Noise and Vibration Compatibility Feasibility Assessment

Residential Component

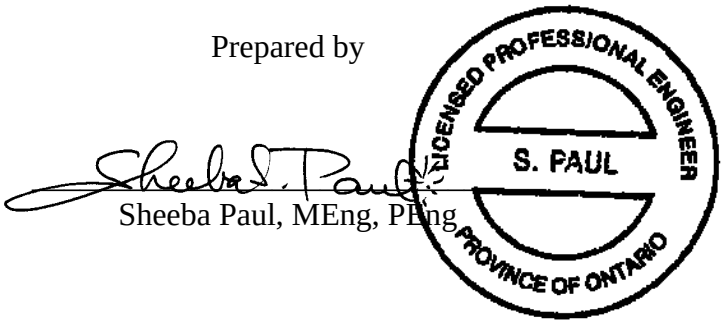
Proposed RMOW Transit Hub

King Street West and Victoria Street North, Kitchener, ON

For

The Regional Municipality of Waterloo
150 Frederick Street, 8th Floor
Kitchener, Ontario, N2G 4J3

Prepared by



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1 INTRODUCTION, TERMS OF REFERENCE AND SUMMARY

HGC Engineering was retained by the Regional Municipality of Waterloo (RMOW) to conduct a noise and vibration feasibility study to investigate the feasibility of developing a portion of the proposed RMOW Transit Hub Lands for high density residential uses. The development would be located on the Northeast corner of the intersection of Kings Street West and Victoria Street North in the City of Kitchener, Ontario. The surrounding area includes a mixture of existing residential, institutional, and commercial land uses.

There are a number of guidelines and criteria available for use in assessing the environmental noise and vibration impact of proposed transit facilities on the surrounding environment. HGC Engineering conducted an extensive literature review and prepared a document entitled "Guideline for the Noise and Vibration Assessment of Transit Projects" dated April 2011 for the Ontario Ministry of the Environment (MOE) for use in this regard.

The terms of reference for this study were developed by the Municipality in terms of Planning Comments provided by the RMOW contained in the Record of Pre-Submission Consultation for the project prepared by the City of Kitchener, September 20, 2011 and provided to HGC Engineering by the project planning consultant, the GSP Group:

"As residential land uses are being introduced as a new permitted use, a preliminary Noise/Compatibility Assessment is required to determine if residential uses are feasible in this location. This preliminary noise/compatibility feasibility assessment should assess existing noise/vibration levels and also forecast predicted noise/vibration levels from the forthcoming Go and light rail transit"

So the scope of the current study is not to assess the potential noise and vibration impact of the Transit Hub Facility per se, but to determine the feasibility of a possible residential component of the facility with regard to potential impacts from noise and vibration. Site visits were conducted during December 2011 and January 2012 to identify significant transportation and other noise sources in the vicinity of the proposed development and to conduct sound and

vibration measurements.

Road and rail traffic information for King Street, Victoria Street, the adjacent rail line (GO, VIA and Freight movements), and the proposed LRT and Bus Transit operations was obtained from the RMOW and Rail authorities. The data was used along with the site measurements to assist in determining the appropriate sound level limits with respect to noise from the various sources and the expected worst case road and rail traffic sound levels at the proposed residential units.

The results of this worst case analysis indicate that it would be feasible to locate residential towers on the proposed RMOW Regional Transit Hub site. Future road and rail traffic sound levels are expected to be in excess of the MOE and RMOW guideline limits at the facades of the proposed residential towers. No ground borne vibration excesses were identified and there were no significant stationary sources of sound identified in the area. Central air conditioning as an alternative means of ventilation to open windows is required, and the building facades will need to be designed to incorporate sufficient noise mitigation. A discussion is also provided with regard to acoustical considerations in the design of the transit hub and its operations.

Detailed noise studies should be conducted when a more defined site plan is available to address the traffic noise excesses and provide recommendations for acoustically insulating building façade designs. The detailed noise studies should also address the potential noise impact of stationary sources of sound at the commercial uses currently under development across the rail line to the north as well as stationary sources of sound associated with the proposed development itself (such as rooftop mechanical equipment) to impact the proposed residential units.

2 SITE DESCRIPTION AND NOISE SOURCES

Figure 1 is a Key Plan of the area and Figure 2 is a Demonstration Plan for the site prepared by the GSP Group. Figure 3 is an aerial photo which shows the adjacent land uses. Figure 4 shows the road/rail traffic noise prediction locations [A] to [F].

A detailed development plan has not been prepared for the site but GSP Group has prepared a series of Demonstration Plans to illustrate possible development scenarios in support of Official Plan and Zoning By-Law amendment application. One possible development scenario for the site has one or two residential/hotel towers of up to 25 storeys (total height) on a four to six storey podium at the intersection of King and Victoria Streets. The residential buildings would be setback 30 m from the railway right of way. It is this development scenario that has been used in this study of noise and vibration.

Site visits were made by HGC Engineering personnel in December 2011 and January 2012 to make observations of the acoustical environment and perform measurements of potentially significant noise/vibration sources. An institutional building (School of Pharmacy) is located to the south across King Street. A commercial plaza and a temporary Go Transit layover facility are located to the southwest across King Street. A multi storey residential building (The Kaufman Lofts) is located to the east across Victoria Street. Two old industrial complexes are located to the west across the railway line. One is currently under renovation for commercial uses and the second is occupied by commercial, warehousing and studio uses. Residential uses are located further west. The buildings on site will be replaced during the redevelopment of the subject site for the proposed transit related uses, except for the Rumpel Felt building. Currently the subject site is occupied with existing commercial land uses.

3 ASSESSMENT OF ROAD AND RAIL TRAFFIC NOISE ON THE PROPOSED RESIDENTIAL TOWERS

3.1 Criteria for Traffic Noise Sources

Guidelines for acceptable levels of road and rail traffic noise impacting residential developments are given in the MOE publication LU-131 “Noise Assessment Criteria in Land Use Planning”, its Annex and its accompanying document “Requirements, Procedures and Implementation, 1997”. The levels are listed in Table I below. As well, a copy of the CN principal mainline requirements is included as Appendix A.

Table I: MOE Road and Rail Traffic Noise Criteria (dBA)

Area	Daytime L_{EQ} (16 hour) Road / Rail	Nighttime L_{EQ}(8 hour) Road / Rail
Outside Bedroom Windows	55 dBA	50 dBA
Outdoor Living Area	55 dBA	--
Inside Living/Dining Rooms	45 dBA / 40 dBA	--
Inside Bedrooms	--	40 dBA / 35 dBA

These criteria apply to GO, Via and Freight rail traffic operating on railway rights of way, Light Rail traffic on Municipal streets or rights of way, vehicular traffic, including intercity (GO and Greyhound) and RMOW transit busses operating on Municipal Streets. Daytime refers to the period between 07:00 and 23:00, while nighttime refers to the period between 23:00 and 07:00. The term "Outdoor Living Area" (OLA) is used in reference to an outdoor patio, a backyard, a terrace or other area where passive recreation is expected to occur. Balconies that are less than 4 m in depth are not considered to be outdoor living areas under MOE guidelines.

Indoor guidelines are 5 dBA more stringent for rail noise than for road noise, to account for the low frequency (rumbling) character of locomotive sound, and its greater potential to transmit

through exterior wall/window assemblies. The guidelines in the MOE publication allow the sound level in an Outdoor Living Area to be exceeded by up to 5 dBA, without mitigation, if warning clauses are placed in the purchase and rental agreements to the property. Where OLA sound levels exceed 60 dBA (road and rail noise combined), physical mitigation is required to reduce the OLA sound level to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible.

An alternative form of ventilation is required where nighttime sound levels at bedroom windows exceed 50 dBA so that bedroom windows can remain closed. Air conditioning is a requirement under MOE/CN guidelines where nighttime sound levels outside bedroom windows exceed 60 dBA. Sound attenuating building constructions are required when nighttime sound levels exceed 55 dBA at the plane of the bedroom window.

Warning clauses to notify future residents of possible excesses are also required when nighttime sound levels exceed 50 dBA at the plane of the bedroom window and daytime sound levels exceed 55 dBA in the outdoor living area and at the plane of the living room window due to road and rail traffic.

MOE guidelines recommend exterior walls built with a masonry veneer or its acoustical equivalent from foundation to rafters as a minimum construction for any dwellings with a 24 hour L_{EQ} that is greater than 60 dBA, and which are within 100 m of the right of way of the railway.

The railways also provide minimum requirements for safety as well as sound and vibration for proposed residential developments located adjacent to their rights-of-way. These refer to minimum required setbacks, berms, fencing and warning clauses. The reader is referred to a copy of CN requirements for a new development adjacent to a secondary main rail line, which is located in Appendix A. CNR staff should be contacted to discuss the implications of these requirements in the context of the subject site.

3.2 Traffic Noise Predictions

3.2.1 Road Traffic Data

Ultimate road traffic data for King Street was obtained from Regional Municipality of Waterloo in the form of the Annual Average Daily Traffic (AADT) projected to the year 2031 and is provided in Appendix A. A commercial vehicle percentage of 4.5% split into 1.0% medium trucks and 3.5% heavy trucks was provided for King Street. A posted speed limit of 50 kph and a day-night split of 90%/10% were used. Greyhound and GO buses are also expected to visit the facility. Information regarding the increase of service was not provided. It has been assumed that the heavy trucks percentage provided by the RMOW in their 2031 projection includes the Greyhound and GO buses.

Ultimate road traffic data for Victoria Street was obtained from Regional Municipality of Waterloo in the form of the Annual Average Daily Traffic (AADT) projected to the year 2031 and is provided in Appendix A. A commercial vehicle percentage of 2.4% split into 1.4% medium trucks and 1.0% heavy trucks was provided for Victoria Street. An additional 12 buses per hour were included in the analysis for Victoria Street in addition to the vehicular information from the RMOW for the year 2031 and the heavy truck percentage was increased to 2% accordingly. The posted speed limit of 50 kph and a day-night split of 90%/10% were used. Table II summarizes the traffic volume data used in the analysis.

Table II: Ultimate Road Traffic Data (Year 2031)

Road Name		**Cars**	**Medium Trucks**	**Heavy Trucks**	**Total**
King Street	**Daytime**	12 463	131	457	**13 050**
	Nighttime	1 385	15	51	**1 450**
	Total	**13 848**	**145**	**508**	**14 500**
Victoria Street	**Daytime**	16 606	241	344	17 190
	Nighttime	1 845	27	38	1 910
	Total	**18 451**	**267**	**382**	**19 100**

3.2.2 Rail Traffic Data

Current rail traffic data was obtained from HGC Engineering project files for similar projects in the area and originally from GEXR Railway. The data is provided in Appendix A. This data was used for the noise predictions. The information obtained from the GEXR railway indicates that at present, five passenger trains, four commuter trains and two freight trains are operated during the daytime (07:00 – 23:00), and one passenger train and one commuter train during the night-time (23:00 – 07:00). Based on the existing forecast passenger and commuter trains are expected to increase by 100%. Freight traffic is expected to increase between 5% and 10% over the next three years. However to be conservative, freight traffic was grown by 7.5% to the year 2022 and two freight trains were assumed at night. There are several level grade crossings in the area, two of which will be replaced by grade separations (King Street and Weber Street) and one which will be closed as the site is redeveloped. Whistle noise has been included in the analysis for both directions. GO Transit was also contacted for their forecasts for this railway line. GEXR confirmed that their data includes GO Transit's forecasted trains. Table III summarizes the projected rail traffic data for 2022 used in the analysis.

Table III: Projected Rail Traffic Data for 2022

Train Type	Volume Day/Night	Number of Locos	Number of Cars	Speed (kph)
Passenger (GO)	10/2	1	5	113
Commuter	8/2	2	10	113
Freight	5/2	2	59	89

3.2.3 Future LRT Along King Street

Preliminary information regarding the future light rail transit (LRT) was provided by the Region of Waterloo. The analysis includes rail based LRT vehicles along King Street.

LRT data provided by the RMOW is contained in Appendix A. These numbers are a conservative estimate assuming that the vehicles arrive every 5 minutes during the daytime and every 10 minutes during the nighttime in both directions. Table IV summarizes this information.

Table IV: 2031 LRT Traffic Data

Track	No. of Vehicles Daytime (07:00-23:00)	No. of Vehicles Night-time (23:00-07:00)	Speed
Northbound	192	48	50 km/h
Southbound	192	48	50 km/h
Total	384	96	50 km/h

3.2.4 Road, Rail and LRT Traffic Noise Predictions

To assess the levels of road, rail and LRT traffic noise which will impact the site in the future, predictions were made using STAMSON version 5.04, a computer algorithm developed by the MOE. Sample STAMSON output is included in Appendix B.

Predictions of the traffic sound levels were made at the various facades of the residential buildings. The results of these predictions are summarized in Table V. The acoustic requirements may be subject to modifications if the site plan is changed significantly.

Sound level predictions were performed at the most potentially exposed OLA locations (on the roof of the podia) to determine barrier requirements. Sound levels were predicted at the top storey of the residential buildings during the daytime and nighttime hours to investigate

ventilation requirements. The building envelope setback indicated on the Demonstration Plan was used in the analysis.

Table V: Predicted Future Daytime Traffic Sound Levels, [$L_{EQ-16\ hr}$, dBA]

Prediction Location	Description	Road	Rail/LRT	Total
[A]	West façade, West Tower, 23rd floor	67	61/59	68
[B]	North Façade, West Tower, 23rd floor	60	66/52	67
	7th floor podium*	50	56/41	57
[C]	East Façade, West Tower, 23rd floor	67	58/57	68
[D]	North façade, East Tower, 17th floor	60	66/50	67
	7th floor podium*	48	56/36	57
[E]	East façade, East Tower, 17th floor	61	65/46	67
[F]	Southeast façade, East Tower, 17th Floor	67	58/57	68

Note: * Sound level includes a 1.07 m high parapet wall

Table VI: Predicted Future Nighttime Traffic Sound Levels, [$L_{EQ-8\ hr}$, dBA]

Prediction Location	Description	Road	Rail/LRT	Total
[A]	West façade, West Tower, 23rd floor	60	58/56	63
[B]	North Façade, West Tower, 23rd floor	54	64/49	65
[C]	East Façade, West Tower, 23rd floor	61	56/53	62
[D]	North façade, East Tower, 17th floor	53	65/47	65
[E]	East façade, East Tower, 17th floor	55	63/43	64
[F]	Southeast façade, East Tower, 17th Floor	60	56/53	62

These predictions are considered to represent the worst case scenario of potential traffic noise impact as ultimate road traffic volumes, maximum train speeds and numbers of cars and locomotives have been considered. The traffic volumes have also been increased to include the future RMOW, Go Transit and Greyhound Busses and the future LRT and GO Transit trains.

3.3 Discussion and Recommendations

The sound level predictions indicate that road, rail and LRT traffic sound levels exceed MOE criteria during the daytime and nighttime hours at the building facades with exposure to King Street, the railway line and Victoria Street. Recommendations are provided below.

3.3.1 Outdoor Living Areas

The residential buildings may have balconies that are less than 4 m in depth. Such balconies are not considered to be outdoor living areas under MOE guidelines. They are therefore, exempt from traffic noise assessment and physical mitigation will not be required.
Sound level predictions were performed on the roof of the 6-storey podiums (prediction location [B] and [D]), since this area may be a potential outdoor amenity area. The predicted sound levels on these roof areas will be 57 dBA, assuming a standard 1.07 m high solid parapet wall, dominated by railway line to the north. This barrier height is preliminary. Specific requirements or alternative landscaping features may be considered during detail design to shield and outdoor areas, or selected parts thereof which comprise required outdoor amenity space.

3.3.2 Ventilation Requirements

The predicted sound levels at all the facades are high enough that residential towers should be equipped with central air conditioning systems to allow windows to remain closed. It is anticipated that central air conditioning systems will be provided in all suites. The outdoor

rooftop mechanical equipment associated with the central air conditioning systems for residential buildings should comply with the criteria of MOE publication NPC-205, Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban).

3.3.3 Building Facade Constructions

Predicted sound levels at the building facades were used to determine preliminary sound insulation requirements for the building envelope.

Exterior Wall Constructions

The construction of the exterior walls of the buildings is unknown at this time, but typically may include masonry components or spandrel glass and/or metal panels within an aluminum window system. In this analysis, it has been assumed that sound transmitted through elements other than the glazing elements is negligible in comparison. The detailed noise studies conducted for the towers for site plan approval would need to provide designs for the exterior walls that are not glazed to have sufficient acoustical insulation value such that the noise transmitted through those components is negligible in comparison with the windows. For example, if the exterior walls include spandrel glass or metal panels within an aluminum window system, sufficient sound insulation can typically be achieved by using a drywall assembly (2 layers) on separate framing behind the spandrel panels. Further input regarding the sound insulating design of the exterior walls should be provided in the detailed traffic noise studies.

Exterior Doors

There may be glazed exterior doors (sliding or swing) for entry onto the balconies from living/dining rooms and some bedrooms. The glazing areas of the doors should be counted as part of the total window glazing area. All exterior doors should include good weather seals to reduce air infiltration to the minimum achievable levels.

Acoustical Requirements for Glazing

As most of the environmental noise will be transmitted through the glazing, fixed and operable glazing elements will need to be selected to ensure that the indoor sound level targets of the MOE will be met. Acoustical requirements for glazing depend strongly on window areas in a room relative to the associated floor area. At the time of this report, floor plans and elevations were not yet available, so worst case assumptions have been made to demonstrate feasibility.

Given the close proximity of this site to traffic noise sources, upgraded glazing elements are expected. As a general guideline, for prediction location [A] where sound levels are dominated by road traffic, the required acoustic insulation factor is AIF 30 for the living/dining rooms and bedrooms based on sound transmission through the windows only. As an example two 4 mm glass panes with a 10 mm airspace can achieve a sound transmission class (STC) of 32 or 33 which would satisfy this requirement.

For prediction location [B] where sound levels are dominated by rail traffic, the required acoustic insulation factor is AIF 31 for living/dining rooms and AIF 34 for bedrooms based on sound transmission through the windows only. As an example two 4 mm glass panes with a 10 mm airspace can achieve an STC of 32 or 33 and two 6 mm glass panes with a 10 mm airspace can achieve STC 35 or 36.

When floor plans and elevations are available for the residential towers, detailed noise studies should be completed to design the building façade constructions to provide sufficient acoustical insulation based on actual window to floor area ratios.

3.3.4 Warning Clauses

The RMOW guidelines recommend that warning clauses be included in the property and tenancy agreements, offers of purchase and sale and rental agreements for the property for the residential units. A suitable wording is given below.

> Due to the proximity to Victoria Street, King Street and the future LRT along King Street, projected sound levels on this property exceed the Noise Level Objectives approved by the Regional Municipality of Waterloo and may cause concern to some individuals. Moreover, this dwelling has been developed such that noise attenuation features are included.

CN standard warning clause, for development located near their branch, is given below. The following warning clause is to be included in the property and tenancy agreements and in all offers/agreements of purchase and sale or lease on the Lands that are within 300 meters of the railway right-of-way.

> Warning: Canadian National Railway (CNR) or its assigns or successors in interest has or have a rights-of-way within 300 metres from the land subject hereof. There may be alteration to or expansions of the railway facilities on such rights-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its operations, which expansion may affect the living environment of the residents in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwellings. CNR will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way.

This sample clause is provided by the RMOW as an example and can be modified by the Municipality as required.

4 ASSESSMENT OF GROUND-BORNE VIBRATION FROM RAIL ACTIVITIES

4.1 Criteria for Ground-borne Vibration from Rail Traffic

MOE and CN guidelines require measurement of ground-borne vibration when dwelling units are to be located within 75 metres of a secondary mainline such as the CN Guelph Subdivision.

Vibration is typically measured in terms of oscillatory velocity or acceleration. The CN and GO Transit vibration guidelines are given in terms of ground-borne velocity. In this report, vibration levels are quoted in terms of RMS velocity levels (L_V) in units of decibels [dB] relative to 1 mm/s (i.e., 1 mm/s = 0 dB). The CN guideline limit is 0.14 mm/s, which is equivalent to -17 dB re 1 mm/s. For ease of reference, in this report the CN limit of -17 dB re 1 mm/s is identified on velocity plots in this report. In the past, CN has considered vibration levels exceeding 2.0 mm/s to be a significant problem. These plots are provided in Figures 5 to 8.

CN requires an assessment of ground-borne vibration through measurement if building foundations are to be located within 75 meters of the right-of-way. The proposed residential blocks will have dwelling units within 75 meters of the CN right-of-way. Measurements were performed at the anticipated location of the closest façade of the building, at 35 m from the right of way on the east side of the tracks and at 30 m from the right of way on the west side of the tracks. Table VII shows the peak vibration measurements during each of the train pass-bys.

4.2 Vibration Measurements and Assessment

Vibration measurements were conducted at a distance of 30 m from the railway right of way at the location of the nearest residential building façade of the west tower. The measurements were conducted with a Wilcoxon Velocity Transducer connected to a Hewlett Packard Type 3569A Real Time Spectrum Analyser. The equipment is maintained in yearly calibration and was correctly calibrated in the field before and after the measurements. The results are provided in the following table.

Table VII: Peak Vibration Measurements of Train Pass-bys

Train Pass-by	Train Type	@ 30 m from right of way (dB re 1 mm/s)
1	Go Train Advancing Into Station, 10 Cars, 2 engines	-26
2	Via Train Approaching Station 1 Engine, 4 Cars	-22
3	Second Go Train Advancing 2 Engines, 10 Cars (Stopped During Advance)	-25
4	Freight Train Passby, 2 Engines, 16 Cars.	-20

Based on these measurements, ground borne vibration from rail passbys are not expected to be a concern wrt the proposed residential towers. Vibration levels are below the CN and GO Transit limit of -17 dB re 1mm/s. The lower vibration peaks represent vehicular traffic.

Vibration from the future LRT passbys along King Street is similarly not expected to be a concern. Typical vibration levels generated by LRT passbys are contained in the FTA Noise and Vibration Manual (reference 3). Due primarily to the lighter weight of LRT vehicles, the ground borne vibration levels they generate are significantly less than heavier diesel engine powered trains, by on the order of 20 decibels. However, vibration propagation is quite dependent on soil conditions, so actual measurements of the LRT rail pass-bys should be conducted when the LRT system is in place and considered in the detailed noise study for the west tower.

5 ASSESSMENT OF NOISE FROM THE GO TRANSIT TEMPORARY LAYOVER FACILITY

A temporary GO Transit Layover facility is located approximately 200 m to the west of the site. GO Transit and the Ontario Ministry of The Environment (formally the Ontario Ministry of the Environment and Energy) have developed a "Draft Protocol for Noise and Vibration Assessment" for assessing noise and vibration associated with commuter rail transit facilities. This protocol provides criteria within which proposed GO Transit rail projects can be assessed for noise and vibration. It provides a distinction between rail service and layover sites, where layover sites include the idling of trains in an area off the mainline track. The protocol for layover facilities is site specific and depends on the background sound in the vicinity which includes road traffic sound but excludes the source under assessment. The protocol also stipulates that the assessment consider the potential noise impact during a "predictable worst case hour" of operation, which is defined as a situation when the normally busy activity of the source coincides with in an hour of low background sound. In other words, the principle of assessment involves evaluating the subject source against the background sound from road traffic, on an hourly basis. If the acoustic environment in the vicinity is such that the ambient sound level falls off significantly during quiet hours of the day or night, there are exclusionary minimum sound level limits, which set the lower bound for the acceptability criteria. Specifically, the protocol states that the sound level objective is that the one-hour L_{EQ} in any hour does not exceed the higher of the ambient sound level or 55 dBA L_{EQ}.

Respecting the worst case nature of this study in determining the feasibility of the proposed development the minimum criterion of 55 dBA L_{EQ} will be considered to apply for the purposes of this study

HGC Engineering conducted an acoustical assessment of the GO Transit Layover facility in 2011 and produced a report entitled " Noise Impact Study for the Proposed GO Transit Temporary Layover Facility Kitchener, Ontario" dated October 21, 2010. In addition we visited

the Go Transit Layover Facility and conducted post start up sound level measurements in January 2012. The results of that assessment and the recent sound level measurements indicate that the sound levels produced by the facility do not exceed the applicable limits at the location of the proposed residential towers on the subject site.

6 ASSESSMENT OF EXISTING INDUSTRIAL AND COMMERCIAL (STATIONARY) SOURCES OF SOUND

Industrial and commercial sources of sound are assessed separately from traffic sources under MOE Guidelines. There are a number of existing institutional and commercial uses located in the area. During the site visits there were no significant industrial noise sources identified with the potential to negatively impact the proposed residential uses, although it is noted in the aerial photography that the rooftop cooling towers associated with the School of Pharmacy are located in relatively close proximity (approximately 50 m) from the façade of the west tower and will be in clear view of the upper floors of that building. Measurements were not possible of this source since they were not in operation due to the time of year. As well, the old industrial buildings to the north of the railway corridor are currently under renovation and it is currently unknown what noise sources may be associated with them in the future. An investigation of these potential noise sources should be included in the recommended detailed noise assessments.

6.1 Criteria for Stationary (Industrial or Commercial) Sources of Sound

6.1.1 D1 – D6 Guidelines for Land Use Compatibility

The terms of reference for this study provided by the Municipality refers to determining if the proposed residential towers are feasible and compatible with adjacent commercial/industrial uses. The MOE D1-D6 Series of Guidelines for Land Use Compatibility were prepared to address issues of compatibility between industrial and noise sensitive land uses in relation to land use changes.

For planning purposes for Greenfield sites, the potential zone of influence of a Class I industrial use is 75 m and the minimum recommended distance setback is 20 m. The potential zone of influence of a Class II industry is 300 m and the minimum recommended distance setback is 75 m. For infill projects or projects located in Transitional areas the recommended minimum distance setbacks can be reduced, based on the results of technical studies.

In this case it is not clear if the D1- D6 guidelines specifically apply since there are/will be no remaining industrial land uses in the vicinity of the proposed residential towers and future industrial uses in this area are unlikely given the redevelopment found in the neighbourhood. In as much as commercial uses would need to be considered, they would typically be considered as no more than a Class I use, and a minimum distance setback of 20 m would apply, which is fully satisfied in the context of the subject site by the Municipal Roadways and Rail Corridor.

6.1.2 MOE Guideline LU-131 "Noise Assessment Criteria in Land Use Planning"

In addition to providing the criteria for road and rail traffic assessments discussed in previous sections of this report, LU-131 is the MOE Guideline specified for use in assessing Land Use Compatibility issues as per the D1 – D6 Guidelines. An industrial or commercial facility is classified in MOE guidelines as a stationary source of sound (as compared to sources such as traffic or construction, for example) for noise assessment purposes. Any residential towers of the proposed Transit Hub site are considered to be a noise sensitive land use. In terms of background sound, the development is located in an urban (Type I) acoustical environment which is characterized by an acoustical environment dominated by road traffic and human activity.

LU-131 is intended for use in the planning of residential land uses and provides the acceptability limits for sound due to industrial or commercial operations in that regard. The facade of a residence (i.e., in the plane of a window), or any associated usable outdoor area is considered a sensitive point of reception. LU-131 stipulates that the sound level limit for steady sounds from a stationary noise source during daytime hours (07:00 to 19:00) is the greater of the minimum one-

hour average background sound level, or 50 dBA. The background sound level is defined as the sound level that occurs when the source under consideration is not operating, and may include traffic noise and natural sounds. Similar limits apply to impulsive sound, such as that from metalworking operations, although a higher limit of 100 dBAI applies to infrequent impulse events.

Typical ambient sound levels can be determined through sound level monitoring or predicted from road traffic volumes in areas where traffic sound is dominant. Where it can be demonstrated that the hourly background sound levels remain greater than the exclusionary minimum daytime limit listed above, the daytime criterion becomes the lowest measured/predicted one-hour L_{EQ} sound level.

The future detailed noise studies should develop criteria and conduct assessments of the potential for specific stationary noise sources to impact the proposed residential units utilizing the LU-131 Guidelines.

7 DISCUSSION AND RECOMMENDATIONS WITH REGARD THE DESIGN OF THE TRANSIT HUB FACILITIES.

In addition to the road and rail pass-bys and the mechanical equipment discussed in the previous sections, the other noise sources associated with the Transit Hub would include bus transit vehicles when they are travelling on the Transit Hub property, in which case they are considered to be part of the stationary noise of the facility. LU-131 encourages noise mitigation at the source if possible. We note that the Demonstration Plan shows the bus terminal block to be covered. This is a beneficial feature which will shield the facing residential windows from the bus movements and should be maintained in the design. Consideration should also be given to providing acoustical treatment to the underside of the roof structure to absorb bus noise and reduce the sound levels in the passenger terminal boarding areas.

Similarly, while not specifically required in MOE Guidelines weather protection canopies or "lean to" types of structures could be provided on the GO Transit train boarding platform to provide additional attenuation of rail traffic noise.

8 SUMMARY OF RECOMMENDATIONS

1. Any residential towers should be equipped with central air conditioning systems that will allow the windows to remain closed.

2. The outdoor mechanical equipment associated with the central air conditioning systems for the residential towers, and other rooftop mechanical equipment associated with other aspects of the Transit Hub itself should comply with the criteria of MOE publication NPC-205, Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban).

3. Detailed noise and vibration studies should be conducted for the residential towers when floor plans and building elevations are available. The scope of the detailed noise studies should be:

    - to design the building facades with sufficient acoustical insulation to address the traffic noise in the area
    - to provide sufficient mitigation (appropriate siting or noise barriers) for any designated outdoor living areas associated with the residential towers
    - to ensure that the mechanical equipment associated with the central air conditioning systems complies with the criteria of MOE publication NPC-205 at both on and offsite sensitive receptor locations.
    - to consider the noise emissions from any stationary noise sources such as rooftop mechanical equipment associated with the commercial development to the north, the School of Pharmacy to the west, the Kaufman Lofts to the south and the other buildings associated with the Transit Hub and to recommend any noise mitigation

features such as source controls which may be required to meet the applicable sound level limits contained in MOE Guideline LU-131.

- Conduct site measurements and assessment of ground borne vibration from the LRT and CN Rail line.

4. Warning clauses should be included in the property and tenancy agreements and offers of purchase and sale for the dwelling units in the two residential towers to inform the future owners/occupants of the noise issues and the presence of the roadways and the nearby industries.

The reader is referred to the previous sections of this report where these recommendations are discussed in more detail.

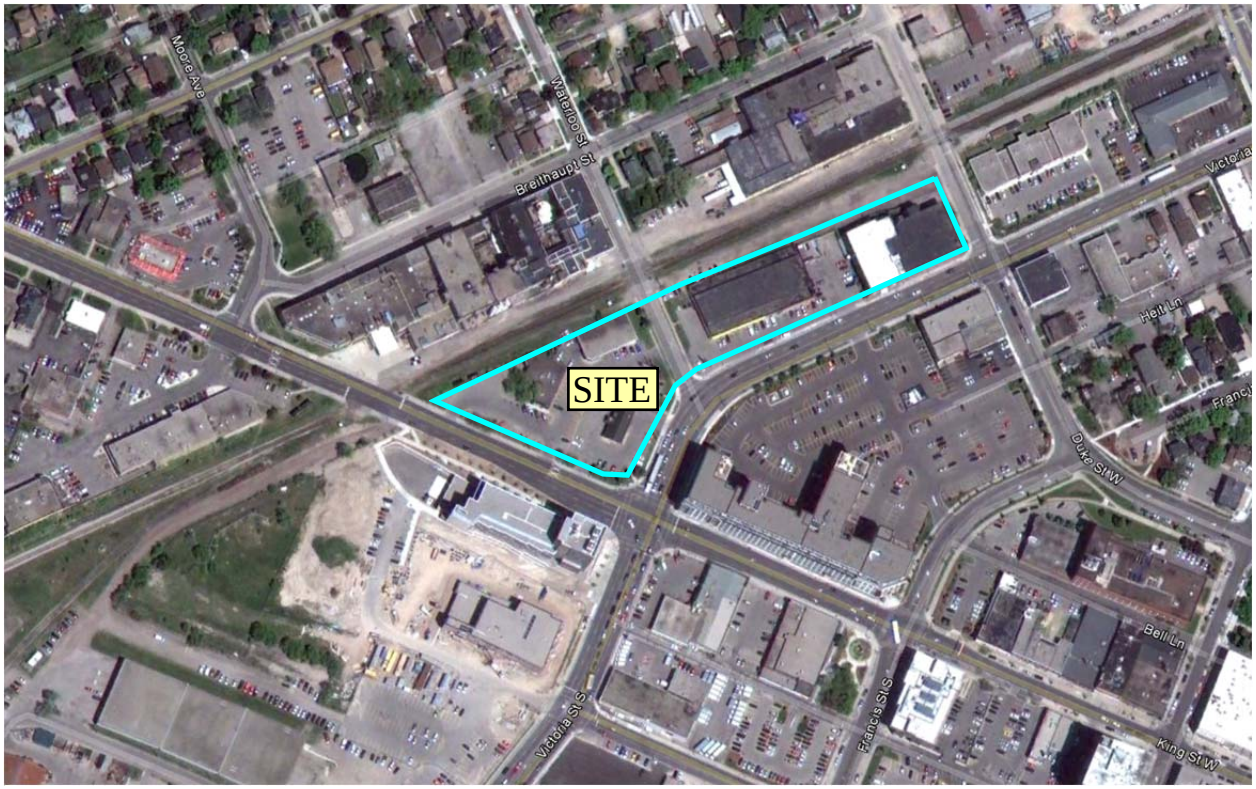

Figure 1- Key Plan

Figure 2 - Demonstration Plan, GSP Group

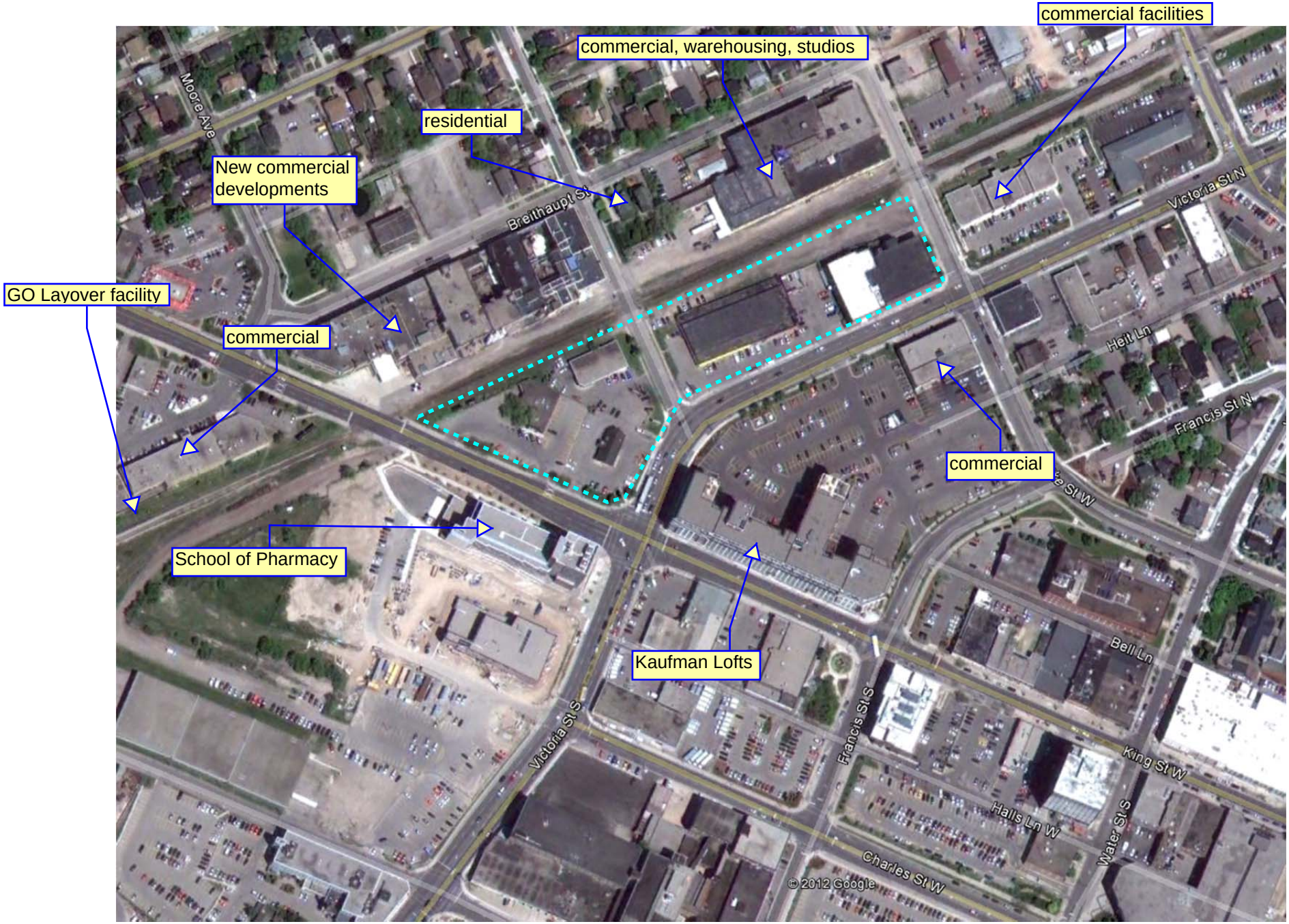

Figure 3 - Aerial Photo Showing Surrounding Land Uses