1.6	No	Yes
NSA13_R20	3	61.4	62.9	No	1.5	No	No
NSA13_R21	3	60.3	61.2	No	0.9	No	No
NSA13_R22	10	62.4	62.4	No	0.0	No	No
NSA14_R23	8	62.0	61.9	No	-0.1	No	No
NSA14_R24	8	62.7	60.9	No	-1.8	No	No
NSA14_R25	11	63.1	59.9	No	-3.2	No	No
NSA14_R26	31	59.1	60.8	No	1.7	No	No
NSA14_R27	12	59.2	60.8	No	1.6	No	No
NSA15_R28 [c]	1	69.7	71.1	Yes	1.4	No	Yes
NSA15_R29 [c]	1	66.2	67.4	Yes	1.2	No	Yes
NSA15_R30 [c]	1	64.1	66.1	Yes	2.0	No	Yes
NSA15_R31	1	60.4	61.9	No	1.5	No	No
NSA15_R32 [c]	3	63.8	65.1	Yes	1.3	No	Yes

Notes:

[a] For the receptors with negative values for increase in sound levels, ramps will be farther away from the receptor for the future build footprint, hence less noise impacts are expected.

[b] Mitigation is not investigated for this receptor as it is a new development, and the mitigation is expected to be incorporated in the design by the developer.

[c] Mitigation is investigated for these receptors.

[d] Future No-Build sound levels from 2032 traffic data, considered as a conservative approach.

An increase in sound level of up to 2.6 dB for interim footprint and up to 2.9 dB for the ultimate Project footprint are predicted at R14 with the Project. The assessment predicts that Future Build noise levels are expected to exceed 65 dBA, the sound level above which mitigation feasibility is investigated, at three (3) receptors (R18, R28 and R29) for the future interim Project footprint, and at seven (7) receptors (R04, R11, R19, R28, R29, R30 and R32) for the future ultimate Project footprint. Noise mitigation was only investigated for the existing receptors. Mitigation for proposed future development (R04) is not investigated or further discussed in this report as the mitigation is expected to be incorporated in the design by the developer per MECP NPC-300. Acoustic shielding from the proposed developments were not included in the model. Sample calculations are included in Appendix C.

Table 6.3 illustrates the predicted impacts ranked in terms of increasing sound level for the ultimate footprint as per MTO requirements.

Table 6.3: Ranking of Noise Levels for Ultimate Project Footprint

Future Build Sound Level	Receptors	No. of Affected Receptors
56 to 60 dBA	R01, R02, R07, R08, R09, R10, R14, R16, R17, R25	103
61 to 65 dBA	R03, R05, R06, R12, R13, R15, R18, R20, R21, R22, R23, R24, R26, R27, R31, R32	131
66 to 70 dBA	R04, R11, R19, R29, R30	9
71 to 75 dBA	R28	1

Investigation of noise mitigation is presented in the following section.

6.3 Investigation of Noise Mitigation

Based on the predicted noise levels for the Future Build and Future No-build scenarios, noise mitigation was investigated for receptors R11, R19, R28, R29, R30 and R32.

The MTO Guide provides the following guidelines for the mitigation consideration:

- Investigate noise control measures within MTO right-of-way.

- Noise control measures, where introduced, should achieve a minimum of 5 dB noise reduction averaged over the first row of receptors.
- Noise control measures, where introduced, must be technically, economically, and administratively feasible.

The following noise mitigation options are typically considered for road traffic noise:

- Horizontal and vertical alignment changes
- Pavement type changes
- Noise Barriers

Considering the nature of the Project, alignment adjustments as a mitigation option were not considered. In addition, adjustments to pavement type were also not considered as a mitigation measure as asphalt is being used for this Project. Only noise barriers were considered for Project noise mitigation.

Noise barriers reduce noise levels at protected receptors by blocking the path of sound waves emanating from the source towards the receiver, and by absorbing or reflecting the incident sound energy away. Therefore, a noise barrier must at least break the line-of-sight between the source (the roadway) and the receptor (the ground-level OLA of the NSA under investigation) to be effective.

Where noise walls are to be used, they should be free of gaps and cracks, and have a minimum surface density (mass per unit of face area) of 20 kg/m^2 (4 lb/ft^2). It is preferable that barriers are absorptive at least on the roadway side, and this is recommended in situations where parallel walls (e.g., walls on both sides of a roadway) are proposed.

For noise barriers to be considered as mitigation for the Project, they should meet the following MTO requirements:

- Located within the right-of-way
- Achieve at least 5 dB attenuation over the first row of affected receivers

MTO also limits noise barriers to a maximum height of 5 m. Therefore, noise barriers are modelled along the Project right-of-way limit with a height of 5 m above the existing ground surface.

For a barrier to be considered a viable mitigation measure, the investigated noise barriers should be administratively, technically, and economically feasible.

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The relocated noise barrier ENB1 was modelled 5 m high for the ultimate Project footprint scenario and is not assessed for technical or economic feasibility.

The following noise barrier mitigation options were investigated for the Project:

- Increasing the height of the existing noise barrier ENB2, located east of Ormond Street, from 4 m to 5 m for NSAs represented by R19
- 5 m high noise barrier NB1 for R11
- 5 m high noise barrier NB2 for NSAs represented by R28, R29, R30 and R32

A map showing the investigated noise barrier locations is provided in Figure 1.1 and Figure 1.1.

Stantec

Legend

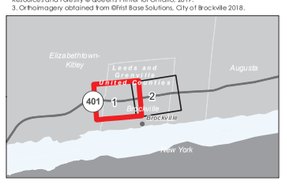
- Receptors
- Investigated Noise Barriers
- Existing Noise Barriers
- Study Area

0 200 400 Meters

1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2019.
3. Orthoimagery obtained from ©First Base Solutions, City of Brockville 2018.



Project Location
City of Brockville

165001160 REVA
Prepared by JSa on 2023-07-06

Client/Project
ONTARIO MINISTRY OF TRANSPORTATION
HIGHWAY 401 REHABILITATION/ RECONSTRUCTION
GWP 4003-19-00

Figure No.
6-1

Title
Location of Investigated Noise Barriers

Stantec

Legend

- Receptors
- Investigated Noise Barriers
- Existing Noise Barriers
- Study Area

0 200 400 Meters

1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
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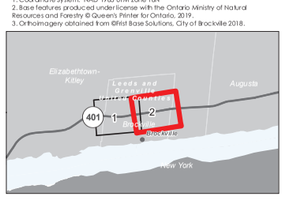

Project Location
City of Brockville

165001160 REVA
Prepared by JSa on 2023-07-06

Client/Project
ONTARIO MINISTRY OF TRANSPORTATION
HIGHWAY 401 REHABILITATION/ RECONSTRUCTION
GWP 4003-19-00

Figure No.
6-2

Title
Location of Investigated Noise Barriers

Table 6.4 lists a summary of the technical and economic feasibility evaluations for the investigated noise barriers.

The technical feasibility evaluation of noise barrier NB1 and relocated noise barrier ENB2 show that they do not provide the minimum average 5 dB reduction over the first-row receptors. Therefore, NB1 and ENB2 do not meet the criteria for technical feasibility and were not assessed for other feasibilities or considered further as a noise mitigation option for the Project.

The technical feasibility evaluation shows that noise barrier NB2 provides the minimum 5 dB reduction average over the first-row receptors. As such, NB2 is considered technically feasible and was further evaluated for economic feasibility.

The economic feasibility evaluation shows that construction of barrier NB2 exceeds the cost-benefit threshold of $120,000 per receptor, and is therefore, not economically feasible. As such, NB2 was not considered further as noise mitigation option for the Project.

Table 6.4: Evaluation of Noise Barriers for Economic/Technical Feasibility

Barrier ID	Benefited Receptors	No. of Benefited Residences	Average Noise Reduction (dB)	Technically Feasible?[a]	Barrier Height (m)	Barrier Length (m)	Approx. Barrier Cost ($)[b]	Approx. Barrier Cost Per Receptor ($)[c]	Economically Feasible?[d]
NB1	R11	1	4	No	5	170	N/A	N/A	N/A
NB2	R28, R29, R30, R31, R32	7	6	Yes	5	390	1,170,000	167,142	No
ENB2[e]	R19, R20, R21	11	2	No	5	330	N/A	N/A	N/A

Notes:
[a] "Yes" if the barrier provides minimum 5 dB noise reduction; else, "No."
[b] Based on an approximate barrier cost of $600 per m^2 of face area.
[c] Total cost divided by the number of benefited residences.
[d] "Yes" if barrier cost is less than $120,000 per receptor; else, "No." "N/A" means that the barrier was not assessed for economic feasibility since it did not pass technical feasibility.
[e] Upgrading existing noise barrier ENB2 east of Ormond Street.

7.0 Construction Noise Assessment

Construction noise impacts are temporary in nature, and largely unavoidable. With adequate controls, impacts can be reduced. However, for some periods of time and types of work, construction noise will be noticeable at some receptor locations. This section of the report provides an evaluation of construction equipment noise and discusses guideline and Code of Practice to reduce construction impacts.

7.1 Analysis Methods

The construction noise impact assessment considered effects of various types of construction equipment. As part of assessing the noise effects due to the use of construction equipment, the maximum sound levels resulting from operation of construction equipment was determined and compared with the applicable criteria limits.

7.2 Expected Construction Activities

The following construction activities are expected as part of the Project:

- Improvement of Highway 401 and ramps, and reconfiguration of interchanges
- Replacement of Stewart Boulevard and North Augusta Road overpasses with profile adjustments to connect new ramps
- Relocation of existing noise wall ENB1 located between Stewart Boulevard and North Augusta Road to farther south
- Paving/repaving of roadway surfaces

7.3 Construction Noise Levels

Construction activities will vary temporally and spatially as the Project progresses. Noise levels from construction at a given receptor location will also vary over time as different activities take place, and as those activities change location within the right-of-way.

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Table 7.1 lists the construction equipment considered for the assessment and a comparison of their noise emissions to the applicable NPC-115 and NPC-118 noise limits. A detailed construction plan or equipment list is not currently available. Therefore, the construction equipment list in Table 7.1 represents typical equipment expected to be used for this type of construction. The listed construction equipment noise emissions are based on Stantec's database of field measurements of construction equipment.

Table 7.1: Construction Equipment Sound Level Assessment - MECP

Type of Equipment	Typical Range of Maximum Sound Levels at 15 m (dBA)	NPC-115/118 Sound Level at 15 m (dBA)	Meets NPC-115/118 Sound Level? (Y/N)
Front-End Loader	77 – 85	85	Y
Backhoe	66 – 80	85	Y
Auger	76 – 84	85	Y
Dump Truck	76 – 88	95[b]	Y
Concrete Truck	77 – 85	85	Y
Concrete Pump and Boom	77 – 82	85	Y
Vibratory Compactor	79 – 83	85	Y
Paving Machine [a]	77 – 89	85	N
Pile Driver [a]	95 - 101	85	N
Crane	73 – 83	85	Y
Grader	79 – 85	85	Y
Hoe Ram [a]	90	85	N

Notes:

a These equipment units have potential to exceed the applicable MECP limits and precautions/noise control feasibility should be investigated if they are used near sensitive receptors.

b Refers to the NPC-118 Sound Level at 15 m.

The typical sound levels presented in Table 7.1 shows that most equipment can be operated in compliance with the MECP NPC-115/118 limits. The list also shows that there is the potential for higher sound levels than permissible limits for paving machines.

The City of Brockville Noise By-Law (No. 076-2-21limits the noise impact of construction equipment at receptors to 85 dBA. None of the receptors or NSAs are within 15 m of the Project footprint, therefore, construction equipment noise levels at the receptors are expected to be within the City limit if they comply with the MECP limits, except for pile driver, paving machine and hoe ram. Once the equipment and construction schedule are finalized, the equipment noise level should be reviewed during detailed design to confirm that noise emissions are within the permissible limit of 85 dBA at 15 m. If the sound levels are higher than the limit, noise control options shall be explored.

7.4 Construction Code of Practice

To minimize the potential for construction noise impacts, it is recommended that provisions shall be written into the contract documentation for the contractor and the following best practices be considered:

- All construction equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order.
- There should be explicit indication that Contractors are expected to comply with all applicable requirements of the contract and local noise by-laws. Enforcement of noise by-laws is the responsibility of the Municipality for all work done by Contractors.
- The Contract documents should contain a provision that any initial noise complaint will trigger verification of construction noise and typical noise control measures.
- In the presence of persistent noise complaints, all construction equipment should be verified to comply with the City of Brockville and MECP NPC-115 and NPC-118 limits.
- In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measures may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration should be given to the technical, administrative, and economic feasibility of the various alternatives.

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8.0 Conclusion and Closure

The potential environmental noise impacts from the future interim and ultimate footprints for Highway 401 and the reconfiguration of Stewart Boulevard and North Augusta Road interchanges was assessed. Both traffic (operational) and construction noise impacts were considered in this assessment.

An increase in sound level of up to 2.6 dB for interim footprint and up to 2.9 dB for the ultimate Project footprint with the Project at R14 was predicted, and the levels were within the 5-dB MTO limit. Predicted Future Build noise levels exceed 65 dBA, the sound level above which mitigation feasibility is investigated, at three (3) receptors (R18, R28 and R29) for future interim Project footprint, and at seven (7) receptors (R04, R11, R19, R28, R29, R30 and R32) for future ultimate Project footprint. Noise mitigation was investigated only for the existing receptors. Mitigation for proposed future development (R04) was not investigated as it is expected to be incorporated in the design of the future development by the developer.

Considering the nature of the Project, alignment and pavement noise mitigation options were not investigated. Only noise barriers as a mitigation option were considered for the Project.

The relocated noise barrier ENB1 (between Stewart Boulevard and Ormond Street) will be constructed to current MTO standards and is expected to be 5 m high. Therefore, 5 m high noise wall is considered for the ultimate footprint scenario.

Two (2) new noise barriers (NB1 and NB2) and upgrade of the existing noise barrier (ENB2) were investigated for noise mitigation for the Project. Noise barriers were assessed for MTO's technical and economical feasibility requirements. Only NB2 was technically feasible and further assessed for economic feasibility. The economic feasibility evaluation for NB2 exceeded the cost-benefit threshold of $120,000 and was not economically feasible. Therefore, noise barriers were ruled out as mitigation and not recommended for this project.

Construction noise for the Project was assessed in accordance with the applicable MECP Publication NPC-115 (MECP 1977) and NPC-118 (MECP 1982) for construction and the City of Brockville Noise By-Law (No. 076-2-21).

The typical sound levels for most of the construction equipment are within the MECP and City noise limits. However, there is potential for higher sound levels than the permissible limits for some equipment. Once equipment and construction schedules are finalized, the equipment noise data should be reviewed during the detailed design stage to confirm that noise emissions are within the limits. If the sound levels are higher than the limits, noise control options may be explored. Methods to minimize construction noise impacts should be included in the Construction Code of Practice, as outlined in the Section 7.4.

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9.0 References

City of Brockville, Noise By-Law No. 076-2-21 “A By-Law to Control Noise in the City of Brockville.” September 28, 2021. (Brockville 2021)

Ontario Ministry of the Environment, Conservation and Parks. 1977. “Model Municipal Noise Control By-law - Publication NPC - 115, Construction Equipment.” (MECP 1977)

Ontario Ministry of the Environment, Conservation and Parks. 1982. “Publication NPC-118 for Motorized Conveyances.” (MECP 1982)

Ontario Ministry of the Environment, Conservation and Parks. 2020. Draft “Publication NPC-306 for *Methods to Determine Sound Levels Due to Road and Rail Traffic*.” (MECP 2020)

Ontario Ministry of Transportation. 2022. “Environmental Guide for Noise, Version 2.0.” (MTO 2022)

Stantec (Stantec Consulting Ltd.) Air Quality Assessment Report for Highway 401 Planning Study, Brockville, from 2 km West of Stewart Boulevard to 750 m East of North Augusta Road, dated March 8, 2023. (Stantec 2023)

Noise Impact Assessment Report
Highway 401 Planning Study, Brockville, from 2 km West of Stewart Boulevard to 750 m East of North Augusta Road (GWP 4003-19-00)

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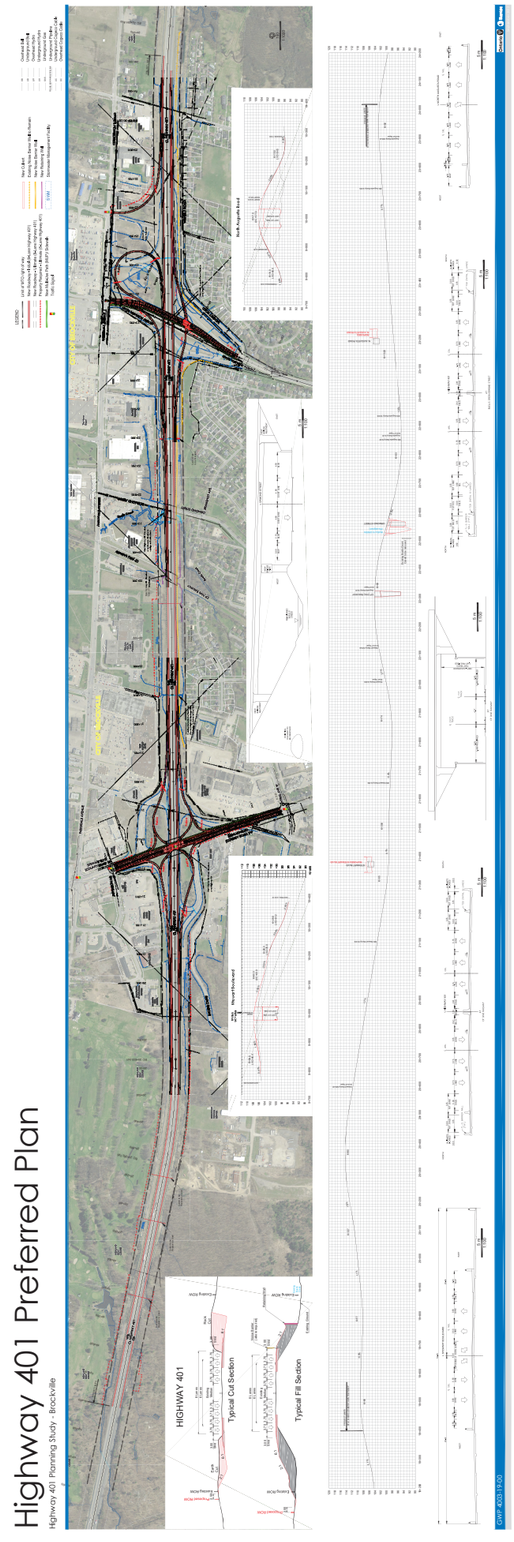
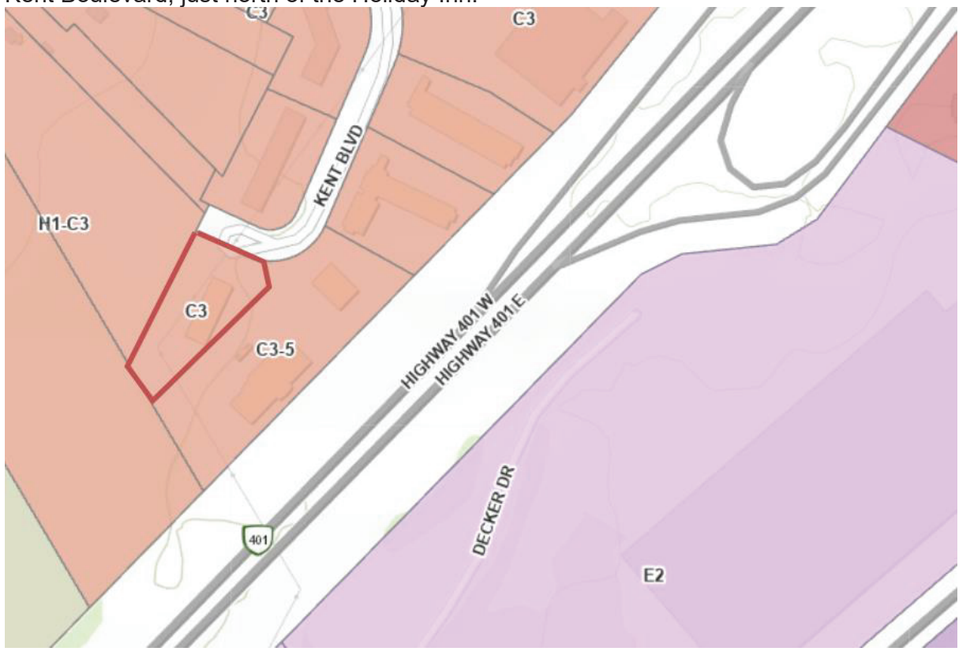
Appendix A
Preferred Design Plan



Appendix B
New Developments Details

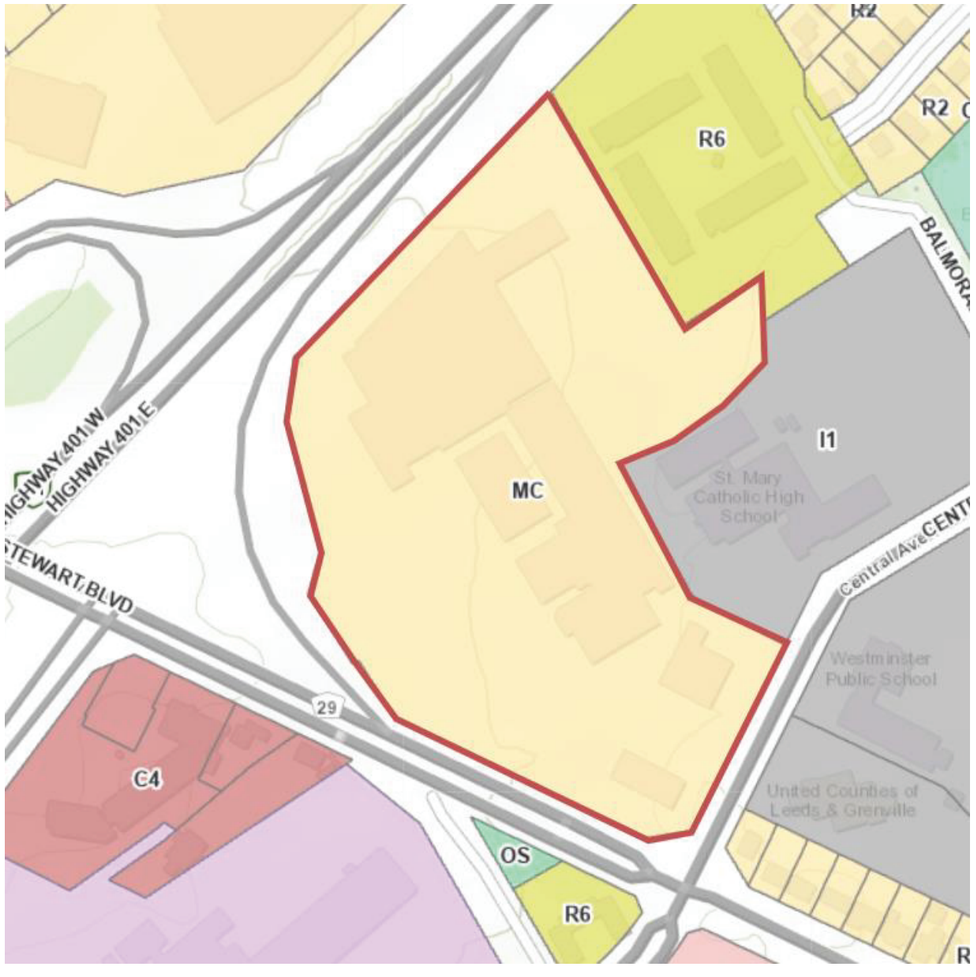
Three New Developments with the City of Brockville:

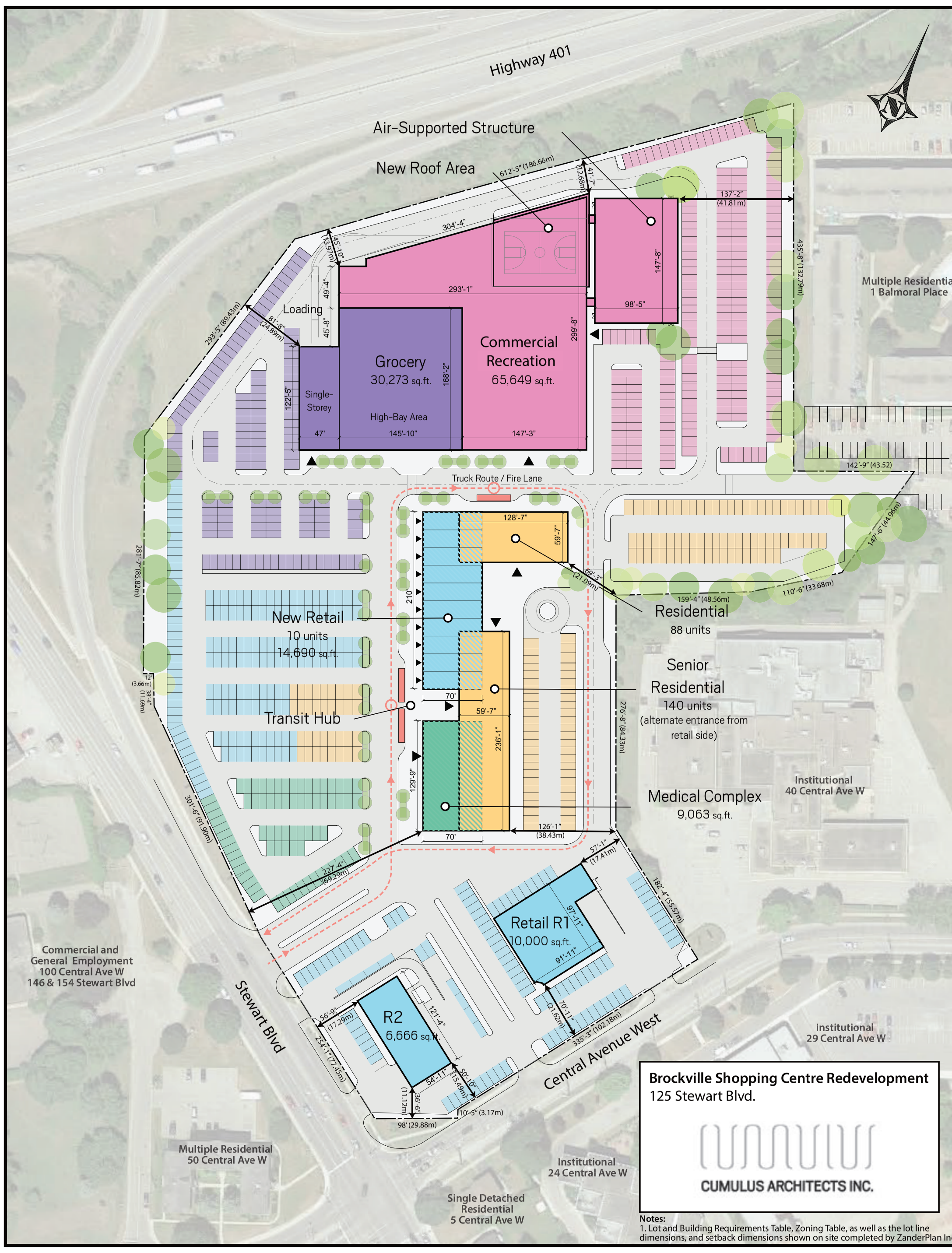
#1 – Official Plan Amendment and Zoning By-law Amendment to change the current Brockville Convention Centre into 8 residential units. This property is located at 7829 Kent Boulevard, just north of the Holiday Inn.



#2 – New Hotel proposed (approx. 100 rooms) at the end of Windsor Drive, directly adjacent to the existing 401 off-ramp at Stewart Boulevard. This proposal just received a minor variance and will shortly be submitting for Site Plan Control.

#3 – Redevelopment of the former Zellers Mall at 125 Stewart Boulevard. The proposal is for redevelopment of the entire site for a truly mixed-use concept. The proposal shows two/three residential towers (not to exceed 36.0 metres in height) along with multiple commercial uses and up to 350 residential apartment units.





Brockville Shopping Centre Redevelopment Conceptual Site Layout

Lot and Building Requirements for Mixed Use Zone

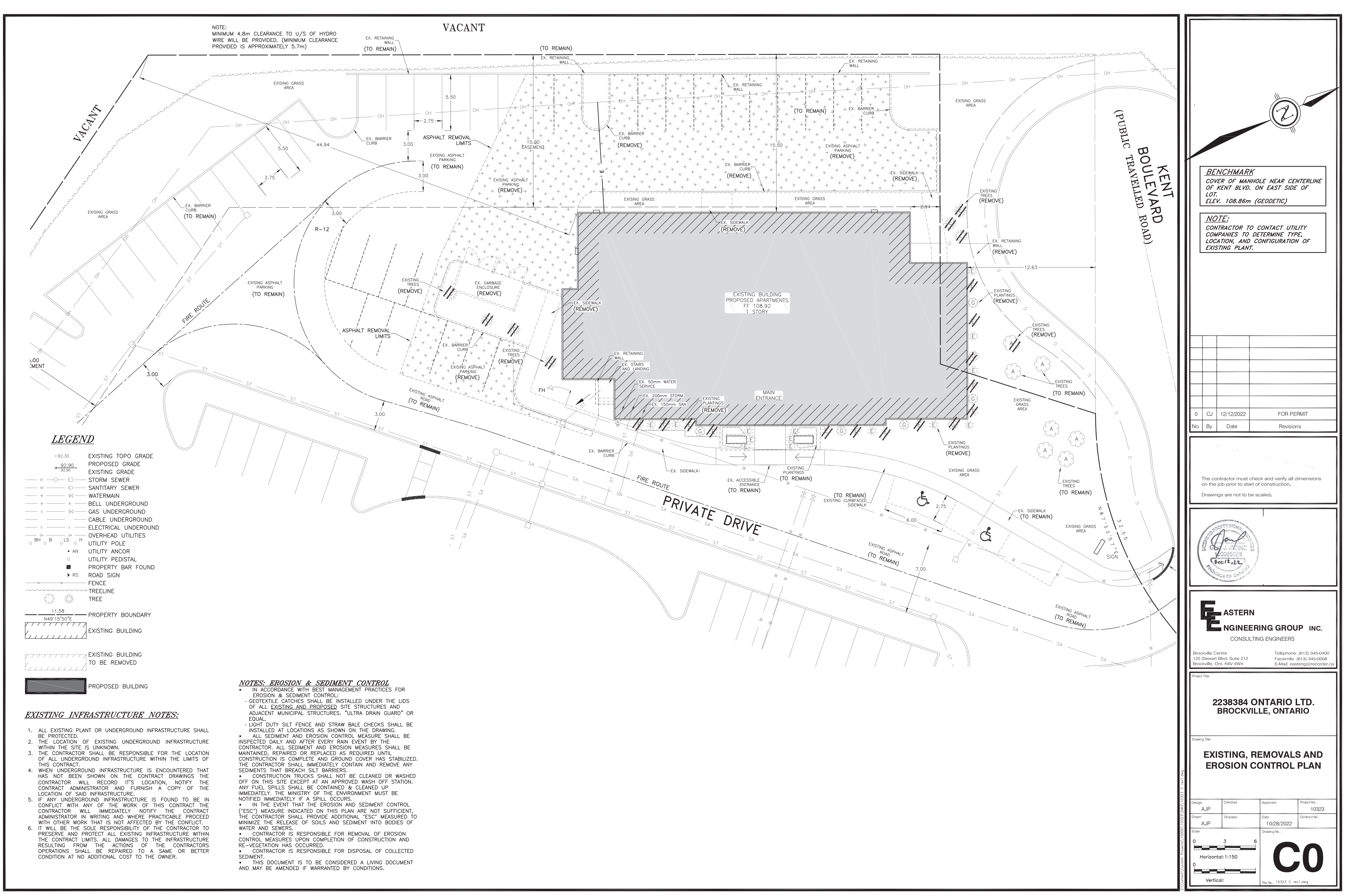
Requirement	Mixed Use Corridor	Proposed
Minimum Lot Frontage	15.0m	102.2m on Central Avenue W
Minimum Lot Area	500.0m2	59,711.2m2
Minimum Front Yard	1.5m	15.5m
Maximum Front Yard	No requirement	n/a
Minimum Exterior Side Yard	3.0m	17.3m
Minimum Interior Side Yard	1.5m or 4.5m where abutting a Residential Zone	17.4m
Minimum Rear Yard	6.0m	12.7m
Maximum Lot Coverage	70%	24%
Minimum Landscaped Open Space	10%	10%
Minimum Ground Floor Height	No requirement	n/a
Minimum Building Height	No requirement	n/a
Maximum Building Height	15.0m	30.0m

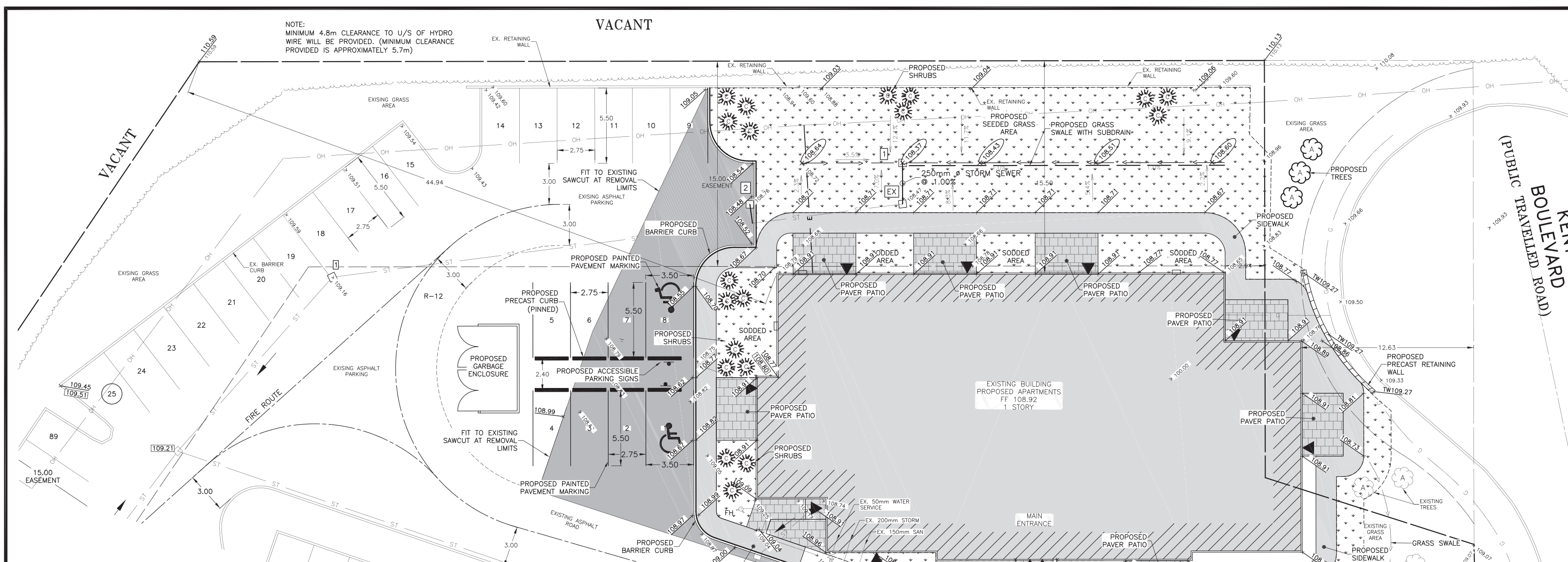
Zoning Table

Zoning Definition	Parking Rate	Proposed GFA/GLA SM or Units	Parking Required	Parking Proposed
Apartment Dwelling	1.1/unit	228 units	251	/
Commercial Recreation Establishment	1/20sq.m gfa	6,099sq.m	305	/
Grocery Store	6/100sq.m gla	2,812sq.m	169	/
Clinic or Medical Office	1/15sq.m gla	842sq.m	56	/
Retail Store	5/100sq.m gla	2,913sq.m	146	/
Total			**927**	**750***

*840 parking spaces are shown on the conceptual site layout, but an exception to 750 parking spaces is being requested to allow room for landscaping and stormwater management features at the Site Plan stage if needed.

ZANDERPLAN
Your rural land planning experts
40 Sunset Boulevard, Perth, ON K7H 2Y4 613-264-9600





EXISTING INFRASTRUCTURE NOTES:

1. ALL EXISTING PLANT OR UNDERGROUND INFRASTRUCTURE SHALL BE PROTECTED.
2. THE LOCATION OF EXISTING UNDERGROUND INFRASTRUCTURE WITHIN THE SITE IS UNKNOWN.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION OF ALL UNDERGROUND INFRASTRUCTURE WITHIN THE LIMITS OF THIS CONTRACT.
4. WHEN UNDERGROUND INFRASTRUCTURE IS ENCOUNTERED THAT HAS NOT BEEN SHOWN ON THE CONTRACT DRAWINGS THE CONTRACTOR WILL RECORD IT'S LOCATION, NOTIFY THE CONTRACT ADMINISTRATOR AND FURNISH A COPY OF THE LOCATION OF SAID INFRASTRUCTURE.
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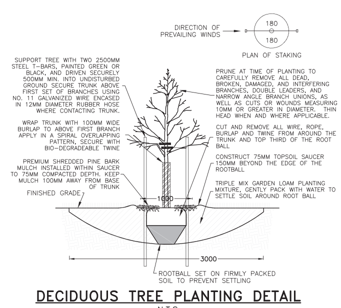
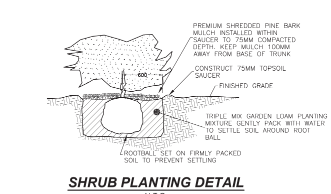
PLANT LEGEND

SYMBOL	NO.	BOTANICAL NAME	COMMON NAME	SIZE
A	7	POPULUS TREMULOIDES	QUAKING ASPEN	200cm
E	19	JUNIPERUS HORIZONTALIS	ANDORRA JUNIPER	40cm



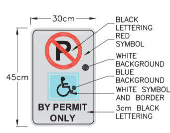
DECIDUOUS TREE PLANTING DETAIL

N.T.S.



SHRUB PLANTING DETAIL

N.T.S.



SIGNAGE NOTES
- PAINTS AND SIGN MATERIALS TO MEET MTO TRAFFIC SIGN SPECIFICATIONS
- SIGNS TO BE INSTALLED TO MTO STANDARDS
- INCLUDES POSTS AND INSTALLATION

ACCESSIBLE PARKING SIGN (OTM Rb-93)

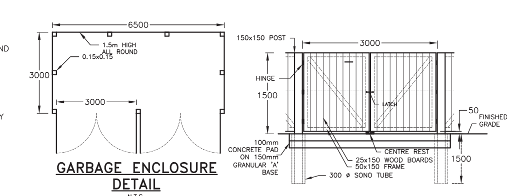
N.T.S.

PROPOSED SIGN INSTALLATION NOTES:

1. ALL SIGN POSTS SHALL BE EMBEDDED A MINIMUM OF 900mm BELOW GRADE AT SPECIFIED LOCATIONS.
2. ALL SIGN POSTS SHALL BE OFFSET 600 mm FROM THE BACK OF ANY CURB, SIDEWALK OR ASPHALT SURFACE UNLESS NOTED ON PLAN.
3. ALL SIGN POSTS AND INSTALLATION SHALL CONFORM TO OPSD 990.110
4. ALL SIGNS SHALL BE MOUNTED A MINIMUM OF 1600mm ABOVE FINISH GRADE TO THE BOTTOM EDGE OF THE SIGN.
5. SIGNS SHALL BE INSTALLED AND CONFORM TO OPSS 703, 2001 AND OTM BOOK 1B, 2, 5 AND 6.

LEGEND

- EXISTING TOPO GRADE
- PROPOSED GRADE
- EXISTING GRADE
- STORM SEWER
- SANTITARY SEWER
- WATERMAIN
- BELL UNDERGROUND
- GAS UNDERGROUND
- CABLE UNDERGROUND
- ELECTRICAL UNDEROUND
- OVERHEAD UTILITIES
- UTILITY POLE
- UTILITY ANCOR
- UTILITY PEDISTAL
- PROPERTY BAR FOUND
- ROAD SIGN
- FENCE
- TREELINE
- TREE
- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING BUILDING TO BE REMOVED
- PROPOSED BUILDING



GARBAGE ENCLOSURE DETAIL

N.T.S.

No.	By	Date	Revisions
0	CJ	12/12/2022	FOR PERMIT

The contractor must check and verify all dimensions on the job prior to start of construction.

Drawings are not to be scaled.

EASTERN ENGINEERING GROUP INC.
CONSULTING ENGINEERS
Brockville Centre, 125 Stewart Blvd. Suite 212, Brockville, Ont. K6V 4W4
Telephone: (613) 345-0400 Facsimile: (613) 345-0008 E-Mail: easteng@recorder.ca

Project Title: **2238384 ONTARIO LTD. BROCKVILLE, ONTARIO**

Drawing Title: **GRADING AND SERVICING PLAN**

Design: AJP | Drawn: AJP | Date: 10/28/2022 | Project No.: 10323
Scale: Horizontal: 1:150 Vertical:
Drawing No.: **C1**
File No.: 10323 C rev1.dwg

BENCHMARK
COVER OF MANHOLE NEAR CENTERLINE OF KENT BLVD. ON EAST SIDE OF LOT.
ELEV. 108.86m (GEODETIC)

NOTE:
CONTRACTOR TO CONTACT UTILITY COMPANIES TO DETERMINE TYPE, LOCATION, AND CONFIGURATION OF EXISTING PLANT.

OPSS SPECIFICATIONS

THE MUNICIPAL-ORIENTED ONTARIO PROVINCIAL STANDARDS IN AFFECT WHEN THE CALL FOR TENDERS FOR THIS CONTRACT WAS ADVERTISED SHALL APPLY FOR THE DURATION OF THE CONTRACT. ALL REFERENCES WITHIN THIS SPECIFICATION TO AN OPSS SHALL BE DEEMED TO MEAN OPSS.MUNI, UNLESS USE OF A PROVINCIAL-ORIENTED SPECIFICATION IS SPECIFIED IN THESE CONTRACT DOCUMENTS. WHEN THERE IS NOT A CORRESPONDING MUNICIPAL-ORIENTED SPECIFICATION, THE REFERENCES BELOW SHALL BE CONSIDERED TO BE THE OPSS LISTED, UNLESS USE OF A PROVINCIAL-ORIENTED SPECIFICATION IS SPECIFIED IN THESE CONTRACT DOCUMENTS.
THE FOLLOWING ONTARIO PROVINCIAL STANDARD SPECIFICATIONS APPLY TO AND FORM PART OF THIS CONTRACT:

102	MUNI 120	127
128	MUNI 180	201
MUNI 206	MUNI 212	310
MUNI 314	351	MUNI 353
MUNI 355	MUNI 401	MUNI 402
MUNI 403	405	407
408	MUNI 410	MUNI 441
MUNI 442	490	MUNI 501
506	MUNI 510	MUNI 517
MUNI 518	MUNI 539	MUNI 706
802	803	MUNI 804
1001	MUNI 1002	MUNI 1003
MUNI 1004	MUNI 1010	MUNI 1101
MUNI 1102	1150	1301
1302	MUNI 1303	1305
1306	1308	1312
MUNI 1315	MUNI 1820	1841
1850	2501	

ONTARIO PROVINCIAL STANDARD SPECIFICATIONS (OPSS) AND ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) FORM PART OF THIS CONTRACT.
THE TEXT OF ALL OPSS'S IS CONTAINED IN THE MANUAL "ONTARIO PROVINCIAL STANDARD SPECIFICATIONS."
THE OPSD'S ARE CONTAINED IN THE MANUAL OF ONTARIO PROVINCIAL STANDARD DRAWINGS.

EXISTING INFRASTRUCTURE NOTES:

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LEGEND

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- PROPOSED GRADE
- EXISTING GRADE
- STORM SEWER
- SANTITARY SEWER
- WATERMAIN
- BELL UNDERGROUND
- GAS UNDERGROUND
- CABLE UNDERGROUND
- ELECTRICAL UNDEROUND
- OVERHEAD UTILITIES
- UTILITY POLE
- UTILITY ANCOR
- UTILITY PEDISTAL
- PROPERTY BAR FOUND
- ROAD SIGN
- FENCE
- TREELINE
- TREE
- PROPERTY BOUNDARY
- EXISTING BUILDING
- EXISTING BUILDING TO BE REMOVED
- PROPOSED BUILDING

PAVEMENT MARKING NOTES
- ALL PARKING STALL LINES, TRAFFIC ARROWS AND HATCHED AREAS SHALL BE PAINTED YELLOW.
- ALL PARKING STALL LINES SHALL BE 100mm WIDE.
- PAINT MUST MEET "OPSS 1716 WATER-BORNE TRAFFIC PAINT" SPECIFICATIONS
- HANDICAPPED PARKING SPACES TO BE PAINTED STANDARD BLUE OVERLAIN WITH THE INTERNATIONAL SYMBOL FOR DISABLED PERSON.

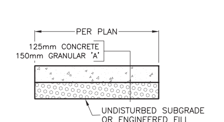
GENERAL NOTES

- ALL WORK ON CITY PROPERTY TO BE PERFORMED BY A CONTRACTOR APPROVED BY THE CITY.
- CONTRACTOR TO VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO THE START OF CONSTRUCTION.
- CONTRACTOR TO OBTAIN ALL NECESSARY PERMITS PRIOR TO START OF CONSTRUCTION.

LAWN AREAS

SODDED AREAS:PREPARE SODDED AREAS WITH SCREENED TOPSOIL, 150MM COMPACTED DEPTH
INSTALL NO. 1 NURSERY SOD

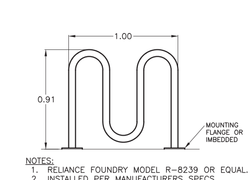
SEEDED AREAS:PREPARE SEEDED AREAS WITH SCREENED TOPSOIL, 150MM COMPACTED DEPTH.
INSTALL THE FOLLOWING SEED BLEND
10% HERON HARD FESCUE
10% MINN FINE KENTUCKY BLUE GRASS
20% SANDPIPER CHEWINGS FESCUE
40% ARUBA CREEPING RED FESCUE
15% ELF PERENNIAL RYEGRASS
5% RED TOP
APPLICATION RATE: 7LBS/1,000S.F.



NOTES:
- EXPANSION JOINTS @ 4.50m INTERVALS AND BOTH ENDS OF DEPRESSED SIDEWALK
- DUMMY JOINTS @ REGULAR 1.50m INTERVALS
- WORK TO CONFORM TO O.P.S.S. 351
- CONCRETE TO BE 30MPa, 7.0% ± 1.5% AIR CONTENT, SLUMP 70mm ± 20mm
- GRANULARS TO BE COMPACTED TO 100% STANDARD PROCTOR DENSITY
- SUBGRADE TO BE EITHER UNDISTURBED NATIVE MATERIAL OR APPROVED GRANULARS COMPACTED TO 100% STANDARD PROCTOR DENSITY

(SW1) SIDEWALK CONCRETE

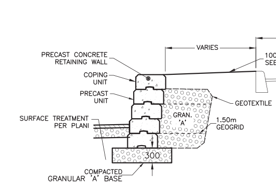
N.T.S.



NOTES:
1. RELIANCE FOUNDRY MODEL R-8239 OR EQUAL.
2. INSTALLED PER MANUFACTURERS SPECS.

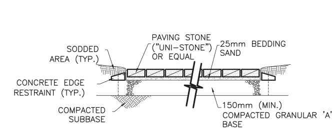
FIVE BIKE RACK

N.T.S.



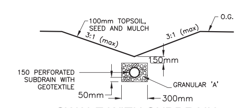
RETAINING WALL

N.T.S.



PAVER DETAIL

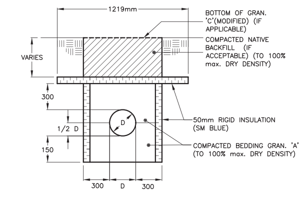
N.T.S.



SWALE WITH SUBDRAIN DETAIL

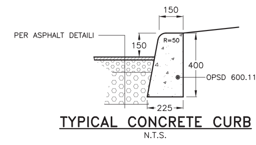
N.T.S.

NOTE
SUBDRAIN CONNECTED TO CATCHBASIN



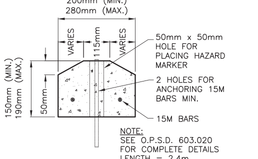
TYPICAL TRENCH DETAIL FOR INSULATED SEWERS

N.T.S.



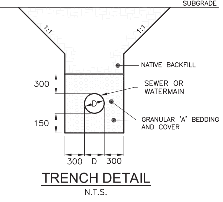
TYPICAL CONCRETE CURB

N.T.S.



TYPICAL PRECAST CONCRETE CURB

N.T.S.



TRENCH DETAIL

N.T.S.

ASPHALT SECTION

N.T.S.

STORM STRUCTURE TABLE					
No.	OPSD	COVER	T/GRATE	SUMP	INVERTS
1	705.010	400.010	108.40	0.600	SE 107.57
2	705.010	100.010	109.28	0.600	E 107.40
EX	EXISTING	EXISTING	108.65	0.600	S 107.44 NW 107.54

No.	By	Date	Revisions
0	CJ	12/12/2022	FOR PERMIT

The contractor must check and verify all dimensions on the job prior to start of construction.

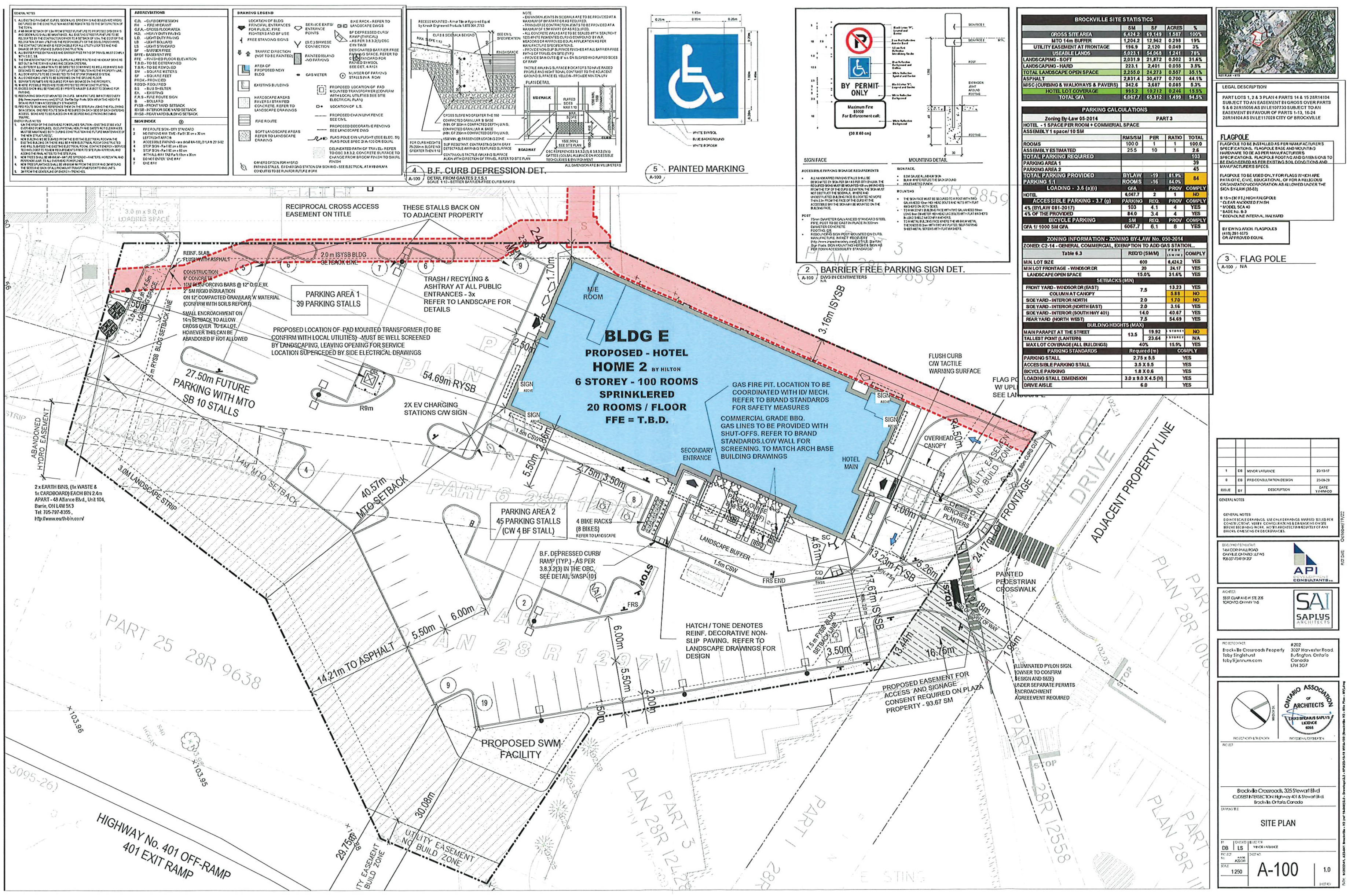
Drawings are not to be scaled.

EASTERN ENGINEERING GROUP INC.
CONSULTING ENGINEERS
Brockville Centre, 125 Stewart Blvd. Suite 212, Brockville, Ont. K6V 4W4
Telephone: (613) 345-0400 Facsimile: (613) 345-0008 E-Mail: easteng@recorder.ca

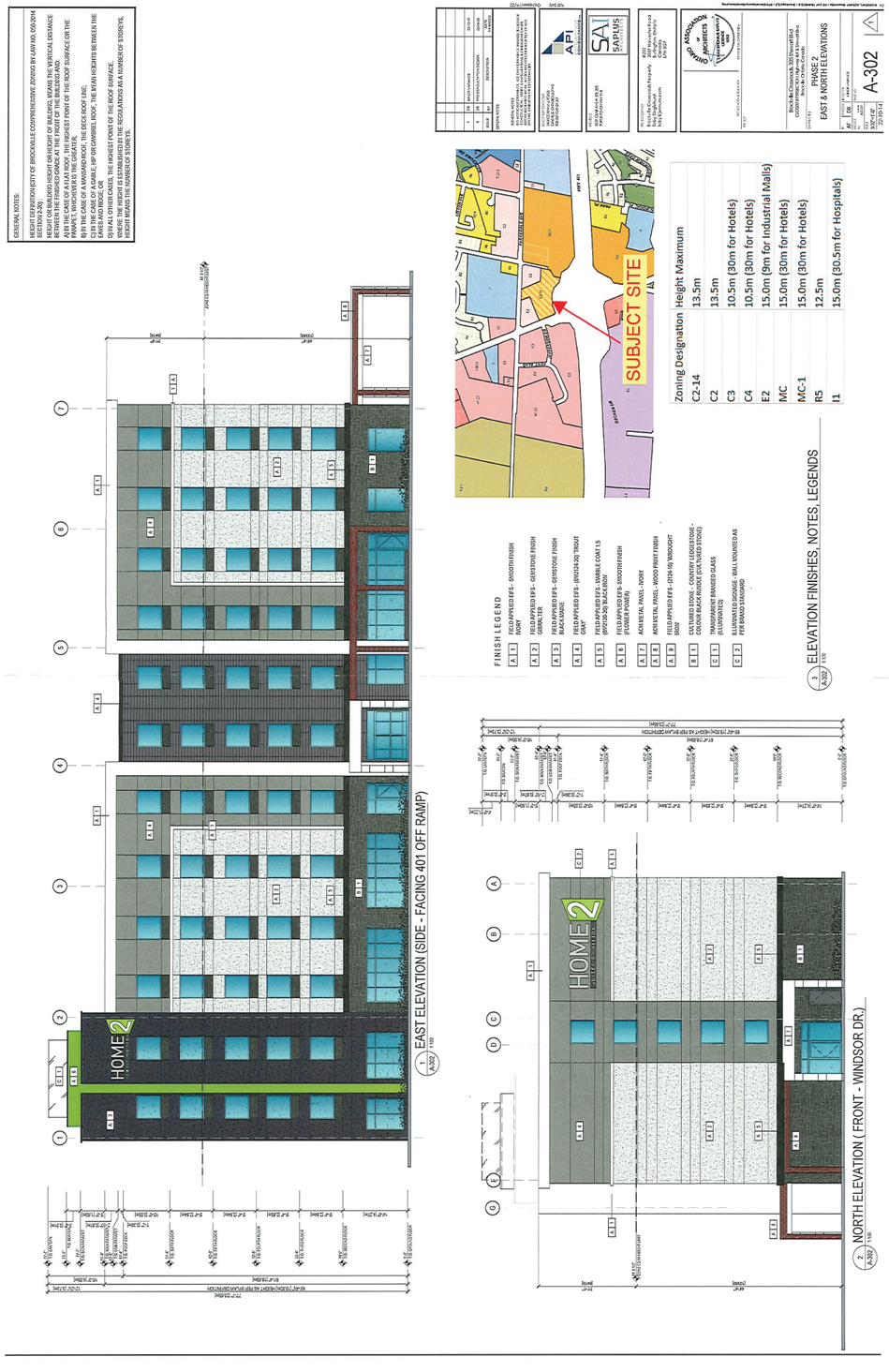
Project Title: **2238384 ONTARIO LTD. BROCKVILLE, ONTARIO**

Drawing Title: **DETAILS**

Design: AJP | Drawn: AJP | Date: 10/28/2022 | Project No.: 10323
Drawing No.: **C2**
File No.: 10323 C rev1.dwg


BLDG E
PROPOSED - HOTEL
HOME 2 BY HILTON
6 STOREY - 100 ROOMS
SPRINKLERED
20 ROOMS / FLOOR
FFE = T.B.D.
PARKING AREA 1
39 PARKING STALLS
PARKING AREA 2
45 PARKING STALLS
(CW 4 BF STALL)
27.50m FUTURE
PARKING WITH MTO
SB 10 STALLS
PROPOSED SWM FACILITY
HIGHWAY No. 401 OFF-RAMP
401 EXIT RAMP
ADJACENT PROPERTY LINE
RECIPROCAL CROSS ACCESS EASEMENT ON TITLE
THESE STALLS BACK ON TO ADJACENT PROPERTY
B.F. CURB DEPRESSION DET.
PAINTED MARKING
BARRIER FREE PARKING SIGN DET.
FLAG POLE
BROCKVILLE SITE STATISTICS
PARKING CALCULATIONS
ZONING INFORMATION - ZONING BY-LAW No. 050-2014
LEGAL DESCRIPTION
FLAGPOLE
SITE PLAN
A-100


GENERAL NOTES:
HEIGHT DEFINITION (CITY OF BROCKVILLE COMPREHENSIVE ZONING BY-LAW NO. 050-2014 SECTION 2-20):
HEIGHT OR BUILDING HEIGHT OR HEIGHT OF BUILDING, MEANS THE VERTICAL DISTANCE BETWEEN THE FINISHED GRADE AT THE FRONT OF THE BUILDING AND:
A) IN THE CASE OF A FLAT ROOF, THE HIGHEST POINT OF THE ROOF SURFACE OR THE PARAPET, WHICHEVER IS THE GREATER;
B) IN THE CASE OF A MANSARD ROOF, THE DECK ROOF LINE;
C) IN THE CASE OF A GABLE, HIP OR GAMBREL ROOF, THE MEAN HEIGHTS BETWEEN THE EAVES AND RIDGE; OR
D) IN ALL OTHER CASES, THE HIGHEST POINT OF THE ROOF SURFACE.
WHERE THE HEIGHT IS ESTABLISHED IN THE REGULATIONS AS A NUMBER OF STOREYS, HEIGHT MEANS THE NUMBER OF STOREYS.
HOME 2
WEST ELEVATION (BACK FACING EXISTING COMMERCIAL)
SOUTH ELEVATION (FACING THE PLAZA- PARKDALE AVE)
FINISH LEGEND
A1 FIELD APPLIED EIFS - SMOOTH FINISH IVORY
A2 FIELD APPLIED EIFS - GEMSTONE FINISH GIBRALTER
A3 FIELD APPLIED EIFS - GEMSTONE FINISH BLACK MAGIC
A4 FIELD APPLIED EIFS - (BM2124-30) 'TROUT GRAY'
A5 FIELD APPLIED EIFS - MARBLE COAT 1.5 (BM2120-20) 'BLACK IRON'
A6 FIELD APPLIED EIFS - SMOOTH FINISH (FLOWER POWER)
A7 ACM METAL PANEL - IVORY
A8 ACM METAL PANEL - WOOD PRINT FINISH
A9 FIELD APPLIED EIFS - (2124-10) 'WROUGHT IRON'
B1 CULTURED STONE - COUNTRY LEDGESTONE - COLOUR BLACK RUNDLE (CULTURED STONE)
C1 TRANSPARENT BRANDED GLASS (ILLUMINATED)
C2 ILLUMINATED SIGNAGE - WALL MOUNTED AS PER BRAND STANDARD
ELEVATION FINISHES, NOTES, LEGENDS
PHASE 2
WEST & SOUTH ELEVATIONS
A-301



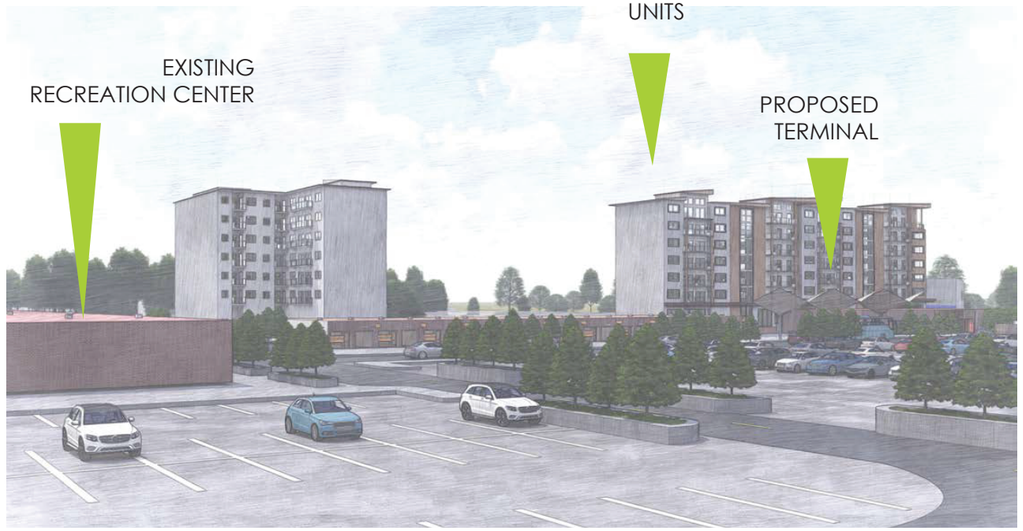
CONCEPTUAL VISUALIZATION & 3D RENDERS

125 Stewart Blvd, Brockville, Ontario

by Ar. Mahmuda

125 Stewart Blvd, Brockville, Ontario

WHOLE SITE MASTER PLAN VISUALIZATION



CONCEPTUAL PHASE VISUALIZATION OF PROPOSED PLAN

VIEW FROM STEWART BLVD STREET

REALISTIC VISUALIZATION OF THE SITE

REALISTIC VISUALIZATION OF THE SITE

Appendix C
Sample Calculations

REPORT:	**Results: Sound Levels - Future No Build**		
TNM VERSION	3.1.7970.37608	REPORT DATE:	10 March 2023
CALCULATED WITH:	3.1.7970.37608	CALCULATION DATE:	3/10/2023 4:02:41 AM
CASE:	TNM	ORGANIZATION:	Stantec
UNITS:	Metric	ANALYSIS BY:	MS
DEFAULT GROUND TYPE:	HardSoil	PROJECT/CONTRACT	Hwy 401 Brockville
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency substantiates the use of a different type with approval FHWA.	
PAVEMENT TYPE(S) USED:	Average		

Receiver			Modeled Traffic Noise Levels					
		Nb.	Laeq (dBA)			Noise Reduction		Type of Impact
Name	No.	R.R.	With Existing Barrier	Without Existing Barrier	Absolute Criterion		Relative	
						Calc.	Criterion	
						dBA	dBA	
R01	1	1	53.9	53.9	65.0	0.0	5	None
R02	2	1	55.0	55.0	65.0	0.0	5	None
R03	3	1	59.9	59.9	65.0	0.0	5	None
R04	4	1	64.8	64.8	65.0	0.0	5	None
R05	5	1	60.5	60.5	65.0	0.0	5	None
R06	6	1	63.3	63.3	65.0	0.0	5	None
R07	7	1	58.4	58.4	65.0	0.0	5	None
R08	8	1	57.0	57.1	65.0	0.1	5	None
R09	9	1	58.6	58.7	65.0	0.1	5	None
R10	10	1	59.0	59.3	65.0	0.3	5	None
R11	11	1	65.4	65.5	65.0	0.0	5	Sound Level
R12	12	1	64.1	64.3	65.0	0.2	5	None
R13	13	1	65.1	65.4	65.0	0.3	5	Sound Level
R14	14	1	55.9	60.9	65.0	5.0	5	None
R15	15	1	61.3	71.0	65.0	9.7	5	None
R16	16	1	58.7	69.2	65.0	10.6	5	None
R17	17	1	60.6	70.5	65.0	9.9	5	None
R18	18	1	64.2	70.0	65.0	5.9	5	None
R19	19	1	63.6	69.9	65.0	6.3	5	None
R20	20	1	61.4	69.8	65.0	8.4	5	None
R21	21	1	60.3	68.6	65.0	8.3	5	None
R22	22	1	62.4	66.0	65.0	3.6	5	None
R23	23	1	62.0	63.5	65.0	1.5	5	None
R24	24	1	62.7	64.5	65.0	1.9	5	None
R25	25	1	63.1	66.6	65.0	3.5	5	None
R26	26	1	59.1	71.1	65.0	12.0	5	None
R27	27	1	59.2	70.8	65.0	11.6	5	None
R28	28	1	69.7	69.7	65.0	0.0	5	Sound Level
R29	29	1	66.2	66.2	65.0	(0.0)	5	Sound Level
R30	30	1	64.1	64.1	65.0	0.0	5	None
R31	32	1	60.4	60.4	65.0	(0.0)	5	None
R32	33	1	63.8	63.8	65.0	0.0	5	None

REPORT: **Results: Sound Levels - Future Build (Interim - 2032)**

TNM VERSION	3.1.7970.37608	REPORT DATE:	13 March 2023
CALCULATED WITH:	3.1.7970.37608	CALCULATION DATE:	3/13/2023 7:10:18 PM
CASE:	TNM	ORGANIZATION:	Stantec
UNITS:	Metric	ANALYSIS BY:	MS
DEFAULT GROUND TYPE:	HardSoil	PROJECT/CONTRACT	Hwy 401 Brockville
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency substantiates the use of a different type with approval FHWA.	
PAVEMENT TYPE(S) USED:	Average		

Receiver			Modeled Traffic Noise Levels					
		Nb.	Laeq (dBA)			Noise Reduction		Type of Impact
Name	No.	R.R.	With Existing Barrier	Without Existing Barrier	Absolute Criterion	Calc.	Relative Criterion	
						dBA	dBA	
R01	1	1	54.0	54.0	65.0	0.0	5	None
R02	2	1	55.0	55.0	65.0	0.0	5	None
R03	3	1	59.8	59.8	65.0	0.0	5	None
R04	4	1	64.9	64.9	65.0	0.0	5	None
R05	5	1	60.3	60.3	65.0	0.0	5	None
R06	6	1	62.9	62.9	65.0	0.0	5	None
R07	7	1	58.2	58.2	65.0	0.0	5	None
R08	8	1	56.9	57.0	65.0	0.1	5	None
R09	9	1	58.3	58.4	65.0	0.1	5	None
R10	10	1	58.7	58.9	65.0	0.2	5	None
R11	11	1	64.9	64.9	65.0	0.0	5	None
R12	12	1	64.0	64.2	65.0	0.2	5	None
R13	13	1	63.7	64.0	65.0	0.3	5	None
R14	14	1	58.5	61.5	65.0	2.9	5	None
R15	15	1	61.5	71.2	65.0	9.7	5	None
R16	16	1	58.1	67.8	65.0	9.8	5	None
R17	17	1	59.8	70.1	65.0	10.3	5	None
R18	18	1	65.8	70.0	65.0	4.2	5	Sound Level
R19	19	1	63.9	69.7	65.0	5.8	5	None
R20	20	1	61.7	69.1	65.0	7.4	5	None
R21	21	1	60.2	66.9	65.0	6.7	5	None
R22	22	1	61.6	64.8	65.0	3.2	5	None
R23	23	1	61.2	63.0	65.0	1.8	5	None
R24	24	1	60.0	63.0	65.0	2.9	5	None
R25	25	1	58.7	63.5	65.0	4.7	5	None
R26	26	1	59.1	70.1	65.0	11.0	5	None
R27	27	1	59.2	71.0	65.0	11.8	5	None
R28	28	1	69.6	69.6	65.0	0.0	5	Sound Level
R29	29	1	66.0	66.0	65.0	0.0	5	Sound Level
R30	30	1	64.2	64.2	65.0	0.0	5	None
R31	32	1	60.4	60.4	65.0	0.0	5	None
R32	33	1	63.6	63.6	65.0	0.0	5	None

REPORT: **Results: Future Build Ultimate Scenario (2042) Unmitigated**

TNM VERSION	3.1.7970.37608	REPORT DATE:	28 May 2023
CALCULATED WITH:	3.1.7970.37608	CALCULATION DATE:	5/28/2023 5:04:36 AM
CASE:	TNM	ORGANIZATION:	Stantec
UNITS:	Metric	ANALYSIS BY:	MST
DEFAULT GROUND TYPE:	HardSoil	PROJECT/CONTRACT	
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency substantiates the use of a different type with approval	
PAVEMENT TYPE(S) USED:	Average		

Receiver			Sound Level Impact		
Name	No.	Nb. R.R.	Laeq (dBA) Unmitigated Sound Leves	Criterion	Type of Impact
R01	1	1	55.5	65.0	None
R02	2	1	56.2	65.0	None
R03	3	1	61.2	65.0	None
R04	4	1	66.2	65.0	Sound Level
R05	5	1	61.3	65.0	None
R06	6	1	64.3	65.0	None
R07	7	1	59.6	65.0	None
R08	8	1	57.3	65.0	None
R09	9	1	58.3	65.0	None
R10	10	1	59.2	65.0	None
R11	11	1	65.7	65.0	Sound Level
R12	12	1	64.5	65.0	None
R13	13	1	64.8	65.0	None
R14	14	1	58.8	65.0	None
R15	15	1	61.2	65.0	None
R16	16	1	58.2	65.0	None
R17	17	1	60.0	65.0	None
R18	18	1	64.9	65.0	None
R19	19	1	65.2	65.0	Sound Level
R20	20	1	62.9	65.0	None
R21	21	1	61.2	65.0	None
R22	22	1	62.4	65.0	None
R23	23	1	61.9	65.0	None
R24	24	1	60.9	65.0	None
R25	25	1	59.9	65.0	None
R26	26	1	60.8	65.0	None
R27	27	1	60.8	65.0	None
R28	28	1	71.1	65.0	Sound Level
R29	29	1	67.4	65.0	Sound Level
R30	30	1	66.1	65.0	Sound Level
R31	32	1	61.9	65.0	None
R32	33	1	65.1	65.0	Sound Level

REPORT:	**Results: Sound Levels - Future Build (Ultimate - 2042) With Investigated Noise Barriers**		
TNM VERSION	3.1.7970.37608	REPORT DATE:	26 May 2023
CALCULATED WITH:	3.1.7970.37608	CALCULATION DATE:	5/26/2023 12:17:11 AM
CASE:	TNM	ORGANIZATION:	Stantec
UNITS:	Metric	ANALYSIS BY:	MST
DEFAULT GROUND TYPE:	HardSoil	PROJECT/CONTRACT	
ATMOSPHERICS:	20°C, 50%		
PAVEMENT TYPE(S) USED:	Average		

Receiver			Sound Level Impact		
Name	No.	Nb. R.R.	Laeq (dBA) Mitigated Sound Leves	Criterion	Type of Impact
R01	1	1	55.5	65.0	None
R02	2	1	56.2	65.0	None
R03	3	1	61.2	65.0	None
R04	4	1	66.2	65.0	Sound Level
R05	5	1	61.2	65.0	None
R06	6	1	64.3	65.0	None
R07	7	1	59.6	65.0	None
R08	8	1	57.2	65.0	None
R09	9	1	58.1	65.0	None
R10	10	1	59.0	65.0	None
R11	11	1	62.1	65.0	None
R12	12	1	64.5	65.0	None
R13	13	1	64.7	65.0	None
R14	14	1	58.7	65.0	None
R15	15	1	61.2	65.0	None
R16	16	1	58.2	65.0	None
R17	17	1	60.0	65.0	None
R18	18	1	62.7	65.0	None
R19	19	1	62.5	65.0	None
R20	20	1	61.0	65.0	None
R21	21	1	59.6	65.0	None
R22	22	1	61.4	65.0	None
R23	23	1	61.6	65.0	None
R24	24	1	60.8	65.0	None
R25	25	1	59.8	65.0	None
R26	26	1	60.8	65.0	None
R27	27	1	60.8	65.0	None
R28	28	1	65.8	65.0	Sound Level
R29	29	1	60.6	65.0	None
R30	30	1	60.3	65.0	None
R31	32	1	58.3	65.0	None
R32	33	1	57.2	65.0	None