Canadian National

Luanne Patterson
Sr System Manager - EA
Environment

Canadian National
Box 8100
Montreal, Quebec Canada
H3C 3N4

August 20, 2018

Lesley Griffiths
Panel Chair
c/o Canadian Environmental Assessment Agency
160 Elgin Street
Ottawa ON, K1A 0H3

By email
Dear Ms. Griffiths:

The Canadian National Railway Company (CN) is pleased to provide our response to complete IR 7 from the *Information Request Packages 7 – Milton Logistics Hub Project Review Panel* (Doc # 644) received on May 17, 2018 as supplemental information for your review and consideration in support of the Environmental Impact Statement (EIS) under the Canadian Environmental Assessment Act, 2012 (CEAA 2012).

We trust this additional information will sufficiently clarify the questions posed by the Review Panel in the review of our proposed Milton Logistics Hub project.

Should you have any questions regarding the above, please do not hesitate to contact me.

Sincerely,
<Original signed by>

Luanne Patterson
Senior System Manager – Environmental Assessment

cc: Dr. Isobel Heathcote, Review Panel Member
Mr. William McMurray, Review Panel Member
Joseph Ronzio, CEAA
Darren Reynolds, CN

CN Milton Logistics Hub ("Project")
CEAR File No. 80100

CN Response to the Review Panel's Information Request 7
Received May 17, 2018

Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

The following information is provided in response to Information Request Package 7 received from the Review Panel on May 17, 2018.

REFERENCED DOCUMENTS

IR7.1 Reference documents regarding setbacks and buffer zones

Rationale: *CN (CEAR #57, 592) and other participants (CEAR #408, 487, 549, 588, 601) have made multiple references to the Railway Association of Canada/Federation of Canadian Municipalities jointly prepared Guidelines for New Development in Proximity to Railway Operations. In particular, participants have referred to various distances and criteria related to residential or industrial setbacks, and buffer zones.*

In Appendix B of its initial submission to the Review Panel (CEAR #405) and Appendix H of its submission on the sufficiency of the EIS (CEAR #549), Halton Municipalities identified the Ontario Ministry of Environment and Climate Change's Guideline D-6: Compatibility Between Industrial Facilities and Sensitive Land Uses, and noted these guidelines identify areas of influence and recommended minimum setback distances.

Information Request:

a) *Provide the Review Panel with the Railway Association of Canada/Federation of Canadian Municipalities Guidelines for New Development in Proximity to Railway Operations and the Ontario Ministry of Environment and Climate Change's Guideline D-6: Compatibility Between Industrial Facilities and Sensitive Land Uses.*

CN Response:

As requested, CN provides the following documents as references for the Panel:

- Railway Association of Canada/Federation of Canadian Municipalities Guidelines for New Development in Proximity to Railway Operations (see **Attachment IR7.1-1**); and,
- Ontario Ministry of Environment and Climate Change's Guideline D-6: Compatibility Between Industrial Facilities and Sensitive Land Uses (see **Attachment IR7.1-2**).

AIR QUALITY

IR7.2 Project site ambient air quality monitoring results

Rationale: *In its response to the Review Panel's Package 3 information request #3.1 (CEAR #613), CN provided information and analysis about the ambient air quality monitoring that was conducted at the Project site from July 2015 to August 2016, to support the air quality assessment. The response also contained baseline information that was not presented in the EIS and the original Air Quality Technical Data Report (CEAR #57), including information for ozone. The results of the on-site air quality monitoring were provided in the updated report (Attachment IR3.1-1).*

In the updated report, CN included two tables:

- *Table 3.1: Summary of Continuous Monitoring Data – July 2015 to August 2016; and*
- *Table 4.1: Comparison of Measured On-Site Ambient Concentrations to Background Values used in the Air Quality Technical Data Report.*

In Table 3.1, CN reported that, for the period of the study, the maximum measured concentration of ozone was 114.6 µg/m^3. Table 4.1 presented the 90th percentile ambient concentrations measured in the onsite monitoring program as 145 µg/m^3 and 142.3 µg/m^3 for 1-hr and 8-hr averaging respectively. On March 20, 2018, Environment and Climate Change Canada submitted a letter to the Review Panel (CEAR #631), noting that the reported ozone concentrations between Tables 3.1 and 4.1 appeared to be inconsistent.

In response to the Review Panel's Package 3 information request #3.9, CN reiterated that the measured level at the project site was 145 µg/m^3 (one hour).

Information Request:

a) Clarify how CN determined that the 90th percentile ozone measurements from the onsite ambient air monitoring program (1-hour and 8 hour), as reported in Table 4.1 of Attachment 3.1-1 and the response to information request #3.9, are greater than the reported maximum ozone values presented in Table 3.1 of Attachment IR3.1-1.

b) In light of the comments provided by Environment and Climate Change Canada, identify and address any other inconsistencies that exist with the ozone concentrations presented in Tables 3.1 and 4.1.

CN Response:

a) Clarify how CN determined that the 90th percentile ozone measurements from the onsite ambient air monitoring program (1-hour and 8 hour), as reported in Table 4.1 of Attachment 3.1-1 and the response to information request #3.9, are greater than the reported maximum ozone values presented in Table 3.1 of Attachment IR3.1-1.

The values for ozone presented in Table 3.1 of Attachment IR3.1-1 were found to have erroneous entries in two months (July 2016 and August 2016) of the O_3 data. A corrected version of the O_3 data alone is presented in **Table IR7.2-1** below. The revised O_3 values are highlighted in yellow for clarity.

Table IR7.2-1 Corrected Table 3.1 rev1 Excerpt O_3 – Summary of Continuous Monitoring Data (July 2015 to August 2016)

Pollutant	Averaging Period (hour)	AAQC			Measured Data	
		ppb	µg/m³		Concentration (ppbv)	Concentration (µg/m³)
O_3	1	80	165	Maximum	59.7	114.6
				Minimum	0.0	0.0
				Mean (Jul. 2015)	-	-
				Mean (Aug. 2015)	16.2	31.6
				Mean (Sept. 2015)	18.6	36.4
				Mean (Oct. 2015)	15.8	31.9
				Mean (Nov. 2015)	17.6	36.3
				Mean (Dec. 2015)	15.8	32.9
				Mean (Jan. 2016)	22.3	47.6
				Mean (Feb.2016)	29.4	61.3
				Mean (Mar. 2016)	29.4	61.3
				Mean (Apr. 2016)	29.8	61.7
				Mean (May 2016)	29.8	59.3
				Mean (Jun. 2016)	32.0	62.5
				Mean (Jul. 2016)	25.7	49.7
				Mean (Aug. 2016)	25.0	48.3
				Mean (Period)	23.6	47.8
				Standard Deviation	9.8	19.5
				# of Exceedances	0	0

Note: yellow highlights indicate revised O_3 values.

The ozone values reported in Table 4.1 are 90th percentile values of the raw data, for both 1 hour and 8 hour average time. Those values are obtained by statistical analysis to calculate averages such as the arithmetic mean, the median, and percentiles such as the 90th percentile. The 90th percentile of values is used for criteria by regulators by definition, the comparable limits and criteria are established for comparison to data values determined using this statistical analysis.

Ambient ozone concentrations were measured with a Thermo Electron Corporation Model 49 Ozone Analyzer. The instrument works by measuring the amount of O_3 in the ambient air with a dual-cell UV photometric detector. The measurement interval of the sampler is 10 seconds, from which 1-minute average concentrations were determined and stored on-site using a Campbell Scientific CR1000 station data acquisition system. Stantec remotely connected to the station data logger and downloaded ambient data in the form of 1-minute and 1-hour average data (processed by the data logger); the 1-minute data were used for analysis. Calibration frequency and methods were generally as recommended by the equipment manufacturer, and also as typical for a monitoring protocol acceptable to regulators (Environment Canada, MOECC). Stantec calculated a 1-hour average O_3 concentration for each hour based on minute data. For each hour, data from minute 00 to 59 was averaged. As an example, for the hour of 3PM, the 1-hour average concentration was calculated based on the minute data from 15:00 to 15:59.

1-hour 90th percentile
Stantec used the percentile function in Excel to calculate the 90th percentile of the 1-hour average O_3 concentrations. The formula calculated the 1-hour 90th percentile value based on valid 1-hour average concentrations measured over the sample period of July 30, 2015 at 10:00 to August 31, 2016 at 23:00.

8-hour 90th percentile
For determination of the 90th percentile 8-hour concentration, the first step was to calculate 8-hour average concentrations. This was done on a rolling average basis, where the 8-hour average for 12:00 AM (00:00) was the eight-hour period of hours 00:00 to 07:00, the average for 1:00 AM was for the period 01:00 to 08:00 and so on. The percentile function in Excel was then used to determine the 90th percentile of these 8-hour average concentrations over the same sample period (July 30, 2015 to August 31, 2016) as the 1-hour data.

After a review in response to the IR comments, an error on the values that were originally presented in Table 4.1 was identified and have now been revised to the updated values for Ozone O_3 in **Table IR7.2-2**. The revised values are highlighted in yellow.

Table IR7.2-2 Corrected Table 4.1 rev1 Excerpt O3 – Comparison of Measured Baseline Ambient Concentrations to Background Values used in the Air Quality TDR

Contaminant	CAS	Air Quality Objectives /Criteria (µg/m³)	Averaging Period (hours)	Background Concentration (µg /m³) used in TDR	Measured Baseline Concentration (µg /m³) [1]	Baseline > Background Concentration in TDR [2]
Ozone	10028-15-6	165 (MOECC AAQC)	1	Note 2	72.5	-
		129 (63 ppb) (CAAQS) [3]	8	Note 2	71.7	-

Notes:

1 – 1 hour and 24 hour concentrations are based on the 90th percentile measurement over the sample period; annual concentrations are the annual average measured concentrations.

2 – Background concentrations for these pollutants were not assessed in the Air Quality TDR. "-" therefore represents "not applicable" in this table excerpt.

3 – Canadian Ambient Air Quality Standard (CAAQS) for O_3 is 63 ppb (129 µg/m3), which is calculated as the 3-year average of the annual 4th highest daily maximum 8-hour average concentration. A direct comparison to this value from the current measurement program cannot be made as only 1 year of data is available.

The values of 72.5 µg/m³ and 71.7 µg/m³ for 1-hour and 8-hour averaging periods, respectively, are the 90th percentile values of the maximum values recorded. Note that the Canadian Ambient Air Quality Standard (CAAQS) for O_3 is 63 ppb (129 µg/m³), for the 3-year average of the annual 4th highest daily maximum 8-hour average concentration. A direct comparison to this value from the current measurement program cannot be made as only 1 year of data is available. However, it is possible to consider the 4th highest value based on the 1 year of data for approximate comparison. Based on review of the one year of data, the 4th highest 8-hour value is 55 ppb for O_3, as discussed in response to IR3.9 (b) (CEAR #613), which is below the CAAQS for O_3.

b) *In light of the comments provided by Environment and Climate Change Canada, identify and address any other inconsistencies that exist with the ozone concentrations presented in Tables 3.1 and 4.1.*

There are no additional anomalies in O_3 concentrations other than those that are explained in part a). The corrected Table 3.1 and Table 4.1 values from the field monitoring station are presented in **Tables IR7.2-1** and **IR7.2-2** in part a) above.

We highlight that the Project will not emit O_3 directly, and that the values of O_3 were not used in developing the conclusion of the Air Quality TDR or for other subsequent numerical analysis. The corrections explained above do not change the conclusions in the EIS or Air Quality TDR.

WATER

IR7.3 Residual contaminants from past agricultural land use

Rationale: *In response to the Review Panel's Package 3 information request #3.37 (CEAR #613), CN clarified that the 55.3 hectares of existing agricultural lands within the project development area would be converted, a portion of which would become grassed drainage swales. These would be constructed as part of the stormwater management system and would connect the stormwater sewers to the stormwater management ponds, as depicted in Figure 5 of Appendix E.15 of the EIS. CN stated that estimates of stormwater management system effluent concentrations and loads for pesticides and herbicides were not included in the EIS because the 55.3 hectares of agriculture lands that would be converted would have no new application of fertilizers, pesticides and herbicides.*

Although agricultural products would no longer be applied in the 55.3 hectares of agriculture lands that would be converted, Environment and Climate Change Canada commented that it is unclear whether residual contaminants from historical applications of contaminants could enter the stormwater management ponds during site preparation and construction (CEAR #631).

Information Request:

a) *Identify any residual contaminants from past application of herbicides, pesticides, fertilizers and animal-based manure that could be exposed during site preparation and construction (including from the removal of the existing online agricultural pond), and describe the potential for entry of these contaminants into the stormwater management ponds.*

b) *Describe the measures CN would take on site to minimize the mobilization and transport of historic contaminants during the site preparation, construction and operation phases of the Project, including measures that could be taken during removal of the pond.*

CN Response:

a) *Identify any residual contaminants from past application of herbicides, pesticides, fertilizers and animal-based manure that could be exposed during site preparation and construction (including from the removal of the existing online agricultural pond), and describe the potential for entry of these contaminants into the stormwater management ponds.*

Residual concentrations of agricultural herbicides and pesticides were identified and described in the Soil Chemical Analysis TDR (EIS Appendix E.13) and further discussed in response to IR3.20. Further assessment of the residual contaminants associated with fertilizers and agricultural animal-based manures have been assessed below in preparing this response.

The primary residual contaminants from the past application of agricultural herbicides, pesticides, fertilizers and animal-based manure that could be exposed during site preparation and construction include:

- Herbicides
- Pesticides

- Nitrogen (N) Compounds
- Phosphorous (P) Compounds
- Pathogenic Organisms

The soils that would be expected to potentially contain these residuals would be the shallow surface or topsoils (~0.5 m below grade). This is the target soil horizon for the application of herbicides, pesticides, fertilizers and animal-based manures during agricultural production. This depth is based on the types of dominant agricultural row crops observed at the site in recent years of hay (2015), soybeans (2016) and corn (2017) (see responses to IR4.55 (CEAR #632) and IR4.21 (CEAR #656)). Corn is also the dominant agricultural row crop at the site in 2018. The Ontario Ministry of Agriculture, Food and Rural Affairs (2017) indicates that the deepest tillage practice in Ontario commonly used for these crop types rips the soil to a depth of 0.35 m below grade.

The potential for these contaminants to enter into the stormwater management (SWM) ponds as a result of site preparation and construction activities is based on two factors: (a) exposure and mobilization caused by alterations to the existing soils and (b) discharge into SWM ponds caused by potential transport mechanisms.

Site Preparation and Construction Activities

As noted in EIS Section 3.4.1.1, the construction of the Terminal will require approximately 180 ha of existing land to be disturbed, which will include stripping of all surficial organics and topsoil, site grading, including cut and fill earthworks, and realigning mainline tracks to create a level working area. Such activities will disturb and relocate the existing topsoil / organic soil layer within the PDA.

As such, the total agricultural soil area, as a subsequent contributing area, would be concentrated through site preparation activities and most of the above noted residuals would be sequestered to where topsoil is relocated (i.e., vegetated berms, grassed swales, landscape areas, etc.) (as described in response to IR3.41 (CEAR #613)), thereby reducing the contributing area relative to existing conditions. This topsoil, which is the source of the residuals from past agricultural activities, would similarly be sequestered in these areas with the implementation of construction and operation erosion and sediment control measures.

Transport Mechanisms

The primary transport mechanisms for the potential residual contaminants from the past application of herbicides, pesticides, fertilizers and animal-based manures to enter the SWM ponds, which ultimately enter Tributary A or Indian Creek, include:

- Attached to soil and sediment particles in overland runoff as sorbed herbicides/pesticides, sorbed nutrient compounds (N, P) and pathogenic organisms
- Attached to soil particles caused by wind erosion as sorbed herbicides/pesticides, sorbed nutrient compounds (N, P) and pathogenic organisms

The response to IR3.29 discusses that infiltrating water within the soil profile is expected to become perched or move very slowly within the Halton Tills present at the site, based on the calculated horizontal hydraulic conductivities ranging from 1.0×10^{-7} m/s to 7.3×10^{-10} m/s (EIS Appendix E.6,

Appendix B, Table 1). Based on this, the transport of dissolved contaminants via shallow groundwater flows will not be a major transport mechanism.

During construction, overland runoff and wind erosion will be reduced through application of pre-construction agricultural row crop management, and implementation of a construction erosion and sediment control (ESC) plan (to be developed during detailed design), including application of a multi-barrier approach and topsoil protection measures. These measures will specifically focus on stabilizing soils to reduce contaminant transport to the SWM system. See additional details on these measures in part b) of this response.

During operation, overland runoff and wind erosion will be reduced with increased paved surfaces (e.g., terminal yard, parking areas, roads) (EIS Appendix E.15, Table 6.7) and establishment of vegetation on vegetated berms, grassed swales and landscaped areas constructed using stripped topsoils, thereby reducing the quantity of exposed soils within the PDA (EIS Appendix E.15, Appendix B; response to IR3.41 (CEAR #613)). The annual sediment loads within the PDA are predicted to experience a 44% reduction for the post-construction condition compared to the existing condition (EIS Appendix E.15, Table 6.7), which also reduces the potential contribution of residuals that have adhered to such particles. See additional details in part b) of this response.

Residual Contaminants from Past Agricultural Activities

Based on the information presented in the EIS (EIS appendix E.5, EIS Appendix E.13), and further assessment undertaken in response to this IR, the following information focuses on overland runoff and wind erosion transport mechanisms for the agricultural residual contaminants.

Pesticides/Herbicides

Surficial soil samples were collected from agricultural fields in test pits (TPs), boreholes (BHs) or monitoring wells (MWs) as part of the Soil TDR (EIS Appendix E.13). Chemical analysis was conducted for 30 select pesticides and herbicides. A total of 14 soil samples were collected between May 2 and June 10, 2015 from active rotational crop fields for pesticide/herbicide analysis (BHs – 10, 14, 16, 20, 22, 24, 25, 26, 28, 60, 61, MW12, TPs113 and 130). In addition, two soil samples were collected from forested land use areas (TP114 and BH23) and one from an inactive agricultural pasture (BH59). None of the pesticides and herbicides analyzed exceeded the laboratory reportable detection limits (RDLs) for the 30 parameters analyzed. The RDLs are the smallest concentration or value the laboratory reports accounting for day-to-day variation in laboratory instrument sensitivity and analysis processes. Three of the pesticides/herbicides have CCME Canadian Soil Quality Guideline (2015) criteria, and none of the RDL values exceeded these criteria values.

The agricultural field crops within the PDA are part of commercial farming operations. Commercial farmers in Ontario must pass a Grower Pesticide Safety Course to use Class 2 or 3 pesticides on their crops (Ontario Regulation 63/09 under the *Ontario Pesticides Act*). The course covers the handling and use of pesticides for an agricultural operation. Class 2 or 3 pesticides and herbicides range from very to less hazardous commercial or restricted chemicals. The safety course also covers correctly reading pesticide labels, including following directions to apply appropriate application rates at correct times for the target pests/weeds and in appropriate weather conditions. If a pesticide or herbicide spill occurs in an agricultural field, the Ontario Spills Action Centre must be immediately notified.

Based on the soil sample chemical analysis results for select pesticides and herbicides, and training requirements for the use of agricultural pesticides under the *Ontario Pesticides Act*, residual product within the PDA soils is expected to be low in concentration (below CCME Canadian Soil Quality Guidelines) for the pesticide types sampled in 2015. During the construction phase, topsoils will be sequestered to areas where vegetated berms, grassed swales and landscape areas will be constructed and temporary soil stockpiles (as noted in response to IR3.41 (CEAR #613)). The multi-barrier approach as part of the ESC plan will be applied, which will include specific measures focused on these placed topsoils of silt fencing, rock and geotextile check dams (within temporary and permanent swales) and straw bale filters (again placed within permanent and temporary swales) (EIS Appendix E.15, Appendix B; response to IR3.41 (CEAR #613)). Vegetation seeding of permanent swales and berms will occur as soon as feasible following construction with ESC measures remaining in place until vegetation has established (as noted in response to IR3.31 (CEAR #613)). Based on the observed low concentrations of pesticides and herbicides in the agricultural soils and implementation of ESC measures during construction to reduce potential transport of herbicides and pesticides contaminated soil particles to the SWM system, there is a low potential for entry expected into the SWM ponds during the construction phase.

During operation within the PDA, 47.2 hectare (ha) (EIS Appendix E.15, Table 6.8) of the total 185 ha area (EIS Appendix E.15, Section 3.1) will be paved or overlain by buildings and railway tracks; soils within these areas will be effectively covered and not available for transport by overland flow and wind erosion. Additionally, topsoils will be used to create ditching, swales and embankment slopes, which will be vegetated to stabilize the soils reducing potential erosion (response to IR3.41 (CEAR #613); EIS Appendix E.15, Appendix B). The post-construction annual sediment load to Tributary A and Indian Creek is predicted to undergo a 44% reduction compared to the existing condition annual sediment load. Based on the observed low concentrations of pesticides and herbicides in the agricultural soils and predicted reductions in sediment loading during the operation phase, there is a low potential for entry expected into the SWM system for these pesticides types via transportation by overland runoff and wind erosion.

Animal Based Manures and Chemical Fertilizers

Animal-based manures and chemical fertilizers are applied to agricultural row crops as nutrient amendments to provide nitrogen (N), phosphorus (P) and potassium (K) compounds to promote plant growth. The potential contaminants of concern from animal-based manures are N and P compounds, and pathogenic organisms. Within chemical fertilizers, N and P compounds are the main contaminants of concern.

In 2018, only chemical fertilizer applications have or are planned to be applied to the corn crop following a sub-contractor fertility program matching application rates to expected yield goals.

Nitrogen (N) Compounds

The surface water quality baseline study (EIS Appendix E.15) and subsequent update (provided as Attachment IR2 in response to IR1.2 (CEAR #561)) collected water quality samples that were analyzed for nitrite (NO_2), nitrate (NO_3) and calculated un-ionized ammonia (NH_3) results in Tributary A (TRIB A) and Indian Creek (IC2 and IC3). NH_3 was calculated using the measured total ammonia ($NH_3 + NH_4^+$) concentration and water temperature as per the Canadian Council of the Ministers of the Environment (CCME) ammonia factsheet method (2010). The three monitoring sites are located within watersheds that include active agricultural crop fields. The NO_2 and NH_3 concentrations for the study period (June 2015 to June 2016) were below the CCME Canadian

Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG-FAL) criteria values during storm flow and baseflow conditions. One NO_3 sample at TRIB A on June 29, 2015 exceeded the long-term CCME CWQG-FAL criteria, while the remaining TRIB A, IC2 and IC3 NO_3 results were below the criteria concentration value.

No major sources of N compounds to Tributary A and Indian Creek upstream of the above monitoring stations, which includes the adjacent PDA, were identified during the baseline study. The PDA lands within the Tributary A and Indian Creek (upstream of IC3) watersheds account for approximately 17% and 5%, respectively, of the total watershed area. Thus, based on these baseline observations during active farming with application of nutrient amendments, crop growth and management and active tillage practices within the active farm soil/topsoil horizon, no increases in N compounds are expected during construction or operation to the SWM ponds. Residual N compounds within the topsoils in the PDA that are actively moved and managed within the PDA with the proposed mitigation measures will not result in an increase or adverse effect on receiving water quality in Tributary A and Indian Creek. The proposed mitigation measures are described in EIS Section 9.8, EIS Appendix E.15, Appendix B, and in response to IR2.27 (CEAR #592) and IR3.41 (CEAR #613).

Within the existing online agricultural pond on Tributary A as part of the surface water quality baseline study (EIS Appendix E.15), a composite sediment sample was collected for analysis (TRIBA2) on June 19, 2015. Total Kjeldahl N (TKN), total ammonia as N, NO_2 and NO_3. Calculated unionized ammonia-N, NO_2 and NO_3 were below the RDLs, which were below the CCME CWQG-FAL criteria values. The observed TKN concentration was 1960 µg/g, where TKN represents the concentration of organic N plus total ammonia-N. With the total ammonia-N concentration being below the RDL value of 20 µg/g, the majority of the TKN concentration was in the form of organic N. The TKN value at TRIBA2 was comparable to other composite sediment samples collected in Indian Creek (ICS1, ICS2, ICS7).

During construction, the Pond will be hydraulically isolated during pond sediment removal and excavation associated with realignment of Tributary A, thus avoiding the disturbance and mobilization of Pond sediments downstream. As part of the hydraulic isolation process, the pond will be dewatered prior to removing the sediments to reduce soil particle mobilization into the discharged water. Sediments removed from the pond will not be reused within the PDA and will be transported off-site for disposal at an approved receiving site. Prior to disposal off-site, samples will be taken for comparison to the Ontario Ministry of Environment soil, groundwater and sediment standards for use under Part XV.1 of the *Environmental Protection Act*, Table 1 Site Condition Standards for agricultural or other property use (EIS Appendix E.13). Further, only a portion of the existing agricultural pond will be disturbed during construction (i.e., portion associated with the Tributary A channel realignment), with the majority of the on-line pond areas to be naturalized (see EIS Figure 4, provided as Attachment IR3.24-2 (CEAR #613) and Attachment IR2.39-2 (CEAR #592)). Implementation of mitigation measures described in part b) of this IR response will be implemented to naturalize the former on-line pond areas and reduce overland runoff and wind erosion of disturbed sediments and their potential organic N loads.

Phosphorus Compounds

The surface water quality baseline study (EIS Appendix E.15) and subsequent update (provided as Attachment IR2 in response to IR1.2 (CEAR #561)) collected water quality samples that were analyzed for soluble reactive phosphorus (SRP) and total phosphorus (TP) in Tributary A (TRIB A) and Indian Creek (IC2 and IC3). At TRIB A, SRP and TP results ranged from 0.021 to 0.130 mg P/L

and 0.069 to 0.21 mg P/L, respectively. At IC2 and IC3, SRP and TP results ranged from 0.010 to 0.060 mg P/L and 0.024 to 0.35 mg P/L, respectively. The TP concentrations at the three sites range from meso-eutrophic (0.02 to 0.035 mg P/L) to hyper-eutrophic (0.1 mg P/L) for trophic status (CCME 2004). Meso-eutrophic to hyper-eutrophic trophic status ranges indicate freshwater systems that are not P limited for the growth of aquatic vegetation and algae (high P concentrations). There are no CCME CWQG-FAL criteria for P compounds besides trophic status. The SRP results at the three sites range from 10% to 100% with 75th percentile values that range from 36% to 51% of the TP concentration values. These baseline study SRP and TP results indicate that the Tributary A and Indian Creek watercourse systems are not limited by P for the growth of aquatic vegetation and algae (high concentrations), including increased organic matter causing high sedimentation and anoxic conditions in water bodies (CCME 2004).

EIS Appendix E.15 and the response to IR1.2 (CEAR #561) assesses existing and post-construction P concentrations and loads within the PDA in Tributary A and Indian Creek from the various land uses, including the existing agricultural row crop fields. P has been identified as a potential contaminant of concern for this Project and mitigation measures described in part b) of this response are proposed during construction and operation to reduce P loading to Tributary A and Indian Creek from the PDA lands. P loads from agricultural soils within the PDA are expected to potentially enter into the SWM ponds during construction and operation at reduced levels in comparison to active agricultural fields. The P loading model for the post-construction condition assumed a worst-case scenario of 46.5 ha of agricultural land uses within the SWM pond drainage area and their runoff loads of 2.2 kg P/ha entering the SWM pond system. With the proposed ESC mitigation measures (multi-barrier approach) during the stockpiling and construction of temporary and permanent swales and berms during the construction phases, and use of the SWM ponds, there is predicted to be a 40.5% reduction in the total annual P load from the existing condition within the PDA (EIS Appendix E.15, Table 6.8). This reduction in the P load is expected as well during the operations phase, particularly with the stabilization of berms and swales with vegetated covers. The response to IR3.39 (CEAR #613) describes the expected effectiveness of the SWM system within the PDA in reducing P loads. As part of the post-construction monitoring plan described in response to IR3.37 (CEAR #613), total P (TP) will be included as a surface water quality parameter.

Pathogenic Organisms

Pathogenic organisms may be present in the agricultural animal manures applied to PDA agricultural row crop fields. Pathogenic organisms - bacteria and viruses - have a common survivability maximum of two and three months, respectively, in soils following land application of animal manures (Gerba and Smith 2005). The maximum survivability of bacteria and viruses in soils receiving land applied manures is 12 and 6 months, respectively. The presence of these organisms is positively reduced through reduced manure applications rates, such as the implementation of Nutrient Management Strategies and Nutrient Management Plans (Gessel et al. 2004; Hutchinson et al. 2004). In 2018, no animal manures have or are planned to be applied to the PDA agricultural row crop fields. As such, if no manure is applied prior to construction, no further actions are required. However, in the event that manure is applied prior to construction, the potential for some residuals (i.e., from future applications) to be transported into the SWM system during the disturbance of agricultural row crop field soils during construction. The following types of mitigation measures would be applied to reduce this loading:

- Prolonged fallow period (i.e., minimum six months) increases pathogen organism die-off rates, particularly with no further applications of animal manures (Yao et al. 2015)

- Controlling overland runoff using physical barriers and filters reduces the number of pathogens transported to surface water systems by physical filtration (e.g., filter fabrics, grasses) (Spiehs and Goyal 2007; Kay et al. 2012)

- Sedimentation of particle attached microbes with subsequent die-off in water bodies (i.e., ponds) (Kay et al. 2012)

Part b) of this response discusses the physical barriers and filter mitigation measures proposed to reduce the potential pathogenic organism loading into Tributary A and Indian Creek.

With the implementation of a prolonged fallow period (i.e., six months) prior to construction, and implementation of physical barriers as part of the ESC plan during the construction phase to physically filter pathogens in overland runoff, transport of residual pathogens to the SWM ponds would be reduced. Within the SWM ponds themselves, sedimentation of pathogens attached to soil particles would remove additional pathogens. Based on the above proposed fallow period and ESC plan to be further developed during detailed design, there will be a reduction in pathogens entering the SWM ponds during the construction phase from the agricultural soils. If pathogens do enter the SWM ponds sedimentation of particle attached microbes will occur with subsequent die-off in the sediments.

With the establishment of grasses providing physical filtration, the stabilization of soils, the increased paved areas covering soils, the greater than six-month period since animal manures will have been applied, and with no further applications of animal manures during the operations phase, residual pathogens are not expected to be transported by overland runoff to the SWM ponds, and subsequently Tributary A and Indian Creek.

Summary

The following points summarize the potential for entry of residual agricultural contaminants to the SWM ponds within the PDA during the construction phase:

- Pesticides/Herbicides – Low observed existing concentrations of select pesticides during the 2015 soil sampling study (EIS Appendix E.13) in conjunction with the multi-barrier ESC approach and vegetation seeding to stabilize soils, and reduced areal extent of soils (e.g., larger paved areas) will reduce the potential transport of these contaminants to the SWM ponds

- Nitrogen compounds – The surface water quality baseline study (EIS Appendix E.15) observed relatively low concentrations (below CCME guideline criteria) for NO_2, NH_3 and NO_3 in Tributary A and Indian Creek during storm flow and baseflow conditions. These results indicate no major sources of N compounds to Tributary A and Indian Creek from the upstream actively farmed watersheds, including the PDA. With the implementation of the ESC plan to manage exposed agricultural topsoil, there is low potential for residual N contaminants to enter the SWM ponds.

- Phosphorus compounds – P concentrations (TP and SRP) within Tributary A and Indian Creek indicate a system that is not limited for aquatic vegetation and algae growth (high P concentrations) for the existing condition. With the implementation of the ESC plan during construction, there will be a reduction in the P load to the SWM ponds. Following further reductions by SWM ponds, there is predicted to be a 40.5% reduction in the TP load from the PDA to Indian Creek.

- Pathogens – Bacteria and viruses may be present in agricultural animal manures applied to agricultural row crop soils within the Tributary A and Indian Creek watersheds. Mitigation measures, including a six-month fallow period and implementation of physical barriers as ESC measures, will reduce the potential pathogen loading to the SWM ponds. Based on the proposed fallow period and ESC plan, it is not expected that pathogens will be entering the SWM ponds during the construction phase from the agricultural soils. If pathogens do enter the SWM ponds, sedimentation of particle attached pathogens will further reduce the pathogen load within the water column.

The following points summarize the potential for entry of residual agricultural contaminants to the SWM ponds within the PDA during the operations phase:

- Pesticides/Herbicides – With the low observed concentrations of select pesticides during the 2015 soil sampling study (EIS Appendix E.13) in conjunction with vegetated berms and swales stabilizing former agricultural topsoils, and increased impervious areas (e.g., paved) reducing the potential sediment load by 44% compared to the existing condition, there is low potential for the entry of residual pesticides/herbicides into the SWM ponds.

- Nitrogen compounds – The surface water quality baseline study (EIS Appendix E.15) observed relatively low concentrations (below CCME guideline criteria) for NO_2, NH_3 and NO_3 in Tributary A and Indian Creek during storm flow and baseflow conditions. These results indicate no major sources of N compounds to Tributary A and Indian Creek from the upstream watersheds, including the PDA. With the increased impervious areas within the PDA stabilizing soils, and vegetated covers stabilizing soils within the swales and berms, there is low potential for residual N contaminants to enter the SWM ponds.

- Phosphorus compounds – P concentrations (TP and SRP) within Tributary A and Indian Creek indicate a system that is not limited for aquatic vegetation and algae growth (high P concentrations) for the existing condition. The stabilization of agricultural topsoils within the swales and berms by vegetation will reduce the P loads to the SWM ponds. The SWM system is expected to reduce the P load from the PDA in comparison to the existing condition by 40.5% for the operations phase.

- Pathogens - Bacteria and viruses may be present in agricultural animal manures applied to agricultural row crop soils within the Tributary A and Indian Creek watersheds. In 2018 no animal manures were or are planned to be applied to the PDA agricultural crop fields. With the establishment of vegetated cover over the agricultural topsoils in the swales and berms to stabilize them, the greater than six-month period since the application of animal manures, and plans for no further animal manure applications during the operation phase, pathogens are not expected to be transported to the SWM ponds.

b) *Describe the measures CN would take on site to minimize the mobilization and transport of historic contaminants during the site preparation, construction and operation phases of the Project, including measures that could be taken during removal of the pond.*

The following are measures proposed to minimize the mobilization and transport of potential residual agricultural contaminants during the site preparation, construction and operation phases of the Project.

Pre-Construction Agricultural Row Crop Management

The following pre-construction row crop management activities that CN will implement are designed to allow time for increased die-off of pathogenic organisms and volatilization of herbicides/pesticides prior to soil disturbance and removal of nutrient compounds through plant harvesting:

- Prior to the fallow period, the crops would be harvested from the fields. The agricultural crop fields would be left in an untilled condition with a cover crop for this fallow period.
- Prior to ground disturbance as part of construction activities for the Terminal, the agricultural fields within the PDA will be harvested and planted with an erosion protection and nitrogen scavenging cover crop (e.g., winter wheat, cereal rye, barley (Ontario Ministry of Agricultural, Food and Rural Affairs 2017)) and remain fallow with no active agricultural or construction activities for a minimum six-month fall/winter period.

Implementation of Erosion and Sediment Controls During Construction

As described in response to IR3.41, CN will prepare and implement an ESC Plan during construction consistent with the "Erosion and Sediment Control Guideline for Urban Construction", December 2006, Greater Golden Horseshoe Area Conservation Authorities. Specific measures to be incorporated in this plan, which will be developed and refined during detailed design (and submitted to DFO and CEAA (as noted in response to IR5.15 (CEAR #647)), are described in response to IR3.41 (CEAR #613), and include measures to mitigate potential erosion from rainfall/runoff, wind or extreme weather events.

Soil erosion mitigation measures are designed to reduce soil particle loading into the SWM system, and Tributary A and Indian Creek via overland runoff and wind erosion. These measures reduce the transportation of contaminants attached to these soil particles, which include pesticides, herbicides, N and P compounds and pathogenic organisms.

Mitigation During Watercourse Realignments

During construction within existing watercourse channels and the online agricultural pond, there is the potential to disturb sediments with attached contaminants (i.e., pesticides, herbicides, N and P compounds, pathogenic organisms) that could be transported downstream by channel flows, overland runoff and/or wind erosion. These potential transport mechanisms will be reduced to the extent possible by constructing the channel realignment and other works offline and 'in the dry' (as described in response to IR4.48 (CEAR #632)). Infilling and removal of existing channel sections will also be conducted in the dry by isolating work areas and diverting flows around the excavation site, including the agricultural pond, to reduce sediment disturbance and mobilization downstream.

The following are proposed mitigation measures for construction activities within the existing Tributary A online agricultural pond and installation of the watercourse realignments, as described in EIS Appendix E.2 (Section 7.5 and Appendix D, Drawings C-502 and C-503):

- Works to be completed during low flow conditions

- In-water work to be completed in the dry by isolating the work area using pump around or diversion techniques, including:
    - When work is proposed within the existing channels and the online agricultural pond, a pump around operation (e.g., cofferdams with pumping apparatus) will be installed to divert channel flows around the work area.
    - Removal of accumulated silt/debris around temporary cofferdams prior to dam removal.
    - Prior to removing cofferdams, in-channel or pond works will be graded and stabilized, including initial re-vegetation establishment and/or use of erosion control matting to provide initial soil stabilization while vegetation ground cover establishes.
- Works adjacent to watercourse will require installation of appropriate erosion and sediment controls as discussed in the previous mitigation measure section.

Operations Mitigation Measures

During operation of the Project, mitigation measures include maintaining vegetation cover and functioning of proposed SWM ponds. Previously distributed agricultural field crop soils will be in landscaped areas, grassed swales and berms in a stabilized vegetated condition, thereby reducing transport of residual agricultural contaminants attached to soil particles by potential overland runoff and/or wind erosion processes. Maintaining this vegetated cover (e.g., grasses, riparian vegetation, aquatic plants, planted riparian wetlands) will maintain the soils and sediments in a stabilized condition.

Biological uptake of N and P compounds by vegetated cover plant root systems within the PDA will be expected to reduce loads of particulate and dissolved compounds (as noted in response to IR3.37 (CEAR #613)).

Pathogenic organisms from animal-based manures that may potentially survive within the redistributed soils during the operations phase will be reduced through die-off from sedimentation of soil particle attached organisms attached to particles within the SWM ponds (Kay et al. 2012) or through physical filter removal by vegetation covers (i.e., grasses).

IR7.4 Water quality and selection of contaminants of concern

Rationale: *In Table IR3.37-1 (CEAR #613), CN provided the annual average influent and effluent concentrations and loads for the stormwater management ponds for several contaminants of concern. In its response to the Review Panel's Package 3 information request #3.37b, CN identified the following contaminants that would be considered as part of the stormwater management pond effluent water quality monitoring program:*

- *chloride,*
- *total phosphorus,*
- *total suspended solids,*
- *phenol,*
- *chromium,*

- *lead,*
- *copper,*
- *zinc; and*
- *hydrocarbons: benzene, toluene, ethylbenzene, xylenes, total petroleum hydrocarbons, total oil and grease.*

Environment and Climate Change Canada (CEAR #631) observed that the reported upper values of the annual average effluent concentrations for copper and zinc are currently higher than their respective Canadian Council of Minister of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME CWQG-FAL). In addition, in Appendix G of Appendix E.15 of the EIS, baseline levels of several other contaminants were reported to exceed the CCME CWQG-FAL criteria. However, estimated influent and effluent concentrations of these contaminants were not included in Table IR3.37-1. For instance, iron has a CCME CWQG-FAL criteria value of 300 µg/L, while baseline levels were reported as being as high as 8800 µg/L at some stations, yet iron was not identified as a contaminant that would be monitored by CN.

CN has not provided a rationale as to why contaminants with concentrations that are currently higher than their respective CCME CWQG-FAL values would not be monitored.

Information Request:

a) *Describe how certain contaminants were selected as "contaminants of concern" for the purpose of Table IR3.37-1 and for the stormwater management monitoring plan. Include a rationale as to why contaminants with concentrations that are currently higher than their respective CCME CWQG-FAL values would not be monitored.*

CN Response:

Contaminants were selected as parameters for the Project post-development surface water and stormwater management (SWM) system water quality monitoring program, based on the results of two assessments: identification of project effluent contaminants of concern and identification of receiving water contaminants of concern. The following details the contaminants of concern that will be monitored for the Project post-development surface water and SWM system effluent water quality monitoring program and explains how they were selected.

Project Effluent Contaminants of Concern

Relevant contaminants related to rail yard activities were identified based on an assessment of monitored parameters at a similar CN facility (i.e., Calgary Logistics Park) and literature review, as noted in EIS Appendix E.15 and further discussed in responses to IR16-1 (CEAR #72), IR16-2 (CEAR #375) and IR3.37 (CEAR #613). The assessment of monitored parameters at the Calgary Logistics Park included comparison of SWM system monitoring results with the Canadian Council of the Ministers of the Environment (CCME) Canadian Water Quality Guidelines for Freshwater Aquatic Life (CWQG-FAL) to identify potential exceedances of the criteria. The Project effluent contaminants of concern identified by the above assessment results will be included in the Project post-development surface water and SWM system effluent monitoring program. For reference, **Table IR7.4-1** presents the list of project effluent contaminants of concern that will be monitored, the rationale from literature sources, and whether they were monitored at the CN Calgary Logistics Park. The list of monitoring parameters in **Table IR7.4-1** supersedes the list in IR3.37b response (CEAR

#613) and is the complete list CN proposes to monitor during the post-development phase with the inclusion of iron.

Of note, the responses to IR16-1 (CEAR #72) and IR16-2 (CEAR #375) identified iron as a potential contaminant of concern within the railway industry. However, iron was inadvertently omitted from the estimation of annual average influent and effluent concentrations and loads for the contaminants of concern presented in response to IR3.37 (Table IR3.37-1, CEAR #613). As such, for completeness, **Table IR7.4-2** below provides the estimation of annual average influent concentrations and loads for iron. Influent concentrations are estimated for the proposed SWM ponds based on literature review values adapted from sources listed in response to IR16-1.

Table IR7.4-1 Project Effluent and Receiving Water Contaminants of Concern that will be Monitored with Literature Sources, Confirmation of Monitoring at Other Applicable CN Site and June 2015 – June 2016 Existing Condition Study, and Rationale.

Contaminants of Concern	Monitored at Calgary Logistics Park (IR16-2)	Project site (June 2015 to June 2016 [IR1 Attachment 2; IR])		Literature Source	Rationale
		Monitored	Exceeded CCME CWQG-FAL Criteria [a]		
Metals					
Chromium	Yes	Yes	Yes	Burkhardt et al. 2008; Vo et al. 2015 (adapted from Larsson 2004)	Burkhardt et al. 2008 identified this contaminant as part of brake and friction process emissions from Swiss railway operations; Vo et al. 2015 (adapted from Larsson 2004) identified this contaminant in overland runoff from a station yard with trains and cars sitting for prolonged time periods, and frequent moving of cars and equipment, which are similar activities to those proposed at CN Milton.
Copper	Yes	Yes	Yes	Vo et al. 2015 (adapted from Larsson 2004)	Vo et al. 2015 (adapted from Larsson 2004) identified this contaminant in overland runoff from a station yard with trains and cars sitting for prolonged time periods, and frequent moving of cars and equipment, which are similar activities to those proposed at CN Milton.
Lead	Yes	Yes	Yes	Vo et al. 2015 (adapted from Larsson 2004)	
Zinc	Yes	Yes	Yes	Burkhardt et al. 2008; Vo et al. 2015 (adapted from Larsson 2004)	Burkhardt et al. 2008 identified this contaminant as part of brake and friction process emissions from Swiss railway operations; Vo et al. 2015 (adapted from Larsson 2004) identified this contaminant in overland runoff from a station yard with trains and cars sitting for prolonged time periods, and frequent moving of cars and equipment, which are similar activities to those proposed at CN Milton.
Iron	Yes	Yes	Yes	Burkhardt et al. 2008	Burkhardt et al. 2008 identified this contaminant as part of brake and friction process emissions from Swiss railway operations.
Hydrocarbons					
Total Petroleum Hydrocarbons [b]	No	No	N/A	Gil and Im 2014; Vo et al. 2015	Creosote timbers will be used at the site, along with fueling and lubrication and maintenance activities on site. With the SWM facility design including mechanisms for oil separation and capture, individual and group hydrocarbon parameters have been included.
Total Oil and Grease	No	Yes	-		
Benzene	Yes	Yes	No		
Toluene	Yes	Yes	No		
Ethylbenzene	Yes	Yes	No		
Xylenes	Yes	Yes	-		
Non-Grouped Parameters					
Phenols	Yes	-	-	Burkhardt et al. 2008	Phenols are a component of creosote used in railway tie treatment and creosote ties will be used in the stormwater management drainage areas.
Phosphorus	Yes	Yes	-	Chambers et al. 2001; EIS Appendix E.15, Section 4.3.4.1.2	The disturbance of soils during construction can make phosphorus attached to soil particles available for transport by overland runoff.
Total Suspended Sediment	Yes	Yes	No, Narrative [c]	EIS Appendix E.15, Section 4.3.4.1.1	The disturbance of soils during construction and general site maintenance can make soil particles available for transport by overland runoff.

Contaminants of Concern	Monitored at Calgary Logistics Park (IR16-2)	Project site (June 2015 to June 2016 [IR1 Attachment 2; IR])		Literature Source	Rationale
		Monitored	Exceeded CCME CWQG-FAL Criteria [a]		
Oxygen Levels	No	Yes	-	EIS Appendix E.15, Section 6.2.1.3.1.2; IR16-1	A general concern with use of stormwater management ponds employing extended detention.
Water Temperature	No	Yes	-	EIS Appendix E.15, Section 6.2.1.3.1.2	A general concern with use of stormwater management ponds using extended detention and pond surface drainage.
Salinity (Chloride)	No	Yes	Yes	EIS Appendix E.15, Section	Road-based traction controls, including salts, will be used at the Project site, which will drain into the stormwater management system discharging to Tributary A and Indian Creek.

[a] CCME CWQG-FAL – Canadian Council of the Ministers of the Environment Canadian Water Quality Guidelines for Freshwater Aquatic Life.

[b] Part b) of this response provides details on the specific hydrocarbon analytes/parameters that CN will monitor to represent the total petroleum hydrocarbons parameter.

[c] Narrative – total suspended solids - "clear flow: maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-hour period). Maximum average increase of 5 mg/L from background levels for longer term exposures. June 2015 – 2016 sampling program collected baseline data and was not focused on specific land use area discharge points within the PDA.

Table IR7.4-2 SWM Pond Annual Average Influent and Effluent Concentrations and Loads for Iron

Contaminant of Concern	Concentration Units	SWM Ponds 1 and 2 Drainage Area PDA Track Distance [a] (km)	Annual Track Loading Rate (g/km of track) [b]	Total PDA (SWM Ponds 1 + 2) Track Emission Load (kg) [c]	Total PDA (SWM Ponds 1 + 2) Annual Flow Volume (m^3) [d]	Average Influent Concentration	Total SWM System Removal Efficiency (%) [e]	Annual Average Effluent Concentration	SWM Pond 1	SWM Pond 2	PDA (SWM Ponds 1 + 2)
									Annual Average Effluent Load (kg) [f]	Annual Average Effluent Load (kg) [f]	Annual Average Effluent Load (kg) [f]
Iron	µg/L	12.5	2,170	27.1	306,055	3,500.0 [g] - 12,334.4	67.5 – 96.2	133.0 - 4,008.7	20.9 – 631.4	19.8 – 595.5	40.7 – 1,226.9

[a] 12,500 m of terminal and double mainline tracks within the PDA SWM Pond drainage area (see response to IR3.38).

[b] Burkhardt et al. (2008) – cumulative annual emission rate from the Swiss SBB railway network.

[c] Calculated track emission loads from track distance (g/km) multiplied by loading rate (kg); assumed to be fully available for surface water runoff transport.

[d] Surface water runoff volume calculated using drainage area (SWM Pond #1 – 52.8 ha; SWM Pond #2 – 49.8 ha; EIS, Appendix E.15, Appendix B) multiplied by post-development annual surface runoff depth (298.3 mm; EIS, Appendix E.15, Section 6.2.1.1); discharge volume calculation presented in response to IR7.5.[e] Total SWM system efficiency calculated from totaling removal efficiency ranges from the response to CEAA IR16-2, Table 4 (CEAR #375).

[f] Effluent load calculated by multiplying the surface water volumes for the given drainage area (EIS, Appendix E.15, Appendix B; see response to IR7.5) and the lower and upper effluent concentration limits.

[g] Low concentration from study of iron concentrations in surface water runoff within railroad track right of way (Strelkov et al. 2016).

Receiving Water Contaminants of Concern

The Tributary A and Indian Creek June 2015 to June 2016 surface water quality monitoring study monitored a suite of metals, inorganics, general chemistry and hydrocarbon parameters. A number of the parameters monitored between June 2015 and June 2016 were observed to be above CCME CWQG-FAL guideline values as listed in Table 4 in Attachment IR3.20-1, provided in response to IR3.20 (CEAR #613) and were therefore classified as receiving water contaminants of concern.

The post-development monitoring program will monitor receiving water contaminants of concern that are expected to be discharged from the construction and operations activities within the PDA at concentrations that are at or above CCME CWQG-FAL values. The discharge contaminants were identified based on the results of the literature review and Calgary Logistics Park monitoring program results (IR16-1 (CEAR #72) and IR16-2 (CEAR #375)) as discussed in the project effluent section of this response. The rationale for selection of these post-development monitoring parameters is that without mitigation to reduce their concentrations, these contaminants may contribute to further receiving water quality degradation.

Table IR7.4-1 presents the six of eight monitored parameters in Tributary A (TRIB A) and Indian Creek (IC2 and IC3) that exceeded the CCME CWQG-FAL criteria during the June 2015 to June 2016 monitoring period and are expected in the Project effluent (prior to implementation of mitigation measures) and will therefore be included in the post-development monitoring program.

The rationale for not including contaminants which have observed receiving water CCME CWQG-FAL value exceedances and are not expected to exceed guideline values in the project effluent is that the Project effluent will have an assimilative or reductive effect on the quality of those constituents in the receiving waters. Further details on this rationale are provided below.

As stated in the project effluent section of this response, iron has been added to the monitoring program for completeness to align with previous responses (IR16-1 (CEAR #72) and IR16-2 (CEAR #375)) that identified this parameter as a project effluent contaminant of concern.

Receiving Water CCME Exceedances Not Expected in Project Effluent

The proposed monitoring program does not propose to monitor effluent parameters expected to exist in concentrations below guideline values, even though these parameters may be elevated above guideline values in receiving waters. Conservatively, effluent parameters were assessed against guideline values without considering the improvement effect of treatment proposed within the SWM system on site.

Project effluent with parameters below guideline values will have an improvement effect on receiving water quality where existing conditions exceed guideline values.

The following are the two monitored parameters from the June 2015 to June 2016 period at Tributary A (TRIB A) and Indian Creek (IC2 and IC3) with exceedances of the CCME CWQG-FAL criteria that the Project does not expect to discharge above CCME CWQG-FAL criteria (Attachment IR3.20-1, Table 4 (CEAR #613)):

- Nitrate (NO_3) [one observation above CCME CWQG-FAL criteria at TRIB A out of 35 samples collected in Tributary A and Indian Creek during the June 2015 to June 2016 program]

- Silver

The literature review conducted in relation to the response to IR16-1, and monitoring results from the Calgary Logistics Park (IR16-2) did not identify nitrate or silver as contaminants of concern (concentrations above guideline values) in the project effluent and as such they are not included in the proposed monitoring plan. Further discussion of nitrate is provided in response to **IR7.3** as to why it is not expected in the project effluent.

Based on the above assessment, nitrate and silver are not proposed to be monitored as part of the post-development surface water quality monitoring program.

b) Clarify whether hydrocarbons would be monitored individually or as a group (i.e., Total Hydrocarbons).

Hydrocarbons are proposed to be monitored both individually (i.e., benzene, toluene, ethylbenzene, xylenes) and as a group, with "total hydrocarbons" represented as normal straight-chain length hydrocarbon fraction ranges, as follows:

- Fraction 1 – from equivalent carbon number C6 – C10
- Fraction 2 – from equivalent carbon number C10 – C16
- Fraction 3 – from equivalent carbon number C16 – C34

Total Oil and Grease would also be monitored.

Total petroleum hydrocarbons include a range of petroleum classes representing various petroleum products (e.g., liquified gases, gasoline, diesel, lubricating oils) (Tuczynowicz and Robinson 2008). The CCME approach is to assess the above listed four fractional ranges of total petroleum hydrocarbons to identify the potential sources of the hydrocarbons (CCME 2008). The CCME (2008) approach was originally developed for assessing petroleum impacted soils and the fractions were developed based on available ecotoxicological data. As part of the Atlantic Risk Based Correction Action (2016), which applies the CCME procedures for CCME petroleum hydrocarbon standards, a modified total petroleum hydrocarbon value is calculated by summing Fractions 1 to 3 together less the total concentration of benzene, toluene, ethylbenzene and xylenes.

Assessing the petroleum hydrocarbons as the three fractions provides an effective means of assessing and managing potential environmental risk of hydrocarbons. Using the three hydrocarbon fraction groups will allow assessment of the effectiveness of the SWM system in reducing hydrocarbon loading. Fraction 4 has been excluded as it represents the gravimetric heavy hydrocarbons that are found in heavy crude oils and asphalts which are not applicable to an intermodal terminal and are not part of the calculated Total Hydrocarbon value.

IR7.5 Stormwater management ponds influent and effluent concentrations and loads

Rationale: *In response to the Review Panel's Package 3 information request #3.37a, CN provided predicted effluent concentrations and loads for some contaminants that would be discharged from the stormwater management ponds to the receiving environment, but Environment and Climate Change Canada noted in its submission (CEAR #631) that predictions of the associated discharge flow volumes were not provided.*

In Table IR3.37-1 of the same response, CN presented the estimated annual average influent and effluent concentrations and loads for the contaminants of concern, based on literature value ranges of influent concentrations. It is not clear how literature value ranges were selected for this purpose.

Information Request:

a) *Provide the estimated discharge flow volumes used to calculate the contaminant loads presented in Table IR3.37-1.*

b) *Explain how literature values were selected and used to estimate the range of influent concentrations and loads for the contaminants of concern reported in Table IR3.37-1, including any assumptions associated with those predictions.*

CN Response:

a) *Provide the estimated discharge flow volumes used to calculate the contaminant loads presented in Table IR3.37-1.*

The annual discharge volumes from stormwater management (SWM) Ponds 1 and 2 were calculated using the following equation:

$$Discharge\ Volume = Surface\ Runoff\ Depth * Drainage\ Area$$

where:

Discharge Volume = Annual discharge volume from SWM Pond (m^3)

Surface Runoff Depth = Post-development annual surface runoff depth for SWM Pond drainage area (m)

Drainage Area = SWM Pond drainage area (m^2)

Table IR7.5-1 presents the SWM Pond 1 and 2 inputs and calculated annual discharge volumes using the above equation that were used to calculate the contaminant loads presented in Table IR3.37-1 (CEAR #613).

Table IR7.5-1 Estimated Annual Discharge Volumes and Equation Input Values.

SWM Pond	Surface Runoff Depth [a]		Drainage Area [b]		Annual Discharge Volume
	mm	m	ha	m^2	m^3
1	298.3	0.2983	52.8	528,000	157,502
2			49.8	498,000	148,553

[a] Data Value Source: EIS, Appendix E.15, Appendix B

[b] Data Value Source: EIS, Appendix E.15, Section 6.2.1.1

b) Explain how literature values were selected and used to estimate the range of influent concentrations and loads for the contaminants of concern reported in Table IR3.37-1, including any assumptions associated with those predictions.

The ranges of influent concentrations, which were subsequently used to calculate contaminant loads in Table IR3.37-1, were selected based on a review of the following literature sources and associated assumptions for each listed contaminant, which were originally listed in CN's responses to CEAA IR16-1 (CEAR #72) and IR16-2 (CEAR #375):

- **Total Suspended Solids (87 – 188 mg/L)** – Obtained from Aquafor Beech Ltd., 1993. The study investigated urban stormwater runoff for the Metropolitan Toronto waterfront from various land uses, which includes Union Station within its drainage area. Union Station includes yarding and stopping/starting train cars, and vehicle transportation runoff from the surrounding streets, which was assumed to be similar to the untreated overland runoff that would occur at the Terminal. This study was used in the development of the Stormwater Management Planning and Design Manual (MOE, 2003).

- **Total Phosphorus (TP) (0.55 mg/L)** – The influent concentration is calculated using the predicted SWM Ponds 1 and 2 drainage area predicted P loads without treatment (EIS Appendix E.15 Section 6.2.1.3.1.3) divided by the annual discharge volume in part a) of this response. TP loading coefficients used for this calculation were selected based on review of literature sources and land use types applicable to post-construction PDA land covers. Additional details on the selection of loading coefficients is included in the response to **IR7.8**.

- **Soluble Reactive Phosphorus (SRP) (0.55 mg/L)** – As per note C in Table IR3.37-1, provided in response to IR3.37 (CEAR #613), the worst-case scenario SRP concentration was assumed where 100% of the above estimated TP concentration is in the form of SRP. This conservative approach to estimate SRP influent concentrations and loads was used based on the observed percent SRP of TP concentrations within Tributary A (TRIB A) and Indian Creek (IC2 and IC3) during the June 2015 to June 2016 surface water quality baseline study (EIS Appendix E.15), which ranged from 10% to 100% (further details provided in the response to **IR7.3**).

- **Chromium (2.9 – 5.3 µg/L), Copper (25 – 92 µg/L), Lead (9.3 – 16 µg/L) and Zinc (23 – 180 µg/L)** – Obtained from Vo et al. 2015 (adapted from Larsson 2004). The study provided a range of concentrations for a station yard, with trains and cars sitting for prolonged periods of time, and frequent moving of train cars and equipment; study values were applicable to estimate overland runoff concentrations.

- **Total Petroleum Hydrocarbons (6.8 mg/L)** – Obtained from Stormceptor 2004. Study was conducted at an articulated truck shipping facility, which was assumed to be similar in its function to the logistics hub with the moving of shipping containers using trucks within the PDA. Additional details on the reference and the concentration value selection are provided in response to IR3.38 (CEAR #613).

These influent concentrations were used to calculate contaminant loads entering each SWM Pond by multiplying by the surface runoff discharge volumes. The following equation presents how the influent concentrations and discharge volumes calculated in part (a) of this response were used to calculate the effluent load entering each SWM system:

$$Effluent\ Load = Effluent\ Concentration * Discharge\ Volume * \frac{1}{1000}$$

where:

Effluent Load = Annual Average Effluent Load (kg)

Effluent Concentration = Annual Average Effluent Concentration (mg/L)

Discharge Volume = Annual discharge volume from SWM Pond (m^3).

IR7.6 Flows and velocities in realignments and stormwater management ponds

Rationale: *CN has proposed to convey the existing Tributary A water flows through the project development area in a straight line under the terminal. The water would travel through proposed culvert 2A, then overland into culvert 2B, as shown in Figures 3 and 4 of Appendix C of Appendix E.15. The water would exit culvert 2B to the southwest, before turning to the northwest around Pond #1. At the northwest corner of Pond #1, the new channel would bend back towards the southwest before flowing under Tremaine Road and ultimately into Indian Creek.*

In response to the Review Panel's Package 3 information request #3.32 (CEAR #613), CN reported in Table IR3.32-1 and Table IR3.32-2 the predicted typical water detention times within the stormwater management ponds #1 and #2 for 2-year to 100-year storm events for single and consecutive storm events. CN anticipated that the detention times for consecutive events would be only slightly longer than those for a single event because most of the excess water volume would be discharged through the high-flow outlet or the overflow spillway. The high-flow outlet is designed to have two discharge rates depending on storage volume elevation, as explained further in Appendix B of Appendix E.15 of the EIS, while the overflow spillway is used to pass the excess water from regional storm events. CN also provided, in Appendix B of Appendix E.15 of the EIS, predicted pond inflow and outflow rates as well as the individual flow calculations through the orifice, weir and emergency spillway for Pond #1.

In Table IR3.32-3, CN provided peak flow rates for the various extreme events as well as consecutive storm hydrographs for the drainage catchment northeast of Tremaine Road, which includes the project development area, for existing (pre-development project development area) and post-development (with stormwater management ponds active) conditions, depicting the existing and proposed peak flows (Graphs IR3.32.1 through IR3.32.6). Despite the expected increase from the high-flow outlet and overflow spillway, the hydrographs show that proposed peak flows would remain relatively unchanged from existing baseline (pre-development)

conditions, even for the regional storm event and in the case of consecutive storm events. While it is clear that these hydrographs are intended to reflect flows from the drainage catchment northeast of Tremaine Road, it is not clear which current or future stream location they represent.

It is also unclear how water velocities in the realigned Tributary A would be managed to ensure the portion that curves around Pond #1 is not susceptible to erosion and flooding resulting from increased flow rates and velocities under typical conditions, as well as during extreme single or consecutive storm events. Additionally, it is unclear how the addition of water from the high-flow outlet and the overflow spillway from storm water management Pond #1 would affect the predicted flow rates and velocities for single and consecutive extreme storm events.

Information Request:

a) *Provide location(s) for the predicted hydrographs presented in Graphs IR3.32.1 through IR3.32.6. Provide additional hydrographs showing predicted flows during single and consecutive storm events below the discharge points of both ponds, if required.*

b) *Describe how potential additional flows from the high-flow outlet and overflow spillways have been taken into account in developing flow and flood predictions for the channel realignments downstream from the ponds. Provide a quantitative estimate of the confidence intervals for these predictions. Describe the results of any statistical analyses conducted to support these conclusions.*

CN Response:

a) *Provide location(s) for the predicted hydrographs presented in Graphs IR3.32.1 through IR3.32.6. Provide additional hydrographs showing predicted flows during single and consecutive storm events below the discharge points of both ponds, if required.*

The location for the predicted hydrographs presented in Graphs IR3.32.1 through IR3.32.6 is similar to the location of the monitoring station IC3, which is located upstream of Tremaine Road (as identified on **Attachment IR7.6-1: Predicted Hydrograph Flow Rate Location**). The location is the same for all hydrographs. The selected hydrograph location at station IC3 incorporates the entire PDA, as it is located below (i.e., downstream) the discharge points of both stormwater management (SWM) ponds #1 and #2, as well as downstream of the regional storm diversion channel, and thus provides a combined view of the Project's SWM influence against baseline conditions for Indian Creek.

The hydrographs for Tributary A were provided as Attachments IR3.26-1 and IR3.26-2 in response to IR3.26 (CEAR #613). The location of these hydrographs is just prior to where Tributary A discharges to Indian Creek, which is downstream of the discharge point of SWM Pond #1 (as identified on **Attachment IR7.6-1**). The selected location (referred to as Node 2 in Attachment IR3.26-1 and IR3.26-2 (CEAR #613)) incorporates the Tributary A drainage area and discharge from SWM Pond #1, and thus provides a combined view of the Project's SWM influence against baseline conditions for Tributary A.

b) *Describe how potential additional flows from the high-flow outlet and overflow spillways have been taken into account in developing flow and flood predictions for the channel realignments downstream from the ponds. Provide a quantitative estimate of the confidence*

intervals for these predictions. Describe the results of any statistical analyses conducted to support these conclusions.

CN notes that the hydrologic and hydraulic models used for the existing and post-development condition scenarios for this Project are for preliminary site design, including the channel realignments. The existing models were primarily used to assess project impacts for the proposed Project layout with preliminary SWM systems and channel realignments. During the detailed design phase, minor changes may be necessary to the SWM and channel realignment design as the Project layout is finalized. The hydrologic and hydraulic models will therefore be refined during the detailed design phase, and the new outputs used to size the channel realignments and their floodplains, and other site flow conveyance infrastructure.

The maximum flow rate from the high-flow outlet occurs during the 50-year return period event and the overflow spillway begins flowing during the 100-year return period event with maximum design flow during the Regional storm event. A Visual OTTHYMO Version 3.0 (VO3) hydrological model was developed to estimate flows during different storm events for the existing and post-development condition in Tributary A and the drainage area northeast of Tremaine Road, which includes the PDA and drains into Indian Creek. The post-development VO3 model included SWM Pond #1 and its flow operations (erosion control/low-flow, high-flow and overflow spillway) for the Tributary A model, and drainage from the entire PDA, SWM Ponds #1 and #2 outflows and Regional storm diversion flow for the drainage area northeast of Tremaine Road model (EIS Appendix E.15, Appendix B; response to IR3.26, CEAR #613).

To provide further context related to the contributions of the SWM Pond outflows to Tributary A, see **Attachment IR7.6-2: Regional Event Hydrograph with Storm Water Management Pond #1 Inflows Tributary A (Node 2)** displays hydrographs for the existing and post-development condition for Tributary A for the Regional storm event at Node 2 downstream of the SWM Pond #1 outflow, as well as outflow from SWM Pond #1. The existing condition and post-development condition with SWM Pond #1 hydrographs displayed in **Attachment IR7.6-2** are the same as those for the Regional event in Attachment IR3.26-2 (provided as **Attachment IR7.6-3: Hydrographs for 25-Year to Regional Storms in Tributary A (Node 2)** for the Panel's reference).

The SWM Pond #1 hydrograph (provided in **Attachment IR7.6-2**) indicates the points when the maximum low flow (25 mm event; 0.013 m^3/s), high flow (50-year return period event; 0.788 m^3/s) and spillway (Regional storm event; 6.309 m^3/s) flow rates occur at the outlet. The high flow and spillway flow rates represent the combined overall flow rate, which include the lower flow outfalls.

The proposed peak flow rate for Tributary A is 18.67 m^3/s at Node 2 with the SWM #1 Pond peak flow rate representing 33% of Tributary A Node 2 peak flow. This is the highest contribution of SWM Pond #1 to the Tributary A flow rate due to the Regional flow diversion. The 50-year return period post-development condition Node 2 peak flow rate is 9.66 m^3/s (see response to IR3.26, Table IR3.26-1, CEAR #613) with the SWM Pond #1 high flow outlet peak high flow rate of 0.788 m^3/s representing 8% of the Tributary A peak flow rate.

The post-development condition hydrologic flow outputs from the Tributary A VO3 model were input into the Tributary A HEC-RAS model with the channel realignment to appropriately size the channel substrate, and channel and floodplain dimensions (EIS Appendix E.2; EIS Appendix E.15, Appendix C). For Indian Creek, the VO3 modeled post-development condition hydrologic flows for the drainage area northeast of Tremaine Road were added to the appropriate design storm event (e.g., 100-year return period, Regional) Indian Creek flows within the Conservation Halton

HEC-RAS model to appropriately size the channel substrate, and channel and floodplain dimensions (EIS Appendix E.2; EIS Appendix E.15, Appendix C).

As discussed in the response to IR3.32 (CEAR #613), the expected additional flow volumes and reduction in flow rates within Tributary A and Indian Creek downstream of the SWM Ponds #1 and #2 outlets are relatively small (except for Tributary A during events with flows greater than the 100-year return period where a substantial flow rate and volume reduction will occur up to and above the Regional event due to the post-development regional diversion channel). This was accounted for in the design of the channel realignment, in-channel works and floodplain (EIS Appendix E.2). The Indian Creek peak flow used in the design incorporated the VO3 model predicted increase from the drainage area northeast of Tremaine Road. This includes the PDA and the output from the Town of Milton and Philips Engineering (2004) HSPF model results. The in-channel works for the channel realignments have been designed using the threshold channel approach (EIS Appendix E.2, Section 5.2; IR3.30). The threshold channel approach provides channel stability with no net accumulation and scour of sediment through appropriately sizing channel bed and bank materials to have negligible movement during flow events. The D50 substrate within the Tributary A and Indian Creek channel designs was sized to be stable under bankfull conditions (e.g., post-development 1.5 to 2-year return period storm event flows) and the D84 was sized to accommodate the post-development 100-year storm event flow[1].

The application of the threshold channel design approach and substrate sizing followed the guidance in Ontario Ministry of Natural Resources (MNR) Natural Channel Systems: An Approach to Management and Design (MNR 1994), which is the guide typically used for natural channel design in Ontario (as noted in response to IR3.30). As discussed in response to IR3.33, the Indian Creek channel realignment channel erosion threshold 100-year return period flows were assessed at a higher flow rate (72.95 m^3/s) and steeper channel slope (0.007 m/m) than the existing condition, and selected the most conservative particle size of six calculation methods, which adds a safety factor to accommodate potential modeled hydrologic flow uncertainty (noted in response to IR3.32 (CEAR #613)). These safety factors are in addition to the predicted lower channel velocities in Indian Creek (Appendix C of EIS Appendix E.2).

The Tributary A and Indian Creek channel realignment sections were designed to maintain flood conveyance and connection of Tributary A and Indian Creek channels to their floodplain within, and upstream and downstream of the PDA (EIS Appendix E.2; Appendix C of EIS Appendix E.15; response to IR3.30 (CEAR #613)). Indian Creek has previously been identified as having good access to its floodplain (Philips Engineering 2004). In addition to conveying the predicted Regional storm event flows within the Indian Creek reach in the PDA, including outflows from the SWM Pond overflow spillways, the Indian Creek channel realignment floodplain was designed to increase floodplain storage capacity by 9% from the existing condition (response to IR3.24 (CEAR #613)). This provides resiliency in the floodplain design and accommodates potential modeled hydrologic flow uncertainty impacts to flood line elevations. The landscape design for Tributary A and Indian Creek is proposed to be well vegetated with woody shrubs that provide resistance to erosion associated with predicted floodplain velocities.

[1] D50 represents the median grain size that 50% of the sediment is smaller than the diameter indicated and D84 represents the grain size that 84% of the sediment is smaller than the diameter indicated (EIS Appendix E.2).

Estimation of Confidence Intervals

The VO3 model used to predict the design storm event hydrologic flow rates used for the design of the channel realignments is a deterministic model that estimates hydrologic flows using specific hydrologic inputs. The storm events used in the model are simulated precipitation events of specific size (i.e., 25 mm) and return period (i.e., 50 year) following prescribed precipitation distributions (i.e., Chicago) based on intensity-duration-frequency (IDF) values from the Toronto Lester B. Pearson International Airport meteorological station. The precipitation distribution includes a high rainfall intensity peak intended to yield a resulting conservatively high flow peak. The selection of other model input parameters such as initial abstraction and Antecedent Moisture Conditions (AMC) can also contribute to the conservatism in runoff flows and peak flow values.

The level of confidence in the model results is directly related to the confidence in the inputs (see response to IR3.36 (CEAR #613); personal communication, Edward Graham, President CIVICA Water Management Solutions (VO3 software developer), July 3, 2018). The initial algorithms for the VO3 model were developed and tested in the 1980s, including comparison to other hydrologic flow models (Wisner and P'ng 1983). As part of the testing process, Wisner and P'ng (1983) compared the OTTHYMO simulated peak flows to observed peak flows for 13 flow events in three watersheds in Ontario. The observed peak flows for the comparison events ranged from 0.71 to 2.49 m^3/s. The average percent error in peak flow (PEP) difference between simulated and observed has been calculated using the following equation for the Wisner and P'ng (1983) results:

$$PEP = \frac{Q_s - Q_o}{Q_o} * 100$$

where:

Q_s = simulated peak flow (m^3/s)
Q_o = observed peak flow (m^3/s)

The calculated average PEP, which is also referred to as model average bias or relative peak flow, for the 13 flow events is -6% indicating that the OTTHYMO model underestimated the peak flow rates on average by 6%. The median PEP value is -5%. The closer the average PEP value is to 0%, the better the model is at predicting observed peak flows. The range of PEP values was from -35% to 21%. The -35% PEP event was within the Malvern watershed (23 ha; 34% impervious area) for the 3rd highest of four modeled rainfall events (observed 0.71 m^3/s). The two higher peak flow events (observed 0.92 and 0.9 m^3/s) simulated in the Malvern watershed had PEP values that were -19.6 and -5.6%, respectively. The average of the PEP values from the three watersheds indicate the Visual OTTHYMO model peak flows has a relatively good fit (<10% bias) with the observed peak flow data.

VO3 (the 3rd version of Visual OTTHYMO) has been used with confidence in Ontario by Conservation Authorities to develop hydrologic models in various watersheds and is commonly used for appropriately size and design SWM systems. The VO3 model includes a guide that recommends typical input parameters dependent on surficial soil and surface properties that improve model accuracy and confidence based on developer experience since the initial model development. Stantec, AECOM and many other consultants use this approach when using the VO3 model for SWM system and channel realignment design without conducting a full sensitivity analysis of input parameters and model calibration to observed flows. Additionally, the VO3 model was not calibrated or validated using monitored flow data because the storm events used

were all artificially simulated and distributed as per SWM design guidance (Ontario Ministry of the Environment 2003) to provide conservative runoff and peak flow estimates. The exception was the Hurricane Hazel storm (Regional event) which has a known hyetograph.

The post-development condition within the PDA represents a relevant land use change from agricultural row crop fields to rail yard, paved surfaces and buildings. These changes in land use also represent a relevant change in soil type with the increase in impervious surface. Vegetation within the PDA will change with the removal of agricultural crops and replacement with grasses and shrub landscape vegetation. There are also changes in local drainage with diversion of runoff in the PDA (EIS Appendix E.15). These are the most relevant changes to the model input parameterization. The main input parameters not changing for the post-development condition are the meteorological inputs. Based on the substantial changes for the post-development condition model setup, having a calibrated and validated model that has been updated does not guarantee the level of accuracy for the post-development condition. The setup of these parameters is based on model guidance documentation and engineering experience within realistic value ranges. The VO3 developers have observed that confidence in predicted flows increases with increases in drainage area imperviousness, making it a preferred tool for SWM design, such as the SWM Ponds #1 and #2 systems (personal communication, Edward Graham, President CIVICA Water Management Solutions, July 3, 2018). Based on this model observation, for the post-development condition with its increased impervious area, predicted hydrologic flows are expected to be more accurate.

Stantec and AECOM recommend use of the VO3 hydrologic model in the detailed design for the channel realignment. Additionally, as discussed above, conservatism and resiliency has been incorporated into the preliminary design to accommodate uncertainty with the predicted design flows, which would be expected to be in the good fit range of ±10% as observed by the Wisner and P'ng (1983) study.

A further reason why confidence intervals were not completed for VO3 modelling has to do with the timing of model development and flow monitoring in the PDA. AECOM's SWM strategy was developed in June 2015. The VO3 model was finalized in a run dated June 11, 2015 and appended to the SWM strategy. Stantec commenced the installation of flow monitoring stations the first week of June 2015 using water level dataloggers. When water level dataloggers are used, a stage:discharge relationship (also referred to as a rating curve) must be developed to convert water levels to flows. Subsequent to water level monitoring station installation, it took many return visits to measure in-situ water levels, depths and flows to develop a representative rating curve for each flow monitoring station. By the time Stantec had developed a rating curve over a wide number of flow events, AECOM's SWM strategy was complete. Thus, the local flow data needed to calibrate and validate the VO3 model was not available at the time of model development.

However, AECOM has now preformed a confidence interval frequency analysis using resampling techniques. 24-hour Chicago design storm events were created using Intensity-Duration-Frequency (IDF) values derived from the rainfall data taken from the AES Toronto Pearson International Airport climatic station (#6158733). AECOM used the resampling technique for estimation of uncertainties in statistics. When applied in frequency analysis, resampling techniques can provide estimates of the uncertainties in both distribution parameters and quantile estimates in circumstances in which confidence limits cannot be obtained theoretically. AECOM used the cumulative distribution function (CDF) of the Gumbel method then calculated the variance estimated quantile in the determined sample depth recordings using the following equations:

$$H = -\ln\left[-\ln(P)\right]; \quad P \in (0,1)$$

$$se(\hat{Q}) = \sqrt{VAR(\hat{Q})} = \frac{\hat{\sigma}}{\sqrt{N}}\sqrt{1.11 + 0.52H + 0.61H^2}$$

This last expression, then, provides the 95% confidence interval for the population mean, and this can also be expressed as:

$$\overline{X} \pm 1.96 \; se(\hat{Q})$$

Where:

Ln = Natural logarithmic function
H = Variable derived from the probability P; the double Ln(Ln) structure just creates as simplifying value that permits calculation of the confidence limits.
P = Probability of non-exceedance for a given cumulative distribution function
N = Number of observations
Q = Variance of the estimated quantile
Se = Standard error
σ = (sigma) standard deviation
$\overline{x}$ = population mean (depths)

The 5% - 95% confidence limits on total depth for 24-hour, 100-year storm is +-1.96*SE. The assessment applies only to the total precipitation depth used in the model for each storm and not for modelled runoff events.

Figure IR7.6-1 shows the 5% - 95% confidence limits on total depth for 24-hour, 100-year storm.

Figure IR7.6-1 Duration Period Rainfall Depth (mm) -95% Confidence Limits (24-hour, 100-year storm)

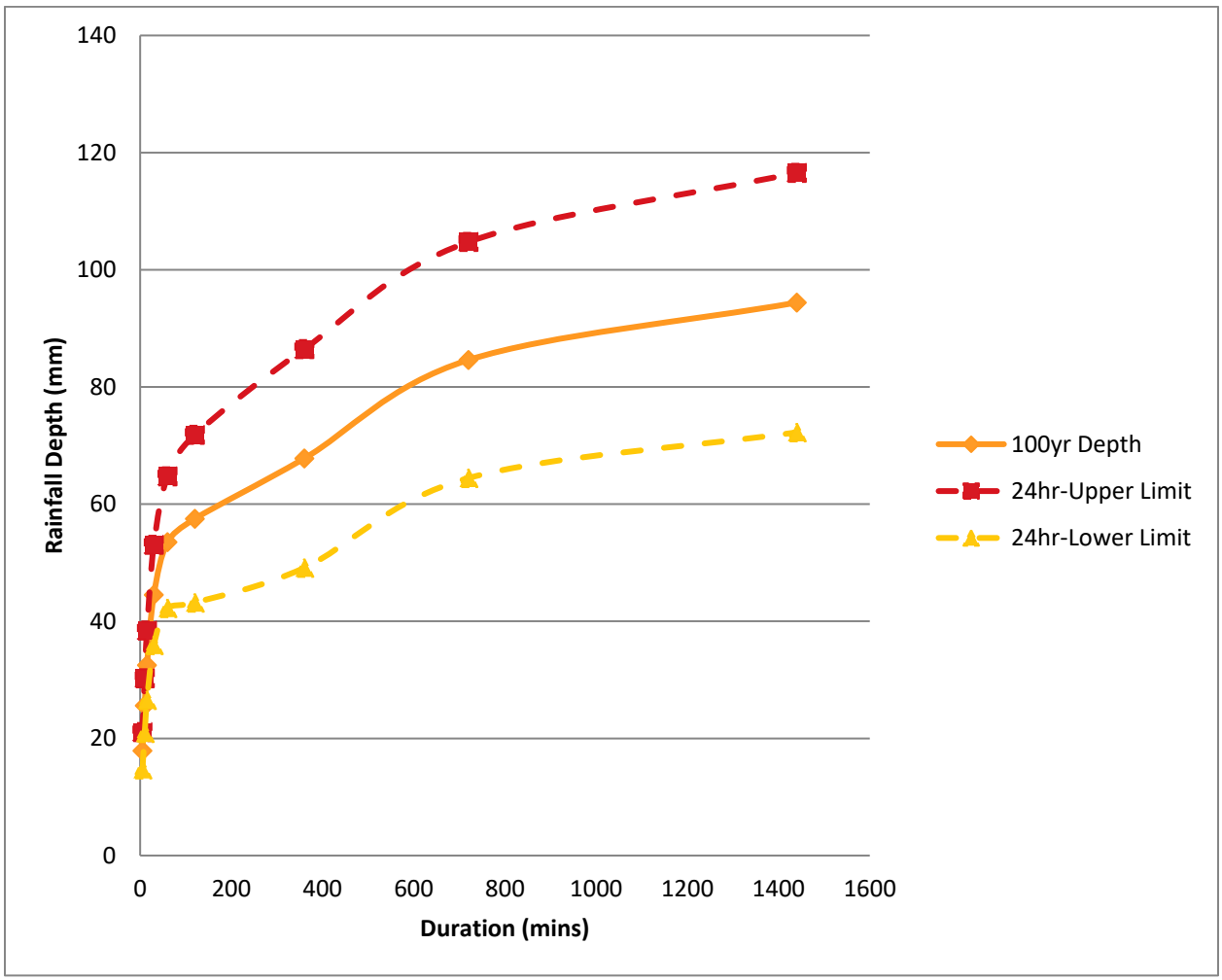
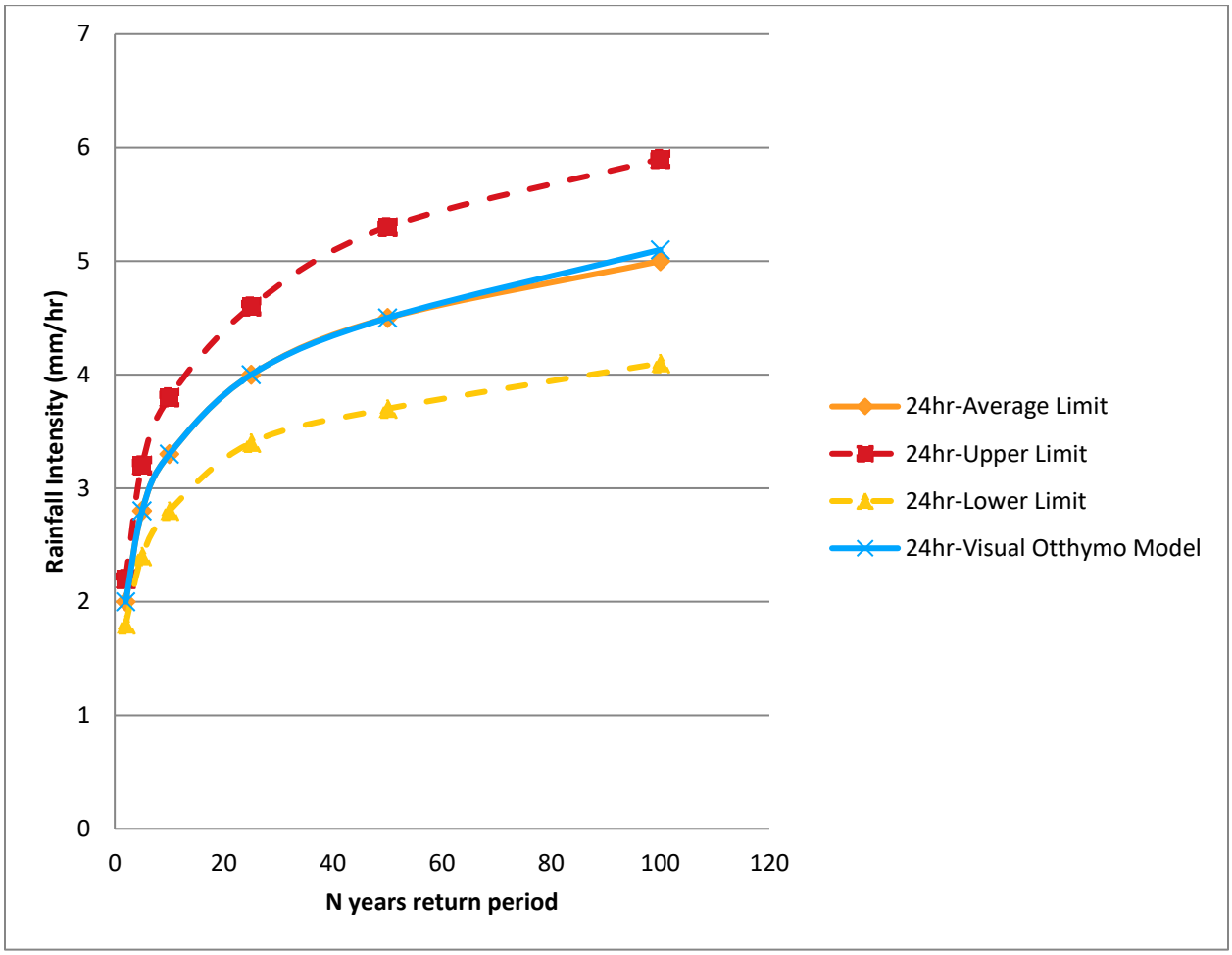


Figure IR7.6-2 shows the 5% - 95% confidence limits on rainfall intensity of a 24-hour storm event. This information is provided by Environment Canada showing short duration rainfall intensity duration frequency data using Gumble method for Toronto International Airport.

Figure IR7.6-2 Return Period Rainfall Rates (mm/hr) -95% Confidence' Limits (24-hour storm)



IR7.7 Water sampling - Reportable and laboratory method and detection limits

Rationale: *In response to the Review Panel's Package 3 information request #3.20b (CEAR #613), CN provided a summary of its water quality sampling results in Table 4 of Attachment IR3.20-1, with detailed results at each of the three monitoring stations (TRIB A, IC2 and IC3) presented in Tables 1, 2 and 3. CN explained that on June 29, 2015, the Reported Detection Limit at the TRIB A monitoring station for 1,2-dichlorobenzene was increased to 1 µg/L. This level is above the 0.7 µg/L Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for Freshwater Aquatic Life (CCME CWQG-FAL). The concentrations of the remaining nine water quality samples for 1,2-dichlorobenzene were 0.2 µg/L and therefore below the established water quality guidelines.*

CN reported that the exceedance was due to dilution of the sample matrix in the laboratory, which caused an increase in the Reported Detection Limit for that one water quality sample. According to Table 1 of Attachment IR3.20-1, Reported Detection Limits were increased for all parameters, including 1,2-dichlorobenzene, on both June 22, 2015 and June 29, 2015 at the TRIB A station. CN's rationale for this approach was presented in the footnotes to Table 1: the June 22,

2015 samples were diluted due to foaming, while the June 29, 2015 samples were diluted due to the sample matrix. In both cases, the dilutions resulted in increased Reported Detection Limit values.

In its comments on CN's response to the Review Panel's Package 3 information requests, Environment and Climate Change Canada (CEAR #631) suggested that, for 1,2-dichlorobenzene, further explanation was needed as to how diluting the sample matrix would cause an increase in the Reported Detection Limit of a water quality sample.

Information Request:

a) *Provide a more detailed rationale to further describe why the samples on June 22 and June 29 were diluted. Explain how diluting a water quality sample would cause an increase in the Reported Detection Limit for that sample. Discuss the consequences of such dilution for the identification and reporting of exceedances in water quality samples.*

CN Response:

The two water quality samples taken on June 22 and June 29, 2015 were diluted by the laboratory in accordance with standard protocols established under Ontario Regulation 153/04 Analytical Dilution Protocol, Section 4.3 (Ministry of the Environment 2011) for determining the concentration of volatile organic compounds, including 1,2-dichlorobenzene. No other samples required dilution.

1,2-dichlorobenzene was analyzed for the June 22 and 29, 2015 water quality samples from the Tributary A monitoring site (TRIB A) using the United States Environmental Protection Agency (USEPA) method 8260C – Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) by the CAEL-accredited laboratory Maxxam Analytics Inc. (Maxxam) (IR1.2, Attachment 2, CEAR #561). The other surface water quality samples collected during the June 2015 to June 2016 monitoring program at TRIB A and the Indian Creek monitoring sites (IC2 and IC3) also used the above method and laboratory for the analysis of 1,2-dichlorobenzene.

The June 22, 2015 TRIB A sample and its field duplicate were identified by Maxxam as having foaming, which required dilution to reduce the effects of the foaming prior to introduction to the GC using the purge and trap method.

The June 29, 2015 TRIB A sample was identified by Maxxam as requiring dilution due to its matrix prior to introduction into the GC using the purge and trap method (Augustyna Dobosz, Maxxam, April 10, 2018). Matrix refers to the components of the sample other than the analyte (i.e., 1,2-dichlorobenzene) being analyzed. The sample matrix potentially interfered with the GC/MS analysis and sample dilution was required.

The samples were diluted by application of Ontario Regulation 153/04 Analytical Dilution Protocol, Section 4.3 (Ministry of the Environment 2011). The dilution process adjusts the reported detection limit (RDL) for the target analytes, which for these samples were volatile organic compounds (VOCs). The dilution factor was calculated using the following equation (Ministry of the Environment, 2011):

$$Dilution\ Factor = \frac{Final\ Volume\ of\ Diluted\ Sample\ (mL)}{Sample\ Aliquot\ Volume\ (mL)}$$

The diluted RDL was then calculated as follows:

$$Diluted\ RDL = Dilution\ Factor * RDL$$

The dilution of the sample effectively reduces the amount of target analyte in the sample being processed (Final Volume of Diluted Sample). Due to this reduced amount of target analyte being analyzed in the diluted sample, concentrations below the RDL in the diluted sample will not necessarily be below the RDL value in the undiluted sample when the dilution factor is considered.

An example of the application of the above calculation of the dilution factor would be if an aliquot[2] sample of 100 millilitres (mL) was required for analysis, but due to foaming or other compounds in the sample interfering with the analysis, an additional 400 mL of water was required to be added to allow the sample to be analyzed. The dilution factor of this new 500 mL final volume of diluted sample is 5. The RDL of the undiluted sample is 0.2 µg/L and the analysis indicates the concentration of the target analyte in the diluted sample is less than the undiluted RDL value. However, as the sample was diluted 5 times its original volume, then the quantity of target analyte is potentially above the undiluted sample RDL 0.2 µg/L. The revised diluted RDL is then calculated to be 1 µg/L (5 times the undiluted RDL).

The June 22, 2015 TRIB A and its field duplicate sample 1,2-dichlorobenzene dilution factor was 2.5 and the undiluted RDL was 0.2 µg/L. The undiluted RDL was less than the CCME Canadian Water Quality Guideline for Freshwater Aquatic Life (CWQG-FAL) criteria value for 1,2-dichlorobenzene of 0.7 µg/L. The diluted RDL was calculated to be 0.5 µg/L, which is also below the criteria value.

The June 29, 2015 TRIB A 1,2-dichlorobenzene dilution factor was 5 and the undiluted RDL was 0.2 µg/L. The undiluted RDL was less than the CCME CWQG-FAL criteria value for 1,2-dichlorobenzene of 0.7 µg/L. The diluted RDL was calculated to be 1 µg/L.

Only the surface water quality sample collected on June 22 and 29, 2015 for TRIB A required dilution to allow analysis for VOCs. The other eight water quality samples collected at TRIB A and analyzed between June 2015 to June 2016 did not require dilution and had 1,2-dichlorobenzene RDL values that were lower than the CCME CWQG-FAL criteria value. The June 22, 2015 diluted sample dilution rate maintained the diluted RDL to be below the CCME CWQG-FAL criteria value.

For this study at TRIB A, as well as IC2 and IC3, only the TRIB A June 29, 2015 water sample required dilution to a level that resulted in an RDL that exceeded the CCME CWQG-FAL criteria value (i.e., one out of a total of 38 samples collected). All other TRIB A, IC2 and IC3 water samples analyzed for 1,2-dichlorobenzene for the June 2015 to June 2016 study had RDL values that were below the CCME CWQG-FAL criteria, as well as results that never exceeded the RDL values. As such, 37 out of the 38 sample results indicate that if 1,2-dichlorobenzene is potentially present within Tributary A and Indian Creek, it is present at concentrations that are less than the RDL values, which in turn are lower than the CCME CWQG-FAL criteria value.

[2] An "aliquot" is defined (by Oxford) as a portion of a larger whole, especially a sample taken for chemical analysis or other treatment.

IR7.8 Phosphorus confidence intervals

Rationale: *In Table 3.40-1 of its response to the Review Panel's Package 3 information requests (CEAR #613), CN provided predicted total phosphorus loads for the project development area under existing and post-development conditions for Tributary A and Indian Creek. The values given were precise estimates to the first decimal place. However no confidence intervals or estimated predictive error were presented to assist the Review Panel and participants to understand what uncertainty, if any, is associated with the predictions.*

Information Request:

a) *Provide a description of the uncertainty associated with the predicted total phosphorus loads presented in Table 3.40-1, including a quantitative estimate of the predictive error. Provide an updated version of Table 3.40-1 that shows the confidence intervals associated with the predicted values. Describe the results of any statistical analyses conducted to support these conclusions.*

CN Response:

Uncertainty related to the phosphorus load models is primarily associated with the export coefficients used to calculate the phosphorus loads. The model predictive error and uncertainty for the existing and post-development condition Tributary A and Indian Creek phosphorus loading models for the PDA used 'most-likely' value export coefficients (i.e., kilograms [kg] phosphorus/hectare [ha]/year) to represent phosphorus loads for the different land uses within the PDA. The most-likely phosphorus export coefficients were identified by conducting a literature review and selecting representative values, based on study land use type, location of study site with preference for Ontario based values, range of values in comparison to other literature values and more recent studies were given preference. The predictive uncertainty range bounds were estimated using the lowest and highest phosphorus export coefficient values identified through literature review.

The low and high phosphorus export coefficient values identified through the literature review and the calculated land use phosphorus loads for the existing and post-development land use conditions within the PDA for the Tributary A and Indian Creek drainage areas are provided in **Attachment IR7.8-1: Predicted Pre- and Post- Development Phosphorous Loads to Tributary A** and **Attachment IR7.8-2: Predicted Pre- and Post- Development Phosphorous Loads to Indian Creek**, respectively.

Based on this information, **Table IR7.8-1** has been prepared as an update of Table IR3.40-1 (CEAR #613), which presents the predicted annual total phosphorus (TP) loads to Indian Creek (including Tributary A) and Tributary A for the land use types within the PDA for the existing and post-development conditions, along with incorporation of the above calculated upper and lower estimate boundary conditions.

Table IR7.8-1 Predicted Existing and Post-Development Project Development Area Tributary A and Indian Creek Total Phosphorus Loads (Update of Table 3.40-1).

Watershed	Annual Total Phosphorus Load from PDA within Watershed						
	Most-Likely Existing Condition (kg)	**Existing Predicted Uncertainty Range (±kg)**	**Existing 90% Confidence Interval (Least, Highest)**	**Most-Likely Post-Development Condition (kg)**	**Post-Development Predicted Uncertainty Range (±kg)**	**Post-Development 90% Confidence Interval (Least, Highest)**	**% Reduction (90% Confidence Interval Least, Highest)**
Trib A [a]	**173.3**	-55.2, +128.1	62.8, 429.5	**82.1**	-24.1, +79.3	33.8, 240.7	52.3 (46.2, 44.0)
Indian Creek [b]	**391.5**	-125.4, +289.2	140.8, 969.8	**232.9**	-71.4, +207.0	90.2, 647.1	40.5 (35.9, 33.3)

Bold text indicates values from Table IR3.40-1 (CEAR #613).
[a] Source of existing and post-development condition load mean values – response to IR3.40.
[b] Source of existing and post-development condition load mean values - EIS, Appendix E.15.
[c] 90% confidence interval represented as 2 times the upper and lower predicted uncertainty range (modified Chebyshev inequality - Reckhow 1981).

The predicted lower and higher boundary conditions differ in value due to the use of different literature values to represent the low and high phosphorus export coefficient ranges for each land use. A 90% confidence interval was calculated for the Tributary A and Indian Creek PDA phosphorus load results using a modified version of the Chebyshev inequality (Reckhow 1981). The following equation represents the calculation of the confidence interval associated with predicted error:

$$Prob[(\mathrm{P_{ml}}\text{-h*}\mathrm{S_{L\text{-}}}) \leq P_{ml} \leq Prob(P_{ml} + h * S_{L+})] \geq 1 - \frac{1}{2.25h^2}$$

where:

P_{ml} = most-likely phosphorus load (kg)
h = numerical multiplier of predicted error
S_{L-} = negative/low loading error contribution
SL+ = positive/high loading error contribution

Using a value of 2 for h, the confidence limit is calculated by the following equation:

$$1 - \frac{1}{2.25(h=2)^2} = 0.89 \sim 0.9\ (90\%\ confidence\ interval)$$

The resulting confidence intervals for the existing and post-development condition Tributary A and Indian Creek PDA phosphorus load models represent percent reductions that are lower in value than the most-likely value predicted reductions (-4.6% to -8.3%). The post-development PDA condition with SWM system represents phosphorus load reductions of greater than 30% within the PDA compared to the existing condition when comparing the high and low values of the predicted loading boundary conditions.

The confidence interval value ranges of the existing and post-development condition models for Tributary A and Indian Creek do overlap. This overlap is due to the wide range of phosphorus export coefficient values present in the literature, which suggests the potential that there could be no decrease in phosphorus loads from the existing to post-construction condition. However, the uncertainty associated with the land use based phosphorus export coefficients used in the existing and post-development condition models would potentially apply to both model scenarios depending on the land use type coefficient that is causing the uncertainty (e.g., Treed Upland/ Hedge Rows – where there is no predicted change in total land use area in the PDA draining to Indian Creek in both scenarios). Given equal predicted error to both model scenarios, the estimated phosphorus load reductions remain valid. As such, the "no decrease in phosphorus load" scenario (i.e., scenario for the confidence intervals presented in **Table IR7.8-1**) is not expected to occur for this Project (i.e., a decrease in phosphorus load is expected) based on the land use changes proposed in the PDA as a result of the Project (i.e., change from agricultural row crops that receive nutrient amendments to paved surfaces and rail tracks) and the implementation of mitigation measures (i.e., SWM system).

PHYSICAL AND CULTURAL HERITAGE

IR7.9 Maintenance of cultural heritage properties

Rationale: *In the Review Panel's Package 4.1 information request #4.36, the Review Panel asked CN to describe the plans and responsibilities to maintain the four cultural heritage resources identified on its property: CHR-1, CHR-3, CHR-4 and CHR-5 (refer to in Attachment IR4.35-1)(CEAR #632). In response, CN reiterated its plan to protect and monitor the properties in the project development area (CHR-1 and CHR-4) during construction and to remove and salvage the shed located on CHR-4. However, CN did not explain how it intends to maintain the integrity of the heritage properties it owns while the Project is in operation, especially in light of CN's indication that CHR-4 and CHR-5 are to be vacated prior to construction (Response to the Review Panel's Package 4.1 information request #4.30 (CEAR #632)).*

Information Request:

a) *Describe any plans or responsibilities CN has to maintain the integrity of the cultural heritage properties located on its land during the operation phase.*

CN Response:

The response to IR4.36 (CEAR #632) describes CN's plans and responsibilities to maintain the integrity of the cultural heritage resources located on its land during the construction phase. The intent of implementing appropriate mitigation during construction is to avoid the disturbance or destruction of part or all of a heritage resource, as discussed in EIS Section 6.5.6 (i.e., the loss of or alteration to, the cultural heritage value or interest of a resource without appropriate mitigation), and to protect these structures during construction in order to maintain them during operation.

Mitigation measures will be implemented during construction to maintain the integrity of the cultural heritage resources located on, and adjacent to, CN lands during and following construction (as identified in Attachment IR5.1-1 (CEAR #655)).

While the shed (CHR4) will be removed, appropriate mitigation measures during construction will be applied and the remaining heritage resources within the PDA will be maintained.

Heritage Resources / Properties to be Vacated

Some structures will be vacated prior to construction, while others (located outside of the PDA) will continue to be occupied during operation. For CN-owned properties with heritage value that are or will be vacated prior to construction (i.e., those located within the PDA - CHR-3, the house and barn at CHR-4 and CHR-5), will be secured until such time as an adaptive re-use is identified for the structures. This will entail closing up, or "de-activating", a building for an extended period of time to temporarily protect the structure from weather and secure it from vandalism (i.e., boarding windows and doors). At this time, no adaptive re-use alternatives have been identified.

Heritage Resources / Properties to be Occupied

For CN-owned heritage resources that will continue to be occupied by tenants (i.e., those located outside of the PDA), CN is responsible for the maintenance and up-keep of these structures as a property owner and landlord and is committed to maintaining these structures accordingly. Should such structures be vacated and no longer leased to tenant occupants, CN would secure these structures as described above.

Future Development or Adaptive Re-Use

In the event that future development or adaptive re-use of the CN-owned heritage resources is proposed, a review of these structures will be conducted to determine the need for and scope of appropriate protection.

SOCIO-ECONOMIC

IR7.10 Population growth in Milton and Halton Region

Rationale: *Throughout the EIS, CN has repeatedly noted that the Town of Milton is a rapidly growing community.*

CN reported that the Town of Milton has expanded from a population of 31,471 in 2001 to an estimated 98,000 in 2014, with a projected population of 228,084 by 2031. Similarly, Halton Region has grown from 375,229 in 2001 to an estimated 575,000 in 2016. By 2031, CN reported that Halton Region was estimated to grow to 815,000 residents. CN noted that the Boyne Survey Secondary Plan area is planned to accommodate 50,000 of these new residents by 2021.

In its presentation to the Review Panel during the Orientation session (CEAR #550), Conservation Halton provided population growth projections similar to those presented by CN.

In its submission to the Review Panel for the Orientation Session (CEAR #455), the Ministry of Municipal Affairs and Housing indicated that, for planning purposes, it provided the Regional Municipality of Halton with population data and projections from 1991 to 2021. The Review Panel does not yet have a full picture as to how the population size or geographic distribution has changed over that time period.

While there have been many references to the rapid growth of Milton, the Review Panel does not have information regarding the population of Milton for the period of 1990 to 2001. Although CN has provided a high-level description of urbanization, agricultural conversion and other land use changes in the Town of Milton (CEAR #375), the nature and geographic extent of those changes between 1990 and the present have not been provided to the Review Panel.

Information Request:

a) *Provide additional information on the population growth of the Town of Milton and Halton Region from 1990 to 2001. Present this information in a consolidated summary with the population data and projections previously provided for the 2001 to 2041time period.*

b) *If available, provide maps or aerial images to depict the growth or urban development in the Town of Milton between 1990 and the present, delineating the main residential areas.*

CN Response:

a) *Provide additional information on the population growth of the Town of Milton and Halton Region from 1990 to 2001. Present this information in a consolidated summary with the population data and projections previously provided for the 2001 to 2041time period.*

Based on information available through Statistics Canada, as well as information available through provincial and municipal sources, population numbers and projections for the Town of Milton and Region of Halton are provided in **Table IR7.10-1**. All population numbers, including information previously provided for the 2001 to 2041 period (EIS, Appendix E.12), have been updated based on the most recent information available through these sources.

Table IR7.10-1 Population Data for Milton and Halton Region by Year (1991 to 2041)

Year		Milton[1]		Halton[1]	
		Population	% change	Population	% change
Census Data	1991	32,075	-	313,136	-
	1996	32,104	0.1%	339,875	8.5%
	2001	31,471	-2.0%	375,229	10.4%
	2006	53,939	71.4%	439,256	17.1%
	2011	83,575	54.9%	495,440	12.8%
	2016	101,175	21.1%	548,435	10.7%
Projections	2021	161,750[3]	59.9%	630,700[2]	15.0%
	2026	195,735[3]	21.0%	692,900[2]	9.9%
	2031	238,000[4]	21.6%	759,100[2]	9.6%
	2036	N/A	-	827,700[2]	9.0%
	2041	369,000[5]	24.5%[6]	898,300[2]	8.5%

N/A – Not available

1 - Statistics Canada (1996, 2006, 2007, 2011, 2012, 2016a), unless otherwise noted by 2, 3, 4, 5.

2 - Ontario Population Projections Update, 2016–2041 (Ontario Ministry of Finance, 2017).

3 - Best Planning Estimates of Population, Occupied Dwelling Units and Employment, 2011-2031 (Halton Region, June 2011).

4 - Halton Regional Official Plan: September 28, 2015 Interim Office Consolidation (Halton Region, 2015).

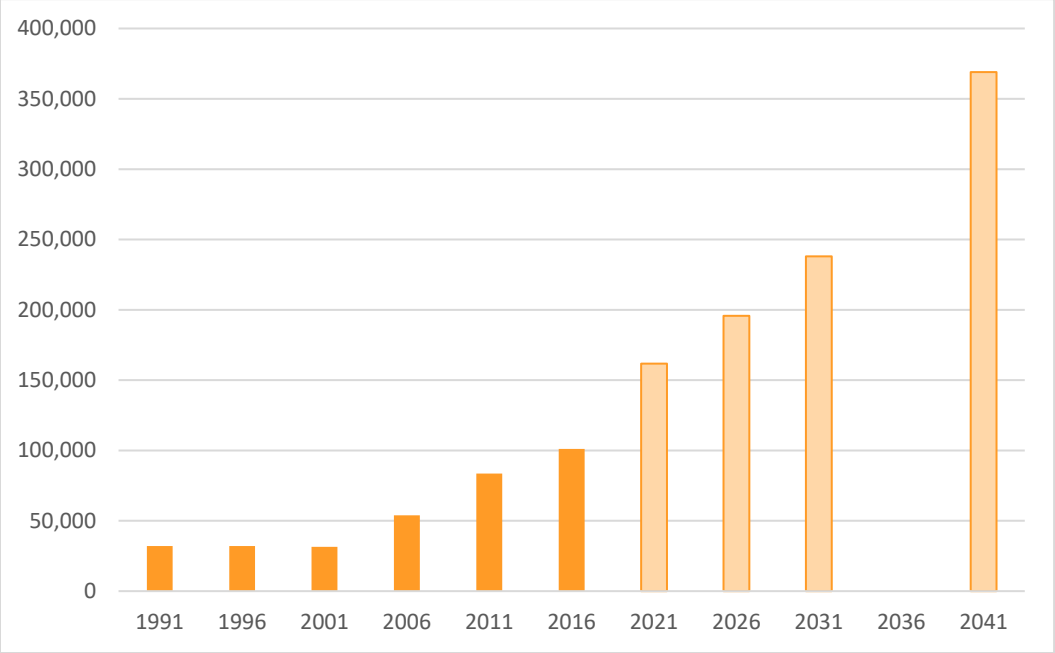
5 - Town of Milton Employment Land Needs Assessment Study (Watson and Associates, 2016).

6 - Five-year cumulative rate of population increase from 2031 to 2041 due to absence of data for 2036.

Of note, the 2016 population projections for the Town of Milton (124,645) and Region of Halton (575,000) presented in EIS Appendix E.12 have been replaced with census data from Statistics Canada for 2016 (**Table IR7.10-1**). Also, population projections for 2031 to 2041 vary slightly (depending on the source and date of publication), but all show projected population increases in the Town of Milton and Halton Region over this period (most recent data shown in **Table IR7.10-1**).

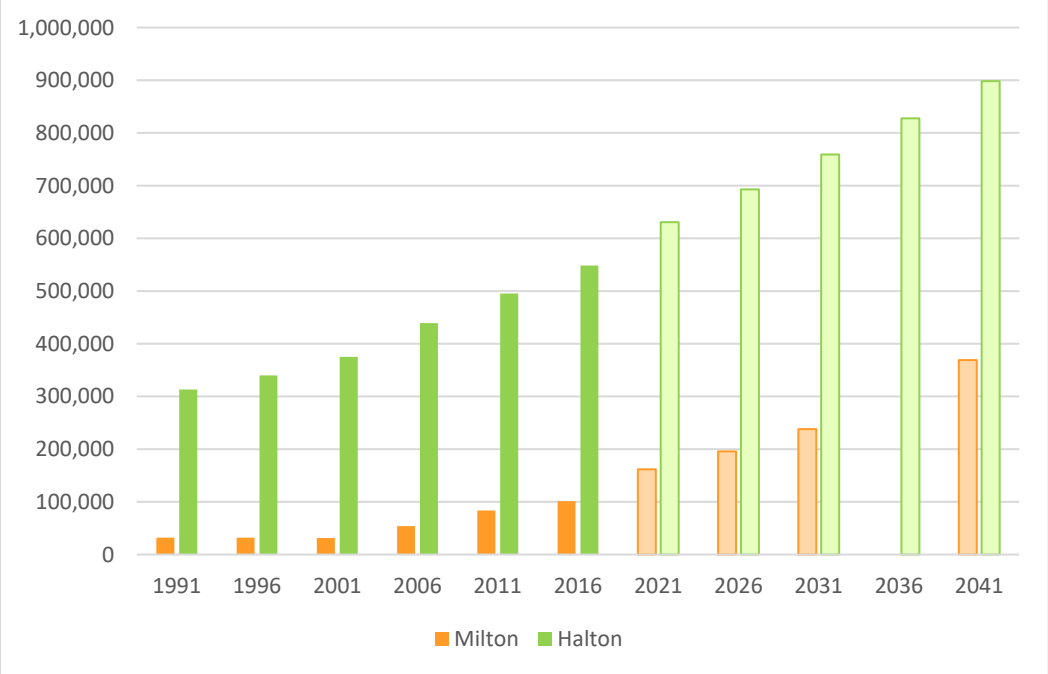
Graphically, **Figure IR7.10-1** shows population growth in the Town of Milton from 1991 to 2041, while **Figure IR7.10-2** provides a comparison of the population in the Town of Milton relative to Halton Region over this same period.

Figure IR7.10-1 Town of Milton Population Growth (1991 to 2041)



Note: Lighter columns indicate population projections; no Town of Milton projection available for 2036

Figure IR7.10-2 Comparison of Milton and Halton Population (1991 to 2041)



Note: Lighter columns indicate population projections; no Town of Milton projection available for 2036

b) *If available, provide maps or aerial images to depict the growth or urban development in the Town of Milton between 1990 and the present, delineating the main residential areas.*

Human Activity and the Environment 2015: The Changing Landscape of Canadian Metropolitan Areas (Statistics Canada, 2016a) provides an analysis of land cover and land use change in Canada's largest urbanized areas based on a review of available satellite, population and agricultural data. Based on this information, the following attachments have been prepared to illustrate growth in the Town of Milton since 1990:

- **Attachment IR7.10-1: Built-up Areas in Milton (1991)**
- **Attachment IR7.10-2: Built-up Areas in Milton (2001)**
- **Attachment IR7.10-3: Built-up Areas in Milton (2011)**

These figures identify "built-up areas" (i.e., buildings, roads, parking lots, parks, and gardens) over time and include residential, commercial, institutional, and industrial areas, as identified by Statistics Canada (2016a). The main residential areas have been identified in each of the attachments based on residential areas identified in the Region Official Plan.

In addition, **Attachment IR7.10-4: Built-up Areas in Milton (2017)** has been prepared based on an interpretation of aerial photographs taken during the Spring of 2017 (First Base Solutions, 2018).

IR7.11 Possible connection to municipal water and sanitary services

Rationale: *In Table 2.2 of the EIS, CN indicated that connection to the municipal water and sanitary services was not available at present, but if such services were extended to the Project location in the future, CN would explore opportunities to connect into these systems with the municipality.*

In its response to the Review Panel's Package 2 information request #2.40 (CEAR# 592), CN anticipated that it would require four water delivery trucks per day during peak months to supply the anticipated required volume of potable water. CN further estimated that wastewater flows from the Project would be approximately 11,335 litres per day. In response to the Review Panel's Package 2 information request #2.38, CN indicated that because the Project would not be connected to the municipal sanitary sewers, sewage would be stored in a septic holding tank and removed periodically by a licensed sewage system contractor.

In Appendix E.12 of the EIS CN stated that the installation of wastewater mains on Britannia Road between Tremaine Road and Regional Road 25 was scheduled to be complete by December 2015. However, CN did not indicate whether it would prefer to connect to the municipal water supply and sanitary services, if these services were available prior to construction of the Project.

Information Request:

a) *Provide an update on whether the water and sanitary systems scheduled for installation in December 2015 have been put in place along Britannia Road between Tremaine Road and Regional Road 25, or provide an updated timeline of when these services may extend to the project area.*

b) *If these services became available prior to Project construction, describe whether CN's preferred alternative for potable water supply and wastewater management would remain as proposed in the EIS, or whether it would prefer to connect to the municipal services.*

c) *If CN's preferred alternative would be to connect to municipal services, describe any changes to the Project design that would be required, the environmental effects that could occur as a result of such connection, and whether this activity could result in constraints on the capacity of those municipal systems or services.*

If applicable, to respond to this information request, coordinate with the Halton Municipalities, and as appropriate, refer to responses to other Review Panel's Package 2 information requests, namely information requests #2.21 (Alternatives for non-potable water during operations), #2.38 (General maintenance of water storage structures) and #2.40 (Project water budget).

CN Response:

a) *Provide an update on whether the water and sanitary systems scheduled for installation in December 2015 have been put in place along Britannia Road between Tremaine Road and Regional Road 25, or provide an updated timeline of when these services may extend to the project area.*

The water and sanitary systems have been installed along Britannia Road between Tremaine Road and Regional Road 25.

According to the Water Operations Maps for the Town of Milton (Halton Region, 2017a), a 400 cm water main exists along the north side of Britannia Road between Tremaine Road and First Line (see **Attachment IR7.11-1: Britannia Road Water Main**). According to the Sanitary Operations Maps for the Town of Milton (Halton Region, 2017b), a 375 cm to 1200 cm concrete sanitary sewer exists along the north side of Britannia Road between Tremaine Road and First Line (see **Attachment IR7.11-2: Britannia Road Sanitary Sewer**).

b) *If these services became available prior to Project construction, describe whether CN's preferred alternative for potable water supply and wastewater management would remain as proposed in the EIS, or whether it would prefer to connect to the municipal services.*

CN has no plans to connect to these utilities. Potable water for use at the Project will be delivered by a licensed bulk water delivery contractor and stored within underground storage tanks for use at the administration building. Sanitary sewage generated on-site will be collected in a holding tank on-site that will be pumped out and disposed at a licensed disposal facility.

c) *If CN's preferred alternative would be to connect to municipal services, describe any changes to the Project design that would be required, the environmental effects that could occur as a result of such connection, and whether this activity could result in constraints on the capacity of those municipal systems or services.*

As mentioned in the answer to part b), CN does not plan to connect to the Regional water or sanitary systems.

IR7.12 Use and value of the area cycling routes

Rationale: *In subsection 6.3.9 of the EIS, CN indicated that the Town of Milton is part of Escarpment Country, which attracts more than 1.5 million visitors to the area each year. CN also noted that cycling is a popular activity that may draw cyclists from outside of Halton Region.*

Local residents have indicated that they use Tremaine Road, Britannia Road and Lower Base Line as cycling routes. In Figure 10 of Appendix E.12 of the EIS, CN illustrated five established cycling routes within the local assessment area that it used for its assessment of the Project effects on recreational land and resource use. In subsection 6.3.9 of the EIS, CN indicated that of these routes, only the Lower Base Line cycling route intersects with the project development area.

The value of the area for cycling, including the number of users and the relative importance of these routes in the regional context, remains unclear.

Information Request:

a) Provide available information regarding how many cyclists use the five routes identified in Figure 10 of Appendix E.12 of the EIS, as well as any other cycling routes in the area near the proposed Project.

b) Describe the relative importance of these cycling routes in the regional context.

If appropriate, coordinate with Halton Municipalities and the Government of Ontario to provide information in response to this information request.

CN Response:

a) Provide available information regarding how many cyclists use the five routes identified in Figure 10 of Appendix E.12 of the EIS, as well as any other cycling routes in the area near the proposed Project.

Accessible, published information was sought regarding usage statistics for the five routes identified in Figure 10 of the Socio-Economic TDR (EIS Appendix E.12), as well as any other cycling routes in the area near the proposed Project. This included a review of published information available through the following sources:

- Halton Region Cycling Maps (Region of Halton n.d.)
- Active Transportation Master Plan Study Report (Halton Region 2015)
- Halton Region 2016 Transportation Progress Report (Halton Region 2016)
- Town of Milton Cycling Master Plan (Town of Milton 2014)
- Town of Milton Cycling Participation Strategy, September 2014 (Town of Milton 2014)
- Community Cycling Routes & Community Connections Map (Cycle Milton 2015)
- #CycleON Ontario's Cycling Strategy (Ontario Ministry of Transportation (MTO) 2018)

Usage statistics for cycling routes on rural or urban roadways were not provided in any of these reports, nor was there any reference to it having been collected.

The Active Transportation Master Plan Study Report (Halton Region May 2015) identified a potential pilot project for Milton that would include bicycle and pedestrian counters. This pilot project would use permanent counting stations to be installed in chosen locations to monitor cycling and walking activity. The Report also identified that "Halton Region will review and consider purchasing portable counters to use in various locations throughout the region to determine the level of cycling and walking". However, no information was publicly available to confirm if the pilot project was implemented and if usage information was collected.

CN submitted a request to Halton Region, the Town of Milton and the Ontario Ministry of Transportation (MTO) for any cycling counts or usage statistics in the Town of Milton (see **Attachment IR7.12-1: Requests for Cycling Usage Information**). In response to the request, CN received responses from MTO and Halton Region.

MTO replied with its latest and only available bicycle counts collected as part the Turning Movement Counts (TMCs) at three of MTO's Highway 401 interchanges in Milton, and another interchange in Oakville (see **Attachment IR7.12-2: MTO Response to Request for Cycling Usage Information**). None of the interchanges are located within the Local Assessment Area (LAA) for land and resource use described within the Socio-economic TDR (EIS Appendix E.12), and none of the results showed high levels of bicycle TMCs.

Halton Region replied that that the Region does not have any cycling data associated with cycling routes within the Town of Milton (see **Attachment IR7.12-3: Halton Region Response to Request for Cycling Usage Information**). They also indicated that the Region does not undertake a cycling count program and has not implemented the pilot project for pedestrian and cycling counts referred to in the Active Transportation Master Plan Study Report (Halton Region, May 2015). While cycling counts were conducted as part of a Cycling Tourism Plan at locations in Oakville, Burlington, and northern Halton Hills, these locations fall outside the Town of Milton and outside of the LAA for the Project.

Finally, Halton Region noted that cycling counts collected through the Greater Toronto & Hamilton Area (GTHA) Cordon Count Program for 2016 could be accessed through the University of Toronto's Data Management Group.

Upon reviewing this information, it was noted that two screenlines and six stations were located within the LAA for the Project. Screenlines (each about 3 km long) were established roughly along Derry Road and Bronte Street South, abutting the northern limit of the PDA, while stations were located within or near the LAA. The data provided in the GTHA Cordon Count Program does not specify when the data was collected (i.e., date), but indicates that bicycle counts vary between three and nine bicycles at the six Stations between the hours of 05:01 and 24:00. The screenline data indicates crossings of between 13 and 28 bicycles over the period of 06:01 and 10:00. The stations and screenlines do not align or intersect with the identified cycling routes.

In conclusion, no usage statistics are available for the five specific cycling routes identified in the EIS or any other defined cycling routes in the area near the proposed Project.

b) Describe the relative importance of these cycling routes in the regional context.

Cycling is a popular activity in the Town of Milton and Halton Region, and may draw cyclists from outside Halton Region. In Halton Region, there are 8 regional cycling routes covering 438 km, with another 7 shorter routes covering 162 km (Halton Region, n.d.). In Milton, there are 8 designated cycling routes covering 54.2 km of paths, parks and trails for cyclists of all ages (Cycle Milton, 2015). Further, there are 133 lane-km (bike lanes and paved shoulder) of on-road bikeways on Regional roads, as well as 132 km of sidewalks and 80 km of multi-use trails adjacent to Regional roads, in Halton Region (Halton Region, 2015). As identified on Figure 10 of the Socio-Economic TDR (EIS Appendix E.12), there are five established cycling routes within the Local Assessment Area for the Project, and of these routes, only the Lower Base Line route intersects with the PDA, where Lower Base Line is identified as part of the "Tour de Trafalgar" route, a 40 km route that starts and ends at the Oakville GO station.

As described in Section 5.4.6.1 of the Socio-Economic TDR (EIS Appendix E.12), a portion of Lower Base Line was included in the cycling time trials route for the 2015 Pan American (Pan Am) Games. The cycling time trials route started and ended at the Mattamy National Cycling Centre (Milton Velodrome), which was constructed in 2015 for the 2015 Pan Am/ Parapan American Games. The cycling time trials route included portions of First Line and Lower Base Line (east of First Line) (see **Attachment IR7.12-4: Pan Am Games Milton Time Trial Course**), although the actual road cycling races were held at Ontario Place in Toronto (Toronto 2015 Pan Am/Parapan Am Games, 2015). While roadways within the LAA were part of the designated Pan Am Games routes, none of the roads within the PDA affected by the Project (i.e., truck entrance / intersection on Britannia Road or the Lower Base Line underpass) were included as part of Pan American Games cycling routes.

As part of the Active Transportation Master Plan Study Report (Halton Region, 2015), the roadways surrounding the Project (i.e., Britannia Road, Tremaine Road, Lower Base Line and First Line) are not identified as part of the existing regional cycling network (see **Attachment IR7.12-5: Existing Regional Cycling Network**). At present, there are no dedicated bike lanes or paths within the PDA or on the roadways surrounding the CN property. However, as described within the Active Transportation Master Plan Study Report (2015), bike lanes are proposed for many routes throughout the Region, including Britannia Road and Tremaine Road surrounding the Project as part of the proposed regional cycling network (see **Attachment IR7.12-6: Proposed Regional Cycling Network**).

In addition to the road cycling routes formally recognized in the Active Transportation Master Plan Study Report, all municipal roads located in the Region of Halton are available for cycling, providing many options for cyclists. Many of the rural roads located along the Niagara Escarpment and in the northern area of the Region, in particular, are popular with cyclists.

Of note, through discussions with the Town of Milton, the preliminary plans for the Lower Base Line underpass have been prepared to accommodate a bike lane in both directions (should they be proposed in the future), even though dedicated bike lanes are not proposed on Lower Base Line as part of the future regional cycling network in the Active Transportation Master Plan Study Report (2015) (**Attachment IR7.12-6**).

More recently, the MTO completed the Province-wide Cycling Network Study (MTO, 2018), which was undertaken to identify a network of on and off-road cycling routes to provide a wide range of cyclists with the facilities necessary to explore Ontario by bike. The routes identified on the network are subject to further evaluation, but provide guidance for provincial and municipal staff,

stakeholders and other partners to inform the future planning, design and implementation of cycling infrastructure at the provincial, regional and local level in Ontario (MTO, 2018). **Attachment IR7.12-7: Province-wide Cycling Network Routes in Halton Region** identifies that segments of the province-wide cycling network within Halton Region are located around the fringes of Halton Region; none of which occur within the LAA.

IR7.13 Lower Base Line Road grade separation

Rationale: *In Section II, subsection D, part 1 of CN's application pursuant to section 98(2) of the Canada Transportation Act (CEAR #395), CN stated that it would be responsible for the design, construction and maintenance of the underpass proposed for the grade separation where the CN mainline track crosses Lower Base Line. CN indicated it would work with the municipal road authority to incorporate its requirements and that it would assume all costs associated with construction and maintenance of the basic grade separation. CN anticipated that it would enter into an agreement with the Town of Milton respecting all aspects of the construction and maintenance of the proposed grade separation.*

In response to the Review Panel's Package 3 information request #2.33 (CEAR #592), CN indicated that it was currently developing the conceptual design of the underpass while communicating with the Town of Milton to incorporate its anticipated future needs.

Information Request:

a) *Provide an update on the status of any discussions between the Town of Milton and CN concerning the proposed grade separation at Lower Base Line and whether any updated information on the design of the grade separation is available.*

CN Response:

Since submission of the EIS, CN has engaged with the Town of Milton regarding the design, construction and maintenance of the Lower Base Line grade separation, including the conceptual general arrangement (i.e., conceptual layout and design) and draft grade separation agreement.

As per CN's response to IR3.45, on April 18, 2017, CN met with the Town of Milton to discuss several different projects in Milton, one of which was the proposed Lower Base Line underpass. At this meeting, CN explained to the Town that the grade separation is part of the overall Milton Logistics Hub Project currently undergoing a federal environmental assessment by the independent Joint Review Panel and requested the Town advise CN of any proposed design criteria with regards to the design of the grade separation. During this meeting, the Town informed CN that the grade separation should be designed to accommodate four (4) lanes (two in each direction) and a multi-use path to accommodate potential future upgrades from the existing two-lane rural cross-section. CN informed the Town of Milton they would incorporate this information into a conceptual general arrangement for their review.

On February 1, 2018, CN met with the Town of Milton again to discuss several different projects in Milton, including the proposed Lower Base Line underpass. During this meeting, a draft conceptual general arrangement for the grade separation was presented to the Town staff for discussion purposes. CN informed the Town they would provide the finalized conceptual general

arrangement along with a draft grade separation agreement as soon as both documents were completed and available for review.

On July 4, 2018, CN met with the Town of Milton again to discuss several different projects, including the proposed Lower Base Line underpass. During this meeting, CN reiterated to the Town of Milton that the finalized conceptual general arrangement would be consistent with the road authority's proposed design criteria discussed in the 2017 meeting between the two parties. CN expressed to the Town of Milton how they would like to collaboratively advance the agreement simultaneously with the federal environmental assessment process.

A copy of the conceptual general arrangement for the Lower Base Line grade separation was provided to the Panel as Attachment IR3.45-1 in response to IR3.45 (CEAR #613).

CN is continuing to engage with the Town of Milton regarding the design, construction and maintenance of the Lower Base Line grade separation.

REFERENCES

Atlantic Risk Based Corrective Action (RBCA). 2016. Guidelines for Laboratories. Tier I and II Petroleum Hydrocarbons Methods. Atlantic RBCA.

Aquafor Beech Ltd. 1993. Wet Weather Discharges to the Metropolitan Toronto Waterfront, prepared for the Metropolitan Toronto and Region Remedial Action Plan.

Burkhardt, M., L. Rossi and M. Boller. 2008. Diffuse release of environmental hazards by railways. Desalination. 226(2008): 106 – 113.

Canadian Council of the Ministers of the Environment (CCME). 2008. Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil. Technical Supplement. CCME. 28 pp.

Canadian Council of Ministers of the Environment (CCME). n/d. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health. Accessed May 2015. Available online at: http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

CCME. 2004. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems. In: Canadian Environmental Quality Guidelines. 2004. Canadian Council of the Ministers of the Environment. Winnipeg, MB.

CCME. 2010. Ammonia. Canadian water quality guidelines for the protection of aquatic life: Ammonia. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

Cycle Milton. 2015. Community Cycling Routes & Community Connections Map. Available at: http://www.cyclemilton.ca/en/cycling-in-milton/Milton-Maps.asp. Last Accessed June 15, 2018.

Department of Justice. 2018. Metal Mining Effluent Regulations. Consolidation. SOR/2002-222

Gessel, P.D., N.C. Hansen, S.M. Goyal, L.J. Johnston, and J. Webb. 2004. Persistence of zoonotic pathogens in surface soil treated with different rates of liquid pig manure. Appl. Soil. Ecol. 25:237-243.

Gerba, C.P. and J.E Smith, Jr. 2005. Sources of pathogenic microorganisms and their fate during land application of wastes. J. Environ. Qual. 34: 42-48.

Halton Region. n.d. Halton Region Cycling Maps. Available at: http://www.halton.ca/cms/One.aspx?pageId=124221. Last Accessed June 15, 2018.

Halton Region. 2011. Best Planning Estimates of Population, Occupied Dwelling Units and Employment, 2011-2031 (June 2011).

Halton Region. 2015. Active Transportation Master Plan Study Report – Halton Region, May 2015. Available at: http://www.halton.ca/cms/One.aspx?portalId=8310&pageId=76801. Last Accessed June 15, 2018.

Halton Region. 2015. Halton Region Official Plan: Interim Office Consolidation of the Regional Official Plan September 28, 2015. Available online at: http://www.halton.ca/cms/One.aspx?pageId=115808#roptext. Accessed: June 27, 2018.

Halton Region. n.d. Halton Region Construction Projects. Last accessed October 9, 2015. Available online at: http://www.halton.ca/living_in_halton/construction_projects/

Halton Region. 2016. Halton Region 2016 Transportation Progress Report. Available at: http://www.halton.ca/common/pages/UserFile.aspx?fileId=157239. Last Accessed June 15, 2018.

Halton Region. 2017a. Water Operations Maps, Town of Milton. November 2017. Available at: http://www.halton.ca/planning_sustainability/demographics_maps/maps/water_wastewater_operating_maps/. Last accessed June 29, 2018.

Halton Region. 2017b. Sanitary Operations Maps, Town of Milton. November 2017. Available at: http://www.halton.ca/planning_sustainability/demographics_maps/maps/water_wastewater_operating_maps/. Last accessed June 29, 2018.

Hargrave, A. and C.F. Shaykewich. 1991. Nitrogen and Phosphorous Losses in Runoff Sediment due to Rainfall in Manitoba pp 266-241. Proceedings 1976 Manitoba Soil Science Workshop.

Hutchison, M.L, L.D. Walters, A. Moore, K.M. Crookes, and S.M. Avery. 2004. Effect of length of time before incorporation on survival of pathogenic bacteria present in livestock wastes applied to agricultural soil. Appl. Environ. Microbiol. 70:5111-5118.

Hutchinson Environmental Sciences Limited and Ministry of Environment. 2011. Lake Simcoe Phosphorus Loading Tool. Version 1.4, June 2012. By: Hutchinson Environmental Sciences Limited and Ontario Ministry of Environment, Greenland, Stoneleigh Data.

Hutchinson Environmental Sciences Ltd. (Hutchinson), Greenland International Consulting Ltd. And Stoneleigh Associates Inc. 2012. Phosphorus Budget Tool in Support of Sustainable Development for Lake Simcoe Watershed. Version 2 Report. 38 pp.

Jeje, Y. 2006. Southern Alberta Landscapes: Meeting the Challenges Ahead: Export Coefficients for Total Phosphorus, Total Nitrogen and Total Suspended Solids in the Southern Alberta Region - A Review of Literature. Prepared for Alberta Environment.

Kay, D., J. Crowther, C. Kay, A.T. McDonald, C. Ferguson, C.M. Stapleton and M.D. Wyer. 2012. Chapter 6: Effectiveness of best management practices for attenuating the transport of livestock-derived pathogens within catchments. In A. Dufour, J. Batran, R. Bos and V. Gannon (Eds.), Animal Waste, Water Quality and Human Health (pp. 195-255). London, UK: IWA Publishing.

Lake Simcoe Region Conservation Authority. 2000. State of the Watershed Report: East Holland River.

Larsson, M. 2004. Toxicity analysis by *Liminous* Bacteria – Investigation of Surface Water and groundwater from Gallivare Yard. Division of Waste Technology – Department of Civil Engineering, Lulea University of Technology, Sweden, IN: Vo et al. (2015)

Maine Department of Environmental Protection. 2000. Madawaska Lake Total Maximum Daily (Annual) Load: Total Phosphorus: Final Lakes TMDL Report. DEPLW 2000-112.

Ministry of the Environment. 2011. Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Analytical Protocol (O. Reg. 153/04). Laboratory Services Branch.

Ministry of Transportation. 2018. Province-wide Cycling Network map. Available at: http://www.mto.gov.on.ca/english/safety/province-wide-cycling-network.shtml. Last accessed July 10, 2018.

Northeast Florida Water Management District, 1994. St. Marks and Wakulla Rivers Resource Assessment and Greenway Protection Plan. Appendix 4.

Novotny, V., and H. Olem. 1997. WATER QUALITY: Prevention, Identification and Management of Diffuse Pollution, Van Nostrand-Reinhold Publ., New York, NY, 1994, J.Wiley & Sons, New York.

Ontario Ministry of Agriculture, Food and Rural Affairs. 2017. Agronomy Guide for Field Crops. Publication 811. 407 pp. + appendices.

Ontario Ministry of the Environment (MOE). 2003. Stormwater Management Planning and Design Manual. Queen's Printer for Ontario. Ontario, Canada.

Ontario Ministry of Finance. 2017. Ontario Population Projections Update, 2016–2041. Queen's Printer for Ontario, 2017. Available online at: https://www.fin.gov.on.ca/en/economy/demographics/projections/projections2016-2041.pdf.

Ontario Ministry of Natural Resources (MNR). 1994. Natural Channel Systems. An Approach to Management and Design.

Philips Engineering Ltd. 2004. Technical Appendix Watercourse Systems Indian Creek / Sixteen Mile Creek Sherwood Survey Subwatershed Planning Study. Town of Milton, Ontario.

Reckhow, K.H., M.N. Beula, and J.T. Simpson. 1980. Modeling phosphorus loading and lake response under uncertainty: A manual and compilation of export coefficients. USEPA. EPA 440/5-80-011. pp. 214.

Reckhow, K.H. 1981. Lake Data Analysis and Nutrient Budget Modeling. Corvallis Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency. 64 pp.

Sanderson, M. 1977. Agricultural Watershed Studies in the Canadian Great Lakes Drainage Basin, Precipitation - Quantity and Quality. PLUARG Technical Report Series. 137 pp.

Shaver, E., R. Horner, J. Supine, C. May, and G. Ridley. 2007. Fundamentals of Urban Run-off Management: Technical and Institutional Issue. 2nd edition. Madison, W: North American Lake Management Society.

Statistics Canada. 1996. 1996 Census of Canada: Electronic Area Profiles - Halton. Accessed: May 24, 2018.

Statistics Canada. 1996. 1996 Census of Canada: Electronic Area Profiles - Milton. Accessed: May 24, 2018.

Statistics Canada. 2006. Community Profiles from the 2006 Census, Statistics Canada - Census Division - Halton. Accessed: May 24, 2018.

Statistics Canada. 2007. 2006 Community Profiles, Milton, Ontario. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. Accessed: May 24, 2018

Statistics Canada. 2011. National Household Survey Profile, Halton, Ontario, 2011. Accessed: May 24, 2018.

Statistics Canada. 2012. Population and Dwelling Counts, for Canada and Census Subdivisions (Municipalities), 2001 and 1996 Censuses. Accessed: May 24, 2018.

Statistics Canada. 2013. National Household Survey Profile, Milton Ontario. 2011 Census. Statistics Canada Catalogue no. 99-004-XWE. Ottawa. Released June 26, 2013. Available online at: http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E. Accessed: May 24, 2018.

Statistics Canada. 2016a. Human Activity and the Environment 2015: The changing landscape of Canadian metropolitan areas. Updated: June 28, 2016. Available online at: https://www150.statcan.gc.ca/n1/en/pub/16-201-x/16-201-x2016000-eng.pdf?st=WIF_vwJa. Accessed: June 19, 2018.

Statistics Canada. 2016b. Community Profiles from the 2016 Census, Statistics Canada - Census Division - Halton. Accessed: May 24, 2018.

Statistics Canada. 2017. Community Profile from the 2016 Census, Milton. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. Available online at: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E. Accessed: May 25, 2018.

Stormceptor. 2004. Field Evaluation of a Stormceptor® Model STC 1200 Westwood, Massachusetts. Stormceptor Group of Companies.

Strelkov, A.K., S.V. Stepanov, S. Yu. Teplykh and A.M. Sargsyan. 2016. Monitoring pollution level in railroad right-of-way. Procedia Environmental Sciences. 32(2016): 147-154

Town of Milton and Philips Engineering. 2004. Indian Creek/Sixteen Mile Creek Sherwood Survey Subwatershed Management Study. Philips Engineering. 176 pp.

Town of Milton. 2014. Report No. COMS-024-14, Town of Milton Cycling Participation Strategy, September 2014. Available at: https://www.milton.ca/meetingdocuments/council/agendas2014/rpts2014/coms-024-14%20town%20of%20milton%20cycling%20participation%20strategy.pdf. Last Accessed June 15, 2018.

Toronto 2015 Pan Am/Parapan Am Games. 2015. Largest Ever Parapan Am Games Make History. Available online at: www.toronto2015.org/newdetails/ largest-ever-parapan-am-games-make-hisotry/7621. Last accessed November 13, 2015.

Tuczynowicz, L. and N. Robinson. 2008. Review of Current International Approaches to Total Petroleum Hydrocarbon Assessment. CRC CARE Technical Report No. 8. CRC for Contaminant Assessment and Remediation of the Environment Pty Ltd. Adelaide, AU

United States Environmental Protection Agency (USEPA). Method 8260C. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).

Vo, P.T., H.H. Ngo, W. Guo, J.L. Zhou, A. Listowski, B. Du, Q. Wi and X.T. Bui. 2015. Stormwater quality management in rail transportation — Past, present and future. Science of the Total Environment. Volume 512-513: 353-363.

Waller, D.H. and W.C. Hart. 1986. Solids, Nutrients and Chlorides in Urban Runoff. NATO ASI Series, Vol.G10, Urban Runoff Pollution, H.C. Torno, J. Marsalek and M. Desordes (ed), Springer-Verlag, Berlin Heidelberg, 59-85.

Watson and Associates. 2016. Town of Milton Employment Land Needs Assessment Study: Phase 2 Analyses and Recommendations Report. Available online at: https://www.milton.ca/en/build/resources/Appendix-2DRAFT-Milton-Employment-LNA-Phase-2-Report-REVISED-Oct-14.pdf. Accessed: June 19, 2018.

Winter, J.G. and H.C. Duthie. 2000. Export coefficient modeling to assess phosphorus loading in an urban watershed. Journal of the American Water Resources Association 36:1053-1061.

Wisner, P. and J.C. P'ng. 1983. OTTHYMO. A Model for Master Drainage Plans. IMPSWM Urban Drainage Modeling Procedures. Department of Civil Engineering. University of Ottawa, Ottawa, ON.

August 20, 2018

ATTACHMENT IR7.1-1
GUIDELINES FOR NEW DEVELOPMENT IN PROXIMITY TO RAILYWAY OPERATIONS

GUIDELINES

for New Development in Proximity to Railway Operations

PREPARED FOR
THE FEDERATION OF CANADIAN MUNICIPALITIES
AND THE RAILWAY ASSOCIATION OF CANADA

May 2013

DIALOG®
J.E. COULTER ASSOCIATES LIMITED

Guidelines for New Development in Proximity to Railway Operations

May 2013

These guidelines were developed through the collaboration of the Railway Association of Canada and the Federation of Canadian Municipalities, who work together through the FCM/RAC Proximity Initiative. For further information, please visit our joint website at www.proximityissues.ca, or contact:

The Railway Association of Canada
99 Bank Street, Suite 901
Ottawa, Ontario K1P 6B9

Tel : (613) 567-8591
Fax : (613) 567-6726

Federation of Canadian Municipalities
24 Clarence Street
Ottawa, Ontario K1N 5P3

Tel : (613) 241-5221
Fax : (613) 241-7440

COVER PHOTOS COURTESY OF THE RAILWAY ASSOCIATION OF CANADA

FCM FEDERATION OF CANADIAN MUNICIPALITIES FÉDÉRATION CANADIENNE DES MUNICIPALITÉS

Railway Association of Canada

DIALOG

J.E. COULTER ASSOCIATES LIMITED

FCM FEDERATION OF CANADIAN MUNICIPALITIES FÉDÉRATION CANADIENNE DES MUNICIPALITÉS

Railway Association of Canada

FCM/RAC Proximity Initiative

May, 2013

We are very pleased to present the new *Guidelines for New Development in Proximity to Railway Operations*.

These new guidelines are intended to replace and build on the FCM/RAC Proximity Guidelines and Best Practices Report, which was originally prepared and published in 2004 and reprinted in 2007. Since that time, there have been significant changes in both federal legislation and some provincial land use acts. The original guidelines have been reviewed, edited, and updated with the help and participation of stakeholders from railways, municipalities, and government to reflect the new legislative framework as well as to add a new section of guidelines and best practices that can be applied when converting industrial/commercial property into residential use when in proximity to railway operations.

The *Guidelines for New Development in Proximity to Railway Operations* is intended for use by municipalities and provincial governments, municipal staff, railways, developers, and property owners when developing lands in proximity to railway operations. They are meant to assist municipal governments and railways in reviewing and determining general planning policies when developing on lands in proximity to railway facilities, as well to establish a process for making site specific recommendations and decisions to reduce land-use incompatibilities for developments in proximity to railway operations. A key component is a model review process for new residential development, infill, and conversions in proximity to railways.

The guiding philisophy of this document is that, by building better today, we can avoid conflicts in the future.

Sincere Regards,

<Original signed by>

Sean Finn

FCM-RAC Proximity Co-Chair
Executive VP Corporate Services
and Chief Legal Officer, CN

<Original signed by>

Doug Reycraft

FCM-RAC Proximity Co-Chair
Mayor, Southwest Middlesex, ON

ACKNOWLEDGMENTS//

These guidelines and best practices were developed by the FCM/RAC Proximity Initiative with the help and participation of stakeholders from government, freight, passenger, and commuter railway operators, municipal councillors and mayors, municipal urban planners, the Federation of Canadian Municipalities and the Railway Association of Canada.

I would like to especially acknowledge the members of the Guidelines Working Group who gave their time, expertise, and insight in vetting the research, developing the format, and editing the product from start to finish.

Adam Snow (Chair)	Third Party Projects Officer - GO Transit
Nick Coleman	Manager, Community Planning & Development, CN
Orest Rojik	Right-of-Way Representative, CPR
Giulio Cescato	Planner, City of Toronto

And also Daniel Fusca of DIALOG who worked with the team.

The project was initiated and approved through the Steering Committee of the FCM/RAC Proximity Initiative:

Doug Reycraft - FCM Co-chair, Mayor, Southwest Middlesex, Ontario

Sean Finn - RAC Co-chair, Executive VP & Chief Legal Officer, CN

Mike Lowenger - VP, Operations & Regulatory Affairs, RAC

Daniel Rubinstein - Research Officer, FCM

John Corey - Manager, Rail Investigations, CTA

Jim Feeny - Director, Regional Public & Govt. Affairs, CN

Cynthia Lulham - Project Manager, FCM/RAC Proximity Initiative

Cameron Stolz - City Councillor, Prince George, BC

Steve Gallagher - Manager, Ontario Rail Operations, Cando Rail

Pauline Quinlan - Mairesse, Ville de Bromont, QC

Gary Price - City Councillor, Cambridge, ON

Frank Butzelaar - President & CEO, Southern Railway BC Ltd.

Louis Machado - Vice-président adjoint Exploitation, AMT

Randy Marsh - Director, Government & Public Affairs, CP

Adam Snow - Third Party Projects Officer - GO Transit

Heath Slee - Director, East Kootenay RD

Ranjan Kelly - Project Manager, Data Bases & Websites, RAC

Lynda Macleod - Manager, Legislative Affairs, CN

Paul Goyette - Director, Communications & Public Affairs, RAC

Malcolm Andrews - Senior Manager, Corporate Communications, VIA

Mee Lan Wong - Policy Advisor, Transport Canada

Nick Coleman - Manager, Community Planning & Development, CN

We gratefully acknowledge their valued input and support.

<Original signed by>

Cynthia Lulham
Project Manager, FCM/RAC Proximity Initiative

CONTENTS//

As cities in Canada continue to urbanize, and as they place a greater emphasis on curbing urban sprawl, demand for new forms of infill development is growing, including on sites in proximity to railway corridors.

In particular, commercial and industrial properties in proximity to railway operations, and in some cases the buildings situated on those properties, are increasingly being converted to residential uses. At the same time, both the passenger and freight operations of railways are growing steadily, leading to an increasing potential for conflicts between rail operations and adjacent land uses.

Areas in proximity to railway operations are challenging settings for new development, and in particular, for residential development. It is often difficult to reconcile the expectation and concerns of residents with railway operations. For this reason, developments must be carefully planned so as not to unduly expose residents to railway activities as well as not to interfere with the continued operation of the corridor itself, or the potential for future expansion, as railways play an important economic role in society that must be safeguarded.

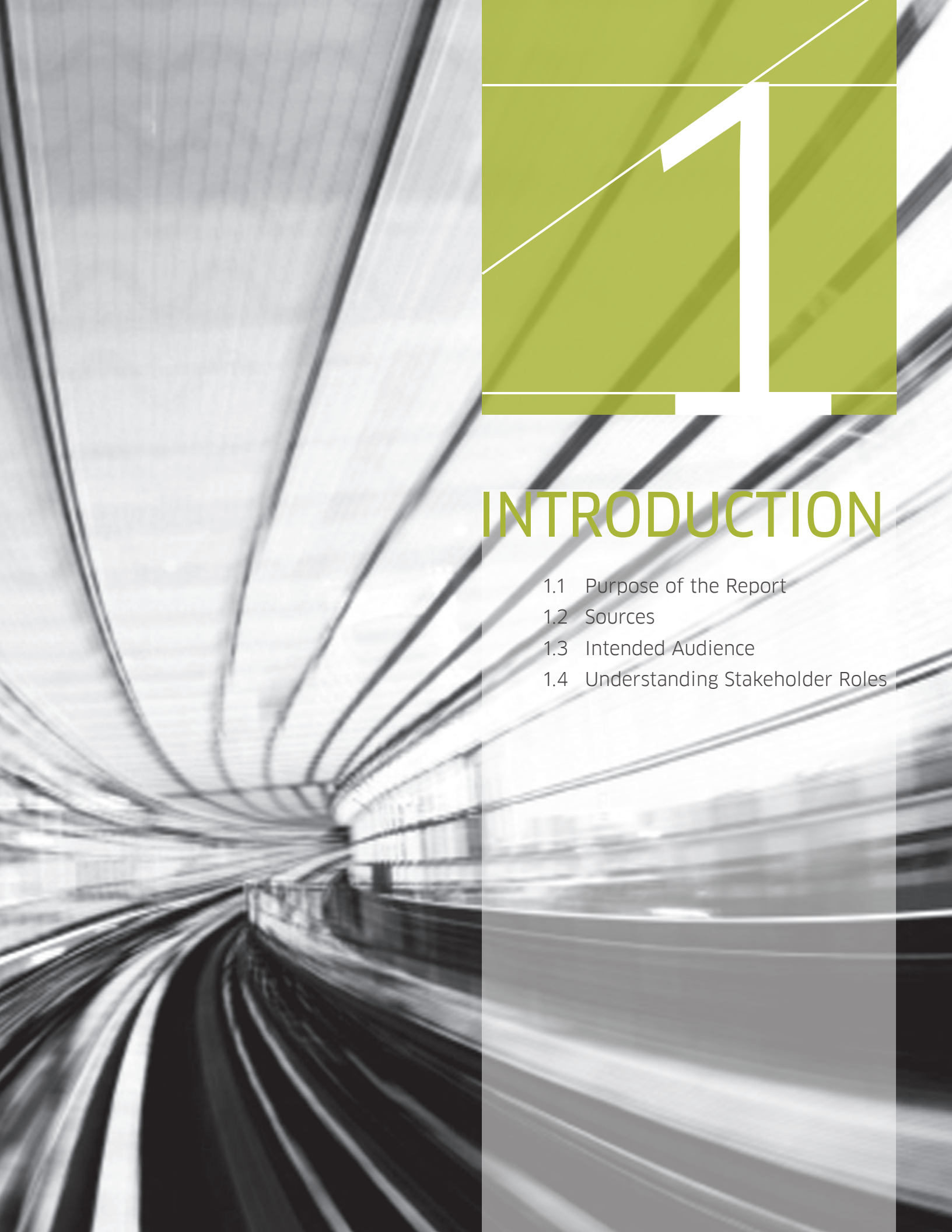
This report strongly recommends that municipalities should take a proactive approach to identifying and planning for potential conflicts between rail operations and new developments in proximity to railway corridors. Prior to the receipt of an application for a specific project, the municipality should have already have identified key sites for potential redevelopment, conversion, or future rail crossings, and will have generated site-specific policies to manage such future change.

To further assist municipalities and other stakeholders, this report provides a comprehensive set of guidelines for use when developing on lands in proximity to railway operations. The intent of the guidelines is to:

- promote awareness around the issues (noise, vibration, safety) and mitigation measures associated with development near railway operations, particularly those associated with residential development;
- promote greater consistency in the application of relevant standards across the country;
- establish an effective approvals process for new residential development, infill, and conversions from industrial/commercial uses that allows municipal planners to effectively evaluate such proposals with an eye to ensuring that appropriate sound, vibration, and safety mitigation is secured; and
- enhance the quality of living environments in close proximity to railway operations.

The report builds on the 2004 FCM/RAC Proximity Guidelines and is intended for use by municipalities and provincial governments, municipal staff, railways, developers, and property owners when new developments in proximity to railway operations are proposed. Information has been assembled through a comprehensive literature/best practices review from national and international sources as well as a consultation process involving planners, architects, developers, and other professionals from across Canada, the USA, and Australia, as well as members of RAC and FCM.

In addition to the detailed guidelines, the report offers a set of implementation tools and recommendations that are meant to establish a clear framework for the dissemination, promotion, and adoption of the guidelines; as well as suggested improvements to the development approval process. A key recommendation is for a new development assessment tool, called a Development Viability Assessment, which will allow municipal planners to better evaluate proposals for residential development in areas where standard mitigation cannot be accommodated due to site constraints.



1

INTRODUCTION

1.0 // INTRODUCTION

Cities are the economic engines of Canada, and our quality of life and economic competitiveness depend on strong municipalities and sustainable municipal growth and development.

Equally important to the economy of Canada, railways ensure the efficient movement of goods and people. In so doing, railways make a vital contribution to the Canadian economy and to the success of Canadian communities. As cities across Canada begin to realize the benefits of curbing urban sprawl, and as consumer demand for more housing in urban centres grows, the push to intensify existing built-up areas, including sites in proximity to railway operations, has grown steadily stronger. At the same time, increased demand for rail service, the high cost of transport fuel, and new sustainability objectives have added new pressure to the railway industry, which is expanding rapidly. When issues related to proximity to railway operations are not properly understood and addressed, the resulting problems can often be intractable and long lasting.

Rail/municipal proximity issues typically occur in three principle situations: land development near rail operations; new or expanded rail facilities; and road/rail crossings. The nature and integrity of railway corridors and yards need to be respected and protected. In addition to noise and vibration, safety, trespass, drainage, and/or blocked crossings are other inherent issues generated when both commnuities and railways grow in proximity to one another. The lack of a comprehensive set of proximity management guidelines, applied consistently across municipal jurisdictions, has greatly amplified these proximity issues in recent years, resulting in some cases in (real and perceived) social, health, economic, and safety issues for people, municipalities, and railways.

In 2003, the FCM and RAC began an important partnership to develop common approaches to the prevention and resolution of issues arising from development occurring in close proximity to railway corridors and other rail operations. Under a Memorandum of Understanding (MOU) agreed to by both parties, a Community-Rail Proximity Initiative was established and a Steering Committee was formed with a mandate to develop and implement a strategy to reduce misunderstanding and avoid unnecessary conflicts arising from railway-community proximity. The result was a framework for a proximity initiative, with the following areas requiring action:

- develop commonly understood proximity guidelines;
- improve awareness among all stakeholders regarding the need for effective planning and management; and
- develop dispute resolution protocols to guide concerned parties when issues emerge.

In 2004 the FCM and RAC Proximity Initiative published a report identifying best practices and guidelines for new developments in proximity to railway operations (reprinted 2007). This document is intended to update and replace that original document, and includes additional best practices and guidelines dealing specifically with residential conversion or infill projects on former industrial or commercial lands. The intent of this report is to provide municipalities with the necessary tools to facilitate decision-making, and to provide a framework for ensuring that new development in proximity to railway corridors is suitably configured to address the various risks and constraints present in railway environments.

Additionally, this report is intended to address the variable nature in the delivery of mitigative measures for new developments in proximity to railway operations across Canadian jurisdictions. A site-specific process is identified whereby the specific site conditions related to a proposed development can be assessed by municipalities in order to determine the mitigation measures most appropriate for that site, especially in locations where standard mitigation cannot be accommodated in a reasonable manner. Additionally, when a development application involves a residential component, the process will help municipalities to decide whether the site is appropriate for such a use. When it comes to safety, all parties must be aware that there are inherent safety implications associated with new developments in proximity to a railway line, and that these implications can often be mitigated, but typically not entirely eliminated. The goal is to establish a common, standardized process, whereby potential impacts to safety in the context of development applications in proximity to rail corridors can be assessed.

Finally, it is desirable for municipalities to take a proactive approach to identifying and planning for potential rail -oriented conflicts prior to the receipt of an application

PHOTO SOURCE: RAILWAY ASSOCIATION OF CANADA

for a specific project. In the context of creating municipal and secondary plans, it behooves planners to identify key sites for potential redevelopment, conversion, or future rail crossings, and to generate site-specific policies to manage this future change.

1.1 // PURPOSE OF THE REPORT

The main objective of this report is to provide a set of guidelines that can be applied to mitigate the impacts of locating new development in proximity to railway operations. It is important to note that these guidelines are not intended to be applied to existing locations where proximity issues already exist, as these locations present their own unique challenges which must be addressed on site specific basis.

The report will:

- provide a framework to better facilitate municipal and railway growth;
- develop awareness around the issues associated with new development along railway corridors, including residential conversion or infill projects, particularly in terms of noise, vibration, and safety;
- provide model development guidelines, policies, and regulations, and illustrate best practices for use and adaptation as appropriate by all stakeholders, most particularly railways, municipalities, and land developers;
- establish a mechanism that allows municipal planners to effectively evaluate the appropriateness of an application to convert industrial or commercial lands in proximity to railway corridors to residential uses, and of other residential infill projects near railway corridors;
- establish a balance between the railway operational needs and the desire of municipalities to facilitate residential and other intensification in existing built-up areas;
- inform and influence railway and municipal planning practices and procedures through the provision of guidelines that ensure planning systems and development approval processes more effectively anticipate and manage proximity conflicts;
- promote greater consistency in the application of guidelines across the country;
- identify strategies to enhance the quality of living environments while reducing incompatibility; and
- inform and influence federal and provincial governments with respect to the development and implementation of applicable policies, guidelines, and regulations.

1.2 // SOURCES

The information in this report has been derived from two primary sources:

- a thorough review of academic literature as well as municipal, state, provincial, and federal policy documents from Canada, the USA, and Australia; and
- extensive stakeholder interviews with municipal planners, railways, provincial and state bureaucrats, developers, and professionals with expertise in a variety of fields including property law, noise and vibration mitigation, and crash wall and berm construction.

A full list of references is provided at the end of this report **(Appendix I)**, in addition to a list of organizations consulted as part of the stakeholder interview process **(Appendix H)**.

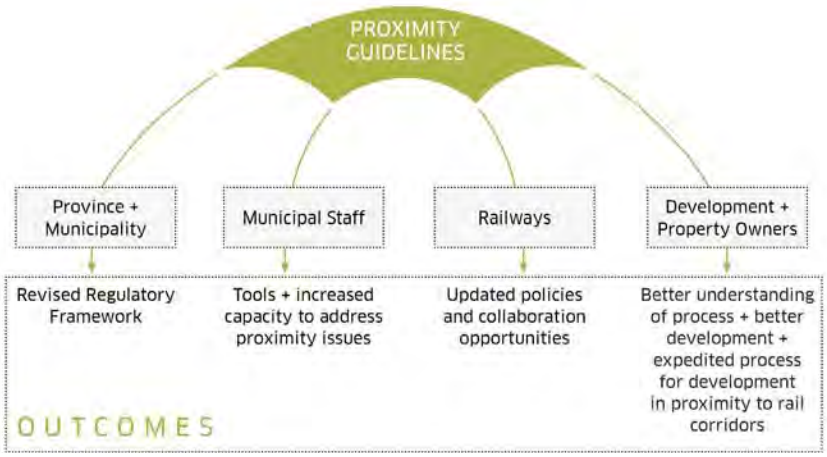


FIGURE 1 // OUTCOMES OF THE GUIDELINES FOR VARIOUS STAKEHOLDER GROUPS.

1.3 // INTENDED AUDIENCE

This report is intended to be used by:

- Municipalities and Provincial Governments, to create or update their policies, regulations, and standards related to new development along railway corridors, in order to create more consistency across the country.
- Municipal staff, as a tool to better understand the safety, vibration, noise, and other issues related to new development along railway corridors, and to more effectively evaluate and provide feedback on development proposals, particularly when they involve a residential component.
- Railways, to update their internal policies regarding development in proximity to railway corridors, particularly residential infill development and conversions, and to provide opportunities for collaboration with stakeholders.
- Developers and property owners, of sites in proximity to railway corridors to better understand the development approval process and the types of mitigation measures that might be required.

1.4 // UNDERSTANDING STAKEHOLDER ROLES

The research associated with this report has revealed the complexity of interaction between public and private agencies and individuals. It further indicated that a lack of understanding of roles and responsibilities has contributed to the problems identified. This section provides a brief overview of these roles. Recommendations for how each stakeholder can assist in the advancement of the goal of reducing proximity issues are found in Section 4.2 Advancing Stakeholder Roles.

1.4.1 Federal

The federal government regulates the activities of CN, CPR, and VIA Rail Canada, and some short line railways that operate interprovincially or internationally. These federal railways are regulated by such legislation as the *Railway Safety Act* (RSA), and the *Canada Transportation Act* (CTA). Applicable legislation, regulations, and guidelines are available from the respective websites.

1.4.2 Provincial

Provinces provide the land use regulatory framework for municipalities through Planning Acts, Provincial Policy Statements or Statements of Provincial Interest, Environmental Assessment Acts, and air quality and noise guidelines (such as the Ontario Ministry of the Environment Noise Assessment in Land Use Planning documents). This legislation generally provides direction on ensuring efficient and appropriate land use allocation and on tying land use planning to sound transportation and planning principles. Generally, provinces also have jurisdiction to establish land use tribunals to adjudicate disputes, although the approach taken by provinces with respect to establishing and empowering such tribunals varies across the country. Additionally, some provinces regulate shortline railways.

1.4.3 Municipal

Municipalities are responsible for ensuring efficient and effective land use and transportation planning within their territory, including consultation with neighbouring property owners (such as railways), in carrying out their planning responsibilities. Municipal planning instruments include various community-wide and area plans, Zoning By-law/ Ordinances, Development Guidelines, Transportation Plans, Conditions of Development Approval, and Development

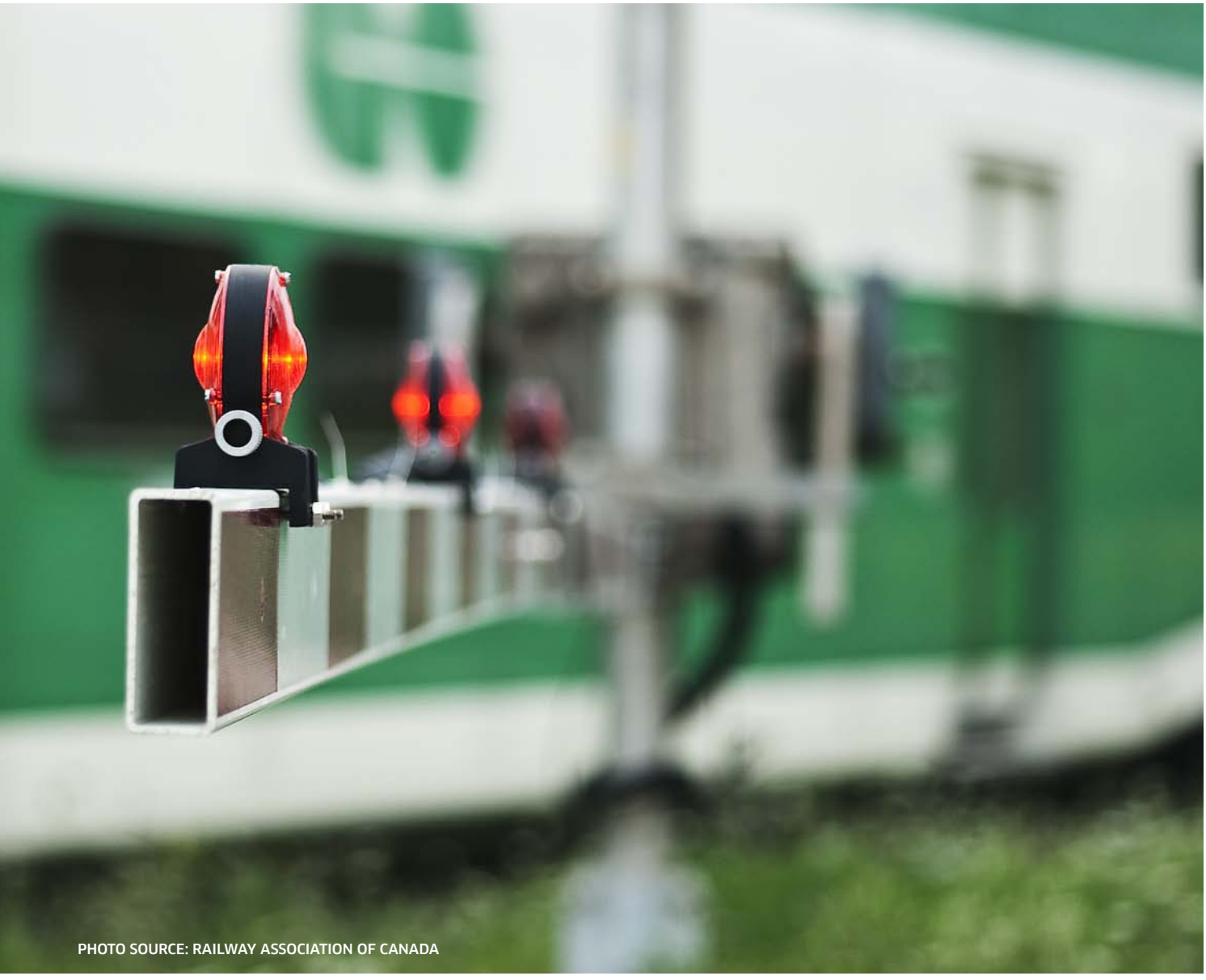


PHOTO SOURCE: RAILWAY ASSOCIATION OF CANADA

Agreements to secure developer obligations and requirements. Municipal governments have a role to play in proximity issues management by ensuring responsible land use planning policies, guidelines, and regulatory frameworks, as well as by providing a development approvals process that reduces the potential for future conflicts between land uses.

1.4.4 Railway

Federally regulated railways are governed, in part, by the requirements of the *Canada Transportation Act* (CTA). Under the CTA, railways are required to obtain an approval from the Canadian Transportation Agency for certain new railway construction projects. Through this process, railways must give notification and consult with interested parties. For existing railway operations, the CTA requires that railways make only such noise and vibration as is reasonable, taking into consideration their operational requirements and the need for the railway to meet its obligation to move passengers and the goods entrusted to it for carriage. Additionally, federal railways are required to adhere to the requirements of the *Railway Safety Act* (RSA), which promotes public safety and the protection of property and the environment in the operation of a railway. Railways also typically establish formal company environmental management policies and participate in voluntary programs and multi-party initiatives such as Direction 2006, Operation Lifesaver, TransCAER, and Responsible Care®.

Both CN and CPR, as well as VIA Rail Canada, and many short line railways across the country, have established guidelines for new development in proximity to their railway corridors, and they have a significant role to play in providing knowledge and expertise to municipal and provincial authorities, as well as developers and property owners.

1.4.5 Land Developer / Property Owner

Land developers are responsible for respecting land use development policies and regulations to achieve development that considers and respects the needs of surrounding existing and future land uses. As initiators of urban developments, they also have the responsibility to ensure that development projects are adequately integrated in existing environment.

1.4.6 Real Estate Sales / Marketing and Transfer Agents

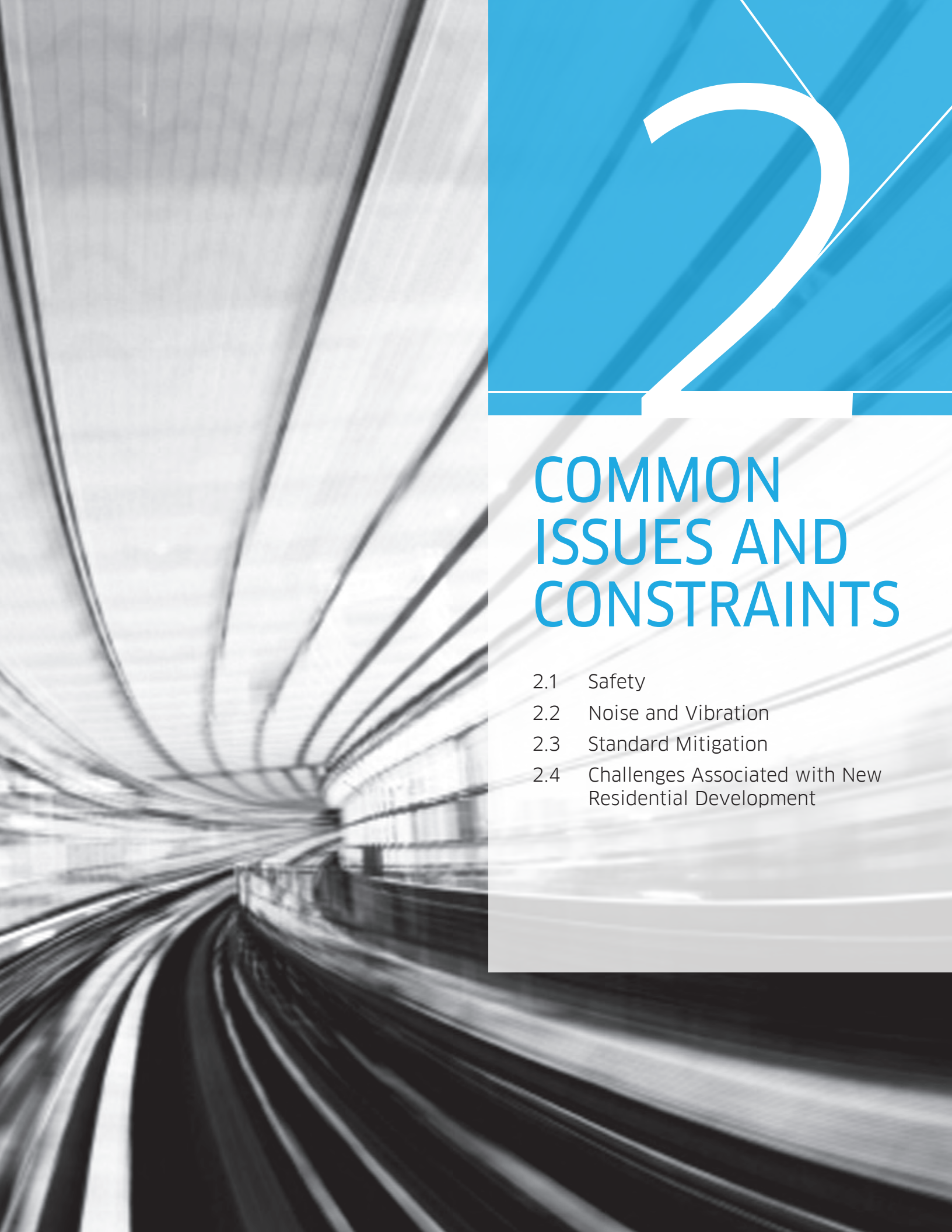
Real estate sales people and property transfer agents (notaries and lawyers) are often the first and only contacts for people purchasing property, and therefore have a professional obligation to seek out and provide accurate information to buyers and sellers.

1.4.7 Academia and Specialized Training Programs

Academic institutions provide training in all fields related to land use planning, development, and railway engineering.

1.4.8 Industry Associations

Industry associations include bodies such as the RAC, FCM, Canadian Association of Municipal Administrators (CAMA), Canadian Institute of Planners (CIP), provincial planning associations, the Canadian Acoustical Association (CAA), and land development groups such as the Urban Development Institute.



2

COMMON ISSUES AND CONSTRAINTS

2.0 // COMMON ISSUES AND CONSTRAINTS

The practice of developing land in close proximity to rail operations, as well as the expansion of rail operations in urban areas, have generated a variety of opportunities...

...as well as challenges for municipalities, developers, and railways, who must work together to balance a variety of sometimes competing goals and aspirations, including:

- the desire to promote excellence in urban design;
- the need, in some cases, to preserve employment lands and protect them from encroaching residential development;
- the growing demand for infill development that promotes the principles of sustainability and smart growth;
- the need to provide sufficient noise and vibration mitigation and safety measures;
- the desire of developers for consistency and clarity in the development process;
- the desire of developers and municipalities to see an improved and streamlined development review process for residential projects in proximity to railway corridors; and
- the necessity of recognizing the significant economic contributions of the railways, and of ensuring their continued ability to provide their services unimpeded.

In addition, it is important to recognize that areas in proximity to railway operations are challenging settings for new development, and in particular, residential development. Railway operations can generate concerns, such as blocked crossings, dangers to trespassers, as well as impacts on the quality of life of nearby residents due to the effects of inherent noise, vibration, and railway incidents . Conversely, developments must be carefully planned so as not to interfere with the continued operation of railway activities, or the potential for future expansion, as railways play an important economic role in society that must be safeguarded.

The most significant constraints related to railway proximity can be broadly categorized as follows:

1. **Inadequate communication** - both formal and informal notification and consultation is lacking between and among stakeholders.
2. **Lack of understanding and awareness of rail/municipal proximity issues** - the issues and regulations affecting rail operations and municipal land use decisions are complex and involve every level of government. Individual stakeholders are not always familiar with the mandate and operating realities of other stakeholder agencies. Rail/municipal proximity issues only arise infrequently for many municipalities, particularly smaller ones, and staff may not be aware of required or appropriate mitigation measures.
3. **Absence of comprehensive or consistent development review** - policies, regulations, and approaches for dealing with land use decisions involving rail proximity issues vary greatly from municipality to municipality, and are lacking detail in most cases. In particular, there is a need for a new development review process that deals specifically with residential development proposals, especially those involving a conversion from commercial or industrial uses, or which are to be located on tight infill sites.

In addition to these common constraints, there are a number of very specific issues which, in some cases, are a result of the constraints, and in others, fuel them. These include issues around safety, noise, vibration, the accommodation of safety mitigation measures, and the accommodation of residential development near railway corridors. Following is a brief summary of some of the

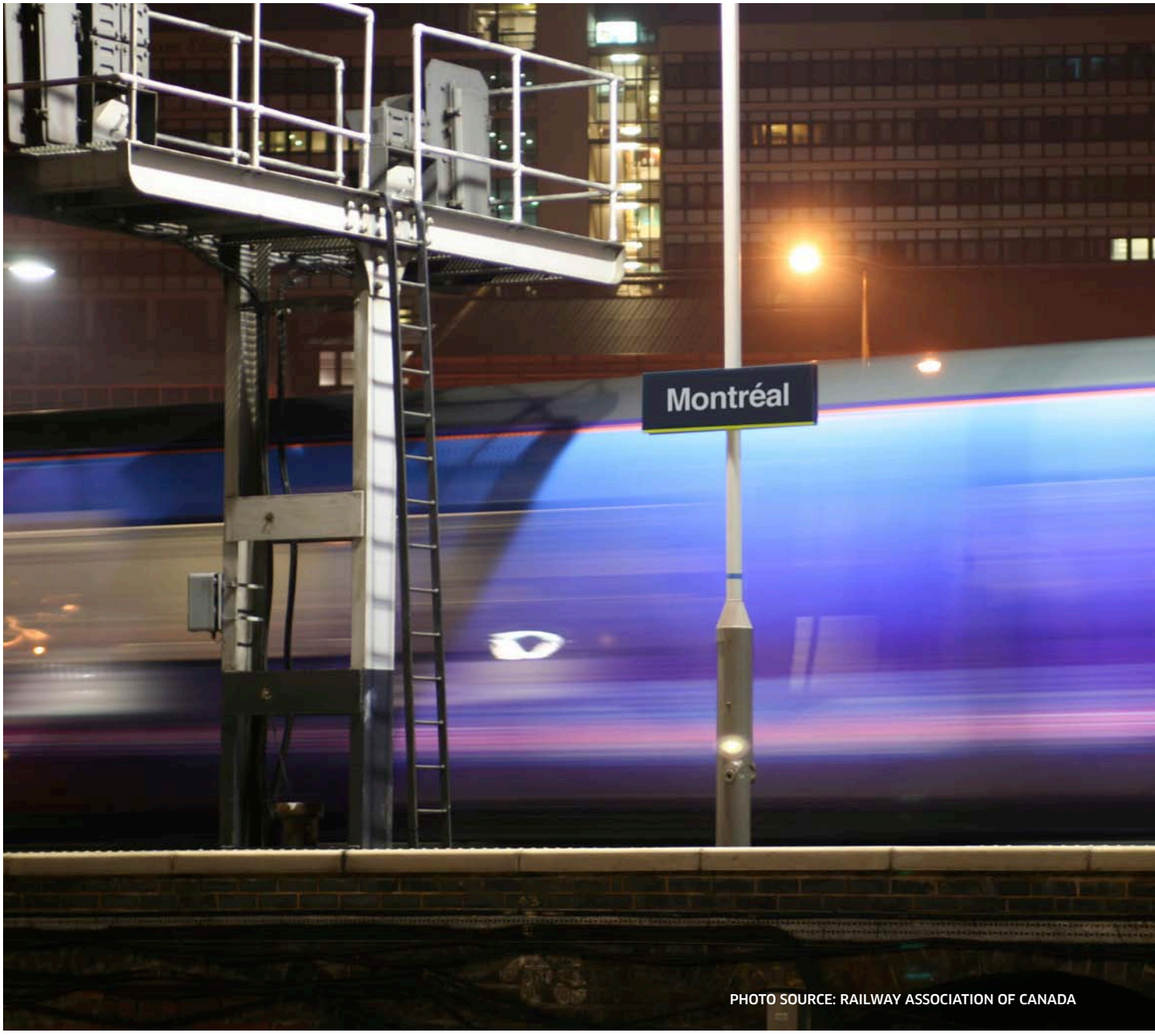


PHOTO SOURCE: RAILWAY ASSOCIATION OF CANADA

more specific issues associated with new development in proximity to railway operations.

2.1 // SAFETY

Safety is a concern which has been expressed by residents living in proximity to railways. In *Stronger Ties: A Shared Commitment to Railway Safety (2007),* a report commissioned as part of a review of the Railway Safety Act, it is noted that rail is one of the safest modes of transportation, and that Canada's railways are among the safest in North America. When accidents do occur, the vast majority are non-main track collisions and derailments occurring primarily in yards or terminals. Only slightly more than 10 percent of railway accidents are collisions or derailments that occur on track between stations or terminals, including branch and feeder lines, although these are the accidents with the greatest consequences in terms of property and environmental damage. Additionally, the number of accidents involving the transportation of dangerous goods has been falling steadily since 1996, even as rail transport of regulated dangerous goods has grown by as much as 60 percent. By far, the greatest number of annual fatalities resulting from railway accidents involves trespassers or vehicle occupants or pedestrians being struck at crossings.[1] As a result, trespassing is at least as great, if not greater a safety concern than is derailment.

2.1.1 Train Derailments

The desire to ensure safety and promote a high quality of life for people living and working in close proximity to railway corridors is a principal objective of railways. As part of that objective, railways have, since the early 1980s, promoted mitigation in the form of a standard setback and berm. These measures have been developed based on a detailed analysis of past incidents and derailments. Together, they contain the derailed cars and allow a derailed train enough room to come to a complete stop. In addition, setbacks and berms also allow for the dissipation of noise and vibration, and have typically been effective at ameliorating the proximity concerns perceived by residents living near railway operations. While these measures are recommended for all types of new development in proximity to railway operations, they have typically only been considered by the railways as a mandatory requirement for residential development. Nevertheless, in some cases where conversion or infill sites are small and cannot accommodate standard setbacks, reduced setbacks may be possible under certain conditions (for example, if the railway line is located in a cut), but in the majority of cases, an alternate form of safety barrier (such as a crash wall) will be required.

Most jurisdictions across Canada have yet to establish a formal requirement for rail corridor building setbacks. In some cases, minimum setback requirements are considered to be too onerous, and are either ignored or subjectively reduced. Ontario, which mandates the involvement of railways on any development proposal in proximity to railway facilities, is the only province where standard setbacks are typically achieved. This creates a perception that developers in that province are treated differently since they bear the additional costs associated with implementing safety mitigation, whereas developers in other provinces do not. In reality, this is simply an outcome of Ontario's stronger regulatory framework for dealing with development in railway environments.

1 Railway Safety Act Review Secretariat. (2007). Stronger ties: A shared commitment to railway safety. Retrieved from the Transport Canada website: www.tc.gc.ca/tcss/RSA_Review-Examen_LSF

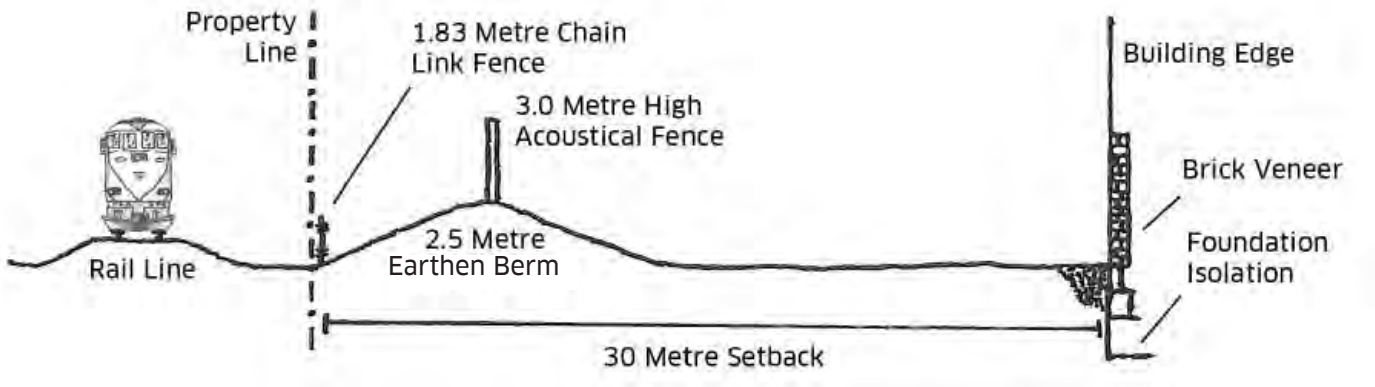


FIGURE 2 // STANDARD MITIGATION FOR NEW RESIDENTIAL DEVELOPMENT IN PROXIMITY TO A MAIN LINE RAILWAY

2.1.2 Crossings

As urban areas grow in proximity to railway corridors, road traffic at existing crossings increases and can lead to demands for improvements to such crossings, demands for additional crossings, or demands for grade separations to accommodate the flow of the traffic from the new development to areas on the other side of the railway. Conversely, Transport Canada and the railways strive to reduce the number of at-grade crossings since each new crossing increases the risk exposure for potential vehicle/train and pedestrian accidents, as well as the related road traffic delays. Grade-separated crossings address both these issues, but are expensive to construct. Safety at railway crossings is a concern for all stakeholders and planning is necessary to consider alternatives to creating new grade crossings, including upgrading and improving safety at existing crossings and grade-separated crossings.

2.2 // NOISE AND VIBRATION

Noise and vibration from rail operations are two of the primary sources of complaints from residents living near railway corridors. Airborne noise at low frequencies (caused by locomotives) can also induce vibration in lightweight elements of a building, which may be perceived to be ground-borne vibration.

There are two sources of rail noise: noise from pass-by trains, and noise from rail yard activities, including shunting. Pass-by noise is typically intermittent, of limited duration and primarily from locomotives. Other sources of pass-by noise include whistles at level crossings[2], and car wheels on the tracks.

Freight rail yard noises tend to be frequent and of longer duration, including shunting cars, idling locomotives, wheel and brake retarder squeal, clamps used to secure containers, bulk loading/unloading operations, shakers, and many others.

Beyond the obvious annoyance, some studies have found that the sleep disturbance induced by adverse levels of noise can affect cardiovascular, physiological, and mental health, and physical performance.[3] However, there is no clear consensus as to the real affects of adverse levels of noise on health.

Ground borne vibration from the wheel-rail interface passes through the track structure into the ground and can transfer and propagate through the ground to nearby buildings. Vibration is more difficult to predict and mitigate than noise and there is no universally accepted method of measurement or applicable guidelines. Vibration evaluation methods are generally based on the human response to vibration. The effects of vibration on occupants include fear of damage to the occupied structure, and interference with sleep, conversation, and other activities.

2.3 // STANDARD MITIGATION

In order to reduce incompatibility issues associated with locating new development (particularly new residential development) in proximity to railway corridors, the railways suggest a package of mitigation measures that have been designed to ameliorate the inherent potential

2 Applicable to federally regulated railways and some provincially regulated railways (notably in Quebec and Ontario). Trains are required to sound their whistles for at least 400 metres before entering a public crossing, unless relief has been granted in accordance with the regulatory process.

3 Berglund, B., Lindvall, T., & Schwela, D. H., eds. (1999). Guidelines for community noise [Research Report]. Retrieved from World Health Organization website: http://www.who.int/docstore/peh/noise/guidelines2.html

for the occurrence of safety, security, noise, vibration, and trespass issues. These mitigation measures (illustrated in FIGURE 2) include a minimum setback, earthen berm, acoustical and/or chain link security fence, as well as additional measures for sound and vibration attenuation.

It should be noted that many of these measures are most effective only when they are implemented together as part of the entire package of standard mitigation measures. For example, the setback contributes to mitigation against the potential impact of a railway incident as well as noise and vibration, through distance separation. The earthen berm, in turn, can protect against the physical components of a derailment (in conjunction with the setback), and provides mitigation of wheel and rail noise, reduces the masonry or wood component (and cost) of the overall noise barrier height, and offers an opportunity for the productive use of foundation excavations. Implementation of the entire package of mitigation measures is, therefore, highly desirable, as it provides the highest possible overall attenuation of incompatibility issues. It should also be noted that implementation of such measures is easiest to achieve for new greenfield development. For this reason, these measures are not intended as retrofits for existing residential neighbourhoods in proximity to railway operations. As well, challenges may be encountered in the case of conversions or infill projects on small or constrained sites, and any implications related to the use of alternative mitigation measures need to be carefully evaluated.

2.3.1 Maintenance

A common issue that emerged through this process was that of the responsibility for maintaining mitigation infrastructure. Currently, there is no standard approach to dealing with the maintenance of mitigation infrastructure. In some cases, as is the current practice in Saskatoon, the municipality takes on this responsibility. Increasingly, however, this is seen as an undue burden on municipal coffers, particularly within the current difficult budgetary climate. In Ontario, there was a time when the railways occasionally took possession of the portion of the berm beyond the fence facing onto the railway corridor, but this land attracted property taxes at residential rates. As such, this practice has largely ended. Commonly, property owners maintain ownership of this portion of land, and are expected to maintain the mitigation infrastructure themselves. This strategy can work for commercial or industrial developments, or in the case of condominium developments, where the land becomes part of the common areas of the condominium and maintenance becomes the responsibility of the corporation. In the case of freehold developments, however, where the responsibility for maintenance lies with individual property owners, it is virtually impossible for them to easily access the side of the berm facing onto the railway corridor, and would be dangerous for them to do so in any case. Recommendations regarding a Mitigation Infrastructure Maintenance Strategy are included in Section 4.1.2 of this report.

2.4 // CHALLENGES ASSOCIATED WITH NEW RESIDENTIAL DEVELOPMENT

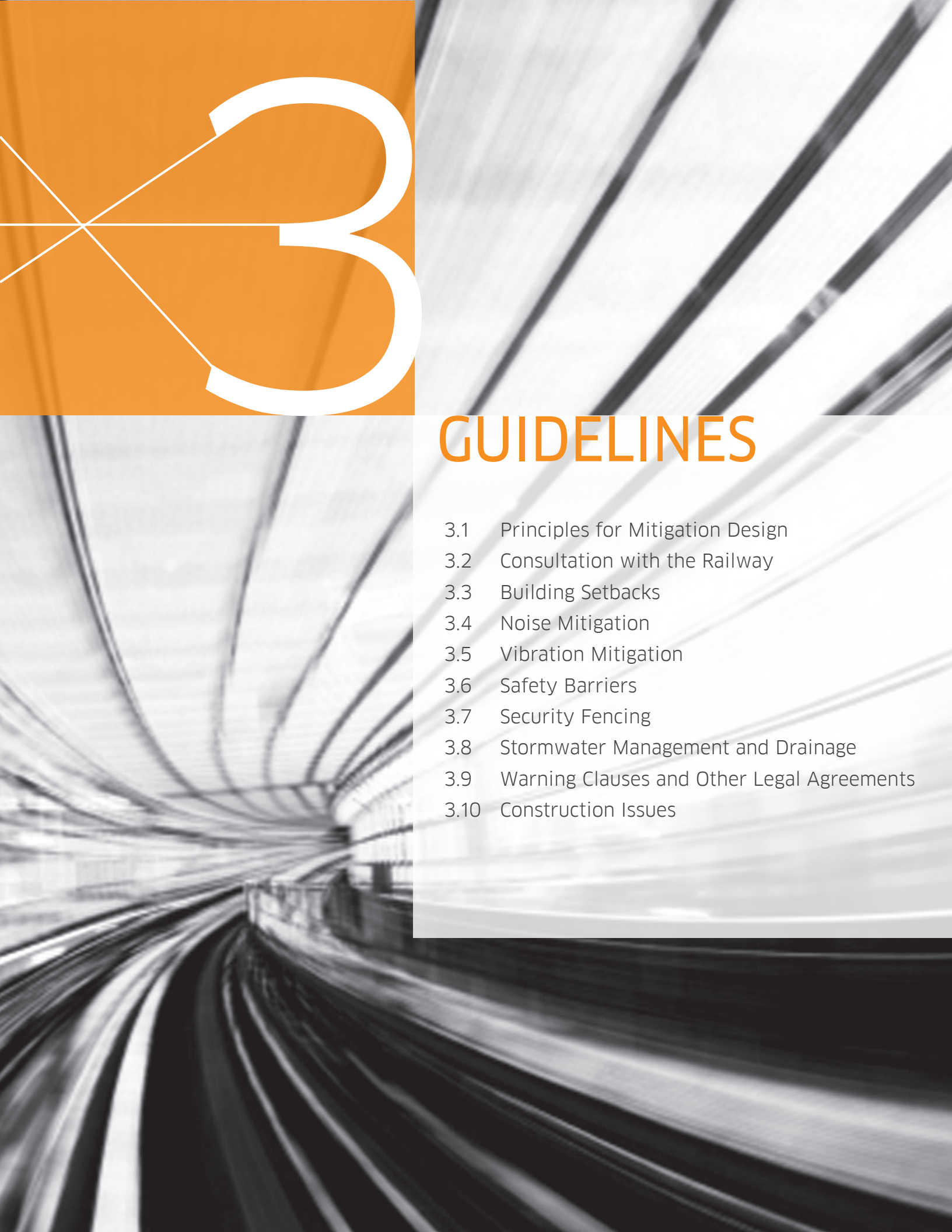
Residential development is particularly challenging in the context of a railway environment. As noted above, safety, noise, and vibration issues become more significant when dealing with residential development. Partly, this is because people are more sensitive to these issues in the context of their own homes than in other contexts (work, leisure, etc.). It is also because the negative effects of noise and vibration become more

pronounced when they disturb normal sleeping patterns.

When residential development in proximity to railway corridors occurs on large greenfield sites, dealing with these issues is typically not a challenge, as standard mitigation measures can be easily accommodated, and are quite effective. Residential development becomes significantly more challenging, however, when the context is a small infill site, such as those typically associated with the conversion of commercial or industrial properties. In addition to their small size, these sites are also often oddly shaped, and do not easily accommodate standard mitigation measures such as a setback and berm. In addition, existing commercial buildings that are typically associated with conversions to residential use may not meet current residential building code specifications and for this reason it is very important that proper mitigation measures are implemented for these buildings.

In the case of high-density development, crash walls and extensive vibration isolation become economically feasible, negating the problems associated with small sites. However, where high-density development is not appropriate given the site context, these solutions are not financially feasible for the developer, and a different approach is required. Across Canada, there have been inconsistencies in the way these sites are dealt with, and in some cases, residential development has been allowed with little to no mitigation, which could present proximity issues and concerns to residents in the future.

A major contributing factor with respect to inconsistencies in the application of mitigation measures across Canada is the lack of a clear development approval process for residential development in proximity to railway corridors in most jurisdictions outside of Ontario. A new approach is required that will ensure more consistent outcomes across the country. In particular, municipalities will need to carefully consider the viability of sites for conversion to residential uses, based on criteria such as: existing contextual land use, size of site, appropriateness of high-density development, and the demonstrated effectiveness of alternative mitigation measures. Recommendations regarding a Model Review Process for Residential Development, Infill, and Conversions Adjacent to Railway Corridors can be found in **Section 4.1.1** of this report.



3 GUIDELINES

3.0 // GUIDELINES

The intention of these guidelines is to provide a level of consistency in the approach to the design of buildings and their context in proximity to railway corridors, and the type of mitigation that is provided across the country.

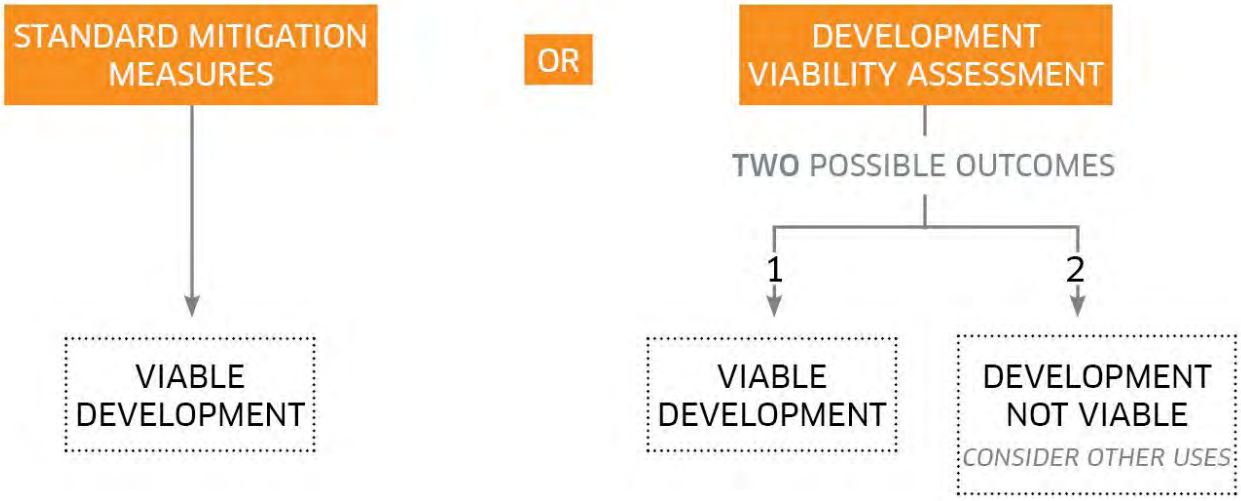


FIGURE 3 // THE DEVELOPMENT VIABILITY ASSESSMENT TOOL IS TO BE USED WHERE STANDARD MITIGATION MEASURES CANNOT BE ACCOMMODATED

The main objective is to mitigate railway-oriented impacts such as noise, vibration, and safety hazards, to ensure that the quality of life of a building's residents and users is not negatively affected. The guidelines are intended to be applied primarily to new residential development but may be useful for all other types of new development as well.

3.1 // PRINCIPLES FOR MITIGATION DESIGN

The following principles for mitigation design should be considered when applying the guidelines below. They are an expression of the intent of the guidelines, and both developers as well as municipalities should have regard for them when designing or assessing new residential development in proximity to a railway corridor.

1. Standard mitigation measures are desired as a minimum requirement.
2. In instances where standard mitigation measures are not viable, alternative development solutions may be introduced in keeping with the Development Viability Assessment process (SEE FIGURE 3).
3. All mitigation measures should be designed to the highest possible urban design standards. Mitigation solutions, as developed through the Development Viability Assessment process, should not create an onerous, highly engineered condition that overwhelms the aesthetic quality of an environment.

3.2 // CONSULTATION WITH THE RAILWAY

Consultation with all stakeholders, including the railways, at the outset of a planning process is imperative to building understanding and informing nearby neighbours. In addition, initiating a conversation with railways can confirm the feasibility of a project and the practicality of proceeding. Key issues or concerns that may need to be addressed will be identified.

- Early contact between the proponent and the railway (preferably in the project's early design phase), is highly recommended, especially for sites in close proximity to railway corridors. This consultation is important in order to determine:
  - » the location of the site in relation to the rail corridor;
  - » the nature of the proposed development;
  - » the frequency, types, and speeds of trains travelling within the corridor;
  - » the potential for expansion of train traffic within the corridor;
  - » any issues the railway may have with the new development or with specific uses proposed for the new development;
  - » the capacity for the site to accommodate standard mitigation measures;
  - » any suggestions for alternate mitigation measures that may be appropriate for the site; and
  - » the specifications to be applied to the project.

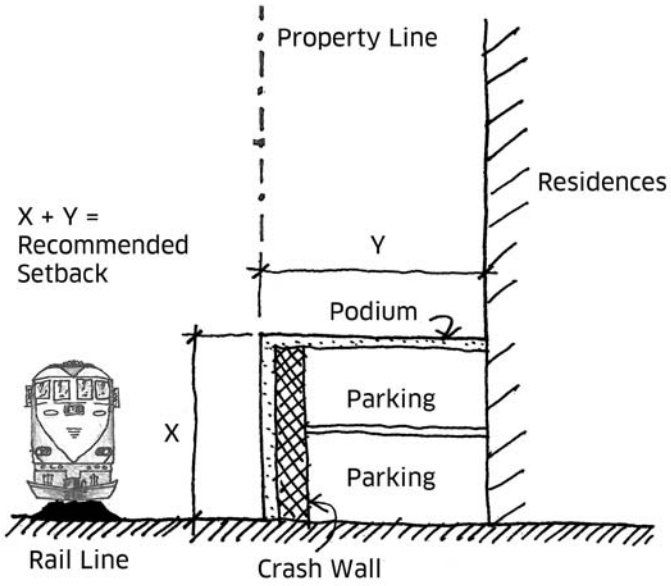


FIGURE 4 // INCORPORATING A CRASH WALL INTO A DEVELOPMENT CAN REDUCE THE RECOMMENDED SETBACK.

3.3 // BUILDING SETBACKS FOR NEW DEVELOPMENTS

A setback from the railway corridor, or railway freight yard, is a highly desirable development condition, particularly in the case of new residential development. It provides a buffer from railway operations; permits dissipation of rail-oriented emissions, vibrations, and noise; and accommodates a safety barrier. Residential separation distances from freight rail yards are intended to address the fundamental land use incompatibilities. Proponents are encouraged to consult with the railway early in the development process to determine the capacity of the site to accommodate standard setbacks (see below). On smaller sites, reduced setbacks should be considered in conjunction with alternative safety measures. Where the recommended setbacks are not technically or practically feasible due, for example, to site conditions or constraints, then a Development Viability Assessment should be undertaken by the proponent to evaluate the conditions specific to the site, determine its suitability for new development, and suggest options for mitigation. Development Viability Assessments are explained in detail in Appendix A.

3.3.1 Guidelines

- The standard recommended building setbacks for new residential development in proximity to railway operations are as follows:
  - » **Freight Rail Yard:** 300 metres
  - » **Principle Main Line:** 30 metres
  - » **Secondary Main Line:** 30 metres
  - » **Principle Branch Line:** 15 metres
  - » **Secondary Branch Line:** 15 metres
  - » **Spur Line:** 15 metres
- Setback distances must be measured from the mutual property line to the building face. This will ensure that the entire railway right-of-way is protected for potential rail expansion in the future.

» Policy Recommendation

Municipalities should establish minimum setback requirements through a zoning bylaw amendment.

- Under typical conditions, the setback is measured as a straight-line horizontal distance.
- Where larger building setbacks are proposed (or are more practicable, such as in rural situations), reduced berm heights should be considered.
- Marginal reductions in the recommended setback of up to 5 metres may be achieved through a reciprocal increase in the height of the safety berm (see Section 3.6 Safety Barriers)
- Horizontal setback requirements may be substantially reduced with the construction of a crash wall (see Section 3.6 Safety Barriers). For example, where a crash wall is incorporated into a low-occupancy podium below a residential tower, the setback distance may be measured as a combination of horizontal and vertical distances, as long as the horizontal and vertical value add up to the recommended setback. This concept is illustrated in FIGURE 4.
- Where there are elevation differences between the railway and a subject development property, appropriate variations in the minimum setback should be determined in consultation with the affected railway. For example, should the railway

FIGURES 5 (LEFT) & 6 (RIGHT) // SETBACK CONFIGURATION OPTIONS FOR OPTIMUM SITE DESIGN

Note that in both scenarios displayed in Figures 5 & 6, the presence of intervening structures between the railway and the outdoor amenity areas may negate the need for a sound barrier. Where a barrier is not required for noise, vegetative or other screening is recommended to provide a visual barrier to the sometimes frightening onset of a high speed passenger train.

tracks be located in a cut, reduced setbacks may be appropriate.

- Appropriate uses within the setback area include public and private roads; parkland and other outdoor recreational space including backyards, swimming pools, and tennis courts; unenclosed gazebos; garages and other parking structures; and storage sheds.

Example setback configurations are illustrated in FIGURES 5 AND 6.

3.4 // NOISE MITIGATION

Noise resulting from rail operations is a key issue with regards to the liveability of residential developments in proximity to railway facilities, and may also be problematic for other types of sensitive uses, including schools, daycares, recording studios, etc. As well as being a major source of annoyance for residents, noise can also have impacts on physical and mental health, particularly if it interferes with normal sleeping patterns.[1] The rail noise issue is site-specific in nature, as the level and impact of noise varies depending on the type of train operations. (see Appendix B for a sample rail classification system). Proponents will have to carefully plan any new development in proximity to a railway corridor to ensure that noise impacts are minimized as much as possible. Generally, during the day, noise should be contained to a level conducive to comfortable speech communication or listening to soft music, and at night it should not interfere with normal sleeping patterns.[2] For building retrofits, while the majority of the guidelines below will apply, special attention should be paid to windows, doors, and the exterior cladding of the building.

3.4.1 Guidelines

- Since rail noise is site-specific in nature, the level and impact of noise on a given site should be accurately assessed by a qualified acoustic consultant through the preparation of a noise impact study. The objective of the noise impact study is to assess the impact of all noise sources affecting the subject lands and to determine the appropriate layout, design, and required control measures. Noise studies should be undertaken by the proponent early in the development process, and should be submitted with the initial proposal.

» Policy Recommendation

Municipalities should consider amending their Official Plan or other appropriate legislation to require noise impact studies as part of any rezoning or Official Plan amendment near railway operations.

- The recommended minimum noise influence areas to be considered for railway corridors when undertaking noise studies are:
  - » **Freight Rail Yards:** 1,000 metres
  - » **Principal Main Lines:** 300 metres
  - » **Secondary Main Lines:** 250 metres
  - » **Principal Branch Lines:** 150 metres
  - » **Secondary Branch Lines:** 75 metres
  - » **Spur Lines:** 75 metres

1 Berglund, B., Lindvall, T., & Schwela, D. H., eds. (1999). Guidelines for community noise [Research Report]. Retrieved from World Health Organization website: http://www.who.int/docstore/peh/noise/guidelines2.html

2 Canada Mortgage and Housing Corporation. (1986). Road and rail noise: Effects on housing [Canada]: Author.

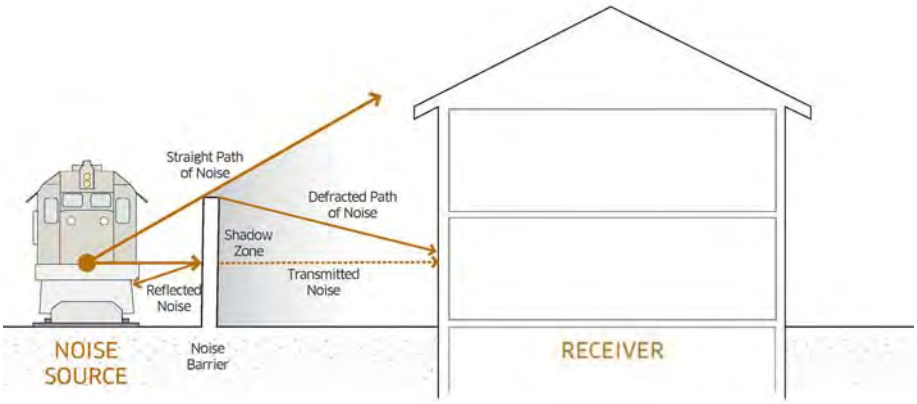


FIGURE 7 // EFFECT OF A NOISE BARRIER ON THE PATH OF NOISE FROM THE RECEIVER TO THE SOURCE. A NOISE BARRIER REDUCES NOISE LEVELS IN THREE WAYS: BY DEFLECTING NOISE OFF OF IT, BY DAMPENING THE NOISE THAT IS TRANSMITTED THROUGH IT, AND BY BENDING, OR DIFFRACTING NOISE OVER IT. THE AREA RECEIVING THE MOST PROTECTION BY THE NOISE BARRIER IS TYPICALLY REFERRED TO AS THE "SHADOW ZONE".

- The acoustic consultant should calculate the external noise exposure, confirm with measurements if there are special conditions, and calculate the resultant internal sound levels. This should take into account the particular features of the proposed development. The measurements and calculations should be representative of the full range of trains and operating conditions likely to occur in the foreseeable future at the particular site or location. The study report should include details of assessment methods, summarize the results, and recommend the required outdoor as well as indoor control measures.
- To achieve an appropriate level of liveability, and to reduce the potential for complaints due to noise emitted from rail operations, new residential buildings in proximity to railway operations should be designed and constructed to comply with the sound level limits criteria shown in AC.1.4 (see AC.1.6 for sound limit criteria for residential buildings in proximity to freight rail shunting yards). Habitable rooms should be designed to meet the criteria when their external windows and doors are closed. If sound levels with the windows or doors open exceed these criteria by more than 10 dBA, the design of ventilation for these rooms should be such that the occupants can leave the windows closed to mitigate against noise (e.g. through the provision of central air conditioning systems).
- In Appendix C, recommended procedures for the preparation of noise impact studies are provided, as well as detailed information on noise measurement. These should be observed.
- It is recommended that proponents consult Section 2.4 of the Canadian Transportation Agency (CTA) report, *Railway Noise Measurement and Reporting Methodology* (2011) for guidance on the recommended content and format of a noise impact study.

3.4.1.1 Avoiding Adverse Noise Impacts through Good Design

Many of the adverse impacts of railway noise can be avoided or minimized through good design practices. Careful consideration of the location and orientation of buildings, as well as their internal layout can minimize the exposure of sensitive spaces to railway noise. Site design should take into consideration the location of the rail corridor, existing sound levels, topography, and nearby buildings. Noise barriers, acoustic shielding from other structures, and the use of appropriate windows, doors, ventilation, and façade materials can all minimize the acoustic impacts of railway operations. Note that many of the design options recommended below have cost and market acceptability liabilities that should be evaluated at the outset of the design process.

3.4.1.2 Noise Barriers

- A noise barrier can effectively reduce outdoor rail noise by between 5dBA and 15dBA, although the largest noise reductions are difficult to achieve without very high barriers. Noise barriers provide significant noise reductions only when they block the line of sight between the noise source and the receiver. Minimum noise barrier heights vary by the classification of the neighbouring rail line.[3] Though the required height will be determined by

3 Note that the height of a noise barrier can be achieved in combination with that of a berm, if present.

FIGURE 8 // PRECEDENT IMAGERY DEMONSTRATING THE INCORPORATION OF URBAN DESIGN AND LIVING WALLS INTO NOISE BARRIERS
SOURCES: (LEFT) WESTFIELD WINDBREAK BY WILTSHIREBLOKE. CC BY-NC-ND 3.0. RETRIEVED FROM: HTTP://WWW.FLICKR.COM/PHOTOS/WILTSHIREBLOKE/3580334228/. (MIDDLE) AUTUMN COLORS BY GEIR HALVORSEN. CC BY-NC-SA 3.0. RETRIEVED FROM: HTTP://WWW.FLICKR.COM/PHOTOS/DAMIEL/47160698/. (RIGHT) IMAGE BY DIALOG.

an acoustic engineer in a noise report, they are typically at least:

- » **Principal Main Line:** 5.5 metres above top of rail
- » **Secondary Main Line:** 4.5 metres above top of rail
- » **Principal Branch Line:** 4.0 metres above top of rail
- » **Secondary Branch Line:** no minimum
- » **Spur Line:** no minimum

Differences in elevation between railway lands and development lands may significantly increase or decrease the required height of the barrier, which must at least break the line of sight. Thus, when not at the same grade, the typical barrier heights are measured from an inclined plane struck between the ground at the wall of the dwelling and the top of the highest rail.

- In keeping with existing railway guidelines for new developments, noise barriers must be constructed adjoining and parallel to the railway right-of-way with returns at each end. They must be constructed without holes or gaps and should be made of a durable material with sufficient mass to limit the noise transmission to at least 10dBA less than the noise that passes over the barrier,[4] at least 20 kg per square metre of surface area. Masonry, concrete, or other specialist construction is preferred in order to achieve the maximum noise reduction combined with longevity. Well-built wood fences are acceptable in most cases. Poorly constructed fences of any type are an unnecessary burden on future residents.
- Consideration should be made to limiting the visual impact of noise barriers in order to maintain a high level of urban design in all new developments, and to discourage vandalism. This can be accomplished by incorporating public art into the design of the barrier, or through the planting of trees and shrubs on the side of the barrier facing the development, particularly where it is exposed to regular sunlight.
- Alternatively, the barrier itself may be constructed as a living wall, which also has the benefit of providing additional noise attenuation. FIGURE 8 provides some examples of how good design practices may be incorporated into the design of noise barriers.

N.B. New barriers constructed on one side of a railway opposite an older neighbourhood without barriers may lead to concerns from existing residents about the potential for noise increases due to barrier reflections. It is common for the characteristics of the noise to change due to frequency, duration, and time of onset, which, combined, may be perceived as a significant increase in noise levels. However, this is not generally supported through onsite measurement, as the train will act as its own barrier to any reflected noise during pass-by.

3.4.1.3 Building Location, Design Orientation, and Room Layout

While low-rise buildings may benefit from shielding provided by topography, barriers, or other buildings, high-rise buildings usually receive less noise shielding, and are, therefore, typically more exposed to noise from

4 Rail Infrastructure Corporation. (November 2003). Interim guidelines for applicants: Consideration of rail noise and vibration in the planning process. Retrieved from http://www.daydesign.com.au/downloads/Interim_guidelines_for_applicants.pdf

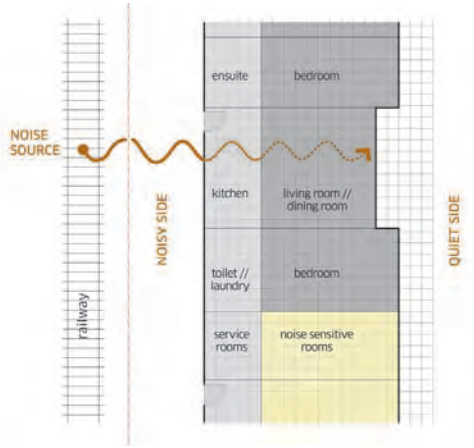


FIGURE 9 // **LOCATING NOISE SENSITIVE ROOMS AWAY FROM RAIL NOISE IN DETACHED DWELLINGS; AND FIGURE 10 (RIGHT) - LOCATING NOISE SENSITIVE ROOMS AWAY FROM RAIL NOISE IN MULTI-UNIT DWELLINGS.** (SOURCE: ADAPTED FROM FIGURE 3.6 IN THE DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS - INTERIM GUIDELINE BY THE STATE OF NEW SOUTH WALES, AUSTRALIA)

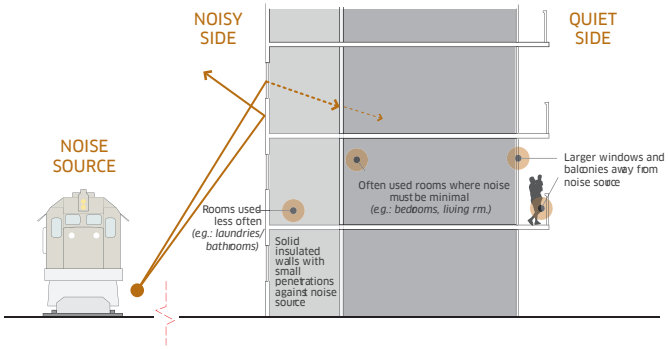


FIGURE 10 // **LOCATING NOISE SENSITIVE ROOMS AWAY FROM RAIL NOISE IN MULTI-UNIT DWELLINGS** (SOURCE: ADAPTED FROM FIGURES 3.5 & 3.6 IN THE DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS - INTERIM GUIDELINE BY THE STATE OF NEW SOUTH WALES, AUSTRALIA)

» Policy Recommendations

Urban Design Guidelines for development near railway corridors would be a valuable tool in suggesting building layout and design. Alternatively, municipal planners should pay close attention to these issues through a site planning process. Jurisdictions that do not allow comprehensive site planning may wish to consider amendments to their land use planning legislation.

Comprehensive zoning for podiums would be a valuable tool for areas in proximity to railway operations that municipalities have identified for redevelopment. Urban Design Guidelines can also speak to appropriate built form, including podium design, setbacks, step backs etc. At a minimum, municipal planners should secure podium massing as part of a site-specific zoning by-law amendment.

Balconies can be regulated through zoning if administered comprehensively and can be secured as part of a site-specific zoning by-law. Urban Design Guidelines should also speak to appropriate balcony design (e.g. recessed versus protruding balconies).

Urban Design Guidelines should contain comprehensive information on best practices for landscape design, and appropriate types and species of plants.

Urban Design Guidelines can speak to materiality. Some jurisdictions, such as Ontario, allow municipalities to regulate external materials through the site plan process. This practice should be encouraged and jurisdictions that do not currently allow for this should consider making appropriate amendments to their land use planning legislation.

rail operations. In either case, noise mitigation needs to be considered at the outset of a development project, during the layout and design stage.

- One of the most effective ways of reducing the impact of rail noise is through the use of a setback, by increasing the separation between the source of noise and the noise sensitive area. Generally, doubling the distance from the noise source to the receiver will reduce the noise levels by between 3dBA and 6dBA.[5] (See Section 3.3 Building Setbacks)
- The layout of residential buildings can also be configured to reduce the impact of rail noise. For example, bedrooms and other habitable areas should be located on the side of the building furthest from the rail corridor. Conversely, rooms that are less sensitive to noise (such as laundry rooms, bathrooms, storage rooms, corridors, and stairwells) can be located on the noisy side of the building to act as a noise buffer. This concept is illustrated in FIGURES 9 AND 10.
- Minimizing the number of doors and windows on the noisy side of the dwelling will help to reduce the intrusion of noise. In the case of multi-unit developments, a single-loaded building where the units are located on the side of the building facing away from the rail corridor is another potential solution for reducing noise penetration.

3.4.1.4 Podiums

- Outdoor rail noise can be substantially reduced by building residential apartments on top of a podium or commercial building space. If the residential

5 State Government of New South Wales, Department of Planning. (2008). Development near rail corridors and busy roads - interim guideline. Retrieved from http://www.planning.nsw.gov.au/rdaguidelines/documents/DevelopmentNearBusyRoadsandRailCorridors.pdf

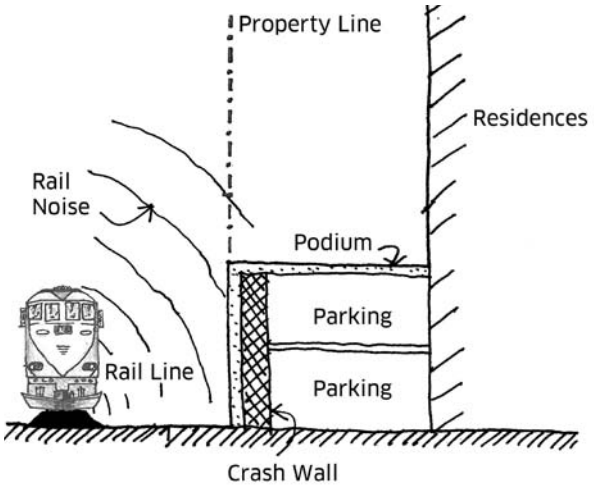


FIGURE 11 // PODIUMS CAN HELP REDUCE THE AMOUNT OF NOISE THAT REACHES RESIDENCES IF A SETBACK IS USED. (SOURCE: ADAPTED FROM FIGURE 3.13 IN THE DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS - INTERIM GUIDELINE BY THE STATE OF NEW SOUTH WALES, AUSTRALIA).

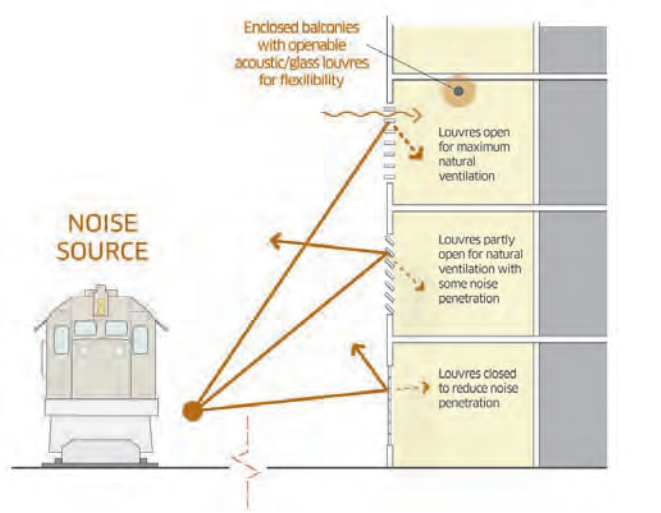


FIGURE 12 // USING ENCLOSED BALCONIES FACING A RAILWAY CORRIDOR AS NOISE SHIELDS. (SOURCE: ADAPTED FROM FIGURE 3.16 IN THE DEVELOPMENT NEAR RAIL CORRIDORS AND BUSY ROADS - INTERIM GUIDELINE BY THE STATE OF NEW SOUTH WALES, AUSTRALIA).

tower is set back, then the podium acts to provide increased distance from the railway corridor, thus reducing the noise from the corridor and providing extra shielding to the lower apartments. This concept is illustrated in FIGURE 11.

3.4.1.5 Balconies

- Providing enclosed balconies can be an effective means of reducing the noise entering a building. Where enclosed balconies are used, acoustic louvres and possibly a fan to move air into and out of the balcony space may be installed to address ventilation requirements. This concept is illustrated in FIGURE 12.

3.4.1.6 Vegetation

- While vegetation such as trees and shrubs does not actually limit the intrusion of noise, it has been shown to create the perception of reduced noise levels. Vegetation is also valuable for improving the aesthetics of noise barriers and for reducing the potential for visual intrusion from railway operations.

3.4.1.7 Walls

- In order to reduce the transmission of noise into the building, it is recommended that masonry or concrete construction or another form of heavy wall be used for all buildings in close proximity to railway corridors. This will aid in controlling the sound-induced vibration of the walls that rattles windows, pictures, and loose items on shelving. Additionally, care should be taken to ensure that the insulation capacity of the wall is not weakened by exhaust fans, doors, or windows of a lesser insulation capacity. To improve insulation response, exhaust vents can be treated with sound-absorbing material or located on walls which are not directly exposed to the external noise.

3.4.1.8 Windows

Acoustically, windows are among the weakest elements of a building façade. An open or acoustically weak window can severely negate the effect of an otherwise acoustically strong façade.[6] Therefore, it is extremely important to carefully consider the effects of windows on the acoustic performance of any building façade in proximity to a railway corridor. In addition to the recommendations below, proponents are advised to familiarize themselves with the Sound Transmission Class (STC) rating system, which allows for a comparison of the noise reduction that different windows provide.[7] In order to successfully ensure noise reduction from windows, proponents should:

- ensure windows are properly sealed by using a flexible caulking such as mastic or silicone on both the inside of the window and outside, between the wall opening and the window frame;
- use double-glazed windows with full acoustic seals. When using double-glazing, the wider the air space between the panes, the higher the insulation (50 mm to 100 mm is preferable in non-sealed widows and 25mm in sealed windows). It is also desirable in some cases to specify the panes with different thicknesses to avoid sympathetic resonance or to use at least one laminated lite to dampen the vibration within the window;
- consider reducing the size of windows (i.e. use punched windows instead of a window wall or curtain wall);

6 State Government of New South Wales, Department of Planning. (2008). Development near rail corridors and busy roads - interim guideline. Retrieved from http://www.planning.nsw.gov.au/rdaguidelines/documents/DevelopmentNearBusyRoadsandRailCorridors.pdf

7 The STC rating of a soundproof window is typically in the range of 45 to 54.

- consider increasing the glass thickness;
- consider using absorbent materials on the window reveals in order to improve noise insulation in particularly awkward cases;
- consider using hinged or casement windows or fixed pane windows instead of sliding windows;
- ensure window frames and their insulation in the wall openings are air tight; and
- incorporate acoustic seals into operable windows for optimal noise insulation.

Note that window frame contributions to noise penetration are typically less for aluminum and wood windows than for vinyl frames, as above.[8]

3.4.1.9 Doors

In order to ensure proper acoustic insulation of doors:

- airtight seals should be used around the perimeter of the door;
- cat flaps, letter box openings, and other apertures should be avoided;
- heavy, thick, and/or dense materials should be used in the construction of the door;
- there should be an airtight seal between the frame and the opening aperture in the façade;
- windows within doors should be considered as they exhibit a higher acoustic performance than the balance of the door material; and
- sliding patio doors should be treated as windows when assessing attenuation performance.

8 Note that STC ratings should include the full window assembly with the frame, as frames have been shown to be a weak component, and may not perform as anticipated from the glazing specifications.

3.5 // VIBRATION MITIGATION

Vibration caused by passing trains is an issue that could affect the structure of a building as well as the liveability of the units inside residential structures. In most cases, structural integrity is not a factor. Like sound, the effects of vibration are site specific and are dependent on the soil and subsurface conditions, the frequency of trains and their speed, as well as the quantity and type of goods they are transporting.

The guidelines below are applicable only to new building construction. In the case of building retrofits, vibration isolation of the entire building is generally not possible. However, individual elevated floors may be stiffened through structural modifications in order to eliminate low-frequency resonances. Vibration isolation is also possible for individual rooms through the creation of a room-within-a-room, essentially by floating a second floor slab on a cushion (acting like springs), and supporting the inner room on top of it.[9] Additional information regarding vibration mitigation options for new and existing buildings can be found in the *FCM/RAC Railway Vibration Mitigation Report*, which can be found on the Proximity Project website.

3.5.1 Guidelines

- Since vibration is site-specific in nature, the level and impact of vibration on a given site can only be accurately assessed by a qualified acoustic or vibration consultant through the preparation of a vibration impact study. It is highly recommended that an acoustic or vibration consultant be obtained by the proponent early in the design process, as mitigation can be difficult. It is recommended

9 Howe, B., & McCabe, N. (March 15 2012). Railway vibration reduction study: Information on railway vibration mitigation [Ottawa, ON]: Railway Association of Canada.

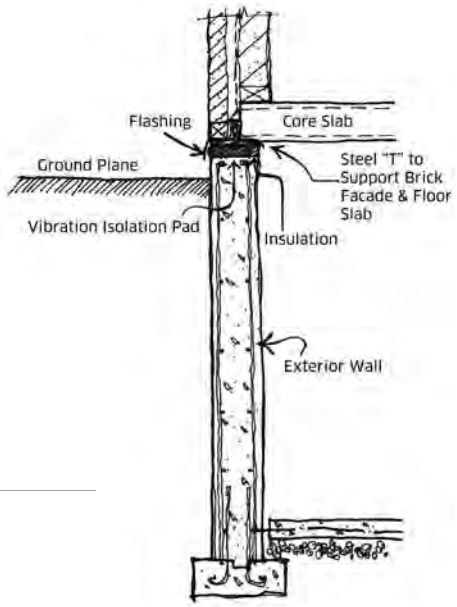


FIGURE 13 // SHALLOW VIBRATION ISOLATION

that the consultant be used to determine whether vibration mitigation measures are necessary and what options are available given the particular conditions of the development site in question. The consultant will employ measurements to characterize the vibration affecting the site in question. In the absence of a future rail corridor not yet operating, estimates based on soil vibration testing are required, although such sites are quite rare.

» **Policy Recommendation**

Municipalities should consider amendments to their Official Plan, where necessary, to make vibration studies a requirement for any zoning by-law amendment and Official Plan amendment applications.

- The recommended minimum vibration influence area to be considered is 75 metres from a railway corridor or rail yard.
- The acoustic consultant should carry out vibration measurements and calculate the resultant internal vibration levels. This should take into account the particular features of the proposed development. The measurements and calculations should be representative of the full range of trains and operating conditions likely to occur at the particular site or location. The study report should include details of the assessment methods, summarize the results, and recommend the required control measures.
- See AC.2.5 for recommended procedures for the preparation of vibration impact studies. These should be observed.
- The important physical parameters that should be considered by the consultant for designing vibration control can be divided into the following four categories:
  - » Operational and vehicle factors: including speed, primary suspension on the vehicle, and flat or worn wheels.
  - » Guideway: the type and condition of the rails and the rail support system.
  - » Geology: soil and subsurface conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth of bedrock. Experience with ground-borne vibration is that vibration propagation is more efficient in stiff soils. Shallow rock (within a metre or two of the surface) seems to prevent significant vibration. Additional factors such as layering of the soil and depth to the water table, including their seasonal fluctuation, can have significant effects on the propagation of ground-borne vibration.
  - » Receiving building: the vibration levels inside a building depend on the vibration energy that reaches the building foundations, the coupling of the building foundation to the soil, and the propagation of the vibration through the building. The general guideline is that the heavier a building is, the lower the response will be to the incident vibration energy.

3.5.2 Examples of Vibration Mitigation Measures

Full vibration isolation requires a significant amount of specialist design input from both the acoustic consultant

and the structural engineer, and is therefore more suited to larger developments, which exhibit greater economies of scale.

3.5.2.1 Low-rise Buildings

- Vibration isolation of lightweight structures is difficult but possible for below grade floors. Normally, the upper floors are isolated from the foundation wall and any internal column supports using rubber pads designed to deflect 5 to 20mm under load. This concept is illustrated in FIGURE 13. Additionally, the following factors should be taken into consideration when designing vibration isolation for lightweight structures:
  - » Using hollow core concrete or concrete construction for the first floor makes the isolation problem easier to solve.
  - » Thought must be given to temporary wind and earthquake horizontal loads.
  - » A seam is created around the foundation wall that must be water sealed and insulated.
  - » Finishing components such as wood furring cannot be attached either above or below the isolation joint.
  - » All of these special items would likely be carried out by trades untrained in vibration control and therefore, a good deal of site supervision is required.
- Minor vibration control (usually only a 30% reduction) can be achieved by lining the outside of the foundation walls with a resilient layer. This practice takes advantage of the fact that the waves of vibration from surface rail travel mostly on the surface, dying down with depth. To obtain reasonable results, however, the lining must be quite soft and yet be able to withstand the lateral soil pressures present on the foundation wall.

3.5.3.2 Deep Foundation Buildings

- In the case of deep concrete foundations near rail lines, the design of vibration isolation for the surface wave should consider whether or not it is necessary to isolate the base of the building columns and walls. Often, these structures are anchored well below the depth where the surface wave penetrates and there are several levels of parking that the vibration must climb to reach a floor where vibration is of concern. Therefore, unless the rail corridor is running in a tunnel, isolation of deep foundation buildings may only require isolation of the foundation wall away from the structure.
- In severe cases, or locations where the foundation is not deeper than the surface wave, vibration isolation may also be required beneath the columns and their foundations, though it may only be necessary to isolate those portions of the structure located closest to the rail line. Consideration should be given to the differential deflection from one column row to the next, if only part of the building is vibration isolated.
- This is an unusual type of construction, which requires considerable professional supervision. The design is usually a joint effort between the vibration and structural engineers. Some architectural expertise is also needed, particularly for waterproofing the gap at the top of the foundation wall below the grade slab and making sure that there are no inadvertent connections between internal walls on the parking slabs and the vibrating

foundation wall, or between the grade slab and the lowest parking slab if the columns are isolated.

3.6 // SAFETY BARRIERS

Safety barriers reduce the risks associated with railway incidents by intercepting or deflecting derailed cars in order to reduce or eliminate potential loss of life and damage to property, as well as to minimize the lateral spread or width in which the rail cars and their contents can travel. The standard safety barrier is an earthen berm, which is intended to absorb the energy of derailed cars, slowing them down and limiting the distance they travel outside of the railway right-of-way. The berm works by intercepting the movement of a derailed car. As the car travels into the berm, it is pulled down by gravity, causing the car to begin to dig into the earth, and pulling it into the intervening earthen mass, slowing it down, and eventually bringing it to a stop.

3.6.1 Guidelines

3.6.1.1 Berms

- Where full setbacks are provided, safety barriers are constructed as berms, which are simple earthen mounds compacted to 95% modified proctor. Setbacks and berms should typically be provided together in order to afford a maximum level of mitigation. Berms are to be constructed adjoining and parallel to the railway right-of-way with returns at the ends and to the following specifications:
  - » Principle Main Line: 2.5 metres above grade with side slopes not steeper than 2.5 to 1
  - » Secondary Main Line: 2.0 metres above grade with side slopes not steeper than 2.5 to 1

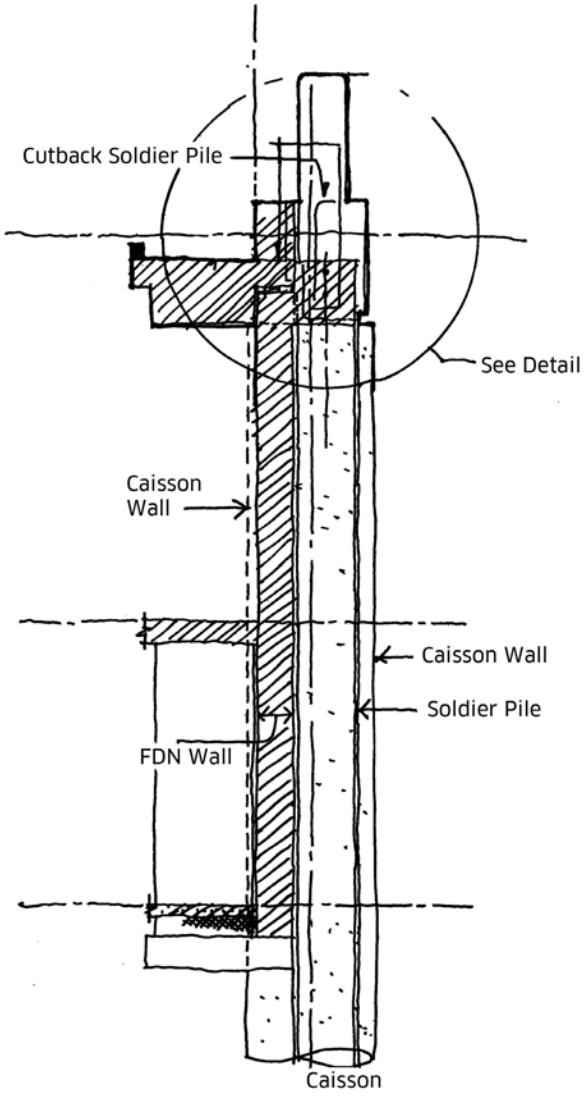


FIGURE 14A // DEEP VIBRATION ISOLATION, COMBINED WITH CRASH WALL.

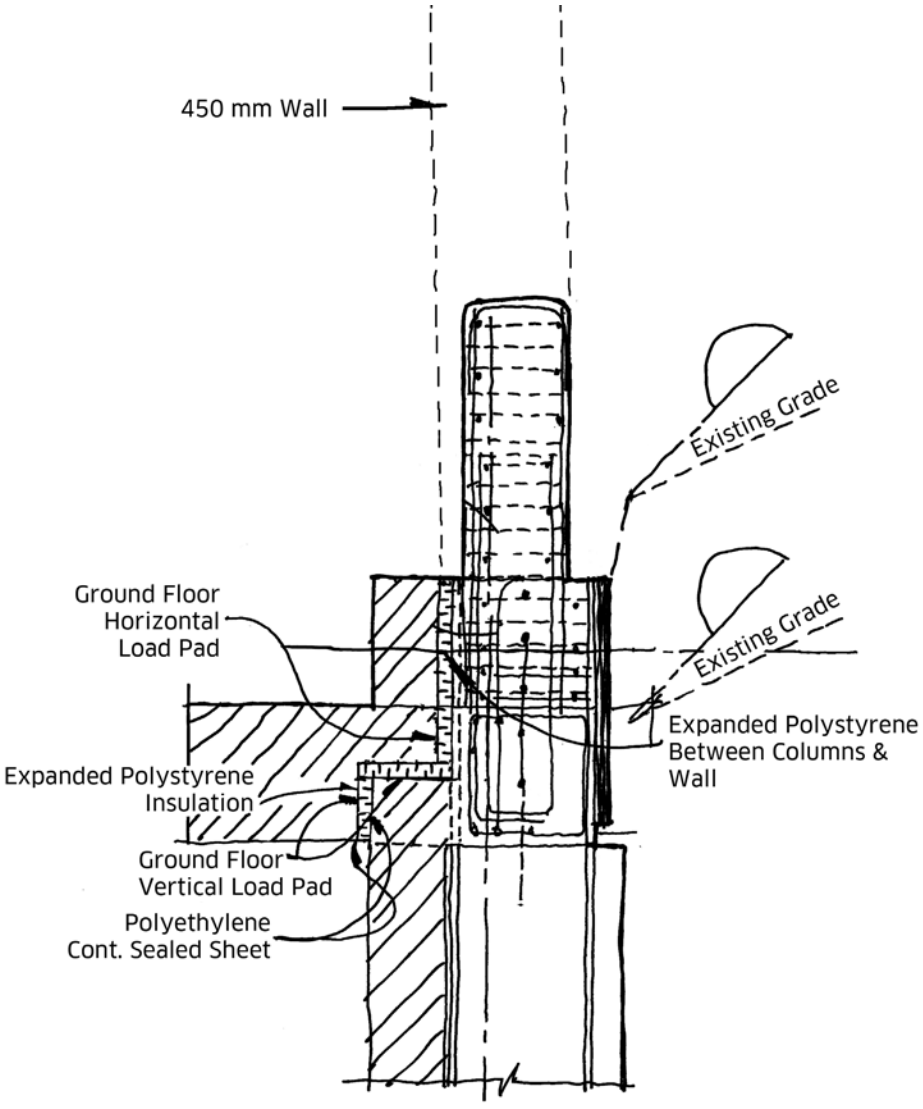


FIGURE 14B // DEEP VIBRATION ISOLATION DETAIL, COMBINED WITH CRASH WALL.

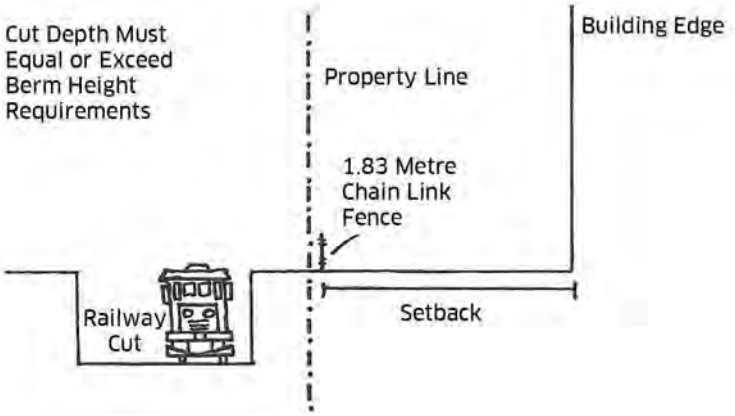


FIGURE 15 // NO BERM IS REQUIRED WHERE THE RAILWAY IS IN A CUT OF EQUIVALENT DEPTH

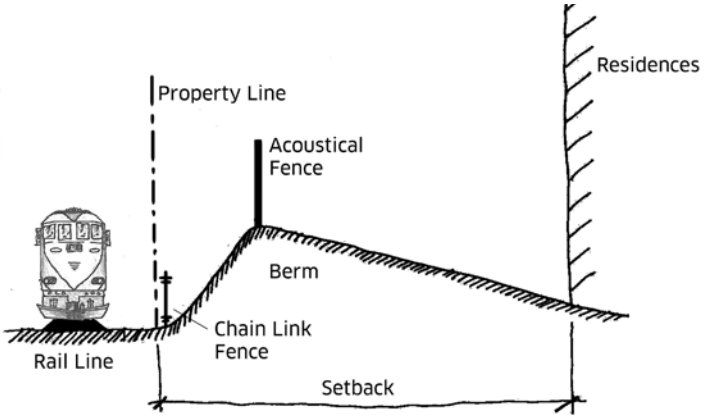


FIGURE 16 // GRADUALLY RETURNING TO GRADE FROM THE TOP OF THE BERM AVOIDS CREATING UNUSABLE BACKYARD SPACE OR BLOCKING SUNLIGHT

- » Principle Branch Line: 2.0 metres above grade with side slopes not steeper than 2.5 to 1
- » Secondary Branch Line: 2.0 metres above grade with side slopes not steeper than 2.5 to 1
- » Spur Line: no requirement

N.B. Berms built to the above specifications will have a full width of as many as 15 metres.

- Berm height is to be measured from grade at the property line. Reduced berm heights are possible where larger setbacks are proposed.
- Steeper slopes may be possible in tight situations, and should be negotiated with the affected railway.
- Where the railway line is in a cut of equivalent depth, no berm is required (FIGURE 15).
- There is no requirement for the proponent to drop back to grade on the side of the berm facing the subject development property. The entire grade of the development could be raised to the required height, or could be sloped more gradually. This may be desirable to avoid creating unusable backyard space, due to the otherwise steep slope of the berm. This concept is illustrated in FIGURE 16.
- Marginal reductions in the recommended setback of up to 5 metres may be achieved through a reciprocal increase in the height of the berm.
- If applicable to the site conditions, in lieu of the recommended berm, a ditch or valley between the railway and the subject new development property that is generally equivalent to or greater than the inverse of the berm could be considered (e.g. a ditch that is 2.5 metres deep and approximately 14 metres wide in the case of a property adjacent to a Principle Main Line). This concept is illustrated in FIGURE 17.
- Where the standard berm and setback are not technically or practically feasible, due for example, to site conditions or constraints, then a Development Viability Assessment should be undertaken by the proponent to evaluate the conditions specific to the site, determine its suitability for development, and suggest alternative safety measures such as crash walls or crash berms. Development Viability Assessments are explained in detail in APPENDIX A.

» **Policy Recommendation**

Urban Design Guidelines may be useful tools for establishing specifications for the proper use and design of berms.

3.6.1.2 Crash Berms

Crash berms are reinforced berms – essentially a hybrid of a regular berm and a crash wall. They are generally preferable to crash walls, because they are more effective at absorbing the impact of a train derailment. This results from both the berm's mass and the nature of the material of which it is composed. Crash berms are also highly cost effective and particularly useful in spatially constrained sites where a full berm cannot be accommodated.

In derailment scenarios other than a head-on or close to head-on interception, the standard earthen berm and setback distance will be more effective in absorbing the kinetic energy of the derailed train than a reinforced concrete crash wall. The reason for this is that anything other than a 90 degree interception of the crash wall will result in some deflection of the energy in the derailing

PHOTO SOURCE: RAILWAY ASSOCIATION OF CANADA

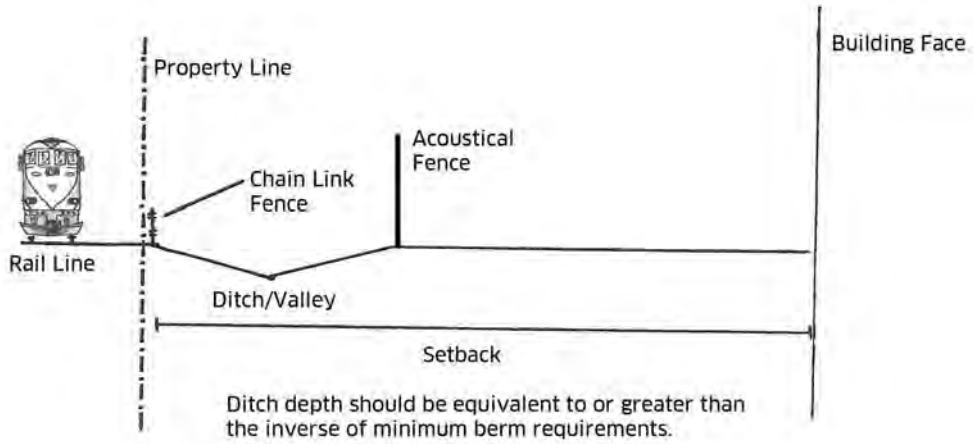


FIGURE 17 // A DITCH OR VALLEY OF EQUIVALENT DEPTH CAN BE USED IN PLACE OF A STANDARD BERM ADJACENT TO A MAIN LINE RAILWAY

train back towards the corridor, thus extending the time and distance of the derailment event. This extension of derailment time and distance results in greater risk of damage to private property along a longer section of the rail corridor, to more lives, and results in more expensive clean up and restoration work within the rail corridor. The preference therefore, is to design "crash berms" which are typically concrete wall structures retaining more earth behind the wall that in-turn provide more energy absorption characteristics (see FIGURE 18).

3.6.1.3 Crash Walls

Crash walls are concrete structures that are designed to provide the equivalent resistance in the case of a train derailment as the standard berm, particularly in terms of its energy absorptive characteristics. The design of crash walls is dependent on variables such as train speed, weight, and the angle of impact, which will vary from case to case. Changes in these variables will affect the amount of energy that a given crash wall will have to absorb, to effectively stop the movement of the train. In addition, the load that a wall is designed to withstand will differ based on the flexibility of the structure, and therefore, on how much deflection that it provides under impact. For these reasons, it is not possible to specify design standards for crash walls. In keeping with existing guidelines developed by AECOM, the appropriate load that a crash wall will have to withstand must be derived from the criteria outlined below.

- When proposing a crash wall as part of a new residential development adjacent to a railway corridor, the proponent must undertake a detailed study that outlines both the site conditions as well as the design specifics of the proposed structure. This study must be submitted to the affected municipality for approval and must contain the following elements:
  - » a location or key plan. This will be used to identify the mileage and subdivision, the classification of the rail line, and the maximum speed for freight and passenger rail traffic;
  - » a Geotechnical Report of the site;
  - » a site plan clearly indicating the property line, the location of the wall structure, and the centreline and elevation of the nearest rail track;
  - » layout and structure details of the proposed crash wall structure, including all material notes and specifications, as well as construction procedures and sequences. All drawings and calculations must be signed and sealed by a professional engineer;
  - » the extent and treatment of any temporary excavations on railway property; and
  - » a crash wall analysis, reflecting the specified track speeds for passenger and/or freight applicable within the corridor, and which includes the following four load cases:
    - i. Freight Train Load Case 1 - Glancing Blow: three locomotives weighing 200 tonnes each plus six cars weighing 143 tonnes each, impacting the wall at 10 degrees to the wall;
    - ii. Freight Train Load Case 2 - Direct Impact: single car weighing 143 tonnes impacting the wall at 90 degrees to the wall;
    - iii. Passenger Train Load Case 3 - Glancing Blow: two locomotives weighing 148 tonnes each plus 6 cars weighing 74 tonnes each impacting the wall at 10 degrees to the wall; and
    - iv. Passenger Train Load Case 4 - Direct Impact: Single car weighing 74 tonnes impacting the

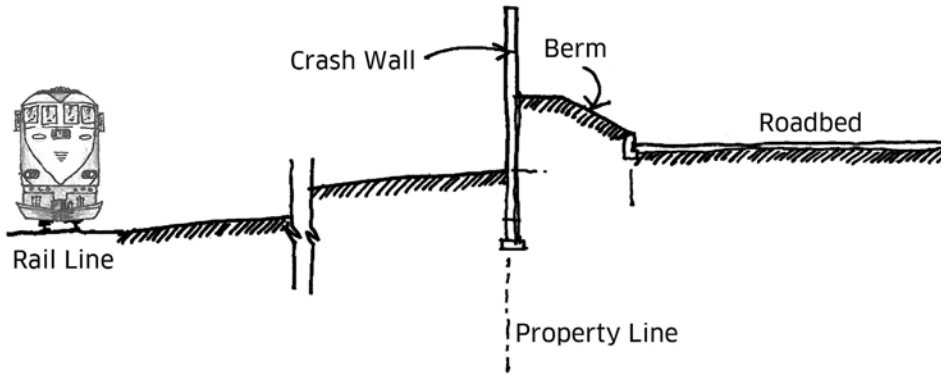


FIGURE 18 // EXAMPLE CONFIGURATION OF A CRASH BERM

wall at 90 degrees to the wall.

- The crash wall design must include horizontal and vertical continuity to distribute the loads from the derailed train.
- To assist in designing the crash wall safety structure, the following should be considered:
    i. The speed of a derailed train or car impacting the wall is equal to the specified track speed;
    ii. The height of the application of the impact force is equal to 0.914 m (3 feet) above ground; and
    iii. The minimum height of the wall facing the tracks is equal to 2.13 m (7 feet) abovethe top of rail elevation.
- For energy dissipation calculations, assume:
    i. Plastic deformation of individual car due to direct impact is equal to 0.3 m (1 foot) maximum;
    ii. Total compression of linkages and equipment of the two or three locomotive and six cars is equal to 3.05 m (10 feet) maximum; and
    iii. Deflection of the wall is to be determined by the designer, which would depend on material, wall dimensions and stiffness of crash wall.

3.7 // SECURITY FENCING

Trespassing onto a railway corridor can have dangerous consequences given the speed and frequency of trains, and their extremely large stopping distances, and every effort should be made to discourage it. This will save lives, reduce emergency whistling, and minimize disruptions to rail service.

3.7.1 GUIDELINES

- At a minimum, all new residential developments in proximity to railway corridors must include a 1.83 metre high chain link fence along the entire mutual property line, to be constructed by the owner entirely on private property. Other materials may also be considered, in consultation with the relevant railway and the municipality. Noise barriers and crash walls are generally acceptable substitutes for standard fencing, although additional standard fencing may be required in any location with direct exposure to the rail corridor in order to ensure there is a continuous barrier to trespassing.

» **Policy Recommendation**

Tresspass issues can be avoided through careful land use planning. Land uses on each side of a railway corridor or yard should be evaluated with a view to minimizing potential trespass problems. For example, schools, commercial uses, parks or plazas should not be located in proximity to railway facilities without the provision of adequate pedestrian crossings.

- Due to common increased trespass problems associated with parks, trails, open space, community centres, and schools located in proximity to the railway right-of-way, increased safety/security measures should be considered, such as precast fencing and fencing perpendicular to the railway property line at the ends of a subject development property.

PHOTO SOURCE: DIALOG

3.8 // STORMWATER MANAGEMENT AND DRAINAGE

Stormwater management and drainage infrastructure associated with a development or railway corridor adjustments should not adversely impact on the function, operation, or maintenance of the corridor, or should not adversely affect area development.

3.8.1 GUIDELINES

- The proponent should consult with the affected railway regarding any proposed development that may have impacts on existing drainage patterns. Railway corridors/properties with their relative flat profile are not typically designed to handle additional flows from neighbouring properties, and so development should not discharge or direct stormwater, roof water, or floodwater onto a railway corridor.
- Any proposed alterations to existing rail corridor drainage patterns must be substantiated by a suitable drainage report, as appropriate.
- Any development-related changes to drainage must be addressed using infrastructure and/or other means located entirely within the confines of the subject development site.
- Stormwater or floodwater flows should be designed to:
  - » maintain the structural integrity of the railway corridor infrastructure;
  - » avoid scour or deposition; and
  - » prevent obstruction of the railway corridor as a result of stormwater or flood debris.
- Drainage systems should be designed so that stormwater is captured on site for reuse or diverted away from the rail corridor to a drainage system, ensuring that existing drainage is not overloaded.
- Building design should ensure that gutters and balcony overflows do not discharge into rail infrastructure. Where drainage into the railway corridor is unavoidable due to site characteristics, discussion should be held early on with the railway. If upgrades are required to the drainage system solely due to nearby development, the costs involved should reasonably be met by the proponent. All disturbed surfaces must be stabilized.
- Similarly, railways should consult with municipalities where facility expansions or changes may impact drainage patterns.

3.9 // WARNING CLAUSES AND OTHER LEGAL AGREEMENTS

Warning clauses are considered an essential component of the stakeholder communication process, and ensure all parties interested in the selling, purchasing, or leasing of residential lands in proximity to railway corridors are aware of any property constraints and the potential implications associated with rail corridor activity.

3.9.1 GUIDELINES

- Municipalities are encouraged to promote the use of appropriate specific rail operations warning clauses, if feasible, in consultation with the appropriate railway, to ensure that those who may acquire an interest in a subject property are notified of the existence and nature of the rail operations, the potential for increased rail activities, the potential for annoyance

or disruptions, and that complaints should not be directed to the railways. Such warning clauses should be registered on title if possible and be inserted into all agreements of purchase and sale or lease for the affected lots/units.

- Municipalities are encouraged to pursue the minimum influence areas outlined in the report when using warning clauses or other notification mechanisms.
- Appropriate legal agreements and restrictive covenants registered on title are also recommended to be used, if feasible, to secure the construction and maintenance of any required mitigation measures, as well as the use of warning clauses and any other notification requirements.
- Where it is not feasible to secure warning clauses, every effort should be made to provide notification to those who may acquire an interest in a subject property. This can be accomplished through other legal agreements, property signage, and/or descriptions on websites associated with the subject property.
- Municipalities should consider the use of environmental easements for operational emissions, registered on title of development properties, to ensure clear notification to those who may acquire an interest in the property. Easements will provide the railway with a legal right to create emissions over a development property and reduce the potential for future land use conflicts.
- Stronger and clearer direction is recommended for real estate sales and marketing representatives, such as mandatory disclosure protocols to those who may acquire an interest in a subject property, with respect to the nature and extent of rail operations in the vicinity and regarding any applicable warning clauses and mitigation measures. The site constraints and mitigation measures being implemented should be communicated through marketing and promotional material, signage, website descriptions, and informed sales staff committed to full disclosure.
- Municipalities are encouraged to require appropriate signage/documentation at development marketing and sales centres that:
  - » identifies the lots or blocks that have been identified by any noise and vibration studies and which may experience noise and vibration impacts;
  - » identifies the type and location of sound barriers and security fencing;
  - » identifies any required warning clause(s); and
  - » contains a statement that railways can operate on a 24 hour a day basis, 7 days a week.

  Additionally, studies undertaken to assess and mitigate noise, vibration, and other emissions should be released to potential purchasers for review in order to enhance their understanding of the site constraints and to help minimize future conflict.
- Where title agreements, restrictive covenants, and/or warning clauses are not currently permitted, appropriate legislative amendments are recommended. This may require coordination at the provincial level to provide appropriate and/or improved direction to stakeholders.
- Warnings and easements provide notice to purchasers, but are not to be used as a complete alternative to the installation of mitigation measures.

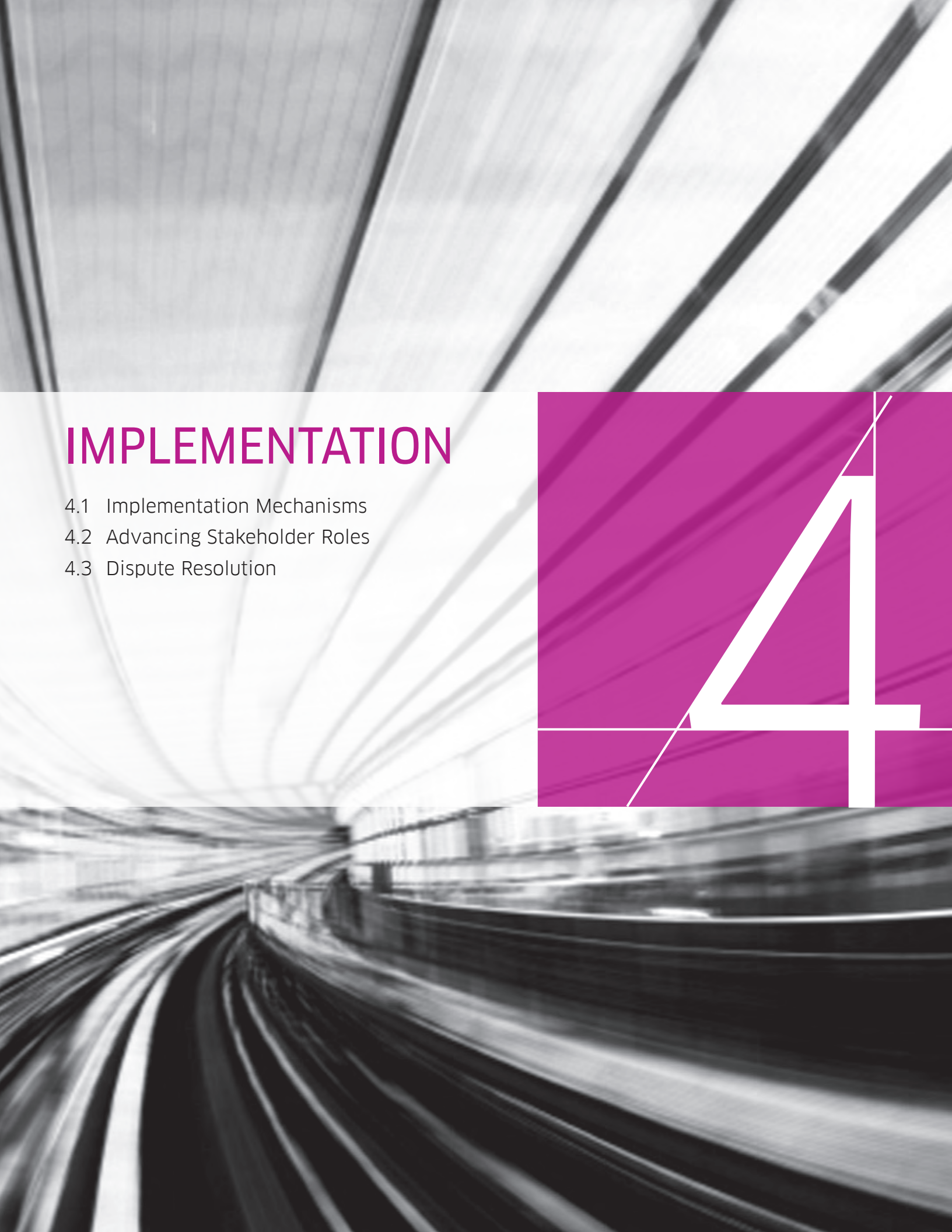
PHOTO SOURCE: DIALOG

3.10 // CONSTRUCTION ISSUES

Planning for construction of new developments in proximity to railway corridors requires unique considerations that should aim to maintain safety while avoiding disruptions to rail service. The efficiency of the operation of railway services should be maintained and no adverse impacts on the corridor or railway operations should occur during the design and construction of a new development located in proximity to a railway corridor.

3.10.1 GUIDELINES

- Prior to the start of construction of a new development, rail corridor-related infrastructure must be identified and plans adjusted as required to ensure that these features are not adversely affected by the proposed construction. Rail corridor-related infrastructure may include, but is not limited to:
  - » trackage;
  - » fibre optic cables;
  - » retaining walls;
  - » bridge abutments; and,
  - » signal bridge footings.
- No entry upon, below, or above the rail corridor shall be permitted without prior consent from the railway.
- Appropriate permits and flagging are required for work immediately adjacent to railway corridors. The proponent is responsible for any related costs.
- Temporary fencing / hoarding is required, as appropriate, to discourage unauthorized access to the rail corridor. Plans illustrating proposed fencing / hoarding locations as well as any other construction related infrastructure, should be submitted to the approval authority and the relevant railway.
- Cranes, concrete pumps, and other equipment capable of moving into or across the airspace above railway corridors may cause safety and other issues if their operation is not strictly managed. This type of equipment must not be used in airspace over the rail corridor without prior approval from the railway.
- Existing services and utilities under a rail corridor must be protected from increased loads during the construction and operation of the development.
- Construction must not obstruct emergency access to the railway corridor.



IMPLEMENTATION

4

4.0 // IMPLEMENTATION

The following implementation recommendations are intended to provide specific guidance to municipal and provincial governments...

...towards ensuring that the guidelines are consistently and effectively adopted in as many jurisdictions as possible. Processes are identified that may be employed to entrench these guidelines in policy.

4.1 // IMPLEMENTATION MECHANISMS

4.1.1 Model Review Process For New Residential Development, Infill & Conversions in Proximity to Railway Corridors

OBJECTIVE:

Establish a clear and effective process that ensures consistent application of these Guidelines across all jurisdictions in Canada when dealing with new residential development, infill, and conversions.

RECOMMENDATION:

The Model Review Process for New Residential Development, Infill and Conversions in Proximity to Railway Corridors is outlined in FIGURE 19. It is meant to ensure clarity with respect to how railways are to be involved in a meaningful way at the outset of a planning process. Ultimately, the goal is to achieve a much greater level of consistency in the way proposals for new residential development in proximity to railway corridors are evaluated and approved across all Canadian provinces and territories.

The proposed process recognizes that there will be many sites that can easily accommodate the standard mitigation recommended by the railways. In instances where this is the case, it is expected that standard mitigation will be proposed. In urban areas land values and availability have placed greater development pressure on smaller sites close to railway corridors. These sites are less likely to be able to accommodate a standard berm and setback. In this case, a Development Viability Assessment report will be required.[1]

This report, which is explained in detail in APPENDIX A, will provide a comprehensive assessment of the site conditions of the property in question, including an evaluation of any potential conflicts with the new development that may result from its proximity to the railway corridor. It will also evaluate any potential impacts on the operation of the railway as a result of the new development, both during the construction phase and afterwards. It will take into consideration details of the proposed development site, including topography, soil conditions, and proximity to the railway corridor; details of the railway corridor, including track geometry or alignment, the existence of junctions, and track speed; details of the proposed development, including the number of potential residents, proposed collision protection in the event of a train derailment; construction details; and an identification of the potential hazards and risks associated with development on that particular site. Municipalities will use the Development Viability Assessment to determine whether development is appropriate given the site conditions and potential risks involved.

An important component of the new process is the requirement for pre-application consultation with the relevant railway. This will be a critical step towards ensuring a smooth and expedited approval process, and will be an important opportunity to have a frank discussion about development options, as well as to resolve any potential conflicts. It will be during these pre-application consultations that a decision will be made regarding the capacity of the site to accommodate standard mitigation. Where a Development Viability Assessment is required, this will also be an important opportunity for the

1 Again, this report does not recommend that all sites are appropriate for residential development. In cases where the standard setback and berm cannot be accommodated, municipalities should carefully consider the viability of the site for conversion to residential, based on criteria such as: existing contextual land use, size of site, appropriateness of high-density development, and the demonstrated effectiveness of alternative mitigation measures, as determined through the Development Viability Assessment.

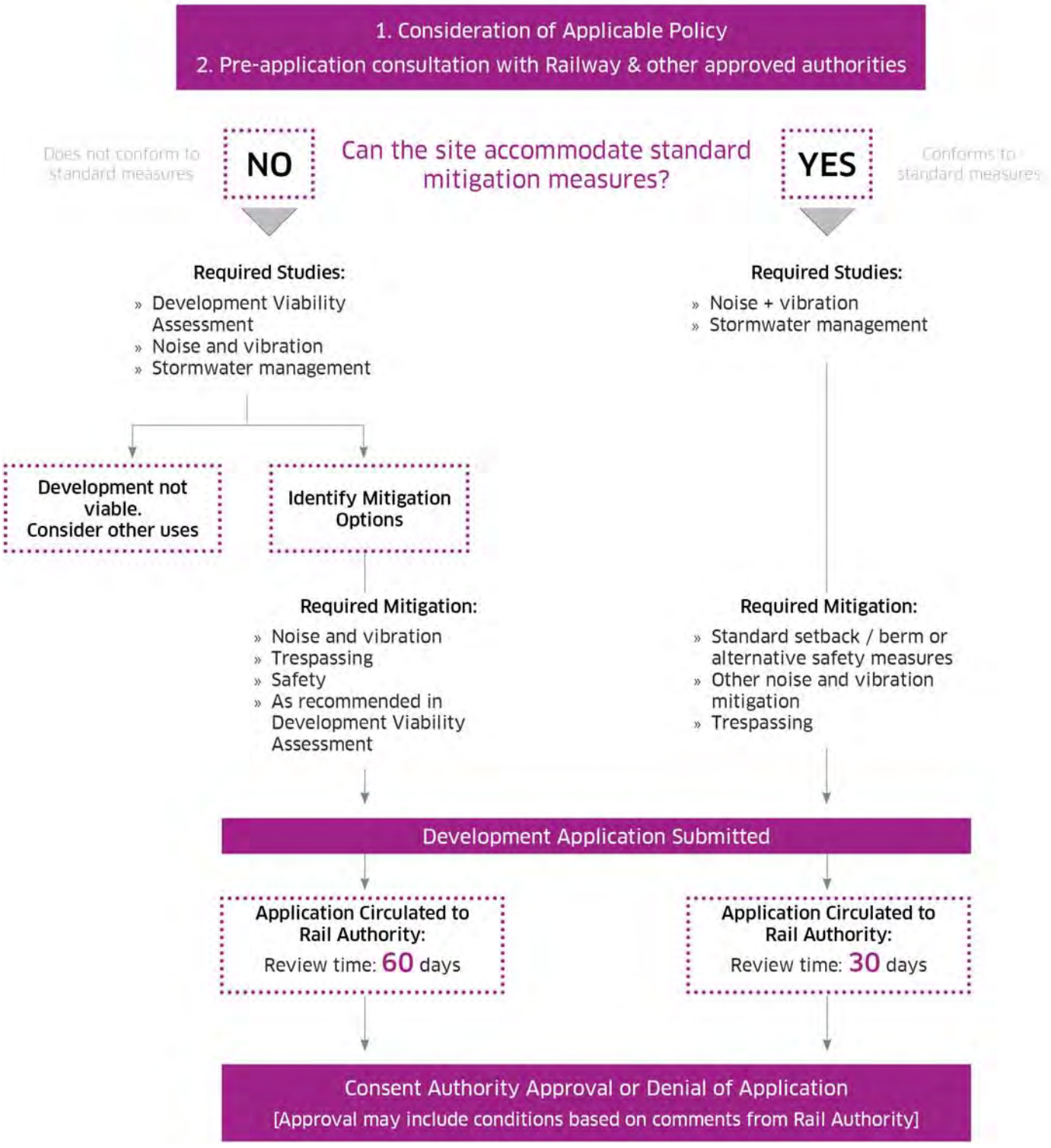


FIGURE 19 // MODEL REVIEW PROCESS FOR NEW RESIDENTIAL DEVELOPMENT, INFILL & CONVERSIONS IN PROXIMITY TO RAILWAY CORRIDORS

applicant to gain a better understanding of the process associated with developing one.

Once a development application has been submitted to the railway for review, it will have 30 days to respond (60 days in cases where a Development Viability Assessment has been required), and indicate any conditions for consideration and negotiation. The final decision as to whether or not to impose those conditions will lie with the approval authority (usually the municipality).

The Model Review Process for New Residential Development, Infill & Conversions in Proximity to Railway Corridors should be adopted by provincial governments, potentially through amendments to existing planning legislation, in order to ensure its consistent application across all municipalities. However, in the absence of provincial interest, the process could be adopted as a bylaw at the municipal level. It is recommended that this process be applicable to any residential development located on land within 300 metres of a railway right-of-way where an official plan amendment, plan of subdivision, or zoning bylaw amendment is required.

4.1.2 Mitigation Infrastructure Maintenance Strategy

OBJECTIVE:

Ensure a consistent and sensible approach to the future maintenance of mitigation infrastructure.

RECOMMENDATION:

Responsbility for the maintenance of berms, chainlink fences, and sound walls should be allocated as follows:

- Landowners should be responsible for maintaining the fence, the sound wall, and that portion of the berm contained within their site.
- In cases where a sound wall is erected, the portion of the berm situated on the side adjoining the railway corridor should be maintained by the railway. However, this should only occur if the property under that part of the berm becomes the property of the railway and has been exempted from all municipal property taxes as a concession to the railways for taking on a maintenance responsibility.

4.2 // ADVANCING STAKEHOLDER ROLES

OBJECTIVE:

To establish clarity regarding the roles and responsibilities of various stakeholders involved in reducing railway proximity issues.

RECOMMENDATIONS:

4.2.1 Federal

- The federal government and the Canadian Transportation Agency are encouraged to use and have regard for this report in proximity dispute investigations with respect to new developments built close to railway operations, and in the development and implementation of any related guidelines, to facilitate a more comprehensive approach that appropriately considers the land use planning framework for new developments along with the rail operations issues.

4.2.2 Provincial

- Provincial Authorities should consider revising their land use planning legislation to incorporate mandatory requirements for early consultations between municipalities, railways, and landowners in advance of

proposed land use or transportation changes, projects, or works within 300 metres of railway operations. The objective of doing so is to facilitate a collaborative approach to site development.

- Provincial Authorities should consider requiring mandatory notice to railways in the case of proposed official plans or official plan amendments, plans of subdivision, zoning by-laws, holding by-laws, interim control by-laws, and/or consent to sever lands, where the subject lands fall within 300 metres of railway operations.
- Provincial Authorities may also wish to empower their municipalities with stronger site plan controls where appropriate, such as:
  - » control of materiality;
  - » site layout and design; and
  - » road widening and land conveyances.
- Provincial Authorities should consider establishing a provincial noise guideline framework that sets impact study requirements (how and when to assess noise sources), and establishes specific sound level criteria for noise sensitive land uses.
- Provincial Authorities should consider amendments to their building codes that support extra mitigation for developments near railway corridors, such as:
  - » vibration isolation & foundation design,
  - » balcony design,
  - » podium design,
  - » drainage,
  - » appropriate fenestration, and
  - » door placement and materiality.
- Provincial Authorities should monitor compliance with relevant regulations and sanction their breach.

4.2.3 Municipal

- Municipalities, land developers, property owners and railways all need to place a higher priority on information sharing and establishing better working relationships both informally and formally through consultation protocols and procedures.
- Municipalities should ensure that planning staff are aware of and familiar with any applicable policies for development in proximity to railway operations (e.g. railway policies and/or guidelines).
- Municipalities are encouraged to provide clear direction and strong regulatory frameworks (e.g. through District Plans, Official Plans, Official Community Plans, Zoning By-laws, etc) to ensure that land development respects and protects rail infrastructure and will not lead to future conflicts. This may include:
  - » Undertaking a comprehensive evaluation of land uses in proximity to railway operations, with a view to minimizing potential conflicts due to proximity, including those related to safety, vibration, and noise. For example, residential development may not be appropriate in low-density areas where lot sizes preclude the possibility of incorporating standard mitigation measures. Additionally, schools or commercial uses located across a railway corridor from residential uses are likely to result in trespassing issues if there are no public crossings in the immediate vicinity;

» Establishing a clear process for evaluating the viability of development proposals on sites that cannot accommodate standard mitigation measures, with a view to determining the appropriateness of the development, and identifying appropriate alternate mitigation measures. See Section 4.1.1 for recommendations on a Development Viability Assessment;

» Establishing implementation mechanisms for mitigation measures, including long-term maintenance requirements if applicable (e.g. legal agreements registered on title). See Section 4.1.2 for recommendations on a Mitigation Infrastructure Maintenance Strategy;

» Undertaking a comprehensive review of site access and railway crossings with a view to ensuring adequate site access setbacks from at-grade crossings (to prevent vehicular blockage of crossings), protecting at-grade road/rail crossing sightlines, implementing crossing improvements, and discouraging new at-grade road crossings;

» Entrenching in policy the protection of railway corridors and yards for the movement of freight and people, including allowing for future expansion capacity, if applicable;

» Planning and protecting for future infrastructure improvements (e.g. grade separations and rail corridor widenings); and

» Respecting safe transportation principles. For example, the assessment of new, at-grade rail crossings should consider safe community planning principles and whether other alternatives are possible, not just simply whether a crossing is technically feasible.

- Municipalities are encouraged to use their planning policy and regulatory instruments (e.g. District Plans, Official Plans, Official Community Plans, Secondary Plans, Transportation Plans, Zoning By-laws/Ordinances, etc.) to secure appropriate railway consultation protocols as well as mitigation procedures and measures.
- As soon as planning is initiated or proposals are known by municipalities, notification and consultation should be initiated for:
  - » Development or redevelopment proposals within 300 metres of rail operations, or for proposals for rail-serviced industrial parks; and
  - » Infrastructure works, which may affect a rail facility, such as roads, utilities, etc.
- Municipal Authorities should consider amendments to their municipal regulatory documents (e.g. Official Plan, Official Community Plan, etc.) as required to implement mandatory noise and vibration studies for developments near railway operations, and to establish specific sound and vibration level criteria for sensitive land uses.
- Municipal Authorities should consider zoning by-law amendments as required to implement aspects of these guidelines, including securing appropriate mitigation measures.

  N.B. A note of caution is required for any systematic zoning by-law amendment. Blanket zoning by-law amendments should only be used to implement portions of this study in areas municipalities have already identified for redevelopment. This should

be applied comprehensively and with study as to their affect. For example, it makes little sense to employ a 30 metre setback in areas that do not have lot depths which can support them. In many cases, it may be more desirable for municipalities to secure mitigation measures in a site-specific manner, through the use of the Development Viability Assessment Tool. However, in employing such an approach, Municipal Planners should be mindful to secure appropriate mitigation measures in a site-specific by-law.

- Municipalities should consider and respect the plans, requirements, and operating realities of railways and work cooperatively with them to increase awareness regarding the railway legislative, regulatory, and operating environment, and to implement consultation planning protocols and procedures for land development proposals and applications.
- Municipalities should work with railways and other levels of government to increase coordination for development approvals that also require rail regulatory approvals (e.g. new road crossings) to ensure that the respective approvals are not dealt with in isolation and/or prematurely.
- Municipalities should be aware of and implement, where feasible, Transport Canada's safety recommendations with respect to sightlines for at-grade crossings. The recommendations include a minimum 30 metre distance between the railway right-of-way and any vehicular ingress/egress. In addition, trees, utility poles, mitigation measures, etc. are not to block sightlines or views of the crossing warning signs or systems.
- Municipal Authorities should consider developing Urban Design Guidelines for infill development near railway corridors. This document already contains a number of suggestions on what such a document could include and how it could be usefully employed.

4.2.4 Railway

- Municipalities, land developers, property owners and railways all need to place a higher priority on information sharing and establishing better working relationships both informally and formally through consultation protocols and procedures.
- As soon as planning is initiated or proposals are known by railways, communication should be initiated to discuss:
  - » transportation plans that incorporate freight transportation issues; and
  - » all new, expanded, or modified rail facilities.
- Railways are encouraged to be proactive in identifying, planning, and protecting for the optimized use of railway corridors and yards.
- Railways are encouraged to develop and/or modify company procedures and practices with respect to increased consultation and formal proximity issues management protocols with the following guidance:
  - » Undertake consultation for projects prior to seeking CTA approval;
  - » When new facilities are built or significant expansions are undertaken, implement on-going community advisory panel discussions with regular meetings. Such panels typically include representation from the railway, the municipality, the community, other levels of government, if applicable, and possibly industry; and,

  - » Railway initiation of long-term business and infrastructure planning exercises, in consultation with municipalities, can facilitate stronger and more effective relationships and partnerships.
- Railways are encouraged to work with municipalities, landowners, and other stakeholders in evaluating and implementing appropriate mitigation measures, where feasible, with respect to new rail facilities located in proximity to existing sensitive development.
- Railways should work cooperatively with municipalities to increase awareness regarding the railway legislative, regulatory, and operating environment.
- Railways should utilize opportunities to get involved in land-use planning processes and matters. Municipal planning instruments can be effective tools in implementing, or at least facilitating the implementation, of long-term rail transportation planning objectives.
- Railways are encouraged to work with industry associations and all levels of government to establish standardized agreements and procedures with respect to all types of crossings.
- Railways are encouraged to pursue implementation of the RAC Railroad Emission Guidelines (See **AE.1.1** for more information).
- Railways are encouraged to integrate transportation planning involving provincial, municipal, Port Authorities, and multiple railways, which is critical to balancing rail capacity upgrades, minimizing community impacts, and ensuring that economic benefits occur.

4.2.5 Land Developer/Property Owner

- Ideally, prospective land developers should consult with the appropriate railway prior to finalizing any agreement to purchase a property in proximity to railway operations. Otherwise, property owners should consult with municipalities and railways as early as possible on development applications and proposals to ensure compliance with policies, guidelines, and regulations, and in order to fulfill obligations of development approvals.
- Enter into agreements with municipalities and/or railways as required to ensure proximity issues are addressed now and into the future and comply with those requirements.
- Property owners should be informed, understand, acknowledge, and respect any mitigation maintenance obligations and/or warning clauses.

4.2.6 Real Estate Sales/Marketing and Transfer Agents

- Real estate sales people and property transfer agents should ensure that potential purchasers are made fully aware of the existence and nature of rail operations and are aware of and understand the mitigation measures to be implemented and maintained.

4.2.7 Academia and Specialized Training Programs

- These institutions should ensure that curriculums incorporate the latest research available to provide future land use planners, land developers, and railway engineers with better and more comprehensive tools and practices to anticipate and prevent proximity conflicts.

4.2.8 Industry Associations

- FCM, having undertaken to produce these guidelines, should continue to act as their steward. As such, a comprehensive strategy should be established to disseminate them to provincial and municipal planners and regulatory bodies, railways, developers, and other property owners. A component of this strategy may include integration at professional events and conferences. A key objective will be to promote their integration into regulatory policy frameworks.
- Other industry associations should ensure their membership is informed and involved in the latest research and proactively engaged in raising awareness and educating their members through seminars and other training programs.

4.3 // DISPUTE RESOLUTION

4.3.1 Background

In the vast majority of cases in Canada, railway company tracks and their stakeholder neighbours coexist seamlessly. However, disputes between railways and stakeholders can occasionally occur. These disputes provide insight into the issues that some stakeholders have experienced with noise, vibration, accidents, historical land use conflicts, and a variety of site-specific conditions that can result from railway operations. These disputes are often expressed through letters of complaint directed to railway, municipal and federal government officials, appeals to the Ontario Municipal Board, court cases, as well as complaints before the Canadian Transportation Agency (Agency).

4.3.2 Local Dispute Resolution Framework

In most disputes, complainants and railways can independently resolve matters by negotiating agreements amongst themselves. Stakeholders are encouraged to have regard for and utilize, where applicable, the Local Dispute Resolution Framework established by the RAC/FCM Dispute Resolution Subcommittee. This dispute resolution process should be considered prior to involving the Agency.

A. The following guiding principles should be considered through the local dispute resolution process:

1. Identify issues of concern to each party.
2. Ensure representatives within the dispute resolution process have negotiating authority. Decision making authority should also be declared.
3. Establish in-person dialogue and share all relevant information among parties.

B. Dispute Resolution Escalation Process

Municipal and railway representatives should attempt resolution in an escalating manner as prescribed below, recognizing that each of these steps would be time consuming for all parties.

1. Resolve locally between two parties using the Generic Local Dispute Resolution Process.
2. Proceed to third-party mediation/facilitation support if resolution not achieved.
3. Proceed to other available legal steps.

C. Generic Local Dispute Escalation Process

1. Face-to-face meeting to determine specific process steps to be used in resolution attempt. A Community Advisory Panel formation should be considered at this point.
2. Determination of which functions and individuals will represent the respective parties. Generally this would include the municipality, the railway, and other appropriate stakeholders.
3. Issue identification:

a) Raised through community to railway. This type of issues could be the result of an unresolved outstanding proximity issue, operational modifications, or changes in rail customer operation (misdirected to railway).

b) Planned railway development that may impact community in the future.

c) Raised through the railway to community. This type of issue could be the result of a municipal government action (rezoning, etc.).

4. Exploration of the elements of the issue. Ensure each party is made aware of the other's view of the issue – a listing of the various aspects/impacts related to the issue.
5. Consult any existing relevant proximity guidelines or related best practices (e.g. this report).
6. Face-to-face meetings between parties representing the issue to initiate dialogue for dispute resolution process. Education, advocacy of respective positions.
7. Attempt compromise/jointly agreed solution. (If not proceed to step B2 above).
8. For Jointly agreed solutions; determine necessary internal, external communication requirements and or requisite public involvement strategies for implementation of compromise.

4.3.3 The Canadian Transportation Agency's Mandate on Noise & Vibration

4.3.3.1 Agency Mandate Under the Canadian Transportation Act CTA)

The Agency is a quasi-judicial administrative tribunal of the federal government that can assist individuals, municipalities, railways, and other parties in resolving disputes.

The amendments to the Act now authorize the Agency to resolve complaints regarding *noise and vibration* caused by the construction and operation of railways under its jurisdiction.

Section 95.1 of the CTA states that a railway shall cause only such noise and vibration as is reasonable, taking into account:

- its obligations under sections 113 and 114 of the CTA, if applicable;
- its operational requirements; and
- the area where the construction or operation is taking place.

If the Agency determines that the noise or vibration is not reasonable, it may order a railway to undertake any change in its railway construction or operation that the Agency considers reasonable to comply with the noise and vibration provisions set out in section 95.1 of the

CTA. Agency decisions are legally binding on the parties involved, subject to the appeal rights.

The amendments to the CTA also grant power to the Agency to mediate or arbitrate certain railway disputes with the agreement of all parties involved, and in some cases in matters that fall outside of the Agency's jurisdiction.

The Agency has developed *Guidelines for the Resolution of Complaints Concerning Railway Noise and Vibration* (Guidelines) They explain the process to be followed and include a complaint form, and can be found through the following link: www.otc-cta.gc.ca/eng/rail-noise-and-vibration-complaints.

4.3.4 Collaborative Resolution of Complaints

The CTA specifies that before the Agency can investigate a complaint regarding railway noise or vibrations, it must be satisfied that the collaborative measures set out in the Guidelines have been exhausted.

Collaboration allows both complainants and railways to have a say in resolving an issue. A solution in which both parties have had input is more likely to constitute a long-term solution and is one that can often be implemented more effectively and efficiently than a decision rendered through an adjudicative process.

Under the Agency's Guidelines, collaborative measures are expected to be completed within 60 days of the railway receiving a written complaint - unless the parties agree to extend the process (The railway must respond to a written complaint within 30 days, and agree on a date within the following 30 days to meet and discuss the resolution of the complaint). To satisfy the collaborative measures requirements of the CTA, the following measures must be undertaken:

- Direct communication shall be established among the parties.
- A meaningful dialogue shall take place.
- Proposed solutions shall be constructive and feasible.
- Facilitation and mediation shall be considered.

Mediation is a collaborative approach to solving disputes in which a neutral third party helps to keep the discussion focused and assists the parties in finding a mutually beneficial solution. The parties jointly make decisions to resolve the disputed issues and ultimately determine the outcome. The mediation process is described below.

4.3.4.1 Mediation

Mediation has successfully resolved disputes with major rail and air carriers, airport authorities, and private citizens. It provides an opportunity for the parties involved to understand each other's perspective, identify facts, check assumptions, recognize common ground, and test possible solutions.

Mediation is an informal alternative to the Agency's formal decision-making process. It can be faster and less expensive, with the opportunity to reach an agreement that benefits both sides. Mediation tends to work well in disputes involving several major transportation service providers. In fact, a number of carriers have mentioned in recent years that they consider mediation their first alternative for dispute resolution.

To initiate a mediation process, contact the Agency and it will contact the other parties to determine if they are willing to participate. If all parties agree to join the process, an Agency-appointed mediator will manage the process. Discussions will take place in an informal setting. Collectively, all of the conflicting issues are addressed in

an attempt to negotiate a settlement.

Mediation must take place within a 30-day statutory deadline, which is much shorter than the 120-day deadline established in the CTA for the Agency's formal dispute-resolution process. The deadline can be extended if all parties agree. A settlement Agreement that is reached as a result of mediation may be filed with the Agency and, after filing, is enforceable as if it were an Order of the Agency. A complete description of the mediation process can be found on the Agency's web site.

All mediation discussions remain confidential, unless both parties agree otherwise. If the dispute is not settled and requires formal adjudication, confidentiality will be maintained and the mediator will be excluded from the formal process.

4.3.4.3 Filing a Complaint with the Agency

The Agency will only conduct an investigation or hear a complaint once it is satisfied that the parties have tried and exhausted the collaborative measures set out above. Should one of the parties fail to collaborate, the Agency may accept the filing of a complaint before the expiry of the above-noted 60 day collaborative period.

In cases where the parties are not able to resolve the issues between themselves or by way of facilitation or mediation, a complaint may be filed with the Agency requesting a determination under the formal adjudication process. The complaint must include evidence that the parties have tried and exhausted, or that one of the parties has failed to participate in, the collaborative measures set out above.

Formal complaints may be filed by individuals, institutions, local groups, or municipalities. When the Agency reviews a complaint, it will ensure that the municipal government is informed of the complaint and will seek its comments.

To avoid reviewing numerous complaints for the same concern(s), the Agency encourages complainants to consult others potentially affected before filing a complaint. This may save time and effort for all parties.

For such group complaints, parties should confirm the list of complainant(s) and who is represented under the group; provide contact information and evidence of authorization to represent; provide a list of the members of the association and their contact information, where there is an organization/association; provide, in the case of an organization/association, the incorporation documents and the a description of the organization/association and its members' interest in the complaint.

The *Guidelines for the Resolution of Complaints Concerning Railway Noise and Vibration* are primarily meant to address noise and vibration disputes with regard to existing railway infrastructure or facilities. For railway construction projects that require Agency approval under subsection 98(1) of the CTA, railways must evaluate various issues, including noise and vibration.

4.3.4.4 Formal Process

In accordance with its General Rules, after receiving a complaint, the Agency ensures that each interested party has the opportunity to comment on the complaint and any disputed issues. In general, the Agency invites the other interested parties to file their answer within 30 days, and then allows the complainant 10 days to reply.

Both complainants and railways are responsible for presenting evidence to support their position before the Agency. The Agency may pose its own questions, request further information, and conduct a site visit

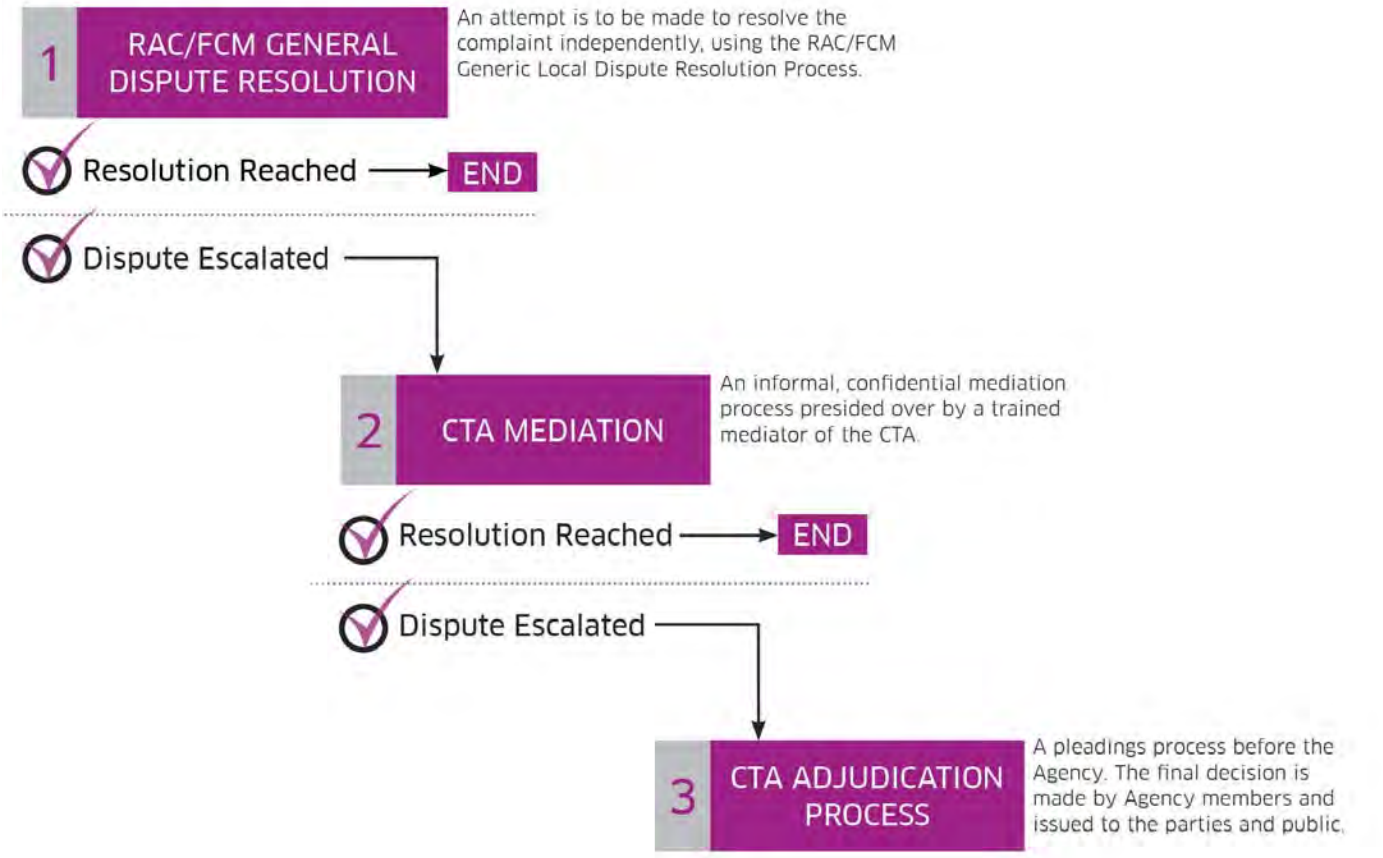


FIGURE 20 // DISPUTE RESOLUTION PROCESS

investigation where necessary.

As an impartial body, the Agency cannot prepare or document a complaint nor can it provide funding to any party for the preparation of a complaint, answer, or reply. The Agency reviews all evidence that it has obtained through its investigation to develop a comprehensive understanding of the circumstances of each case, before rendering its decision or determination.

The Agency strives to process complaints within 120 days of receiving a complete application. However, given the complexities or the number of parties involved in some noise or vibration complaints, this goal may not always be met. In such cases, the Agency will act as expeditiously as possible. Parties are encouraged to continue to work together to seek a resolution even though a complaint may be before the Agency.

When the Agency has reached a decision, the Agency provides it to all parties of the case and posts it on its public web site.

4.3.4.5 More Information

Canadian Transportation Agency
Ottawa, Ontario K1A 0N9
Telephone: 1-888-222-2592
TTY: 1-800-669-5575
Facsimile: 819-997-6727
E-mail: info@otc-cta.gc.ca
Web site: www.cta.gc.ca

For more information on the CTA, the Agency and its responsibilities, or Agency Decisions, and Orders, you can access the Agency's web site at www.cta.gc.ca.

Web site addresses and information on the Agency are subject to change without notice and were accurate at the time of publication. For the most up-to-date information, visit the Agency's web site.

PHOTO SOURCE: RAILWAY ASSOCIATION OF CANADA

5

CONCLUSION

5.0 // CONCLUSION

As the shift continues towards curbing urban sprawl and intensifying existing built-up areas, lands close to railway corridors will continue to become more desirable for development.

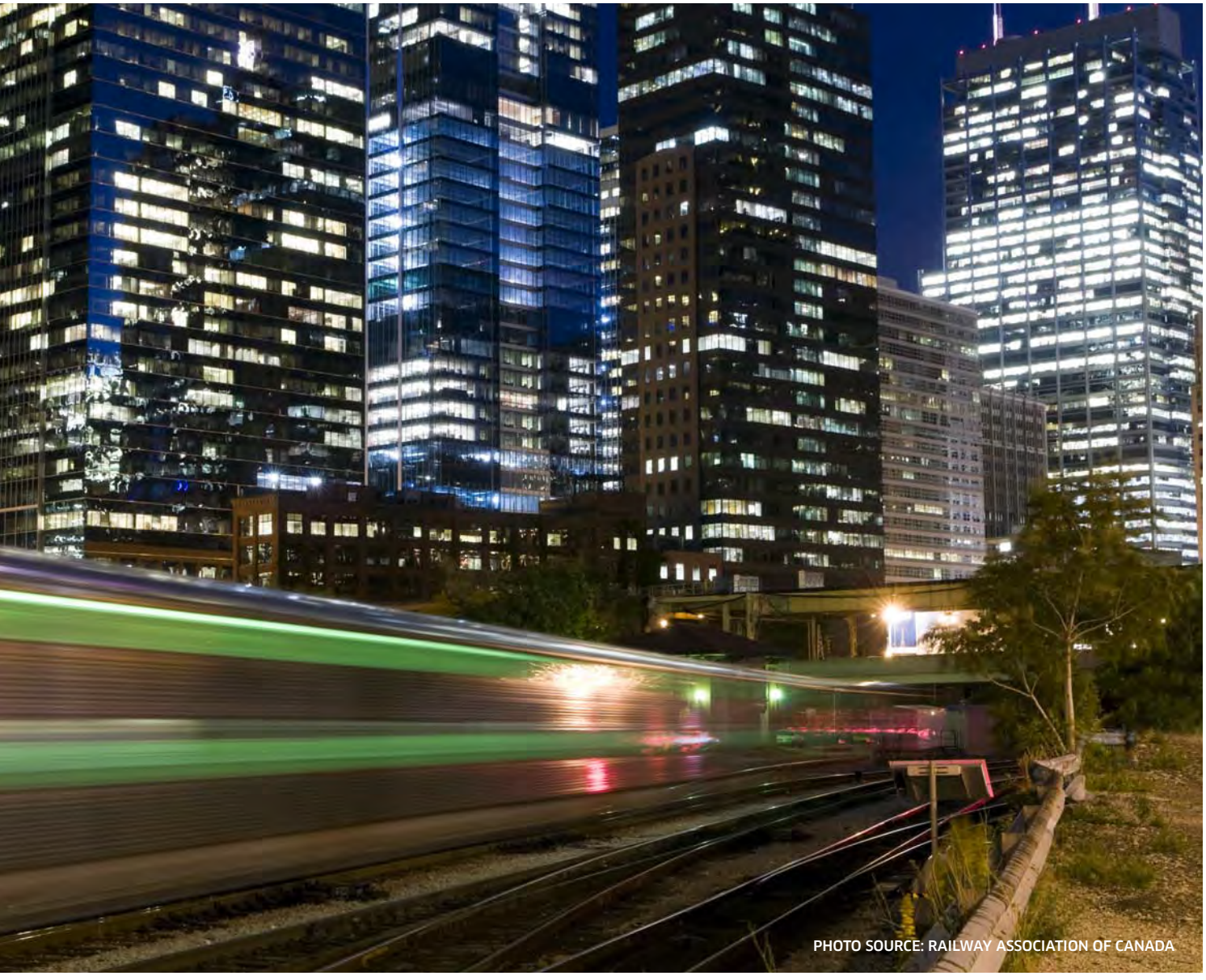


PHOTO SOURCE: RAILWAY ASSOCIATION OF CANADA

The proximity guidelines provided here are intended to help anticipate potential conflicts, improve awareness of development issues around railway operations, and clarify the requirements for new development in proximity to railway operations and activities. They provide strategies that will help to reduce misunderstanding and avoid unecessary conflicts arising between railway operations and nearby new development. The guidelines further provide recommendations to promote a higher level of consistency nationwide with respect to new development approval processes as well as the design of new development projects in proximity to railway operations and their respective mitigation measures.

Topics covered include:

- Common issues and constraints;
- A series of guidelines addressing mitigation design, consultation, setbacks, noise, vibration, safety barriers, security fencing, stormwater management and drainage, warning clauses and other legal agreements, and construction issues;
- Understanding of stakeholder roles; and
- Implementation.

Additionally, the report appendices contain the following:

- A Development Viability Assessment;
- A sample rail classification system;
- Noise and vibration procedures and criteria;
- Recommendations for the evaluation of new rail facilities or significant expansions to existing rail facilities in proximity to residential or other sensitive land uses; and
- A series of national and international best practices.

Careful consideration has been given to provide a balanced approach to new development in proximity to railway corridors that provides a thoughtful response to site-specific constraints, safety, and land-use compatibility. Ultimately it is in the interest of the public and all other parties involved to ensure that when new development is deemed to be appropriate near a railway corridor, the mitigation measures outlined in this report are taken to ensure they are both compatible and safe.

The various stakeholders identified are encouraged to review and establish or update, as necessary, their respective planning instruments and company practices/ procedures. Opportunities should be explored to inject these guidelines into relevant curriculum at education institutions teaching land use planning, civil engineering, and railway engineering, as well as disseminating this information through relevant professional associations.

APPENDICES

APPENDIX A // DEVELOPMENT VIABILITY ASSESSMENT

APPENDIX
GUIDELINES FOR NEW DEVELOPMENT IN PROXIMITY TO RAILWAY OPERATIONS

AA.1 // INTRODUCTION

Development of residential structures in proximity to railway corridors can pose many challenges, particularly in terms of successfully mitigating the various vibration, noise, and safety impacts associated with railway operations. The standard mitigation measures, illustrated below, have been designed to provide proponents with the simplest and most effective solution for dealing with these common issues.

However, in some cases, particularly in already built-up areas of the country's largest cities, development proposals will be put forward for smaller or constrained sites that are not able to accommodate these measures, particularly the full setback and berm. In cases where municipalities have already determined that residential is the best use for these sites, such proposals will be subject to a Development Viability Assessment, the intent of which is to evaluate any potential conflicts that may result from the proximity of the development to the neighbouring rail corridor, as well as any potential impacts on the operation of the railway as a result of the new development, both during the construction phase and afterwards. The proposed development will not be permitted to proceed unless the impacts on both the railway and the development itself are appropriately managed and mitigated. It must be noted that the intention of the Development Viability Assessment tool is not to justify the absence of mitigation in any given development proposal. Rather, it is to allow for an assessment based on the specific and inherent characteristics of a site, and therefore, the identification of appropriate mitigation measures.

As such, the Development Viability Assessment is a tool to assist developers who cannot accommodate standard mitigation measures in assessing the viability of their site for development and in designing the appropriate mitigation to effectively address the potential impacts associated with building near railway operations. The development viability assessment exercise, which should be carried out by a qualified planner or engineer in close consultation with the affected railway, must:

i. identify all potential hazards to the operational railway, its staff, customers, and the future residents of the development;

ii. take into account the operational requirements of the railway facilities and the whole life cycle of the development;

iii. identify design and construction issues that may impact on the feasibility of the new development;

iv. identify the potential risks and necessary safety controls and design measures required to reduce the risks to the safety and operational integrity of the railway corridor and avoid long-term disruptions to railway operations that would arise from a defect or failure of structure elements; and

v. identify how an incident could be managed if it were to occur.

It is strongly recommended that proponents consult with the affected railway when preparing a Development Viability Assessment to ensure that all relevant matters are addressed.

This document establishes the minimum generic requirements that must be addressed as part of a Development Viability Assessment accompanying a development application for land in proximity to railway operations. Proponents should note that there

may be additional topics that will need to be addressed in a Development Viability Assessment, depending on the unique nature of the subject site and proposed development. These additional topics should be determined in consultation with the affected railway and local municipality.

Municipalities should use the results of the Development Viability Assessment to determine whether proposed mitigation measures are appropriate.

The following sections outline basic content requirements for a standard Development Viability Assessment.

AA.2 // SITE DETAILS

The Assessment must include a detailed understanding of the conditions of the subject site in order to generate a strong understanding of the context through which conflicts may arise. At a minimum, the factors to be considered are:

i. site condition (cutting, embankments, etc.);

ii. soil type, geology;

iii. topography;

iv. prevailing drainage patterns over the site; and

v. proximity to the railway corridor and other railway infrastructure/utilities.

AA.3 // RAILWAY DETAILS

It is imperative that details of the railway corridor (or other facility) itself also be evaluated in order to properly determine the potential conflicts associated with a new development in close proximity to railway activities. At a minimum, the factors to be considered are:

i. track geometry and alignment (i.e. is the track straight or curved?);

ii. the existence of switches or junctions;

iii. track speed, including any potential or anticipated changes to the track speed;

iv. derailment history of the site and of other sites similar in nature;

v. current and future estimated usage and growth in patronage (10-year horizon);

vi. details of any future/planned corridor upgrades/works, or any protection of the corridor for future expansion, where no plans are in existence; and

vii. topography of the track (i.e. is it in a cut, on an embankment, or at grade?).

AA.4 // DEVELOPMENT DETAILS

Details of the development itself, including its design and operational components, are important in understanding whether the building has been designed to withstand potential conflicts as a result of the railway corridor, as well as ensuring that the new development will not pose any adverse impacts upon the railway operations and infrastructure. At a minimum, the following information must be provided:

i. proximity of the proposed development to the railway corridor or other railway infrastructure;

ii. clearances and setbacks of the proposed development to the railway corridor; and

iii. any collision protection features proposed for the new development, to protect it in the case of a train derailment.

AA.5 // CONSTRUCTION DETAILS

While it is understood that construction details will not be finalized at the development application stage, there are a number of impacts associated with construction on a site in proximity to a railway corridor that need to be considered prior to development approval. These construction impacts need to be considered as part of the Development Viability Assessment. This portion of the assessment is intended to ensure that the railway corridor, infrastructure, staff, and users can be adequately protected from activities associated with the construction of the development. At a minimum, the following information must be provided:

i. corridor encroachment - provide details with regard to:
    a. whether access to the railway corridor will be required;
    b. whether any materials will be lifted over the railway corridor;
    c. whether any temporary vehicle-crossing or access points are required; and
    d. whether there will be any disruption to services or other railway operations as a result of construction;

Generally, encroachment within a railway corridor for construction purposes is not permitted and alternative construction options will need to be identified.

i. provide details of how the security of the railway corridor will be maintained during construction, (i.e. by providing details about the type and height of security fencing to be used);
ii. provide details of any planned demolition, excavation and retaining works within 30 metres of the railway corridor and specify the type and quantity of works to be undertaken;
iii. services and utilities - provide details of:
    a. whether any services or utilities will be required to cross the railway corridor; and
    b. whether any existing railway services/ utilities will be interfered with; and
iv. stormwater, drainage, sediment, and erosion control - provide details of how any temporary stormwater and drainage will operate during construction, and how sediment and erosion control will be managed.

AA.6 // IDENTIFY HAZARDS AND RISKS

Once details unique to the site, railway corridor, development design, and construction have been determined, the individual risks must be identified and evaluated with individual mitigation measures planned for each. Such risks may include injury or loss of life and damage to public and private infrastructure. At a minimum, consideration must be given to:

i. the safety of people occupying the development and the potential for the loss of life in the event of a train derailment;
ii. potential structural damage to the proposed development resulting from a collision by a derailed train; and
iii. the ability of trespassers to enter into the railway corridor.

APPENDIX B // SAMPLE RAIL CLASSIFICATION SYSTEM

The following table is a general sample classification of rail line types. Proponents are advised to consult with the relevant railway to obtain information on the classification, traffic volume, and traffic speed, of the railway lines in proximity to any proposed development. Contact information for railways is available from the Proximity Project's website (see **APPENDIX G**).

SAMPLE RAIL CLASSIFICATION SYSTEM* (*TO BE CONFIRMED BY RELEVANT RAILWAY)

Main Line *(typically separated into "Principal" and "Secondary" Main Line)*	• Volume generally exceeds 5 trains per day • High speeds, frequently exceeding 80 km/h • Crossings, gradients, etc. may increase normal railway noise and vibration
Branch Line	• Volume generally has less than 5 trains per day • Slower speeds usually limited to 50 km/h • Trains of light to moderate weight
Spur Line	• Unscheduled traffic on demand basis only • Slower speeds limited to 24 km/h • Short trains of light weight

APPENDIX C //
NOISE & VIBRATION PROCEDURES & CRITERIA

AC.1 // NOISE

The rail noise issue is site-specific in nature, as the level and impact of noise varies depending on the frequency and speed of the trains, but more importantly, the impact of noise varies depending on the distance of the receptor to the railway operations. The distance from rail operations where impacts may be experienced can vary considerably depending on the type of rail facility and other factors such as topography and intervening structures.

AC.1.1 // SOUND MEASUREMENT

The type of sound has a bearing on how it is measured. Typical sound level descriptors/metrics for non-impulsive sound events are summarized as follows:

- the A-weighted Sound Level (dBA) is an overall measurement of sound over all frequencies - but with higher weighting given to mid- and higher-frequencies - and provides a reasonable approximation of people's actual judgment of the loudness or annoyance of rail noise at moderate sound levels. Generally, an increase of 10dBA in sound level is equivalent to a doubling in the apparent loudness of the noise;[1]
- the Equivalent Sound Level (Leq), measured in A-weighted decibels (dBA), is an exposure-based descriptor that reflects a receiver's cumulative noise exposure from all events over a specified period of time (e.g. 1 hour, 16 hour day, 8 hour night or 24 hour day). It is the value of the constant sound level that would result in exposure to the same total sound energy as would the specified time varying sound, if the sound level persisted over an equal time interval. This is the commonly used descriptor for impact assessment purposes, and correlates well with the effects of noise on people;
- the Maximum Sound Level (Lmax) is the highest A-weighted sound level occurring during a single noise event. It is typically used in night-time emission limits, as a means of ensuring sleep protection.
- the Sound Exposure Level (SEL) describes the sound level from a single noise event and is used to compare the energy of noise events which have different time durations. It is equivalent to Leq but normalized to 1 second;
- Statistical Sound Levels (Ln%) describe the percentage of time a sound level is exceeded, for example L10%, L50%, etc
- Percent Highly Annoyed (%HA) is an indicator developed by Health Canada to assess the health implications of operational noise in the range of 45 - 75 dB. It is suggested that mitigation be proposed if the predicted change in %HA at a specific receptor is greater than 6.5% between project and baseline noise environments, or when the baseline-plus-project-related noise is in excess of 75 dB.[2]

1 Canada Mortgage and Housing Corporation. (1986). Road and rail noise: Effects on housing [Canada]: Author.

2 Health Canada. (2010). Useful information for environmental assessments. Retrieved from http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/eval/environ_assess-eval/environ_assess-eval-eng.pdf

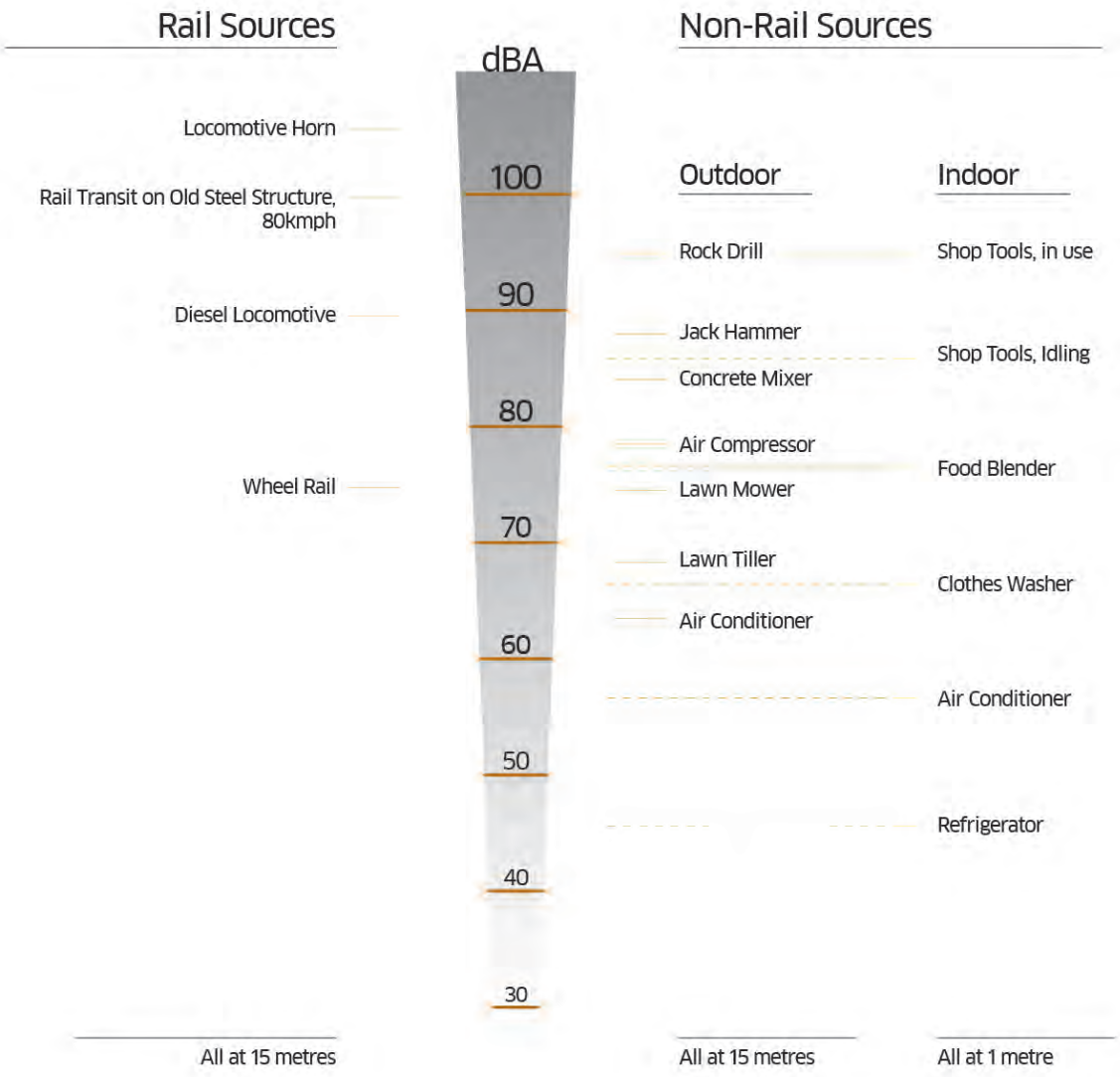


FIGURE 21 - **TYPICAL TRANSIT AND NON-TRANSIT SOURCES OF NOISE, AND THEIR ASSOCIATED DBA** (SOURCE: ADAPTED FROM FIGURE 2-11 IN TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT BY THE FEDERAL TRANSIT ADMINISTRATION).

AC.1.2 // SOURCES OF SOUND FROM RAILWAY OPERATIONS

Principal sources of noise from existing railway infrastructure include:

- wheels and rails;
- diesel locomotives – much of the noise is emitted at the top of the locomotive and in some cases the noise has a distinctive low-frequency character. Both of these factors make locomotive noise difficult to control by means of barriers such as noise walls or earth mounds, because they have to be quite high in order to break the line of sight, and therefore provide noise attenuation;
- special track forms, such as at switches, crossings, diamonds, signals, and wayside detection equipment, cause higher levels of noise and vibration and tend to be more impulsive;
- bridges and elevated structures due to the reverberation in the structures; and
- other sources including brake squeal, curve squeal, train whistling at railway crossings, bells at stations, shunting of rail cars, coupling, idling locomotives, compression or "stretching" of trains, jointed vs. welded tracks, and track maintenance.

AC.1.3 // RECOMMENDED PROCEDURES FOR THE PREPARATION OF NOISE ASSESSMENT REPORTS FOR NEW RESIDENTIAL OR OTHER SENSITIVE LAND USES IN PROXIMITY TO RAILWAY CORRIDORS

1. Studies should be undertaken by a qualified consultant using an approved prediction model.
2. Where studies are not economically or practically feasible, due for example to the scale of a development or the absence of an available mechanism to secure a study, reasonable and practical measures should be undertaken to minimize potential noise impacts, such as increased building setbacks, noise fencing, and building construction techniques (e.g. brick veneer, air conditioning), etc.
3. Obtain existing rail traffic volumes from railway.
4. Use most current draft plan/site plan and grading plans for analysis.
5. Escalate rail traffic volume data by 2.5% compounded annually for a minimum of 10 years, unless future traffic projections are available.
6. Conduct analysis at closest proposed sensitive receptor. The minimum setback distances based on the classification of the rail line, as specified by the railway should be used for the analysis (see Appendix B for a sample rail classification system). If the closest proposed residential receptor is at the greater distance than the minimum setback distance, then the greater distance may be used.
7. The analysis needs to be conducted at the following locations:
    - Outdoor amenity area receptor. This is usually in the rear yard at a point that is 3 m away from the rear wall of the house. This is typically a daytime calculation;
    - 1st, 2nd, and 3rd storey receptor for

low-rise dwellings. The nighttime calculation should be conducted at the façade where a bedroom could be located. The daytime calculation should be conducted at the façade where the living/dining/family areas could be located; and

- If the building is a multi-storey building the calculations should be conducted at the outdoor amenity areas and at the highest floor of the building.

8. The typical receptor heights are summarized below. These are to be used as a guide only. If the actual receptor heights are known they should be used.
    - Outdoor amenity area: 1.5 m above the amenity area elevation;
    - 1st storey receptor: 1.5 m above the 1st floor finished grade elevation;
    - 2nd storey receptor: 4.5 m above the 1st floor finished grade elevation; and
    - 3rd storey receptor: 7.5 m above the 1st floor finished grade elevation.
9. The analysis should be conducted assuming a 16 hour day (LeqDay) and an 8 hour night (LeqNight).
10. When no relief from whistling has been authorized they should be included in the analysis to determine the mitigation measures to achieve the indoor sound level limits. Whistles are not required to be included in the determination of sound barrier requirements.
11. Any topographical differences between the source and receiver should be taken into account.
12. The attenuation provided by dense, evergreen forest of more than 50 m in depth can also be included in the analysis (assuming it will remain intact).
13. Intervening structures that may provide some barrier effect may also be included in the analysis.
14. The results of this analysis should be compared to the applicable sound level limits listed in AC.1.4 to determine the required mitigative measures for both the outdoor amenity areas and the dwelling. Mitigative measures could include noise barriers, architectural and ventilation components (eg. brick veneer, air conditioning, forced air ventilation, window glazing requirements, etc.)
15. The required sound barrier heights to achieve the guidelines at the outdoor amenity areas can be determined using an appropriate model. The relative location with respect to the source and the receiver is required as well as the grades of the tracks, barrier location, and receptor.
16. The sound barrier needs to be designed taking into consideration the minimum safety requirements of the railway.
17. The architectural component requirements must include the minimum requirements of the railways. The remainder of the components can be determined using the AIF procedures found in the CMHC publication, “Road and Rail Noise: Effects on Housing”, (NHA 5156 08/86)

or the BPN 56 procedures found in the National Research Council publication "Building Practice Note 56, Controlling Sound Transmission into Buildings", September 1995.

18. In preparing the report all of the above information must be included so that the report can be appropriately reviewed. In addition to the above, the report should include the following:
    - Key plan;
    - Site plan/draft plan;
    - Summary of the rail traffic data, including the correspondence from the railways;
    - Figure depicting the location of the sound barrier, including any extensions or wraparounds;
    - Top of barrier elevations;
    - Sample calculations with and without the sound barrier;
    - Sample calculations of how the architectural requirements were determined;
    - Summary table of lots/blocks/units requiring mitigation measures, including lots that require air conditioning and warning clauses; and
    - Any other information relevant to the site and the proposed mitigation.

AC1.4 // RECOMMENDED NOISE CRITERIA FOR NEW RESIDENTIAL OR OTHER SENSITIVE LAND USES IN PROXIMITY TO FREIGHT RAILWAY CORRIDORS

TYPE OF SPACE	TIME PERIOD	SOUND LEVEL LIMIT Leq* (dBA) Rail**	OUTDOOR SOUND LEVEL LIMIT Leq * (dBA)
Bedrooms	2300 to 0700 hrs	35	50
Living/dining rooms	0700 to 2300 hrs	40	55
Outdoor Living Area	0700 to 2300 hrs	***55	N/A

* Applicable to transportation noise sources only.

** The indoor sound level limits are used only to determine the architectural component requirements. The outside façade sound level limits are used to determine the air conditioning requirements.

** Mitigation is recommended between 55dBA and 60dBA and if levels are 60dBA or above, mitigation should be implemented to reduce the levels as close as practicable to 55dBA.

(SOURCE: ADAPTED FROM THE ONTARIO MINISTRY OF THE ENVIRONMENT LU-131 GUIDELINE)

AC.1.5 // RECOMMENDED PROCEDURES FOR THE PREPARATION OF NOISE IMPACT STUDIES FOR NEW RESIDENTIAL OR OTHER SENSITIVE LAND USES IN PROXIMITY TO RAIL YARDS

1. Studies should be undertaken by a qualified consultant.
2. Obtain information from the railway regarding the operations of the freight rail yard in question. This information should include existing operations as well as potential future modifications to the rail facility.
3. Obtain minimum sound levels to be used for each source from the railway, if available. These data should also be verified by on-site observations and on-site sound measurements.
4. Calculate the potential impact of all the sources at the closest proposed residential receptor. This should be at a minimum of 300 m from the closest property line of the freight rail yard.
5. The analysis should be conducted for the worst case hour (Leq 1hr).
6. The calculation may be conducted using ISO 2613-2 or other approved model.
7. Impulsive activities, such as train coupling/ uncoupling and stretching should be analyzed using a Logarithmic Mean Impulse Sound Level (LLM) and not included as part of the 1 hour Leq.
8. The analysis may include any attenuation provided by permanent intervening structures as well as vegetation as set out by the prediction model. Topographical differences between the source and receiver should be taken into account.
9. Any tonal characteristics of the sound should be taken into consideration.
10. All analyses should take the proposed grading of the site as well as the grading at the rail yard, particularly when determining the sound barrier heights.
11. The source positions should be determined in consultation with the railway. They should be based on the most likely and reasonable location for that activity.
12. The consultant report shall include the following:
    - Key plan;
    - Site plan/draft plan of the proposed development;
    - Figure depicting the location of each of the sources modeled within the rail yard;
    - Summary table of the source sound levels used in the analysis;
    - Results of the predicted sound levels at various receptors;
    - Results of any on-site sound measurements;
    - Sample calculations with and without any proposed mitigation;
    - Summary table of all lots requiring mitigation;
    - Top of sound barrier elevations, if sound barriers are proposed; and
    - Any other information relevant to the site and the proposed mitigation.

13. The results of the analysis should be compared to the sound level criteria found in **AC.1.6.** Where an excess exists, mitigation that conforms to applicable stationary source guidelines should be recommended.

AC.1.6 // RECOMMENDED NOISE CRITERIA - RESIDENTIAL OR OTHER SENSITIVE LAND USES IN PROXIMITY TO FREIGHT RAIL SHUNTING YARDS

TIME OF DAY	ONE HOUR Leq (dBA) OR L_{LM} (dBAI)	
	Class 1 Area	Class 2 Area
0700 – 1900	50	50
1900 – 2300	47	45
2300 – 0700	45	45

*These criteria are applicable to any usable portion of the lot or dwelling.

**Class 1 and 2 Areas refer to the typical acoustical environment that can be expected within the development zone. Class 1 Areas are acoustic environments dominated by an urban hum, and Class 2 Areas have the acoustic qualities of both Class 1 and Class 3 Areas (which are rural) For more information, refer to Section 2 of the LU-131 Guidelines issued by the Ontario Ministry of the Environment.

(SOURCE: ADAPTED FROM THE ONTARIO MINISTRY OF ENVIRONMENT LU-131 GUIDELINE)

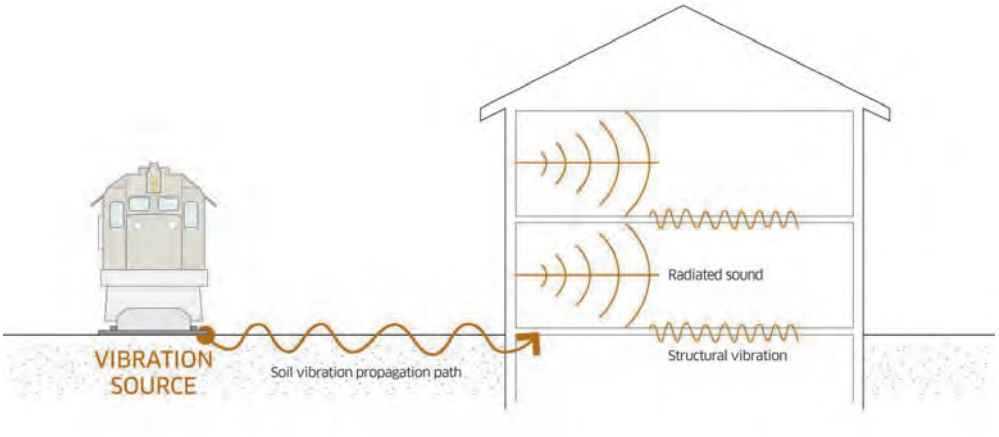


FIGURE 22 // GROUND-BORNE VIBRATION PROPAGATION (SOURCE: ADAPTED FROM FIGURE 7-1 IN TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT BY THE FEDERAL TRANSIT ADMINISTRATION).

AC.2 // VIBRATION

Vibration caused by passing trains is an issue that affects the structure of a building as well as the liveability of the units inside. In most cases, structural integrity is not a factor. Like sound, the effects of vibration are site-specific and are dependent on the soil and subsurface conditions, the frequency of trains and their speed, as well as the quantity and type of goods they are transporting.

Vibration is caused by the friction of the wheels of a train along a track, which generates a vibration energy that is transmitted through the track support system, exciting the adjacent ground and creating vibration waves that spread though the various soil and rock strata to the foundations of nearby buildings. The vibration can then disseminate from the foundation throughout the remainder of the building structure. Experience has shown that vibration levels only slightly above the human perception threshold are likely to result in complaints from residents.

Vibration in buildings in proximity to railway corridors can reach levels that may not be acceptable to building occupants for one or more of the following reasons:

- irritating physical sensations that vibration may cause in the human body;
- interference with activities such as sleep, conversation, and work;
- annoying noise caused by “rattling” of windowpanes, walls, and loose objects. Noise radiated from the motion of the room surfaces can also create a rumble. In essence, the room acts like a giant loudspeaker;
- interference with the proper operation of sensitive instruments (or) processes; and
- misplaced concern about the potential for structural or foundation damage.

Mitigation of vibration and ground-borne noise requires the transmission of the vibration to be inhibited at some point in the path between the railway track and the building. In some instances, sufficient attenuation of ground vibration is provided by the distance from the track (vibration is rarely an issue at distances greater than 50 metres from the track), or by the vibration 'coupling loss' which occurs at the footings of buildings. However, these factors may not be adequate to achieve compliance with the guidelines, and consideration may need to be given to other vibration mitigation measures. However, railway vibration is not normally associated with foundation damage.

AC.2.1 // GROUND-BORNE VIBRATION NOISE

Vibration is an oscillatory motion, which can be described in terms of its displacement, velocity, or acceleration. Because the motion is oscillatory, there is no net displacement of the vibration element and the average of any of the motion descriptors is zero. The response of humans, buildings, and equipment to vibration is more accurately described using velocity or acceleration. The concepts of ground-borne vibration for a rail system are illustrated in FIGURE 22.

AC.2.2 // PEAK PARTICLE VELOCITY AND THE ROOT MEAN SQUARE

The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration signal. Although PPV is appropriate for

evaluating the potential of building damage, it is not suitable for evaluating human responses, as it takes some time for the human body to respond to vibration signals. Because the net average of a vibration signal is zero, the root mean square (RMS) amplitude is used to describe the vibration amplitude.

The criteria for acceptable ground-borne vibration are expressed in terms of RMS velocity in decibels or mm/sec, and the criteria for acceptable ground-borne noise are expressed in terms of A-weighted sound levels.

AC.2.3 // HUMAN PERCEPTION OF GROUND-BORNE VIBRATION AND NOISE

The background vibration velocity level (typically caused by passing vehicles, trucks, buses, etc.) in residential areas is usually less than 0.03mm/sec RMS, well below the threshold of perception for humans, which is around 0.1 mm/sec RMS. In the some cases, depending on the distance, intervening soils, and type of rail infrastructure, the vibration from trains can reach 0.4mm/sec RMS or more. Even high levels of perception, however, are typically an order of magnitude below the minimum levels required for structural or even cosmetic damage in fragile buildings.

Typical levels of ground-borne vibrations are shown in FIGURE 23.

For surface heavy rail traffic, the sound made by the vibration travelling through the earth is rarely significant because of the relatively low frequency content being less audible than the higher vibration frequencies common to surface transit and subways.

The relationship between ground-borne vibration and ground-borne noise depends on the frequency content of the vibration and the acoustical absorption of the receiving room. The more acoustical absorption in the room, the lower will be the noise level. This can be used to mitigate the ground-borne noise impact, but as noted above, is rarely required.

One of the problems in developing suitable criteria for ground-borne vibration is that there has been relatively little research into human response to vibration, in particular, human annoyance with building vibration. Nevertheless, there is some information available on human response to vibration as a function of vibration characteristics: its level, frequency, and direction with respect to the axes of the human body, and duration of exposure time. However, most of the studies on which this information is based were concerned with conditions in which the level and frequency of vibration are constant. Very few studies have addressed human response to complex intermittent vibration such as that induced in buildings by railway corridors. Nonetheless, several countries have published standards that provide guidance for evaluating human response to vibration in buildings. Proponents may utilize the following standards, used internationally, as a reference:

- International Standard ISO 2631-2: 2003 (1989)
- American Standard ANSI S2.71: 2006 (Formerly ANSI S3.29-1983)
- British Standard BS 6472-1: 2008 (1984)
- Norwegian Standard NS 8176.E: 2005
- New Zealand Standard NZS/ISO 2631-2: 1989
- Australian Standard AS 2670-2: 1990

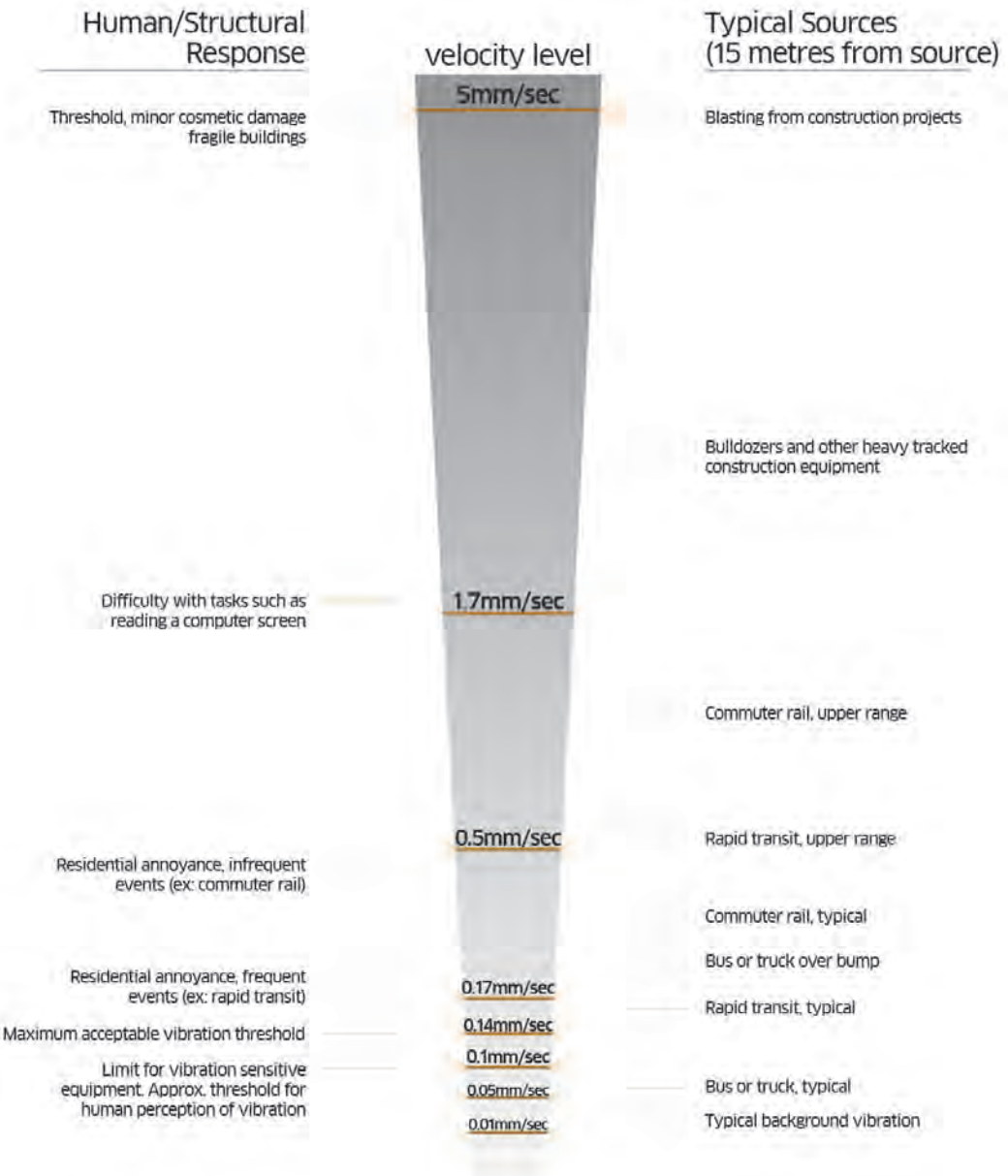


FIGURE 23 // TYPICAL VIBRATION SOURCES AND THEIR ASSOCIATED VELOCITY LEVELS (SOURCE: ADAPTED FROM FIGURE 7-3 IN TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT BY THE FEDERAL TRANSIT ADMINISTRATION).

AC.2.4 // FACTORS INFLUENCING GROUND-BORNE VIBRATION AND NOISE

Factors that may influence levels of ground borne vibration and noise, and that should be considered by the acoustic consultant in the preparation of a vibration impact study are described in the table below.

FACTORS RELATED TO VIBRATION SOURCE	
Factors	**Influence**
Wheel Type and Condition	Wheel flats and general wheel roughness are the major cause of vibration from steel wheel/steel rail systems.
Track/Roadway Surface	Rough track or rough roads are often the cause of vibration problems.
Speed	As intuitively expected, higher speeds result in higher vibration levels. Doubling speed usually results in a vibration level increase of 4 to 6 decibels.

FACTORS RELATED TO VIBRATION PATH	
Factors	**Influence**
Soil Type	Vibration levels are generally higher in stiff clay or well-compacted sandy soils than in loose or poorly compacted or poorly consolidated soils.
Soil Layering	Soil layering will have a substantial, but unpredictable, effect on the vibration levels since each stratum can have significantly different dynamic characteristics.
Depth to Water Table	The depth to the water table may have a significant effect on ground-borne vibration, but a definite relationship has not been established.

FACTORS RELATED TO VIBRATION RECEIVER	
Factors	**Influence**
Foundation Type	Generally, the heavier the building foundation, the greater the coupling loss as the vibration propagates from the ground into the building.
Building Construction	Since ground-borne vibration and noise are almost always evaluated in terms of indoor receivers, the propagation of the vibration through the building must be considered. Each building has different characteristics relative to structure-borne vibration, although, generally, the more massive the building, the lower the levels of ground-borne vibration.
Acoustical Absorption	The amount of acoustical absorption in the receiver room affects the levels of ground-borne noise.

(SOURCE: ADAPTED FROM TABLE 7-2 IN TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT BY THE FEDERAL TRANSIT ADMINISTRATION).

AC.2.5 // RECOMMENDED PROCEDURES FOR THE PREPARATION OF VIBRATION IMPACT STUDIES FOR NEW RESIDENTIAL OR OTHER SENSITIVE LAND USES IN PROXIMITY TO RAILWAY OPERATIONS

Mitigation can take the form of perimeter foundation treatment and thicker foundation walls and in more severe cases the use of rubber inserts to separate the superstructure from the foundation.

1. Studies should be undertaken by a qualified consultant.
2. Where studies are not economically or practically feasible, due for example to the scale of the new development or the absence of an available mechanism to secure a study, reasonable and practical measures should be undertaken to minimize potential vibration impacts, such as increased building setbacks, perimeter foundation treatment (eg. thicker foundations) and/or other vibration isolation measures, etc.
3. Vibration measurements should be conducted for all proposed residential/ institutional type developments. It is not acceptable to use vibration measurements conducted at other locations such as on the opposite side of the tracks, further down the tracks, etc.
4. The vibration measurements should be conducted at the distance corresponding to the closest proposed residential receptor, or on the minimum setbacks based on classification of the rail line. If the proposed dwelling units are located more than 75 m from the railway right-of-way, vibration measurements are not required.
5. Sufficient points parallel to the tracks should be chosen to provide a comprehensive representation of the potentially varying soil conditions.
6. A minimum of five (5) train passbys (comprised of all train types using the rail line) should be recorded at each measurement location.
7. The measurement equipment must be capable of measuring between 4 Hz and 200 Hz ± 3 dB with an RMS averaging time constant of 1 second.
8. All measured data shall be reported.
9. The report should include all of the above as well as:
    - Key plan;
    - Site/draft plan indicating the location of the measurements;
    - Summary of the equipment used to conduct the vibration measurements;
    - Direction, type, speed (if possible), and number of cars of each train measured;
    - Results of all the measurements conducted;
    - Exceedance, if any; and
    - Details of the proposed mitigation, if required.
10. Ground-borne vibration transmission is to be estimated through site testing and evaluation

to determine if dwellings within 75 metres of the railway right-of-way will be impacted by vibration conditions in excess of 0.14 mm/sec. RMS between 4 Hz. And 200 Hz. The monitoring system should be capable of measuring frequencies between 4 Hz and 200 Hz ± 3 dB, with an RMS averaging time constant of 1 second. If in excess, appropriate isolation measures are recommended to be undertaken to ensure living areas do not exceed 0.14 mm/sec. RMS on and above the first floor of the dwelling.

The following references provide additional insight on methods for measuring ground-borne vibration:

- Hunaidi, O. (1996). "Evaluation of human response to building vibration caused by transit buses". Journal of Low Frequency Noise and Vibration, Vol. 15 No.1, p. 25-42. NRCC Report No. 36963.
- Hunaidi, O. and Tremblay, M. (1997). "Traffic-induced building vibrations in Montreal". Canadian Journal of Civil Engineering, Vol. 24, p.736-753.
- Allen, D.E. and Pernica, G. (1998). "Control of floor vibration". Construction Technology Update No.22, Institute for Research in Construction, NRCC.
- Hanson, C.E., Towers, D.A. and Meister, L.D. (2006). "Transit Noise and vibration impact assessment". FTA-VA-90-1003-06, Office of Planning and Environment, Federal Transit Administration, USA.
- Garg, N. and Sharma, O. (2010). "Investigations on transportation induced ground vibrations". Proceedings of 20th International Congress on Acoustics, ICA 2010, Sydney, Australia.

APPENDIX D //
NEW RAIL FACILITIES AND SIGNIFICANT RAIL EXPANSIONS IN PROXIMITY TO RESIDENTIAL OR OTHER SENSITIVE LAND USES

Federally regulated railways are governed, in part, by the requirements of the Canada Transportation Act (CTA). Under the CTA, railways are required to obtain an approval from the Canadian Transportation Agency for certain railway construction projects. Additionally, federal railways are required to adhere to the requirements of the Railway Safety Act (RSA), which promotes public safety and protection of property and the environment in the operation of railways.

As such, evaluations of new rail facilities or significant rail expansions are conducted in accordance with applicable Federal regulations.

These include but are not limited to the following:

1. **Canadian Transportation Act - section 98**

http://www.cta-otc.gc.ca/eng/railway-line-construction

http://laws-lois.justice.gc.ca/eng/acts/C-10.4/page-34.html#h-51

2. **Railway Safety Act - Part 1 Construction or Alteration of Railway Works**

http://laws-lois.justice.gc.ca/eng/acts/R-4.2/page-3.html#docCont

http://laws-lois.justice.gc.ca/eng/regulations/SOR-91-103/page-1.html

3. **Railway Relocation and Crossing Act**

https://www.otc-cta.gc.ca/eng/publication/relocation-railway-lines-urban-areas

http://laws-lois.justice.gc.ca/eng/acts/R-4/index.html

4. **Canadian Environmental Assessment Act, 2012**

http://laws-lois.justice.gc.ca/eng/acts/C-15.21/index.html

APPENDIX E //
BEST PRACTICES

AE.1 // CURRENT BEST PRACTICES IN CANADA

AE.1.1 // RAILWAY NOISE EMISSION GUIDELINES, RAC (CANADA)

The Railway Association of Canada has prepared Noise Emission Guidelines that will assist in controlling noise emitted by moving rail cars and locomotives.

- The RAC initiative is the first attempt at such a guideline in Canada. Federal agencies have indicated that they support the RAC's efforts and look forward to working with all stakeholders on such initiatives and also that they encourage a blend of maximum levels of noise and annoyance-related approaches in the development of such guidelines.
- The RAC guidelines are based on the following United States Codes of Federal Regulations (CFR): CFR Title 40 - Protection of Environment - Part 201 Noise Emission Standards for Transportation Equipment; Interstate Rail Carriers – July 1, 2002; and, CFR Title 49 Transportation – Part 210 Railroad Noise Emission Compliance Regulations – Oct 1, 2002.
- The guidelines apply to the total sound emitted by moving rail cars and locomotives (including the sound produced by refrigeration and air conditioning units that are an integral element of such equipment), active retarders, switcher locomotives, car coupling operations, and load cell test stands, operated by a railway within Canada. There are exceptions where the guidelines do not apply, including steam locomotives, sound emitted from warning devices, special purpose equipment, and inert retarders.
- Railways and the RAC are encouraged to continue with proactive efforts and partnerships to undertake research and education initiatives that build on and improve the draft noise emission guideline, including incorporating aspects of the subject research.

A summary of the guidelines is below:

NOISE SOURCE	NOISE GUIDELINE - A-WEIGHTED SOUND LEVEL IN dB	NOISE MEASURE	MEASUREMENT LOCATION
All locomotives manufactured on or before Dec. 31, 1979			
Stationary, Idle Throttle setting	73	Lmax (slow)1/	30 m
Stationary, all other throttle settings	93	Lmax (slow)	30 m
Moving	96	Lmax (fast)	30 m
All locomotives manufactured after Dec. 31, 1979			
Stationary, Idle Throttle setting	70	Lmax (slow)	30 m
Stationary, all other throttle settings	87	Lmax (slow)	30 m
Moving	90	Lmax (fast)	30 m
Additional req't for switcher locos manufactured on or before Dec. 31, 1979 operating in yards where stationary switcher and other loco noise exceeds the receiving property limit of	65	L90 (fast)2/	Receiving property
Stationary, Idle Throttle setting	70	Lmax (slow)	30 m
Stationary, all other throttle settings	87	Lmax (slow)	30 m
Moving	90	Lmax (fast)	30 m
Rail Cars			
Moving at speeds of 45 mph or less	88	Lmax (fast)	30 m
Moving at speeds greater than 45 mph	93	Lmax (fast)	30 m
Other Yard Equipment and Facilities			
Retarders	83	Ladjavemax (fast)	Receiving property
Car-coupling operations	92	Ladjavemax (fast)	Receiving property
Loco load cell test stands, where the noise from loco load cell operations exceeds the receiving property limits of	65	L90 (fast)2/	Receiving property
Primary Guideline	78	Lmax (slow)	30 m
Secondary Guideline if 30 m measurement not feasible	65	Lmax (fast)	Receiving property located more than 120 m from Load Cell

1/Lmax= maximum sound level

L90= statistical sound level exceeded 90% of the time

Ladjavemax= adjusted average maximum sound level

2/ L90 must be validated by determining that L10-L99 is less than or equal to 4 dB (A).

Receiving property essentially means any residential or commercial property that receives sound (not owned by the railroad).

AE.1.2 // NOISE ASSESSMENT CRITERIA IN LAND USE PLANNING PUBLICATION LU-131 (ONTARIO, CAN)

This guideline outlines noise criteria to be considered in the planning of sensitive land uses adjacent to major facilities such as roads, airports, and railway corridors. It is the only provincial noise guideline applicable to residential development in Canada.[1] The document stipulates a maximum daytime outdoor sound level from rail noise of 55dBA; 35dBA for sleeping quarters at night; and 40dBA for living and dining rooms during the day. It also stipulates that a feasibility study is required within 100 metres of a Principal Main Line railway right-of-way, and 50 metres of a Secondary Main Line railway right-of-way. A detailed noise study is required when sound levels affecting proposed lands exceed the noise criteria by more than 5dBA. Finally, the guideline also outlines specific mitigation requirements when sound levels exceed certain limits.

AE.1.3 // PLANNING AND CONSERVATION LAND STATUTE LAW AMENDMENT ACT, 2006, BILL 51 (ONTARIO, CAN)

The Planning and Conservation Land Statute Law Amendment Act, 2006, Bill 51 provides a more transparent, accessible, and effective land-use planning process, empowering municipalities with more tools to address a variety of land-use planning needs. The bill allows for greater dissemination of information, participation, and consultation to take place earlier on in the planning process, giving local residents and community leaders more opportunity to play their crucial role in shaping their communities.

Bill 51 requires that notice shall be given to railways in the case of proposed official plans or official plan amendments, plans of subdivision, zoning by-laws, holding by-laws, interim control by-laws, and/or consent to sever lands, where the subject lands fall within 300 metres of a railway line. This is the only piece of provincial legislation in Canada which triggers the notification of railways when land-use changes and/or development is proposed in close proximity to rail lands.

AE.1.4 // GUIDELINE D-6: COMPATIBILITY BETWEEN INDUSTRIAL FACILITIES AND SENSITIVE LAND USES (ONTARIO, CAN)

The role of this guideline is to prevent or minimize the encroachment of sensitive land use upon industrial land use and vice versa. The incompatibility of these land uses is due to the possibility for adverse effects created by industrial operations on sensitive land uses.

Application of this guideline should occur during the land use planning process in an effort to prevent or minimize future land use conflicts. It is intended to apply when a change in land use is proposed. The guideline is a direct application of Ministry Guideline D-1, "Land Use Compatibility" (formerly Policy 07-03).

This guideline defines sensitive land uses as:

- recreational uses which are deemed by the municipality or provincial agency to be sensitive; and/or
- any building or associated amenity area which is not directly associated with the industrial use, where humans or the natural environment may be adversely affected by emissions generated by the operation of a nearby industrial facility. For example, residences, senior citizen homes, schools, day care facilities, hospitals, churches and other similar institutional uses, or campgrounds. Residential land is considered to be sensitive 24 hrs/day.

This guideline does not apply to railway corridors, but does apply to railway yards and other ancillary rail facilities.

Industrial facilities are categorized into three classes according to the objectionable nature of their emissions, physical size/scale, production volumes and/or the

1 Noise Guidelines exist in Alberta, but they are applicable only to the energy sector.

intensity and scheduling of operations. This guideline includes an implementation section that contains requirements or recommendations on the following:

- Potential influence area distances
- Land use planning considerations
- Recommended minimum separation distances
- How to measure separation distance
- Commenting or reviewing land use proposals
- Required studies: noise, dust, and odour
- Additional mitigation measures
- Legal agreements and financial assurance to ensure mitigation
- Redevelopment, infilling and mixed use areas requirements including official status, zoning, feasibility analysis, new use of existing buildings, public consultation, environmental warnings for sensitive land uses, phased/sequential development, and site clean-up & decommissioning.
- Accessory residential use

The recommendations or requirements for incompatible land uses are intended to supplement, not replace, controls which are required by legislation for both point source and fugitive emissions at the facility source.

AE.1.5 // DIRECTION 2006 (CANADA)

Community Trespass Prevention is an initiative of Direction 2006, a Government of Canada and public/private partnership initiated in 1996, with the goal of cutting the number of accidents and fatalities in half within 10 years, by 2006. As part of this initiative, the document, *Trespassing on Railway Lines: A Community Problem-Solving Guide* was developed. This document describes the Community, Analysis, Response and Evaluation (C.A.R.E.) problem solving model that was developed to assist communities in identifying and addressing the underlying causes of trespassing. It provides a step-by-step method of identifying, analyzing and effectively addressing trespassing issues in the community.

Direction 2006 has identified four areas of concentration (the four E's) with respect to crossing and trespass prevention, namely:

Education

Operation Lifesaver's success as a safety program lies in educating people of all ages about the dangers of highway/railway crossings and the seriousness of trespassing on railway property. The methods used to reach the public include the production and distribution of educational related material, early elementary and driver education curriculum activities, civic presentations, as well as media coverage.

Enforcement

Laws are in place governing motorists' and pedestrians' rights and responsibilities at highway/railway crossings and on railway property. Without enforcement, however, they will be ignored and disregarded, and incidents will continue to happen. Therefore, provincial and municipal law enforcement agencies are urged to deal with motorists and pedestrians who disregard these laws and jeopardize their lives as well as the lives of others.

Engineering

Highway/railway crossings, railway property and pedestrian crossings must be kept safe, both physically and operationally, and improvements must be made when needed. To ensure a high level of safety, the administrative process of improving railway rights-of-way needs to be reviewed and changed when needed. At the same time, the public needs to be made more aware of federal, provincial and other programs aimed at improving railway safety.

Evaluation

To maintain the quality of Operation Lifesaver, its effect should be measured against its stated goals. Funds are available for technical and program assistance.

Lessons that can be learned from Direction 2006 include:

- The benefits of multi-stakeholder initiatives to raise awareness of public safety matters and reduce the potential for future incidents.
- Promotion of rail safety improvement, particularly improvement and elimination of at-grade crossings and provision of funding for safety initiatives.

AE.2 // INTERNATIONAL BEST PRACTICES

The international case studies described here have been chosen because they represent examples of jurisdictions which employ a comprehensive approach towards mitigation of rail-related impacts on new residential development that includes the use of proximity guidelines. While Australia stands out as a model for Canadian jurisdictions to look towards when crafting their own policies for development adjacent to railway corridors, the differences between the two contexts should be kept in mind. For example, the Australian context allows for a greater government role in its approach to mitigation because railway infrastructure is largely state owned and operated. This is also the reason why the rail authorities must bear a larger share of the responsibility when it comes to mitigation, than is the case in Canada.

AE.2.1 // NEW SOUTH WALES, AUSTRALIA

New South Wales (NSW), located in southeastern Australia, is the largest Australian state by population, with over 7.2 million inhabitants. It is currently experiencing an extended period of urban renewal, particularly in and around Sydney, the state capital and the most populous city in the country. This renewal has led to increased pressure to develop urban infill sites along railway lines, particularly around existing passenger rail stations. At the same time, transportation by rail (both freight-based and passenger-based), has been growing steadily, generating a need to establish new railway lines in some parts of the state, and leading to an increase in the number of complaints about sound and vibration issues by residents living in proximity to existing lines.

In response to these circumstances, the government of NSW has developed a comprehensive strategy consisting of a series of complementary initiatives to address and manage the environmental impacts of noise and vibration from the state's rail system. These include:

- A ***Rail Infrastructure Noise Guideline*** that outlines a process for assessing the noise and vibration impacts of proposed rail infrastructure projects, and for determining appropriate mitigation.
- A ***new state policy,*** called the State Environmental Planning Policy (Infrastructure) 2007 that clearly

articulates a process and requirements for the approval of new residential developments adjacent to existing railway corridors. The policy specifies internal noise levels of 35dBA for bedrooms between 10pm and 7am, and 40dBA for other habitable rooms. It also stipulates conditions under which a rail authority must be notified of a development adjacent to its railway corridors, and gives the authority 21 days to respond.

- New ***planning guidelines*** for development near railway corridors and busy roads that outline procedures for assessing the noise and vibration impacts of existing rail facilities on new residential development, and suggest potential mitigation options.
- New *national rolling stock noise emission standards,* currently under development by the Australasian Railway Association.

Although the *Development Near Rail Corridors and Busy Roads - Interim Guideline* includes recommendations for mitigating against the risk of a derailment, these do not include a mandatory or recommended setback. The State's Director of Policy Planning Systems and Reform suggests that this is because any setback width would be considered arbitrary. Additionally, it is argued that it would be inappropriate to sterilize land adjacent to railway corridors by imposing a setback requirement without compensation or acquisition. In the case of new rail lines under development, it is considered preferable for the infrastructure provider to acquire a corridor wide enough to make accommodations for a buffer. In existing built-up areas around older railway lines, safety is considered on a case-by-case basis through individual risk assessments, although the primary concern of mitigation is the reduction of noise and vibration. It should be noted that developers of new residential buildings in NSW are responsible for all costs associated with providing safety, sound, and vibration mitigation in their developments.

The introduction of the new state policy and planning guidelines has significantly streamlined the development approvals process for new residential development adjacent to railway corridors across the state. The *State Environmental Planning Policy (Infrastructure)* 2007 takes precedence over existing municipal policies within the state, and municipalities must also 'have consideration' for the new guidelines when approving or denying a development application. Failure to do so may result in a decision being overturned by the courts. The privileged position of the rail authorities as adjacent landowners is recognized through the new process, but the 21-day period for providing comments ensures expediency. The state further encourages rail authorities to honour this time limitation through an annual publication of the names of those who consistently fail to meet the deadline. While the process allows for and encourages extensive negotiation, municipal Councils are free to reject the safety recommendations of rail authorities that they feel are unreasonable.

Although the state is still in the process of transitioning into this new system, overall, it is considered thus far, to be a success. The guidelines are heavily used, and new developments are seeing significant benefits, though there are still concerns expressed by residents living in existing housing stock.

AE.2.2 // QUEENSLAND, AUSTRALIA

Queensland, located in northeastern Australia, is the second largest Australian state by area, and the third largest by population, with over 4.5 million inhabitants. It is also home to the country's third most populace city, Brisbane. Regional and metropolitan plans throughout Queensland are calling for Transit Oriented Development (TOD) to address the state's continuing growth and development. These plans typically prescribe more compact urban forms, with higher density development located in the places of greatest accessibility. Increasingly, as in NSW, this has led to greater pressure to develop sites adjacent to railway corridors, generating concerns not only about noise and vibration, but also about the potential impact of new development on railway operations.

In order to properly manage these concerns, a partnership was established between Queensland Rail, Transport and Main Roads (TMR), and the Department of Infrastructure and Planning (DIP), through Growth Management Queensland (GMQ). Through this collaboration, a Guide for development in a railway environment was developed and made available for use by local municipalities and developers. The Guide provides direction for those interested in developing, excavating, or carrying out any other construction activity in or adjacent to a railway corridor, facilities, or infrastructure. It outlines what information must be reviewed and accounted for when undertaking development in a railway environment, which agencies hold jurisdictional responsibility, the applicability of regulatory provisions, the consultation process, and related development parameters. A checklist approach ensures the appropriate steps have been taken to address the matters influencing development in a railway environment, and is complemented by a risk assessment process to assist with the evaluation and refinement of development proposals.

AE.2.3 // CODE OF PRACTICE, RAILWAY NOISE MANAGEMENT, QUEENSLAND RAIL (QUEENSLAND, AUSTRALIA)

Queensland Rail (QR), an Australian government owned corporation, has developed a Code of Practice for Railway Noise Management. The *Code of Practice* is generally a self-imposed set of rules to achieve compliance with the duty to mitigate environmental impacts such as noise and vibration. The self-regulation is similar to the approach to the environment that has been adopted by the Class 1 and other railway companies in Canada.

As part of this *Code of Practice*, QR has developed a "Network Noise Management Plan" that initially involves conducting a statewide noise audit. If "potential noise-affected receptors" are identified then a detailed noise assessment is carried out. Mitigation measures will be implemented where noise levels exceed the EPP levels or if QR cannot achieve compliance with these levels, the railway will strive to comply with QR nominated interim noise levels of 70 dB(A) (24-hour average equivalent continuous A-weighted sound pressure level) and 95 dB(A) (single event maximum sound pressure level).

Queensland Rail has prepared and made available to Queensland local governments "QR Guidelines for Local Governments (and/or other Assessment Managers under the Integrated Planning Act) for Assessing Development Likely to be Affected by Noise from the Operation of a Railway or Railway Activities". These guidelines encourage Queensland local governments to apply noise impact assessments to development applications requiring assessment under the Integrated Planning Act

and which are intended to be located near a railway. The noise impact assessment may require the imposition of conditions on the development to help achieve the required noise levels. Conditions may include devices such as sealed windows and/or double glazing; minimizing the window area facing a noise source; barriers for low level receivers; effective building orientation; or provision of a suitable buffer distance.

Although the Canadian environment differs somewhat from QR (the main difference being that QR is government owned), there are lessons that can be learned, including:

- QR has developed a comprehensive "Network Noise Management Plan" and carries out a detailed noise assessment if potential noise-affected receptors are identified.
- QR has prepared noise impact assessment guidelines to assist local governments in applying guidelines to development applications. The guidelines are comprehensively applied.

AE.3.1 // ROBERTS BANK RAIL CORRIDOR CASE STUDY (BRITISH COLUMBIA, CAN)

The Roberts Bank Rail Corridor (RBRC) represents a 70-kilometre stretch of tracks, connecting Canada's largest container facility and a major coal terminal at Roberts Bank (south of Vancouver) with the North American rail network. Increasing volumes of international freight are shipped as part of Canada's Pacific Gateway, through communities in the Lower Mainland.

The Corridor is comprised primarily of single rail track and currently carries up to 18 trains per day, ranging from 6,000 to 9,500 feet in length. Train traffic volume is expected to increase to 28–38 trains per day by 2021, and it is anticipated that some trains may exceed 12,000 feet in length.

Existing and Future Conditions

The Corridor contains approximately 66 road-rail crossings, of which 12 are overpasses, 38 are public street-level crossings, and 16 are private street-level crossings. Roughly 388,000 vehicles cross the tracks daily, with expected increases to 560,000 vehicle crossings per day by 2021. Future increases in train traffic and vehicular traffic presented infrastructure challenges to the existing street-level rail crossings, impeding the operational efficiency of both rail and road networks. Additionally, the significant volume of trains passing through established communities presented many challenges with respect to noise, vibration, emissions, and safety.

Improving Network Efficiency and Addressing Proximity Issues

In February 2007, the *Roberts Bank Rail Corridor: Road/Rail Interface Study* prioritized the optimal locations for investment in road-rail projects. Careful consideration was also given to selected road closures, network reconfigurations, and traffic management measures designed to maximize benefits to motorists, railways and neighbouring communities. The study also gave consideration to a number of proximity related issues including noise, vibration, emissions, and safety.

The study was a collaborative effort among Transport Canada, British Columbia Ministry of Transportation and Infrastructure, South Coast British Columbia Transportation Authority (TransLink), the Vancouver Fraser Port Authority, and the Greater Vancouver Gateway Council, with contributions from stakeholders

such as corridor municipalities and railway companies. The various agencies turned to the 2007 FCM RAC Proximity Guidelines for direction on addressing issues related to noise and vibration, safety, dispute resolution, and setbacks. The Guidelines were proven to be an effective measure and valuable resource for balancing the needs of the rail agencies, stakeholders, and community members.

Roberts Bank Railway Corridor improvements are intended to:

- Improve the flow of local traffic;
- Improve traffic safety;
- Provide for better access by emergency vehicles during train events;
- Reduce idling of vehicles at level crossings, energy use, and greenhouse gas emissions;
- Reduce or eliminate the necessity for train whistling;
- Enhance the efficiency and safety of rail operations;
- Accommodate the anticipated growth in trade-related traffic; and
- Increase national trade competitiveness by increasing goods-movement along the corridor.

Results and Outcomes

The twelve partners are working proactively to improve road access and safety for local residents by providing alternate routes over increasingly busy railways. In total, eight overpasses and one rail siding project in the RBRC Program will be constructed by 2014. Additional rail improvements will reduce requirements for whistle blowing, close rail crossings to vehicular traffic, and provide an advanced early warning system that will notify drivers of approaching trains.

APPENDIX F // GLOSSARY

Berm

A mound constructed of compacted earth that is situated within the setback area of a property adjacent to a railway line. Berms function of safety barriers, screen undesirable views, and reduce noise.

Crash Wall

A concrete structure often incorporated into the podium of a high-density building adjacent to a railway line that is designed to provide the equivalent resistance in the case of a train derailment as a standard berm.

Noise Impact Study

A study, undertaken by a qualified acoustic consultant, which assesses the impact of all noise sources on a subject property, and determines the appropriate layout, design, and required control measures.

Low Occupancy Podium

A building podium containing non-sensitive uses such parking, retail, or the common elements of a condominium. A low occupancy podium will never contain residential uses.

Railway Corridor

The land which contains a railway track or tracks, measured from property line to property line.

Rail Crossing

A crossing or intersection of a railway and a highway, at grade.

Railway

Any company which owns and operates one or more railway lines.

Railway Line

The physical tracks on which trains operate. Railway lines may be categorized as either a Main Line, Branch Line, or Spur Line, based on the speed and frequency of trains (see Appendix B for a sample rail classification system).

Railway Facility

Any structure or associated lands related to the operation of a railway. Railway facilities include railway corridors, freight yards, and train stations.

Railway Operations

Any activity related to the operation of a railway.

Recommended Setback

The recommended separation distance between a rail corridor and a sensitive land use, such as a residence.

Sensitive Land Uses

A land use where routine or normal activities occurring at reasonably expected times would experience adverse effects from the externalities, such as noise and vibration, generated from the operation of a railway. Sensitive land uses include, but are not limited to, residences or other facilities where people sleep, and institutional structures such as schools and daycares, etc.

STC Rating

STC stands for Sound Transmission Class, and is a single-number rating of a material's or an assembly's ability to resist airborne noise transfer. In general, a higher STC rating indicates a greater ability to block the transmission of noise.

Vibration Impact Study

A study, undertaken by a qualified acoustic or vibration consultant, which assesses the level and impact of vibration on a subject property, determines whether vibration mitigation is necessary, and recommends mitigation options based on the particular conditions of the development site in question.

APPENDIX G // LINKS & OTHER RESOURCES

Railway Association of Canada

www.railcan.ca

(includes relevant government links and links to member railway sites)

Federation of Canadian Municipalities

www.fcm.ca

(includes links to provincial affiliate associations and municipal sites)

RAC/FCM Proximity Project

www.proximityissues.ca

Government of Canada

www.canada.gc.ca

Transport Canada

www.tc.gc.ca

Canadian Transportation Agency

www.cta-otc.gc.ca

Ontario Ministry of the Environment

www.ene.gov.on.ca

Canada Mortgage & Housing Corporation

www.cmhc-schl.gc.ca

Operation Lifesaver

www.operationlifesaver.ca

Safe Communities

www.safecommunities.ca

Queensland Rail

www.corporate.qr.com.au

Queensland Department of Transport and Main Roads

www.tmr.qld.gov.au

New South Wales Department of Planning

www.planning.nsw.gov.au

APPENDIX H // LIST OF STAKEHOLDERS CONSULTED

Municipalities

Borough of Plateau Montreal, City of Montreal

Borough of Riviere-des-Prairies, Pointe-aux-Trembles, City of Montreal

Bureau du Plan, City of Montreal

City of Edmonton

City of Regina

City of Saskatoon

City of Toronto

City of Vancouver

City of Welland

City of Winnipeg

Greater Moncton Planning Commission

Town of Halton Hills

Town of Orangeville

Development Industry

BILD, Policy & Government Relations

Canada Lands Company

Conservatory Group

Hullmark Development

Montreal Design Zone

Namara Developments

Ontario Homebuilders Association

Perimeter Development

Professionals

Aecom

Evans Planning

Goodmans LLP

Jablonsky Ast & Partners

Jade Acoustics Inc.

JSW+ Associates

Canadian Railways & Railroad Operators

Canadian National Railway

Canadian Pacific Railway

Metrolinx

Trillium Railway

International

American Association of Railroads

City of Melbourne, Australia

City of Washington, DC

Government of New South Wales, Australia, Policy Planning Systems and Reform

Surface Transportation Board

Provincial & Federal Ministries & Regulating Agencies

Canadian Transportation Agency

Ontario Ministry of Transportation, Goods Movement Policy Office

Province of Nova Scotia

Saskatchewan Ministry of Municipal Affairs

APPENDIX I // REFERENCES

Allen, D.E. and Pernica, G. (1998). "Control of floor vibration". Construction Technology Update No.22, Institute for Research in Construction, NRCC.

Berglund, B., Lindvall, T., & Schwela, D. H., eds. (1999). *Guidelines for community noise* [Research Report]. Retrieved from World Health Organization website: http://www.who.int/docstore/peh/noise/guidelines2.html

Bill 51: *An Act to amend the Planning Act and the Conservation Land Act and to make related amendments to other Acts.* (2006). Royal Assent Oct. 19, 2006. Retrieved from the Parliament of Ontario website: http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&BillID=455

Canada Mortgage and Housing Corporation. (1986). *Road and rail noise: Effects on housing* [Canada]: Author.

Canadian Transportation Agency. (August 2011). *Railway noise measurement and reporting methodology.* Retrieved from: http://www.otc-cta.gc.ca/eng/railway_noise_measurement

Canadian Transportation Agency. (October 2008). *Guidelines for the resolution of complaints concerning railway noise and vibration.* Retrieved from: https://www.otc-cta.gc.ca/sites/all/files/altformats/books/guidelines-noise-and-vibration_e_0.pdf

Direction 2006. (n.d.) *Trespassing on railway lines: A community problem-solving guide.* Retrieved from: http://www.operationlifesaver.ca/wp-content/uploads/2010/06/en_TrespGuide2003.pdf

Garg, N. and Sharma, O. (2010). "Investigations on transportation induced ground vibrations". Proceedings of 20th International Congress on Acoustics, ICA 2010, Sydney, Australia.

Go Transit. (N.d.). *Go Transit rail corridor development handbook:* Author.

Hanson, C.E., Towers, D.A. and Meister, L.D. (2006). *Transit Noise and vibration impact assessment.* FTA-VA-90-1003-06, Office of Planning and Environment, Federal Transit Administration, USA.

Health Canada. (2010). *Useful information for environmental assessments.* Retrieved from http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/eval/environ_assess-eval/environ_assess-eval-eng.pdf

Howe, B., & McCabe, N. (March 15 2012). *Railway vibration reduction study: Information on railway vibration mitigation* [Ottawa, ON]: Railway Association of Canada.

Hunaidi, O. (1996). "Evaluation of human response to building vibration caused by transit buses". Journal of Low Frequency Noise and Vibration, Vol. 15 No.1, p. 25-42. NRCC Report No. 36963.

Hunaidi, O. and Tremblay, M. (1997). "Traffic-induced building vibrations in Montreal". Canadian Journal of Civil Engineering, Vol. 24, p.736-753.

Noise Assessment Criteria in Land Use Planning (1997, LU-131). Retrieved from the Ontario Ministry of the Environment website: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079357.pdf

Preston, B.J. (April 7 2009). Sustainable Development in the Law Courts: The Polluter Pays Principle. 16th Commonwealth Law Conference, Hong Kong.

Queensland Rail. (November 2007). *Code of practice - railway noise management.* EMS/STD/46/004. Retrieved from http://www.queenslandrail.com.au/AboutUs/

ReleaseOfInformation/Documents/EMS-STD-46-004.pdf

Rail Infrastructure Corporation. (November 2003). *Interim guidelines for applicants: Consideration of rail noise and vibration in the planning process.* Retrieved from http://www.daydesign.com.au/downloads/Interim_guidelines_for_applicants.pdf

Railway Association of Canada, The, & Federation of Canadian Municipalities, The. (2007). *Final Report: Proximity guidelines and best practices* [Montreal, QC]: The Federation of Canadian Municipalities.

Railway Safety Act Review Secretariat. (2007). *Stronger ties: A shared commitment to railway safety.* Retrieved from the Transport Canada website: www.tc.gc.ca/tcss/RSA_Review-Examen_LSF

State Government of New South Wales, Department of Environment . (2007). *Interim guideline for the Assessment of Noise from Rail Infrastructure Projects.* Retrieved from: http://www.environment.nsw.gov.au/noise/railinfranoise.htm

State Government of New South Wales, Department of Planning. (2008). *Development near rail corridors and busy roads - interim guideline.* Retrieved from http://www.planning.nsw.gov.au/rdaguidelines/documents/DevelopmentNearBusyRoadsandRailCorridors.pdf

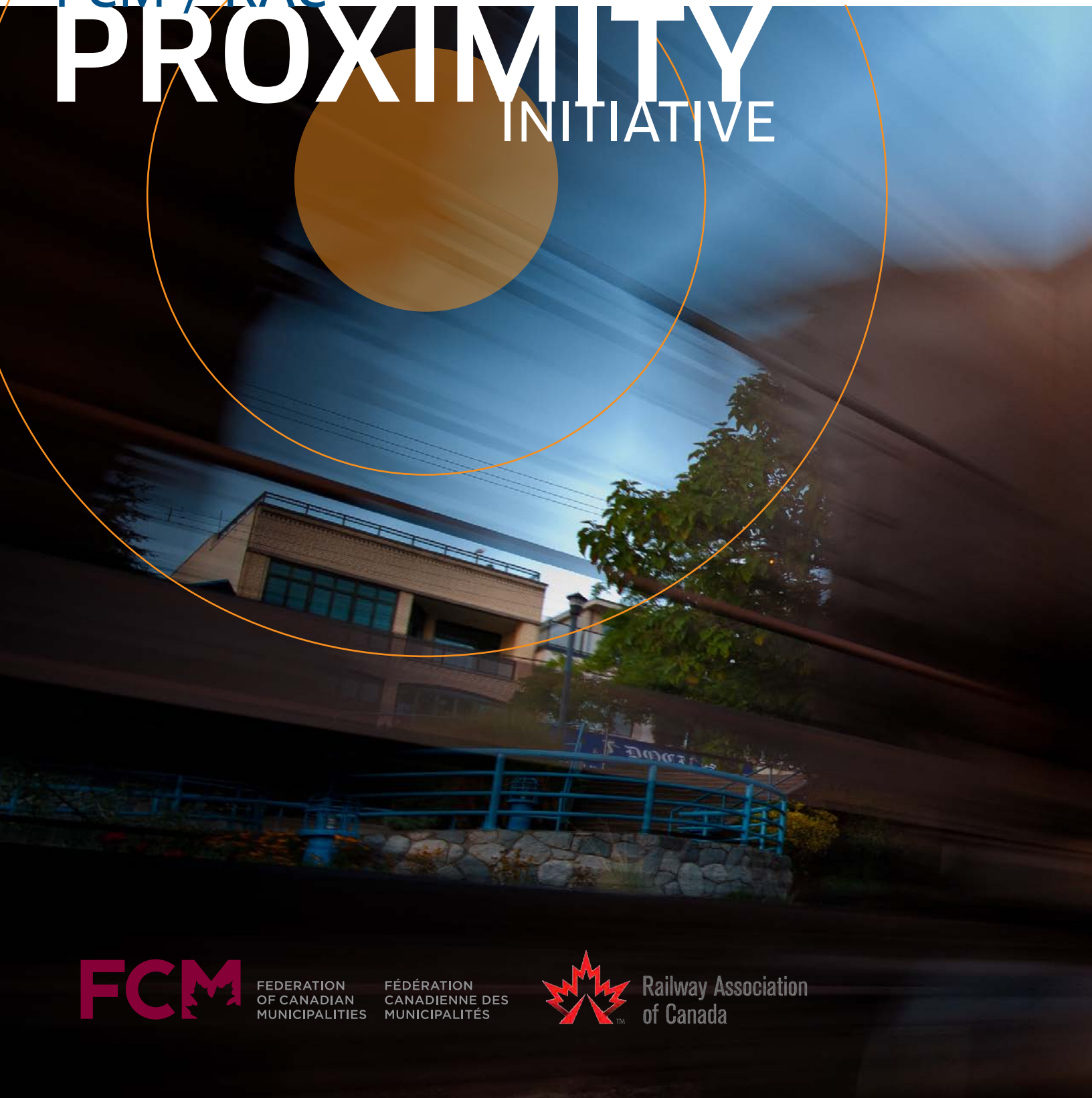
State of Queensland, Department of Infrastructure and Planning. (October 2010). *Guide for development in a railway environment.* Retrieved from: http://www.dlgp.qld.gov.au/resources/guideline/tod/rail-guideline.pdf

Toronto Area Rail Transportation of Dangerous Goods Task Force. (1988). *Consultant's Report* [Ottawa, ON]: Supply and Services Canada.

World Health Organization. (2011). *Burden of disease from environmental noise: Quantification of healthy life years lost in Europe.* Retrieved from: http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

FCM / RAC

PROXIMITY INITIATIVE



FCM FEDERATION OF CANADIAN MUNICIPALITIES FÉDÉRATION CANADIENNE DES MUNICIPALITÉS

Railway Association of Canada

August 20, 2018

ATTACHMENT IR7.1-2
COMPATIBILITY BETWEEN INDUSTRIAL FACILITIES AND SENSITIVE LAND USES

GUIDELINE D-6
(formerly 07-09)

COMPATIBILITY BETWEEN INDUSTRIAL FACILITIES AND SENSITIVE LAND USES

Legislative Authority:

Environmental Protection Act, RSO 1990, Section 14
Environmental Assessment Act, RSO 1990, Section 5(3)
Planning Act, RSO 1990, Sections 2 (a) (b) (c) (f) (g) (h), 17(9), 22(3), 41(4) and 51(3)
Condominium Act, RSO 1990, Section 50(3)
Niagara Escarpment Planning & Development Act, RSO 1990, Section 9

Responsible Director:

Director, Environmental Planning & Analysis Branch

Last Revision Date:

July 1995

Table of Contents

5.0 REFERENCE DOCUMENTS

APPENDICES:

APPENDIX A: INDUSTRIAL CATEGORIZATION CRITERIA

APPENDIX B: RELATIONSHIP BETWEEN MINISTRY CERTIFICATE OF APPROVAL PROCESS & THE PLANNING PROCESS

APPENDIX C: SEPARATION DISTANCES (SECTION VIEW)
SEPARATION DISTANCES (PLAN VIEW)

APPENDIX D: MINISTRY OF CONSUMER AND COMMERCIAL RELATIONS BULLETIN NO. 91003, "ENVIRONMENTAL WARNINGS/ RESTRICTIONS"

SYNOPSIS

This guideline is intended to be applied in the land use planning process to prevent or minimize future land use problems due to the encroachment of sensitive land uses and industrial land uses on one another. The guideline is a direct application of Ministry Guideline D-1, "Land Use Compatibility" (formerly Policy 07-03).

This guideline encourages informed decision-making for Ministry staff as well as land use approval authorities and consultants, and assists in determining compatible mixed land uses and compatible intensification of land uses. The guideline is intended to apply when a change in land use is proposed, and the range of situations are set out in Section 2.0 "Application" of Guideline D-1. Responsibilities and various implementation techniques are discussed in Procedure D-1-1, "Land Use Compatibility: Implementation".

Adequate buffering of incompatible land uses is intended to supplement, not replace, controls which are required by legislation for both point source and fugitive emissions at the facility source. These emissions, which are difficult to control on-site, under all circumstances, all of the time, are associated with normal operating procedures. Appendix B contains information on the Ministry's legislative requirements (e.g. Certificates of Approval) which may apply to industrial facilities.

The Ministry shall not be held liable for municipal planning decisions that disregard Ministry policies and guidelines. When there is a contravention of Ministry legislation, Ministry staff shall enforce compliance.

Nothing in this guideline is intended to alter or modify the definition of "adverse effect" in the *Environmental Protection Act*.

1.0 INTRODUCTION

1.1 Objective

The objective of this guideline is to prevent or minimize the encroachment of sensitive land use upon industrial land use and vice versa, as these two types of land uses are normally incompatible, due to possible adverse effects on sensitive land use created by industrial operations.

To assist planning authorities in achieving the objective,

Appendix A of this guideline categorizes industrial facilities into three Classes according to the objectionable nature of their emissions, their physical size/scale, production volumes and/or the intensity and scheduling of operations. One or more of these factors may cause an adverse effect.

1.2 Scope

1.2.1 Sensitive Land Uses

For the purposes of this guideline, (i.e. where industry is concerned) sensitive land use may include:

- recreational uses which are deemed by the municipality or provincial agency to be sensitive; and/or
- any building or associated amenity area (i.e. may be indoor or outdoor space) which is not directly associated with the industrial use, where humans or the natural environment may be adversely affected by emissions generated by the operation of a nearby industrial facility. For example, the building or amenity area may be associated with residences, senior citizen homes, schools, day care facilities, hospitals, churches and other similar institutional uses, or campgrounds.

See also Section 4.4.4, "Ancillary Land Uses (Sensitive Land Use)" for more information on the types of uses, the land areas and the related activities affected by this guideline.

NOTE: Residential land use shall be considered sensitive 24 hours/day.

1.2.2 Industrial Land Uses

The guideline applies to all types of proposed, committed and/or existing industrial land uses which have the potential to produce point source and/or fugitive air emissions such as noise, vibration, odour, dust and others, either through normal operations, procedures, maintenance or storage activities, and/or from associated traffic/transportation.

This guideline also considers ground borne vibration, but does not deal with other emissions into the soil or ground and surface water. These other matters are addressed through the *Environmental Protection Act (EP Act)*, in particular Regulation 346 and Regulation 347, the *Ontario Water*

Resources Act (OWR Act) in general, and the Municipal Industrial Strategy for Abatement (MISA).

1.2.3 Non-Stationary Industrial Facilities

This guideline is not intended to apply to non-stationary industrial facilities such as a portable asphalt plant.

1.2.4 Other Facilities

This guideline does not apply to the following provincial, municipal or private facilities, land uses or related activities, nor to any on-site industrial-type facilities associated with them, except as noted below:

- sewage treatment facilities;
- landfills or dumps, transfer stations and other waste management facilities and waste processing facilities that require a Waste Certificate of Approval (e.g. facilities for waste oil refining, waste wood chipping and materials recovery facilities [MRFs]);
- agricultural operations;
- roadways (except for ancillary transportation facilities and transportation-related activities for an industrial land use including shipping and receiving);
- airports;
- railways (but it does apply to railway yards and other ancillary rail facilities); and
- pits and quarries (However, in the absence of site specific studies, this guideline should be utilized when sensitive land use encroaches on an existing pit and/or quarry. In these situations the appropriate criteria are the potential influence area and recommended minimum separation distance for a Class III industrial facility as set out in Sections 4.1.1 and 4.3 of this guideline.).

A list of publications which deal with land use compatibility for some of these land uses is provided in Procedure D-1-2, "Land Use Compatibility: Specific Applications".

1.3 Land Uses Compatible with Industrial Facilities

The land uses listed in Section 1.2.4 above are normally compatible with industrial facilities.

1.4 Approach

The general approach in Section 3.0 of Guideline D-1: "Land Use

Compatibility" shall be followed to protect incompatible land uses from each other.

2.0 DEFINITIONS

NOTE: Definitions in addition to those below are provided in Procedure D-1-3, "Land Use Compatibility: Definitions".

Amenity Area

An outdoor space or facility that is used for the enjoyment of persons residing in or utilizing any building(s) on the premises.

Class I Industrial Facility

A place of business for a small scale, self contained plant or building which produces/stores a product which is contained in a package and has low probability of fugitive emissions. Outputs are infrequent, and could be point source or fugitive emissions for any of the following: noise, odour, dust and/or vibration. There are daytime operations only, with infrequent movement of products and/or heavy trucks and no outside storage. See Appendix A of this guideline for classification criteria and examples to categorize a specific industry.

Class II Industrial Facility

A place of business for medium scale processing and manufacturing with outdoor storage of wastes or materials (i.e. it has an open process) and/or there are periodic outputs of minor annoyance. There are occasional outputs of either point source or fugitive emissions for any of the following: noise, odour, dust and/or vibration, and low probability of fugitive emissions. Shift operations are permitted and there is frequent movement of products and/or heavy trucks during daytime hours. See Appendix A of this guideline for classification criteria and examples to categorize a specific industry.

Class III Industrial Facility

A place of business for large scale manufacturing or processing, characterized by: large physical size, outside storage of raw and finished products, large production volumes and continuous movement of products and employees during daily shift operations. It has frequent outputs of major annoyance and there is high probability of fugitive emissions. See Appendix A of this guideline for classification criteria and examples to categorize a specific industry.

Fugitive Emissions

Reasonably expected/predictable contaminant occurrences associated with normal operational practices and procedures (e.g. materials handling or outdoor storage) of industrial facilities, which are generally difficult to practically control at the source or on-site. These emissions are not point sources (i.e. not from stacks or vents). Fugitive emissions are from all sources. These emissions may include odour, noise, vibration and particulate such as dust. Emissions from a breakdown are also not considered 'fugitive'. Breakdown emissions would be covered under a Certificate of Approval contingency plan, or are considered to be a 'spill'.

Industry, Industrial Land Use or Industrial Facility

A facility or activity relating to: the assemblage and/or storage of substances/goods/raw materials; their processing and/or manufacturing; and/or the packaging and shipping of finished products. Industrial facilities are further refined through categorization into 3 Classes in this guideline (see Appendix A of this guideline).

Infilling

Development on a vacant lot or an underdeveloped lot within a built-up area; not redevelopment/re-use.

Redevelopment

Where existing land uses are being phased out and replaced by another type of designated land use as part of a land use plan or proposal which has been substantiated by studies and is in accordance with a municipal official plan policy or other formally approved plan.

3.0 APPLICATION

The information set out Section 2.0 of Guideline D-1, "Land Use Compatibility" shall apply for this guideline also.

4.0 IMPLEMENTATION

Areas of Responsibility for Ministry Staff or the Delegated Authority, Municipalities and Other Planning Authorities and Proponents are identified in Procedure D-1-1, Sections 1, 2 and 3 respectively.

See Procedure D-1-1, "Land Use Compatibility: Implementation" also for general information on legislative and administrative tools.

4.1 Influence Area Concept

4.1.1 Potential Influence Areas for Industrial Land Uses

The Ministry has identified, through case studies and past experience, the following potential influence areas (i.e. areas within which adverse effects may be experienced) for industrial land uses (Illustrated in Appendix C):

Class I - 70 metres*
Class II - 300 metres*
Class III - 1000 metres*

*** See Section 4.4, "Measuring Separation Distance" also.**

4.1.2 Actual Influence Areas for Industrial Land Uses

The actual influence area (overall range within which an adverse effect would be or is experienced) for a particular facility is site-specific, and may be defined within, or in exceptional circumstances (see Section 4.5.2, Separation Distance Greater than the Potential Influence Area"), beyond the potential influence area either before, or where applicable, after buffers have been used to reduce, eliminate or otherwise intercept adverse effects.

In the absence of specific substantiating information (normally obtained through technical studies - see Section 4.6, "Studies") which identifies an actual influence area, the potential influence areas set out in Section 4.1.1 of this guideline shall be used.

4.1.3 Influence Area Reduced Through Industrial Controls

Mitigation at the industrial source, if it affects the criteria considered in Appendix A, may enable an industry to be categorized as a lesser Class (e.g. from a Class II to a Class I), thereby reducing the minimum separation distance requirements set out in Section 4.3, "Recommended Minimum Separation Distances". For example, a rendering plant can be an extremely noxious use, but an enzyme digester can make it "cleaner".

In cases where the separation distance is reduced through other buffering techniques, where feasible the Ministry recommends some site-specific notification (e.g. spot zoning or requirement for re-zoning by the municipality) to deal with future changes in use which would not normally require re-zoning.

4.2 Land Use Planning

4.2.1 Purpose of General Land Use Plans

Impacts from industrial sources relate to operating and maintenance procedures rather than general land use. Land use documents normally do not control the operation of a land use, as the operational details are not normally known when lands are designated for industrial use, and most operational aspects cannot be controlled by municipalities through the land use planning process.

As well, municipal official plans (O.P.s) give general policy direction. Official plans and associated policies have no power of enforcement. There is no allowance for 'performance' zoning. Therefore, it is difficult to calculate actual influence areas at the time the O.P. is contemplated. Uses within a given designation or zoning could have totally different influence areas.

4.2.2 Determining Permitted Uses Within Industrial Land Use Designations

Permitted uses should be based on operational aspects (e.g. plant emissions, hours of operation, traffic movement) and mitigation employed. Zoning by-laws, however, do not normally use such factors in the definition of permitted uses. Therefore, it shall be necessary to consult Appendix A of this guideline, to determine permitted uses within a general land use designation.

4.2.3 Existing and Committed Industrial Land Use

When there are existing and committed industrial uses, the Ministry recommends that the category designation of "Class I", "Class II" or "Class III", according to Appendix A of this policy, be indicated in the land use plans by the approval authority.

Plan approval agencies are encouraged to delineate all potential influence areas or, where known, the actual influence areas, around existing and committed industrial land uses within their jurisdiction, to be used as a 'flag' when a change in land use is proposed within them.

This should be done on a scaled land use plan or map, and included in an easily accessible document, such as an official plan schedule.

NOTE #1: The Canadian Urban Institute is producing a guide

to the creation and use of municipal historical inventories which includes a recommended approach to documenting the types and locations of industries and other potentially polluting activities.

NOTE #2: It would be advisable to include locations of former industrial facilities as well, since decommissioning and soil clean up may be required for site re-use. See Section 4.10.8, "Site Clean Up and Decommissioning" also.

4.2.4 On-Site Separation Distance

There is merit in providing a required separation distance on the facility site. However, there may be a change in industrial land use that does not require a change in zoning, but which nevertheless produces a different influence area not covered off by the existing on-site buffer area.

Therefore, when separation distance is provided partially or entirely on-site, the Ministry recommends that where feasible, some site-specific notification (e.g. spot zoning or requirement for re-zoning by the municipality) is put in place to ensure future changes in use which would not normally require re-zoning will comply with this guideline. The same problem could occur when a buffer area is provided on the sensitive site.

4.2.5 Off-Site Separation Distance

When the separation distance extends beyond the facility/sensitive site boundary or the industrial/sensitive zoned or designated lands, the intervening lands may be of a use or activity compatible with both the facility and the sensitive land use.

For example, depending upon the amount of intervening space, uses could include: warehousing, various commercial uses that relate to types of industries or the neighbouring lands, open/green space, road allowance or, for Class III and Class II industrial uses, Class I industrial uses. If a lower Class of industrial use is used, there must still be adequate separation and/or buffering as established in this guideline to avoid or eliminate adverse effects on any sensitive land uses in the vicinity.

4.3 Recommended Minimum Separation Distances

No incompatible development other than that identified in Section 4.10, "Redevelopment, Infilling and Mixed Use Areas" should occur

in the areas identified below and illustrated in Appendix C, even if additional mitigation for adverse effects, as discussed in Section 4.2 of Procedure D-1-1, "Types of Buffers", is provided:

Class I - 20 metres minimum separation distance*
Class II - 70 metres minimum separation distance*
Class III - 300 metres minimum separation distance*

*** See Section 4.4, "Measuring Separation Distance" also.**

These minimums are based on Ministry studies and historical complaint data. They also make allowance for the fact that conventional zoning classifications usually permit a broad range of uses with varying potential to create land use conflicts.

4.4 Measuring Separation Distance

Depending upon the situation, separation distances may be measured from different points:

4.4.1. General Land Use Plans

Measurement shall be from the area(s) designated for industrial use to the area(s) designated for sensitive land use. This would apply for such matters as municipal official plans and Ministry of Natural Resources District Land Guidelines.

4.4.2 Site Specific Plans

Measurement shall normally be from the closest existing, committed or proposed property/lot line of the industrial land use to the property/lot line of the closest existing, committed or proposed sensitive land use. This approach provides for the full use and enjoyment of both the sensitive land use and the industrial properties. See Sections 4.4.3 and 4.4.4 for exceptional situations.

4.4.3 Zoning/Site Plan Control (Industrial Lands)

Where site-specific zoning or site plan control precludes the use of the setback for any activity associated with the industrial use that could create an adverse effect such as shipping and receiving or outside storage/stockpiling of materials (e.g. front yard must be landscaped, and functions as a buffer), then the setback can be included as part of the measurement, rather than measuring from the industrial property line.

NOTE: This approach could restrict future expansion of existing land uses.

On-site buffers could be required by a municipality through zoning by-law setback requirements in industrial subdivisions, but this may not be practical, as the provision of very deep lots would be necessary. See Section 4.2.4, "On-Site Separation Distance" also. The use of other forms of mitigation may have to wait until a specific industry and/or sensitive land use has been identified/established.

4.4.4 Ancillary Land Uses (Sensitive Land Use)

For sensitive land uses, where the established use of on-site lands are not of a sensitive nature, such as a parking lot servicing a hospital, the land area comprising the parking lot may be included within the separation distance (i.e. measure from where the actual sensitive activities occur).

NOTE: This approach could restrict future expansion of existing land uses. See Section 4.2.4, "On-Site Separation Distance" also.

4.4.5 Vacant Industrial Land

Where there is no existing industrial facility within the area designated/zoned for industrial land use, determination of the potential influence area shall be based upon a hypothetical "worst case scenario" for which the zoned area is committed. Therefore, Ministry staff or the delegated authority shall use the outside range of the potential influence area to determine an appropriate separation distance. See Section 4.2.2, "Determining Permitted Uses Within Industrial Land Use Designations" also.

4.4.6 Changing Industrial Uses

Where an influence area has been established based upon existing industrial land uses, it will be the responsibility of the local municipality to restrict, through zoning or any other available means, the types of future industrial uses that can occur, so that they are compatible with the influence area used.

NOTE: Zoning by-laws cannot control the level of emissions produced (related to specific products) or technology used,

hours of operation or traffic movements. It is difficult to correlate zoning by-laws with the industrial classifications set out in Appendix A, and therefore site-specific/spot zoning or a requirement for re-zoning by the municipality may be necessary to ensure that the establishment of new industrial uses comply with this guideline. See Section 4.2.2, "Determining Permitted Uses Within Industrial Land Use Designations" also.

4.5 Commenting on Land Use Proposals

4.5.1 Considerations When a Change in Land Use is Proposed Within an Influence Area or Potential Influence Area

The potential influence areas, or where known, the actual influence areas (see Section 4.1 of this guideline) should act as a 'flag', and no sensitive land uses shall be permitted within the actual or potential influence areas of Class I, II or III industrial land uses, without evidence to substantiate the absence of a problem. When studies are needed to identify problems and mitigative measures, see Section 4.6, "Studies".

When a land use proposal places sensitive land use beyond a facility's potential influence area, or where known, actual influence area, the Ministry shall not normally object to the change in land use on the basis of land use compatibility. For exceptional situations, see Section 4.5.2 "Separation Distance Greater than the Potential Influence Area".

4.5.2 Separation Distance Greater than the Potential Influence Area

In exceptional circumstances the Ministry shall recommend separation distances greater than the outer limit of the potential influence areas identified in Section 4.1.1 of this guideline. In such cases, the Ministry shall demonstrate the need for greater distance, such as historical data for similar facilities. Studies (see Section 4.6) may be required even if a separation distance beyond the potential influence area is proposed.

4.5.3 Irreconcilable Incompatibilities

When impacts from industrial activities cannot be mitigated or prevented to the level of a trivial impact (i.e. no adverse effects), new development, whether it be an

industrial facility or a sensitive land use, shall not be permitted.

There may be situations where development or redevelopment can be phased until such time that an adverse effect would no longer exist (e.g. the facility ceases to operate or the problem is rectified by new technology).

4.6 Studies

Air quality studies for noise, dust and odour should be provided by the proponent to the approving authority.

NOTE: Studies shall be provided prior to Ministry staff commenting on draft approval, to see if draft approval can be supported (in principle).

4.6.1 Noise

Noise shall be addressed through Ministry Publication LU-131 for all situations applicable to this guideline.

4.6.2 Dust

Contaminant emission sources can be classified as point sources or fugitive sources. Most facilities will produce both point source and fugitive emissions, and it is difficult to allocate emissions to one or the other source.

Regulation 346 sets out standards for contaminants, including suspended particulate matter and dust fall. The document entitled "General Information: Certificates of Approval (Air)" that is referenced in Appendix B provides information on the approval requirements and procedures. Details for assessing emissions from point sources such as stacks and vents, and standards and interim standards are also provided.

Even if Regulation 346 standards are met at the property line of the industrial site, there may still be complaints from neighbouring land uses because: (a) dispersion modelling is not 100% accurate and it cannot be guaranteed that point source emissions will be controlled 100% of the time; and (b) the standards, which are based upon acceptable risk with regard to health, odour and vegetation, are based on 1/2 hour averages, and at some point within a 1/2 hour there may be a high level of emissions.

Emissions from fugitive sources such as dust from traffic

and storage piles are more difficult to quantify, and a plan in itself to minimize fugitive emissions also may not be 100% effective. The Ministry is preparing an interim guideline that addresses areas such as measuring and minimizing fugitive emissions. Therefore, separation of incompatible land uses will help to minimize potential adverse effects from fugitive emissions.

4.6.3 Odour

Odorous contaminants are particularly difficult to control on-site. Although the contaminants emitted may meet the Ministry's standards and interim standards, experience indicates that complaints may still be received from residents living in proximity to the industry, for the reasons set out in Section 4.6.2. Emissions of odorous contaminants may result in off-site odour problems which could constitute an 'adverse effect'. An 'adverse effect' is a violation of Section 14 of the *Environmental Protection Act*. Stack testing under a worst case scenario, odour panel tests and odour control equipment may be required to minimize odour concerns.

4.7 Mitigation

Additional mitigation measures (see Procedure D-1-1, "Land Use Compatibility: Implementation", Section 4.2, "Types of Buffers") may need to be incorporated on either the development lands or the surrounding properties, at the expense of the developer, where the industrial facility is operating in compliance with legislated Ministry requirements.

4.8 Legal Agreements

When mitigative controls are to be installed on surrounding properties, the local municipality or other approving authority should require an agreement between the developer and the affected property owners, to ensure mitigation of adverse effects to the greatest degree possible.

The legal agreement between the developer and other affected parties to ensure adequate mitigation should be reviewed and endorsed by Ministry staff and/or the delegated authority prior to development approval.

4.9 Financial Assurance

The Ministry recommends that bonds be required by the approving authority to ensure that mitigation will be carried out.

4.10 Redevelopment, Infilling & Mixed Use Areas

It may not be possible to achieve the recommended minimum separation distances set out in Section 4.3 of this guideline in areas where infilling, urban redevelopment and/or a transition to mixed use is taking place.

The following requirements shall apply if this Ministry or a delegated authority is to consider proposals for urban redevelopment, infilling and/or a transition to mixed use within less than the Ministry's recommended separation distances set out in Section 4.3 of this guideline:

4.10.1 Official Status

Such proposals must be in accordance with official plan policy or a formal planning approval process, with the boundaries of the redevelopment, infilling or mixed use area clearly defined by the planning authority.

4.10.2 Zoning

The Ministry or delegated authority shall only consider redevelopment, infill and mixed use proposals which put industrial and sensitive land uses together within less than the recommended minimum separation distances (see Section 4.3), if the zoning is use specific (i.e. only the existing or proposed industrial or sensitive use is permitted by the municipality or other approving authority), or if planning considerations are based on the "worst case scenario" based on permitted uses in the industrial zoning by-law.

4.10.3 Feasibility Analysis

When a change in land use is proposed for either industrial or sensitive land use, less than the minimum separation distance set out in Section 4.3 may be acceptable subject to either the municipality or the proponent providing a justifying impact assessment (i.e. a use specific evaluation of the industrial processes and the potential for off-site impacts on existing and proposed sensitive land uses). Mitigation is the key to dealing with less than the minimum to the greatest extent possible.

The overall feasibility of the proposal, from a land use compatibility perspective, should be based on the anticipated adverse effects from each specific industry, and the effectiveness of proposed mitigative measures to lessen impacts on sensitive land uses within the context of planning for the area.

The Ministry or delegated authority shall require the following in order to make an assessment for allowing less than the recommended minimum separation distance:

- Detailed mapping showing the area subject to the proposed development and all industrial facilities and any other sources of adverse effects (e.g. rail lines);

- Mapping shall also indicate all vacant properties currently zoned and/or designated for industrial use along with relevant excerpts from the official plan and/or zoning by-law to indicate the full range of permitted uses. Attempts shall also be made to predict the types and levels of adverse impact that would result in a "worst case scenario" should an industrial use be developed upon any of the vacant parcels.

- Assessment of the types and levels of contaminant discharges being generated by current industrial facilities, including those associated with transportation facilities which serve the industries.

- Based upon actual and anticipated impacts, necessary mitigative measures should be identified based upon technical assessments. Noise and other technical studies shall be submitted to appropriate Ministry staff for review. See Sections 4.6 "Studies" and 4.7, "Mitigation" for more details.

- An indication shall be given as to the methods by which the mitigative measures (approved by the land use authority) will be implemented, i.e. the types of agreements that must be entered into. See Section 4.8, "Legal Agreements" also.

- Where mitigative measures are to be applied off-site to an existing industrial facility, the proponent shall demonstrate that the industrial facility has no objection to the proposed use or to the addition of the necessary mitigative measures. Implementation of approved mitigation measures shall be required as a condition of draft approval.

- Proponents should demonstrate to the approving authority that no objections to the proposed use have been raised by area residents, industries, etc. See Section 4.10.5, "Public Consultation".

4.10.4 New Use of Existing Buildings

The requirement for a feasibility analysis identified in Section 4.10.3 above shall apply as well where a new use is proposed for an existing building.

4.10.5 Public Consultation

When development is proposed at less than the recommended minimum distances identified in Section 4.3, the approving authority is encouraged to require public consultation with all land owners within the influence area or potential influence area of the industrial facility/facilities.

4.10.6 Environmental Warnings for Sensitive Land Uses

When the new development is sensitive, the Ministry recommends that a warning of anticipated nuisance effects be included in any offers of purchase and sale. A means of notifying ensuing purchasers should be determined by the local municipality. A warning may be included in a document which can be registered on title according to the Ministry of Consumer and Commercial Relations Bulletin No. 91003, "Environmental Warnings/Restrictions" (Appendix D).

4.10.7 Phased/Sequential Development

When industry is being phased out as part of a large-scale plan, consideration may be given to staging redevelopment and/or infilling to coincide with the closure of those industries which create a significant impact on the proposed sensitive land use(s).

4.10.8 Site Clean Up & Decommissioning

Guideline C-15 (former Ministry Policy 14-17), "Guidelines for the Clean Up of Contaminated Sites in Ontario" may apply in conjunction with re-use of industrial properties. In such instances, the approving authority should ensure that the level of clean up is appropriate for both the re-use of the site and the protection of sensitive land use receptors.

NOTE: Municipal O.P.s should establish a policy to indicate when site rehabilitation (especially for mixed use, redevelopment and infilling) is required. A policy should also require that there be a qualified individual on-site to oversee the rehabilitation. It is recommended that this requirement be incorporated in a development agreement between the developer and the municipality.

4.11 Accessory Residential Uses

Some municipalities may permit "accessory residential uses" in industrial official plan designations or zoning by-laws (i.e. the owner's residence is on the same property as the business/industry). When the residence will no longer be occupied by the on-site business/industry owner, any re-use of the residence shall be subject to the requirements set out in Section 4.10, "Redevelopment, Infilling & Mixed Use", particularly Section 4.10.4, "New Use of Existing Buildings" and Section 4.10.8, "Site Clean Up & Decommissioning".

Where there are provisions for "accessory residential uses", it may be appropriate for municipalities to prohibit such residential uses where none exist, through an official plan amendment or a site-specific zoning-bylaw (see Section 4.10.2, "Zoning").

5.0 REFERENCE DOCUMENTS

(a) Guideline C-15, "Guidelines for the Clean Up of Contaminated Sites in Ontario"

(b) Guideline D-1, "Land Use Compatibility"

(c) Procedure D-1-1, "Land Use Compatibility: Implementation"

(d) Procedure D-1-2, "Land Use Compatibility: Specific Applications"

(e) Procedure D-1-3, "Land Use Compatibility: Definitions"

(f) Publication LU-131, "Noise Assessment Criteria in Land Use Planning"

August 20, 2018

ATTACHMENT IR7.6-1
PREDICTED HYDROGRAPH FLOW RATE LOCATION

\\Cd1220-f02\01609\active\160960844\drawing\MXD\Surface_Water\Report_Figures\CEAA_IR7_Response\160960844_ir7_FigIR7_6_a_1_Predicted_Hydrograph_Flow_Rate_Location.mxd
Revised: 2018-06-21 By: pworsell

June 2018
160960844

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018. Site layout: July 10, 2015.
3. Orthoimagery © First Base Solutions, 2018. Imagery taken in 2014.

Legend

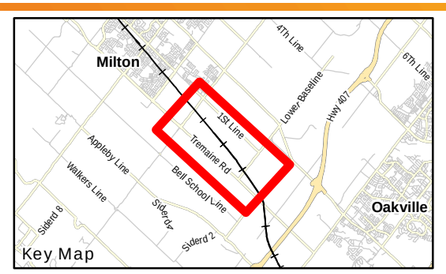
- Tributary A Hydrograph Flow Location
- Levelogger Location

Project Components

- Project Development Area
- Single Track - Mainline
- Double Track - Mainline
- Project Component
- Creek Channel
- Stormwater Management (SWM) Pond

Existing Features

- Existing Single Track Mainline
- Existing Double Track Mainline
- CN-Owned Property
- Permanent Stream
- Intermittent Stream



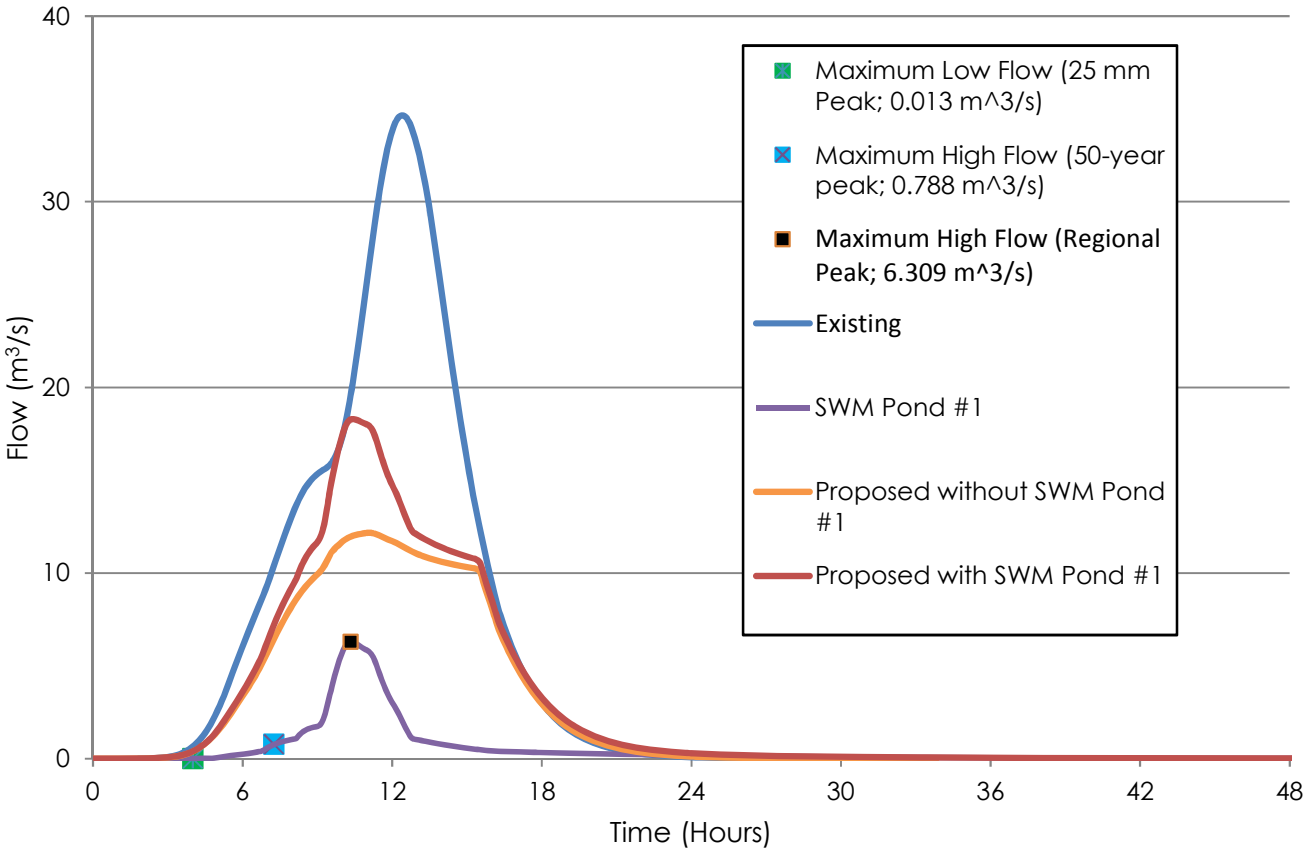
Client/Project
Canadian National Railway
Milton Logistics Hub

Figure No.
IR7.6-1

Title
Predicted Hydrograph Flow Rate Location

August 20, 2018

ATTACHMENT IR7.6-2
REGIONAL EVENT HYDROGRAPH WITH STORMWATER MANAGEMENT POND 1 INFLOWS



Notes:
Source: EIS, Appendix E.15, Appendix B - Visual OTTHYMO flows

Client/Project
Canadian National Railway Milton Logistics Hub

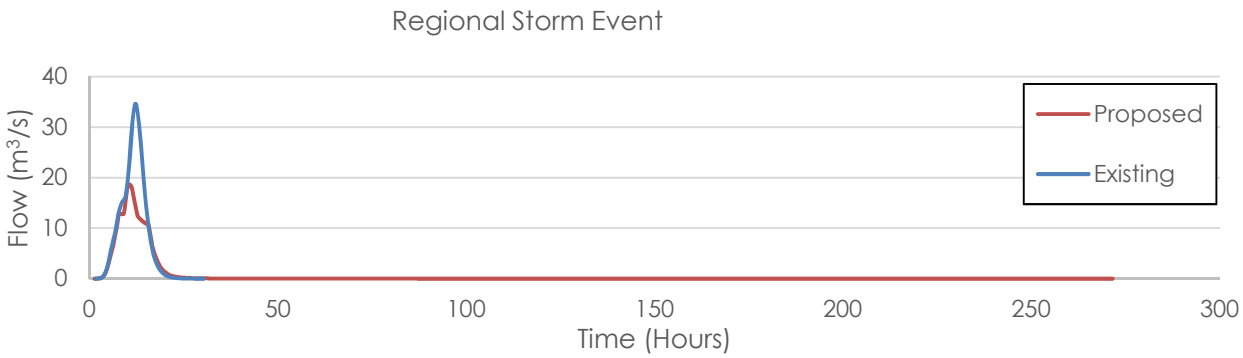
Figure No.
IR7.6-2

Title
Regional Event Hydrograph with Storm Water Management Pond #1 Inflows Tributary A (Node 2)

Stantec

August 20, 2018

ATTACHMENT IR7.6-3
HYDROGRAPHS FOR 25-YEAR TO REGIONAL STORMS IN TRIBUTARY A



Notes:
Source: EIS, Appendix E.15, Appendix B - Visual OTTHYMO flows

Client/Project
Canadian National Railway Milton Logistics Hub

Figure No.
IR7.6-3

Title
25 Year - Regional Storm Event Return Period Event Hydrographs Tributary A (Node 2)

Stantec

August 20, 2018

ATTACHMENT IR7.8-1
PREDICTED PRE- AND POST-DEVELOPMENT PHOSPHOROUS LOADS TO TRIBUTARY A (UPDATE OF TABLE IR3.4-1)

Attachment IR7.8-1: Predicted Pre- and Post- Development Phosphorous Loads to Tributary A (Update of Table IR3.40-1)

Land Use	Low Value		Most Likely Value [a]		High Value		Existing PDA				Post-Development PDA				
	Literature Source	Total Phosphorus Coefficient (kg/ha/yr)	Literature Source	Total Phosphorus Coefficient (kg/ha/yr)	Literature Source	Total Phosphorus Coefficient (kg/ha/yr)	Uncontrolled Drainage Area (ha)	Low Value Annual Total Phosphorus Load (kg)	Most Likely Value Annual Total Phosphorus Load (kg)	High Value Annual Total Phosphorus Load (kg)	Uncontrolled Drainage Area (ha)	SWM Pond Drainage Area (ha)	Low Value Annual Total Phosphorus Load (kg) [c]	Most Likely Value Annual Total Phosphorus Load (kg) [c]	High Value Annual Total Phosphorus Load (kg) [c]
Clear Open Water/ Marsh	Lake Simcoe Region Conservation Authority 2000	0.16	Adapted from Open Water factor accounting for atmospheric deposition Hutchinson et al. 2012	**0.26**	Southern Ontario - Sanderson 1977	0.97	**3.6**	0.6	**0.9**	3.5	**2.2**	**1.4**	0.4	**0.7**	2.5
Treed Upland/ Hedge Rows	Winter and Duthie 2001	0.1	Jeje 2006 (adapted from Reckhow et al. 1980)	**0.21**	Managed Forests (15% clearcut/10% select cut) - Maine Department of Environment Protection 2000	0.5	**0.2**	0.0	**0.1**	0.1	**0**	**0**	0.0	**0**	0.0
Community/ Infrastructure	Hutchinson Environmental Sciences Limited and Ministry of Environment 2011; Impervious Surfaces - Waller and Hart 1986	(0.13); (0.045) [b]	Shaver et al. 2007 a	**(1.1) / (0.33) [b]**	Lake Simcoe Regional Conservation Authority 2000; Maine Department of Environment Protection 2000	(2.01) / (3.5) [b]	**0.1**	0.0	**0.1**	0.3	**0.1**	**0**	0.0	**0.1**	0.5
Agriculture and Undifferentiated Rural Land Use	Agricultural Rotational Crops - Maine Department of Environment Protection 2000	1.5	Jeje 2006 (adapted from Reckhow et al. 1980)	**2.2**	Jeje 2006 (adapted from Hargrave & Skaykewich 1991)	3.8	**78.3**	117.5	**172.2**	297.5	**21.0**	**31.2**	45.5	**66.7**	115.4
Pavement, Buildings, Railway Track	Novotny and Olem 1997	1.49	Commercial/ Industrial – Hutchinson et al. 2012	**1.82**	Northeast Florida Water Mangament District 1994	5.347	**0**	0	**0**	0.0	**1.2**	**22.8**	12.0	**14.6**	43.0
Total								118.1	**173.3**	301.4			58.0	**82.1**	161.4

Bold text indicates values from Table IR3.40-2 (CEAR #613)

Attachment IR7.8-1: Predicted Pre- and Post- Development Phosphorous Loads to Tributary A (Update of Table IR3.40-1)

[a] Mean values used in EIS, Appendix E.15 and estimated based on year of study with preference for most recent, location of study and land cover/use representation.
[b] Assume 50% of land use low density residential and 50% road, respectively.
[c] Assumed 70% removal of total phosphorus by stormwater management (SWM) pond systems for SWM pond drainage areas.

August 20, 2018

ATTACHMENT IR7.8-2
PREDICTED PRE- AND POST-DEVELOPMENT PHOSPOROUS LOADS TO INDIAN CREEK

Attachment IR7.8-2: Predicted Pre- and Post- Development Phosphorous Loads to Indian Creek

Land Use	Low Value		Most Likely Value [a]		High Value		Existing PDA				Post-Development PDA				
	Literature Source	Total Phosphorus Coefficient (kg/ha/yr)	Literature Source	Total Phosphorus Coefficient (kg/ha/yr)	Literature Source	Total Phosphorus Coefficient (kg/ha/yr)	Uncontrolled Drainage Area (ha)	Low Value Annual Total Phosphorus Load (kg)	Most Likely Value Annual Total Phosphorus Load (kg)	High Value Annual Total Phosphorus Load (kg)	Uncontrolled Drainage Area (ha)	SWM Pond Drainage Area (ha)	Low Value Annual Total Phosphorus Load (kg) [c]	Most Likely Value Annual Total Phosphorus Load (kg) [c]	High Value Annual Total Phosphorus Load (kg) [c]
Clear Open Water/ Marsh	Lake Simcoe Region Conservation Authority 2000	0.16	Adapted from Open Water factor accounting for atmospheric deposition Hutchinson et al. 2012	0.26	Southern Ontario - Sanderson 1977	0.97	4.4	0.7	1.1	4.3	4.2	4.3	0.9	1.4	5.3
Treed Upland/ Hedge Rows	Winter and Duthie 2002	0.1	Jeje 2006 (adapted from Reckhow et al. 1980)	0.21	Managed Forests (15% clearcut/10% select cut) - Maine Department of Environment Protection 2000	0.5	2.7	0.3	0.6	1.4	1.7	1.0	0.2	0.4	1.0
Community/ Infrastructure	Hutchinson Environmental Sciences Limited and Ministry of Environment 2011; Impervious Surfaces - Waller and Hart 1986	(0.13); (0.045) [b]	Shaver et al. 2007 a	(1.1) / (0.33) [b]	Lake Simcoe Regional Conservation Authority 2000; Maine Department of Environment Protection 2000	(2.01) / (3.5) [b]	1.3	0.1	1.1	3.6	0.8	0.5	0.2	0.8	5.2
Agriculture and Undifferentiated Rural Land Use	Agricultural Rotational Crops - Maine Department of Environment Protection 2000	1.5	Jeje 2006 (adapted from Reckhow et al. 1980)	2.2	Jeje 2006 (adapted from Hargrave & Skaykewich 1991)	3.8	176.7	265.1	388.7	671.5	78.9	46.5	139.3	204.4	352.8
Pavement, Buildings, Railway Track	Novotny and Olem 1997	1.49	Commercial/ Industrial – Hutchinson et al. 2012	1.82	Northeast Florida Water Management District 1994	5.347	0	0	0	0	0	47.2	21.1	26	75.7
Total							266.1	391.5		680.7			161.6	232.9	440.0

Attachment IR7.8-2: Predicted Pre- and Post- Development Phosphorous Loads to Indian Creek

Bold text indicates values from Table IR3.40-2 (CEAR #613)
[a] Mean values used in EIS, Appendix E.15 and estimated based on year of study with preference for most recent, location of study and land cover/use representation.
[b] Assume 50% of land use low density residential and 50% road, respectively.
[c] Assumed 70% removal of total phosphorus by stormwater management (SWM) pond systems for SWM pond drainage areas.

August 20, 2018

ATTACHMENT IR7.10-1
BUILT-UP AREAS IN MILTON – 1991

\\Cd1220-f02\01609\active\60960844\drawing\MXD\Socio_Economic\Report_Figures\CEAA_IR7_Response\60960844_ir7_FigIR7_10_1_Growth_in_Milton_1991.mxd
Revised: 2018-08-20 By: pworsell

585000 587500 590000 592500 595000 597500 600000 602500

4830000 4827500 4825000 4822500 4820000 4817500 4815000 4812500 4810000 4807500

N

Sideroad 17
Sideroad 15
8Th Line
Sideroad 10
Heritage Road
Old Derry Road
Creditview Road
Mississauga Road
Argentia Road
Falconer Drive
Derry Road West
Millcreek Drive
Highway 401
Terragar Boulevard
Winston Churchill Boulevard
Erin Mills Parkway
Glen Erin Drive
Thomas Street
Lisgar Drive
10Th Line West
Churchill Meadows Boulevard
9Th Line
Hornby Road
Steeles Avenue
Trafalgar Road
Regional Road 25
First Line
Lower Base Line
Britannia Road
James Snow Parkway South
4Th Line
Thompson Road South
Childs Drive
Ontario Street South
Commercial Street
Bronte Street South
Steeles Avenue East
Woodward Avenue
Main Street East
Martin Street
Steeles Avenue West
Main Street West
Lower Baseline East
Burnhamthorpe Road East
6Th Line
Neyagawa Boulevard
River Glen Boulevard
Dundas Street West
Proudfoot Trail
Westoak Trails Boulevard
Upper Middle Road West
Pilgrims Way
Grand Oak Trail
Heritage Way
Bronte Road
Queen Elizabeth Way
Wyecroft Road
Dundas Street
Orchard Road
Derry Road
Twiss Road
Appleby Line
2nd Sideroad
Tremaine Road
Highway 407

REGIONAL MUNICIPALITY OF PEEL

City Of Brampton
Town Of Halton Hills
City Of Mississauga
Town Of Milton
Town Of Halton Hills
Town Of Oakville
City Of Burlington

0 1 2 km
1:70,000

KEY MAP
Milton
Oakville
Hwy 401
Hwy 407
5Th Line
6Th Line
8Th Line
4Th Line
1St Line
Twiss Rd

August 2018
Project No.

Legend

- Built-up Area [i]
- Main Residential Area [ii]
- Current Urban Area (as of 2011) [iii]
- Project Development Area
- Expressway / Highway
- Major Road
- Railway
- Watercourse
- Town of Milton
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Applicable Town of Milton Urban Area boundary not available for 1991.

Additional Notes

i. Statistics Canada. 2016. Human Activity and the Environment 2015: The changing landscape of Canadian metropolitan areas. Updated: June 28, 2016.

ii. Determined based on comparison of land use to Built Up Areas identified by Statistics Canada, 2016 for 1991.

iii. The Urban Area is a generalized area extracted from the Halton Region Official Plan - Map 1: Regional Structure (May 2013). Only the urban area of the Town of Milton is delineated.

Client/Project

Canadian National Railway
Milton Logistics Hub

Figure No.

IR 7.10-1

Title

Built-up Areas in Milton - 1991

August 20, 2018

ATTACHMENT IR7.10-2
BUILT-UP AREAS IN MILTON – 2001

\\Cd1220-f02\01609\active\60960844\drawing\MXD\Socio_Economic\Report_Figures\CEAA_IR7_Response\60960844_ir7_FigIR7_10_2_Growth_in_Milton_2001.mxd
Revised: 2018-08-20 By: pworsell

585000 587500 590000 592500 595000 597500 600000 602500

4830000 4827500 4825000 4822500 4820000 4817500 4815000 4812500 4810000 4807500

N

Sideroad 17
Sideroad 15
8Th Line
Sideroad 10
Heritage Road
Old Derry Road
City Of Brampton
Town Of Halton Hills
City Of Brampton
City Of Mississauga
Creditview Road
Mississauga Road
Argentia Road
Falconer Drive
REGIONAL MUNICIPALITY OF PEEL
Highway 401
Derry Road West
Millcreek Drive
Terragar Boulevard
City Of Mississauga
Town Of Milton
Winston Churchill Boulevard
Erin Mills Parkway
Glen Erin Drive
Thomas Street
Lisgar Drive
Hornby Road
Steeles Avenue
Trafalgar Road
10Th Line West
9Th Line
Churchill Meadows Boulevard
Town Of Halton Hills
Town Of Milton
Steeles Avenue East
Main Street East
Woodward Avenue
James Snow Parkway South
Lower Baseline East
Martin Street
Childs Drive
Ontario Street South
Commercial Street
Thompson Road South
4Th Line
Britannia Road
Steeles Avenue West
Main Street West
Bronte Street South
Burnhamthorpe Road East
6Th Line
Derry Road
Regional Road 25
Town Of Milton
Town Of Oakville
Highway 407
Neyagawa Boulevard
River Glen Boulevard
First Line
Lower Base Line
Town Of Milton
City Of Burlington
Dundas Street West
Proudfoot Trail
Tremaine Road
2nd Sideroad
Appleby Line
Westoak Trails Boulevard
Upper Middle Road West
Pilgrims Way
Grand Oak Trail
Heritage Way
Twiss Road
Bronte Road
Town Of Oakville
City Of Burlington
Dundas Street
Orchard Road
Queen Elizabeth Way
Wyecroft Road

0 1 2 km
1:70,000

KEY MAP
Hwy 401
5Th Line
8Th Line
6Th Line
4Th Line
Milton
1St Line
Hwy 407
Twiss Rd
Oakville

August 2018
Project No.

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.

Legend
- Built-up Area [i]
- Main Residential Area [ii]
- Urban Area (as of 1995) [iv]
- Current Urban Area (as of 2011) [iii]
- Project Development Area
- Expressway / Highway
- Major Road
- Railway
- Watercourse
- Town of Milton
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody

Additional Notes
i. Statistics Canada. 2016. Human Activity and the Environment 2015: The changing landscape of Canadian metropolitan areas. Updated: June 28, 2016.

ii. Determined based on comparison of land use to Built Up Areas identified by Statistics Canada, 2016 for 2001.

iii. The Urban Area is a generalized area extracted from the Halton Region Official Plan - Map 1: Regional Structure (May 2013). Only the urban area of the Town of Milton is delineated.

iv. The Urban Area is a generalized area extracted from the Halton Region Official Plan - Halton Environmentally Sensitive Areas (approved in September 2001). Only the urban area of the Town of Milton is delineated.

Client/Project
Canadian National Railway
Milton Logistics Hub

Figure No.
IR 7.10-2

Title
Built-up Areas in Milton - 2001

August 20, 2018

ATTACHMENT IR7.10-3
BUILT-UP AREAS IN MILTON – 2011

\\Cd1220-f02\01609\active\60960844\drawing\MXD\Socio_Economic\Report_Figures\CEAA_IR7_Response\60960844_ir7_FigIR7_10_3_Growth_in_Milton_2011.mxd
Revised: 2018-08-20 By: pworsell

585000 587500 590000 592500 595000 597500 600000 602500

4830000 4827500 4825000 4822500 4820000 4817500 4815000 4812500 4810000 4807500

N

Sideroad 17
Sideroad 15
8Th Line
Sideroad 10
Heritage Road
Old Derry Road
City Of Brampton
Town Of Halton Hills
City Of Brampton
City Of Mississauga
Creditview Road
Mississauga Road
Argentia Road
Falconer Drive
REGIONAL MUNICIPALITY OF PEEL
Derry Road West
Millcreek Drive
Highway 401
Terragar Boulevard
City Of Mississauga
Town Of Milton
Winston Churchill Boulevard
Erin Mills Parkway
Glen Erin Drive
Thomas Street
Hornby Road
Steeles Avenue
Lisgar Drive
Trafalgar Road
10Th Line West
9Th Line
Churchill Meadows Boulevard
Town Of Halton Hills
Town Of Milton
Steeles Avenue East
Woodward Avenue
Main Street East
James Snow Parkway South
Childs Drive
Martin Street
Ontario Street South
Commercial Street
Thompson Road South
4Th Line
Lower Baseline East
Steeles Avenue West
Britannia Road
Main Street West
Bronte Street South
Burnhamthorpe Road East
6Th Line
Derry Road
Regional Road 25
Town Of Milton
Town Of Oakville
Highway 407
First Line
Base Line
Lower Base Line
Neyagawa Boulevard
River Glen Boulevard
Town Of Milton
City Of Burlington
Tremaine Road
2nd Sideroad
Dundas Street West
Proudfoot Trail
Westoak Trails Boulevard
Upper Middle Road West
Pilgrims Way
Appleby Line
Twiss Road
Grand Oak Trail
Heritage Way
Bronte Road
Town Of Oakville
City Of Burlington
Dundas Street
Orchard Road
Queen Elizabeth Way
Wyecroft Road

KEY MAP
Hwy 401
5th Line
8th Line
6th Line
4th Line
Milton
1St Line
Hwy 407
Twiss Rd
Oakville

0 1 2 km
1:70,000

August 2018
Project No.

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.

Legend
- Built-up Area [i]
- Main Residential Area [ii]
- Current Urban Area (as of 2011) [iii]
- Project Development Area
- Expressway / Highway
- Major Road
- Railway
- Watercourse
- Town of Milton
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody

Additional Notes
i. Statistics Canada. 2016. Human Activity and the Environment 2015: The changing landscape of Canadian metropolitan areas. Updated: June 28, 2016.

ii. Determined based on comparison of land use to Built Up Areas identified by Statistics Canada, 2016 for 2011.

iii. The Urban Area is a generalized area extracted from the Halton Region Official Plan - Map 1: Regional Structure (May 2013). Only the urban area of the Town of Milton is delineated.

Client/Project
Canadian National Railway
Milton Logistics Hub

Figure No.
IR 7.10-3

Title
Built-up Areas in Milton - 2011

August 20, 2018

ATTACHMENT IR7.10-4
BUILT-UP AREAS IN MILTON – 2017

\\Cd1220-f02\01609\active\60960844\drawing\MXD\Socio_Economic\Report_Figures\CEAA_IR7_Response\60960844_ir7_FigIR7_10_4_Growth_in_Milton_2017.mxd
Revised: 2018-08-20 By: pworsell

585000 587500 590000 592500 595000 597500 600000 602500

4830000 4827500 4825000 4822500 4820000 4817500 4815000 4812500 4810000 4807500

N

Sideroad 17
Sideroad 15
8Th Line
Sideroad 10
Heritage Road
Old Derry Road
City Of Brampton
Town Of Halton Hills
City Of Brampton
City Of Mississauga
Creditview Road
Mississauga Road
Argentia Road
Falconer Drive
REGIONAL MUNICIPALITY OF PEEL
Derry Road West
Millcreek Drive
Highway 401
Terragar Boulevard
City Of Mississauga
Town Of Milton
Winston Churchill Boulevard
Erin Mills Parkway
Glen Erin Drive
Thomas Street
Hornby Road
Steeles Avenue
Lisgar Drive
Trafalgar Road
10Th Line West
9Th Line
Churchill Meadows Boulevard
Town Of Halton Hills
Town Of Milton
Steeles Avenue East
Woodward Avenue
Main Street East
James Snow Parkway South
Childs Drive
Martin Street
Ontario Street South
Commercial Street
Thompson Road South
4Th Line
Lower Baseline East
Britannia Road
Steeles Avenue West
Main Street West
Bronte Street South
Burnhamthorpe Road East
6Th Line
Derry Road
Regional Road 25
Town Of Milton
Town Of Oakville
Highway 407
Neyagawa Boulevard
River Glen Boulevard
First Line
Base Line
Lower Base Line
Town Of Milton
City Of Burlington
Dundas Street West
Proudfoot Trail
Tremaine Road
2nd Sideroad
Westoak Trails Boulevard
Upper Middle Road West
Pilgrims Way
Appleby Line
Twiss Road
Grand Oak Trail
Heritage Way
Bronte Road
Town Of Oakville
City Of Burlington
Dundas Street
Orchard Road
Queen Elizabeth Way
Wyecroft Road

0 1 2 km
1:70,000

KEY MAP
Milton
Oakville
Hwy 401
5th Line
6th Line
8th Line
4th Line
1St Line
Hwy 407
Twiss Rd

August 2018
Project No.

Legend

- Built-up Area [i]
- Main Residential Area [ii]
- Current Urban Area (as of 2011) [iii]
- Project Development Area
- Expressway / Highway
- Major Road
- Railway
- Watercourse
- Town of Milton
- Municipal Boundary - Lower Tier
- Municipal Boundary - Upper Tier
- Waterbody

Additional Notes

i. Statistics Canada. 2016. Human Activity and the Environment 2015: The changing landscape of Canadian metropolitan areas. Updated: June 28, 2016.

ii. Determined based on comparison of land use to Built Up Areas identified by Statistics Canada, 2016 for 2017, supplemented through airphoto interpretation by Stantec using aerial photographs taken during the Spring of 2017 (First Base Solutions, 2018).

iii. The Urban Area is a generalized area extracted from the Halton Region Official Plan - Map 1: Regional Structure (May 2013). Only the urban area of the Town of Milton is delineated.

Stantec

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.

Client/Project

Canadian National Railway
Milton Logistics Hub

Figure No.

IR 7.10-4

Title

Built-up Areas in Milton - 2017

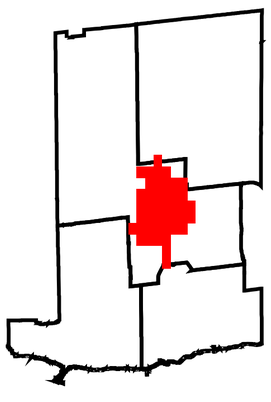
August 20, 2018

ATTACHMENT IR7.11-1
WATER OPERATING MAPS – TOWN OF MILTON

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

WATER OPERATING MAPS

TOWN OF MILTON



Printed: November 2017

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

WATER OPERATING MAPS

TOWN OF MILTON

Protection Valve Type

Q	Air Release
N	Check
°	Pressure Reducing
⏦	Surge
⏦	Vacuum

Control Valve

▫	Valve In Chamber
´	System
,	Zone Isolation, No ByPass
·	Zone Isolation, With ByPass

Fittings

o	Cap
p	Cross
q	Reducer
v	Sleeve
r	Tee
s	Tapping Sleeve

System Structure

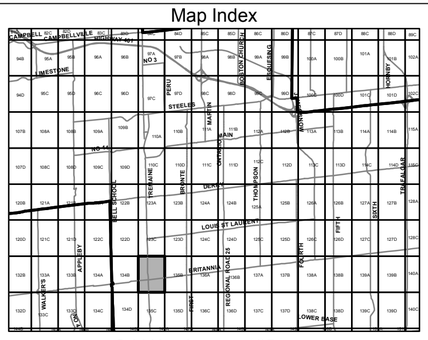
K	Booster Station
L	Intake
J	Municipal Well
I	Reservoir
H	Tank
G	Water Purification Plant

Other

	In Service Watermain
	Proposed Watermain
	Private Watermain/Service Lead
M	System Meter
U	Hydrant
¬	Chamber
	Pressure Zone
	Municipal Boundary

0 25 50 100 150 200 Meters

Map Index



Grid Number: 135A
Print Date: Nov 1, 2017

6205
1200
1360
1390
1436
1456
6199
1596
5761
5400

HATT COURT
PRATT HEIGHTS
M4L
CARR LANDING
TASKER COURT
SHADE LANE
HEAVEN CRESCENT
H225947
H226349
H226350
H226348
H226351
H226352
H226347
150- PVC
BRITANNIA ROAD
400- CPP
750- CPP
FIRST LINE

WATER OPERATING MAPS

TOWN OF MILTON

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

Protection Valve Type

- Q Air Release
- N Check
- ° Pressure Reducing
- Surge
- Vacuum

Control Valve

- Valve In Chamber
- System
- Zone Isolation, No ByPass
- Zone Isolation, With ByPass

Fittings

- o Cap
- p Cross
- q Reducer
- v Sleeve
- r Tee
- s Tapping Sleeve

System Structure

- K Booster Station
- L Intake
- J Municipal Well
- I Reservoir
- H Tank
- G Water Purification Plant

Other

- In Service Watermain
- Proposed Watermain
- Private Watermain/Service Lead
- M System Meter
- U Hydrant
- Chamber
- Pressure Zone
- Municipal Boundary

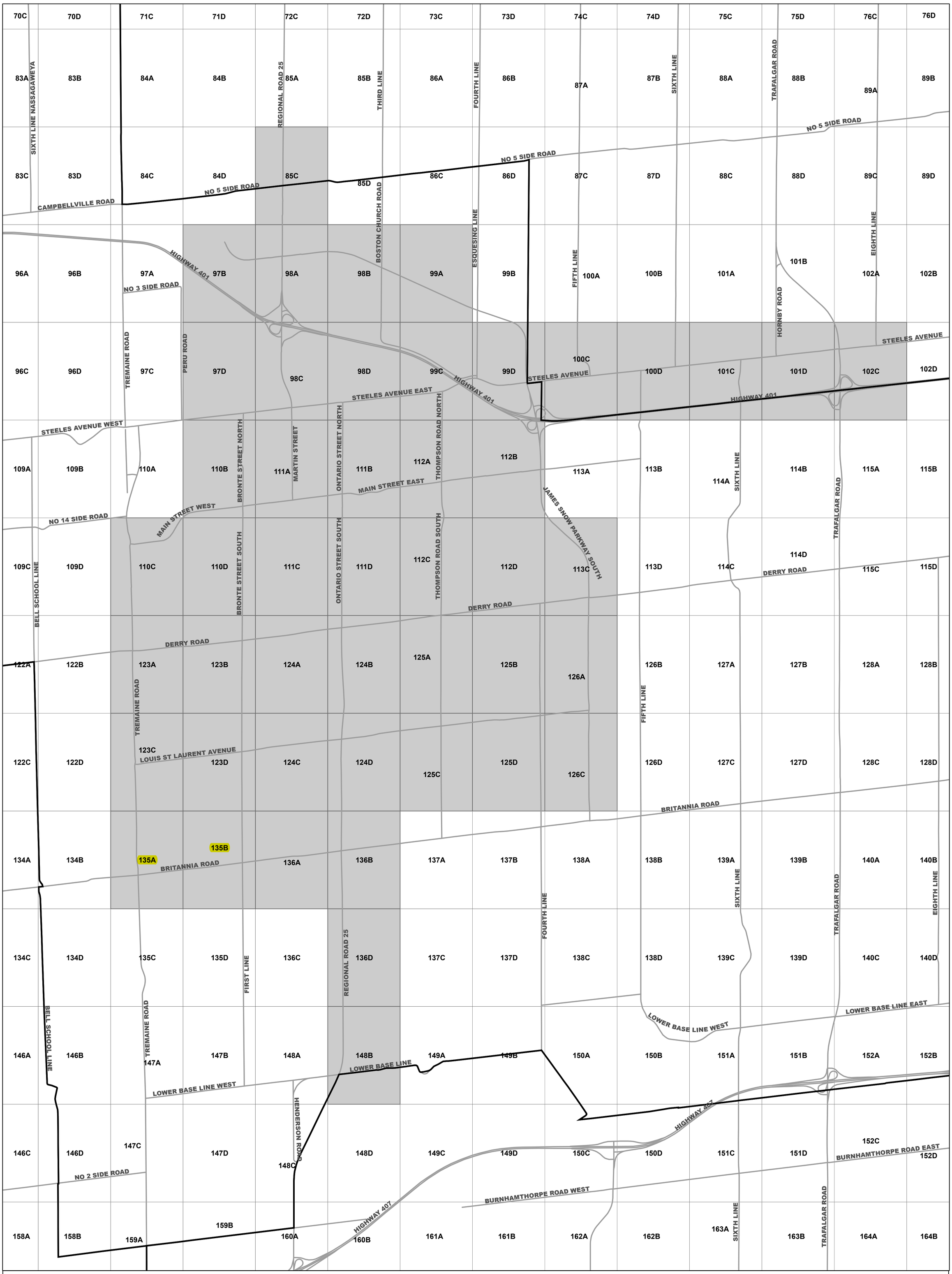
0 25 50 100 150 200 Meters

Map Index

Grid Number: 135B
Print Date: Nov 1, 2017

August 20, 2018

ATTACHMENT IR7.11-2
SANITARY OPERATING MAPS – TOWN OF MILTON

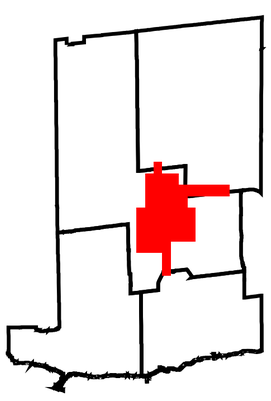


Halton REGION

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

SANITARY OPERATING MAPS

TOWN OF MILTON



Printed: November 2017

6270

6205

6116

6199

6081

5465

TREMAINE ROAD

BRITANNIA ROAD

MH262458

375 - CONC

MH262457

375 - CONC

MH262456

750 - CONC

750 - CONC

5703

5695

5600

SANITARY OPERATING MAPS

TOWN OF MILTON

REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

Sewer Types

- Treated Discharge Sewer
- Untreated Discharge Sewer
- ForceMain
- Proposed ForceMain
- Gravity Sewer (In Service)
- Gravity Sewer (Out of Service)
- Proposed Gravity Sewer

Maintenance Hole Types

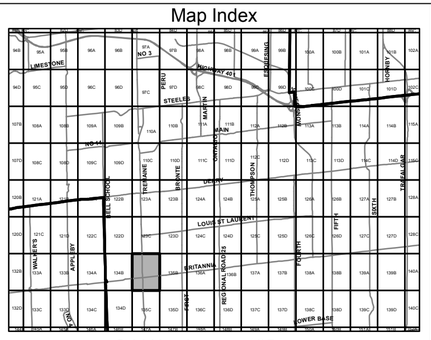
- K Maintenance Hole
- J Chamber

Major System Facilities

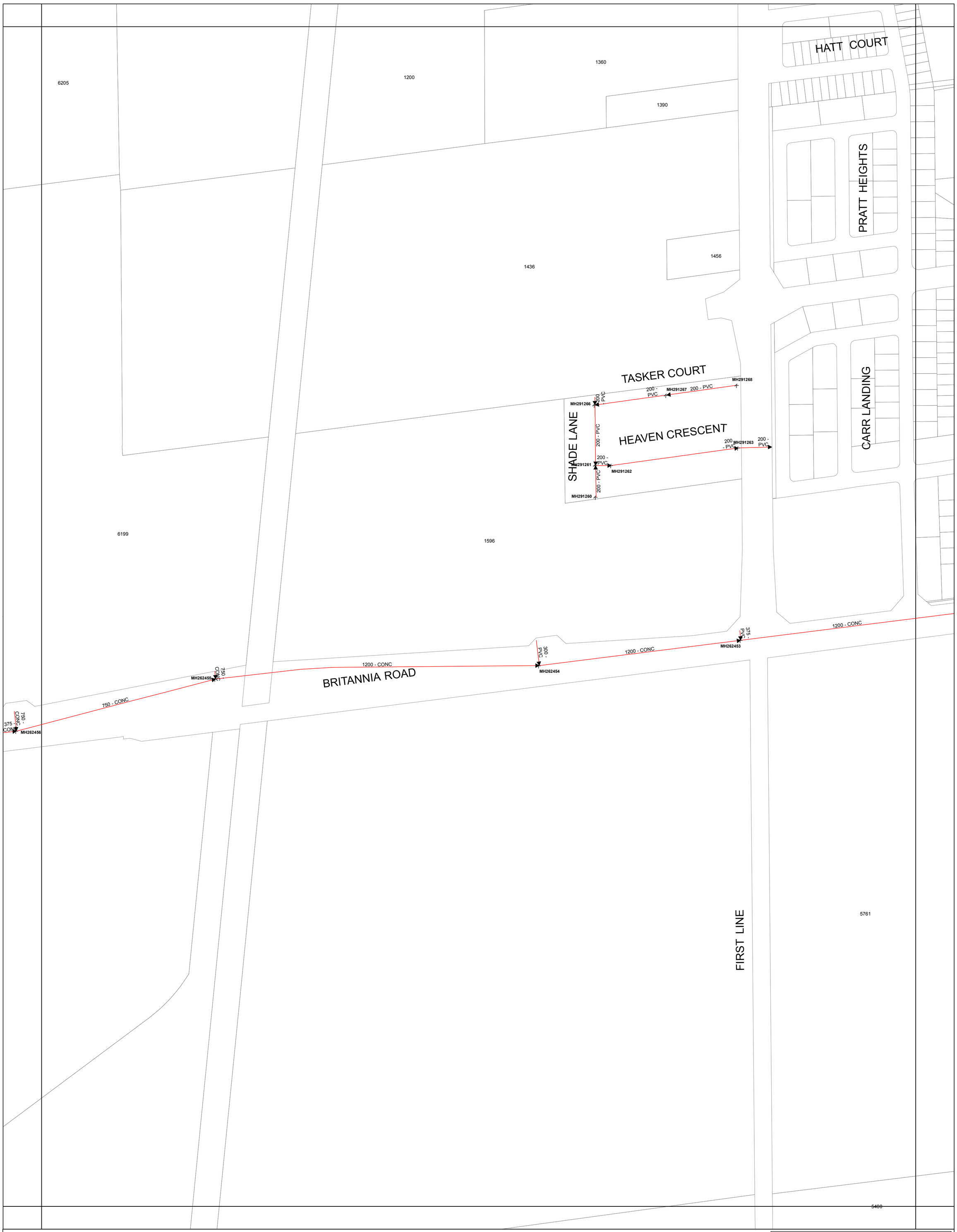
- E Wastewater Storage Tank
- G Wastewater Treatment Plant
- B Pumping Station
- Municipal Boundary

0 25 50 100 150 200 Meters

Map Index



Grid Number: 135A
Print Date: Oct 31, 2017



REGIONAL MUNICIPALITY OF HALTON
Department of Public Works

SANITARY OPERATING MAPS

TOWN OF MILTON

Sewer Types

- Treated Discharge Sewer
- Untreated Discharge Sewer
- ForceMain
- Proposed ForceMain
- Gravity Sewer (In Service)
- Gravity Sewer (Out of Service)
- Proposed Gravity Sewer

Maintenance Hole Types

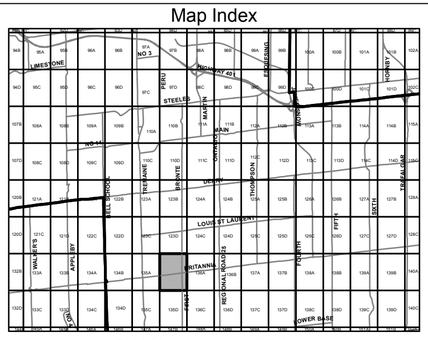
- K — Maintenance Hole
- J — Chamber

Major System Facilities

- E — Wastewater Storage Tank
- G — Wastewater Treatment Plant
- B — Pumping Station
- Municipal Boundary

0 25 50 100 150 200 Meters

Map Index



Grid Number: 135B
Print Date: Oct 31, 2017

August 20, 2018

ATTACHMENT IR7.12-1
REQUESTS FOR CYCLING USAGE INFORMATION

Stantec Consulting Ltd.
1-70 Southgate Drive, Guelph ON N1G 4P5

July 20, 2018

Attention: Ms. Kristene Scott, Commissioner of Community Services
Town of Milton
150 Mary Street
Milton, Ontario L9T 6Z5

Dear Ms. Scott,

Reference: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub

On behalf of the Canadian National Railway Company (CN), we are submitting a request for information regarding cycling counts and/or usage data along the various identified cycling routes within Halton Region, specifically those in proximity to the proposed CN Milton Logistics Hub (the Project).

The Project is undergoing a review by a Joint Review Panel (the Panel) established under the *Canadian Environmental Assessment Act, 2012*, and the *Canada Transportation Act*. In response to the Panel's review of the information submitted by CN, CN has received the following information request regarding usage of the cycling routes near the proposed Project:

> **IR7.12 (part a) Use and value of the area cycling routes**
>
> *Provide available information regarding how many cyclists use the five routes identified in Figure 10 of Appendix E.12 of the EIS, as well as any other cycling routes in the area near the proposed Project.*
>
> *If appropriate, coordinate with Halton Municipalities and the Government of Ontario to provide information in response to this information request.*

Through a review of the Town of Milton Cycling Master Plan (Town of Milton, 2014), it was noted that 11% of survey respondents indicated that they cycle every day in Milton, with 46% indicating that they cycle a few times a week (148 respondents). However, no recorded usage of along cycling routes in Milton is presented. In the Plan, it was noted during the Project Working Group discussions that an approach to evaluate the future use of trail and cycling infrastructure (i.e., bike counts) should be established. However, we have not been able to identify if bike counts or other usage data have been collected in support of (or subsequent to) the completion of this Plan.

Attached is a copy of the figure referenced in the information request from the Panel, which identifies the various cycling routes near the Project, which were identified based on the Halton Region Cycling Maps.

Please provide by August 3, 2018 any information regarding whether the Town of Milton has collected information regarding cycling activity in Milton, and if so, please provide information regarding how many cyclists use the five routes or other cycling routes in the area near the proposed Project.

Reference: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub

A similar request has been submitted to the Ministry of Transportation and Halton Region.

If you have any questions, or wish to discuss this information request, please do not hesitate to contact the undersigned.

Regards,

Stantec Consulting Ltd.
<Original signed by>

Chris Powell M.A.
Project Manager, Environmental Planner
<contact information removed>

Attachment: Figure 10: Cycling Routes within the LAA

cc. Darren Reynolds, CN

Stantec Consulting Ltd.
1-70 Southgate Drive, Guelph ON N1G 4P5

July 20, 2018

Attention: Mr. Darryl Soshycki, Manager
Sustainable and Innovative Transportation Office
Ministry of Transportation
College Park 30th Floor, Suite 3000
777 Bay St
Toronto, ON M7A 2J8

Dear Mr. Soshycki,

Reference: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub

On behalf of the Canadian National Railway Company (CN), we are submitting a request for information regarding cycling counts and/or usage data along the various identified cycling routes within Halton Region, specifically those in proximity to the proposed CN Milton Logistics Hub (the Project).

The Project is undergoing a review by a Joint Review Panel (the Panel) established under the *Canadian Environmental Assessment Act, 2012*, and the *Canada Transportation Act*. In response to the Panel's review of the information submitted by CN, CN has received the following information request regarding usage of the cycling routes near the proposed Project:

> **IR7.12 (part a) Use and value of the area cycling routes**
>
> *Provide available information regarding how many cyclists use the five routes identified in Figure 10 of Appendix E.12 of the EIS, as well as any other cycling routes in the area near the proposed Project.*
>
> *If appropriate, coordinate with Halton Municipalities and the Government of Ontario to provide information in response to this information request.*

Attached is a copy of the figure referenced in the information request from the Panel, which identifies the various cycling routes near the Project, which were identified based on the Halton Region Cycling Maps.

Please provide by August 3, 2018 any information regarding whether MTO has collected information regarding cycling activity in the Town of Milton, and if so, please provide information regarding how many cyclists use the five routes or other cycling routes in the area near the proposed Project.

A similar request has been submitted to Halton Region and Town of Milton.

Reference: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub

If you have any questions, or wish to discuss this information request, please do not hesitate to contact the undersigned.

Regards,

Stantec Consulting Ltd.

Chris Powell M.A.
Project Manager, Environmental Planner
<contact information removed>

Attachment: Figure 10: Cycling Routes within the LAA

cc. Darren Reynolds, CN

Stantec Consulting Ltd.
1-70 Southgate Drive, Guelph ON N1G 4P5

July 20, 2018

Attention: Mr. Jeffrey Reid, Senior Transportation Planner
Halton Region
Public Works, Infrastructure Planning and Policy
1151 Bronte Road
Oakville, Ontario L6M 3L1

Dear Mr. Reid,

Reference: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub

On behalf of the Canadian National Railway Company (CN), we are submitting a request for information regarding cycling counts and/or usage data along the various identified cycling routes within Halton Region, specifically those in proximity to the proposed CN Milton Logistics Hub (the Project).

The Project is undergoing a review by a Joint Review Panel (the Panel) established under the *Canadian Environmental Assessment Act, 2012*, and the *Canada Transportation Act*. In response to the Panel's review of the information submitted by CN, CN has received the following information request regarding usage of the cycling routes near the proposed Project:

> **IR7.12 (part a) Use and value of the area cycling routes**
>
> *Provide available information regarding how many cyclists use the five routes identified in Figure 10 of Appendix E.12 of the EIS, as well as any other cycling routes in the area near the proposed Project.*
>
> *If appropriate, coordinate with Halton Municipalities and the Government of Ontario to provide information in response to this information request.*

We understand through a review of the Active Transportation Master Plan Study Report (Halton Region, 2015), Halton Region has considered a potential pilot project for Milton that would include permanent bicycle and pedestrian counting stations to be installed to monitor cycling and walking activity, as well as the consideration for purchasing portable counters to use in various locations throughout the region. However, we have not been able to identify if the pilot project was implemented or if usage information has been collected.

Attached is a copy of the figure referenced in the information request from the Panel, which identifies the various cycling routes near the Project, which were identified based on the Halton Region Cycling Maps.

Please provide by August 3, 2018 any information regarding whether Halton Region has collected information regarding cycling activity in the Town of Milton, and if so, please provide information regarding how many cyclists use the five routes or other cycling routes in the area near the proposed Project.

Reference: **Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub**

A similar request has been submitted to the Ministry of Transportation and Town of Milton.

If you have any questions, or wish to discuss this information request, please do not hesitate to contact the undersigned.

Regards,

Stantec Consulting Ltd.

Chris Powell M.A.
Project Manager, Environmental Planner
<contact information removed>

Attachment: Figure 10: Cycling Routes within the LAA

cc. Darren Reynolds, CN

August 20, 2018

ATTACHMENT IR7.12-2
MTO RESPONSE TO REQUEST FOR CYCLING USAGE INFORMATION

Powell, Chris (Guelph)

From: Soshycki, Darryl (MTO) <email address removed>
Sent: Friday, July 27, 2018 3:46 PM
To: Kirchhoff, Denis
Cc: Powell, Chris (Guelph)
Subject: RE: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub
Attachments: Bicycle_Counts_Hwy's_in_Milton.pdf

Hello Denis, thanks for your message. Attached are the ministry's latest and only available bicycle counts that were collected as a part of TMCs (Turning Movement Counts) from intersections at MTO's Highway Interchanges in Milton. Let us know if you have any questions about these.

The municipalities may have more information about cycling on the routes identified.

Regards,
Darryl

Darryl Soshycki | Manager
Sustainable & Innovative Transportation Office
Ministry of Transportation
<contact information removed>

From: Kirchhoff, Denis <email address removed>
Sent: July-20-18 1:07 PM
To: Soshycki, Darryl (MTO)
Cc: Powell, Chris (Guelph)
Subject: Cycling Information Along Routes Near the Proposed CN Milton Logistics Hub

Dear Mr. Soshycki,

On behalf of the Canadian National Railway Company (CN), we are submitting a request for information regarding cycling counts and/or usage data along the various identified cycling routes within Halton Region, specifically those in proximity to the proposed CN Milton Logistics Hub (the Project). Please see attached.

Thank you,

Denis Kirchhoff, Ph.D.
Environmental Consultant, Assessment and Permitting
<contact information removed>

Stantec
1-70 Southgate Drive
Guelph ON N1G 4P5 CA

Bicycle Count Form

Location: HWY 401 at Hwy 25 IC (SOUTH RAMP)
Site ID: 2477000000
Count Date: 11/02/2017

Time	APPROACH			
	North	East	South	West
06:00 to 06:15				
06:15 to 06:30				
06:30 to 06:45				
06:45 to 07:00				
07:00 to 07:15				
07:15 to 07:30				
07:30 to 07:45				
07:45 to 08:00			1	
08:00 to 08:15				
08:15 to 08:30				
08:30 to 08:45				
08:45 to 09:00				
09:00 to 09:15				
09:15 to 09:30				
09:30 to 09:45				
09:45 to 10:00				
10:00 to 10:15				
10:15 to 10:30				
10:30 to 10:45				
10:45 to 11:00				
11:00 to 11:15				
11:15 to 11:30				
11:30 to 11:45				
11:45 to 12:00				
12:00 to 12:15				
12:15 to 12:30				
12:30 to 12:45				
12:45 to 13:00				
13:00 to 13:15				
13:15 to 13:30				
13:30 to 13:45				
13:45 to 14:00				
14:00 to 14:15				
14:15 to 14:30				
14:30 to 14:45				
14:45 to 15:00				
15:00 to 15:15				
15:15 to 15:30				
15:30 to 15:45				
15:45 to 16:00				
16:00 to 16:15				
16:15 to 16:30				
16:30 to 16:45		1		
16:45 to 17:00	1			
17:00 to 17:15				
17:15 to 17:30	1			
17:30 to 17:45				
17:45 to 18:00				
18:00 to 18:15				
18:15 to 18:30				
18:30 to 18:45				
18:45 to 19:00				
19:00 to 19:15				
19:15 to 19:30				
19:30 to 19:45				
19:45 to 20:00				

Bicycle Count Form

Location: HWY 401 at Hwy 25 IC (NORTH RAMP)
Site ID: 1477000000
Count Date: 11/02/2017

Time	APPROACH			
	North	East	South	West
06:00 to 06:15				
06:15 to 06:30				
06:30 to 06:45				
06:45 to 07:00				
07:00 to 07:15				
07:15 to 07:30				
07:30 to 07:45				
07:45 to 08:00				
08:00 to 08:15				
08:15 to 08:30				
08:30 to 08:45				
08:45 to 09:00				
09:00 to 09:15				
09:15 to 09:30				
09:30 to 09:45				
09:45 to 10:00				
10:00 to 10:15				
10:15 to 10:30				
10:30 to 10:45				
10:45 to 11:00				
11:00 to 11:15				
11:15 to 11:30				
11:30 to 11:45				
11:45 to 12:00				
12:00 to 12:15				
12:15 to 12:30				
12:30 to 12:45				
12:45 to 13:00				
13:00 to 13:15				
13:15 to 13:30				
13:30 to 13:45				
13:45 to 14:00				
14:00 to 14:15				
14:15 to 14:30				
14:30 to 14:45				
14:45 to 15:00				
15:00 to 15:15				
15:15 to 15:30			1	
15:30 to 15:45				
15:45 to 16:00				
16:00 to 16:15				
16:15 to 16:30				
16:30 to 16:45				
16:45 to 17:00	1			
17:00 to 17:15				
17:15 to 17:30	1			
17:30 to 17:45				
17:45 to 18:00				
18:00 to 18:15				
18:15 to 18:30				
18:30 to 18:45				
18:45 to 19:00				
19:00 to 19:15				
19:15 to 19:30				
19:30 to 19:45				
19:45 to 20:00				

Bicycle Count Form

Location: HWY 401 & JAMES SNOW PARKWAY (SOUTH RAMP)
Site ID: 2476950000
Count Date: 08/26/2017

Time	APPROACH			
	North	East	South	West
06:00 to 06:15				
06:15 to 06:30				
06:30 to 06:45				
06:45 to 07:00				
07:00 to 07:15				
07:15 to 07:30				
07:30 to 07:45				
07:45 to 08:00				
08:00 to 08:15				
08:15 to 08:30				
08:30 to 08:45				
08:45 to 09:00				
09:00 to 09:15				
09:15 to 09:30				
09:30 to 09:45				
09:45 to 10:00				
10:00 to 10:15				
10:15 to 10:30				
10:30 to 10:45				
10:45 to 11:00				
11:00 to 11:15				
11:15 to 11:30				
11:30 to 11:45				
11:45 to 12:00				
12:00 to 12:15				
12:15 to 12:30				
12:30 to 12:45				
12:45 to 13:00				
13:00 to 13:15				
13:15 to 13:30				
13:30 to 13:45				
13:45 to 14:00				
14:00 to 14:15				
14:15 to 14:30				
14:30 to 14:45				
14:45 to 15:00				
15:00 to 15:15				
15:15 to 15:30				
15:30 to 15:45				
15:45 to 16:00				
16:00 to 16:15				
16:15 to 16:30				
16:30 to 16:45				
16:45 to 17:00				
17:00 to 17:15				
17:15 to 17:30				
17:30 to 17:45				
17:45 to 18:00				
18:00 to 18:15				
18:15 to 18:30				
18:30 to 18:45				
18:45 to 19:00				
19:00 to 19:15				
19:15 to 19:30				
19:30 to 19:45				
19:45 to 20:00				

Bicycle Count Form

Location: HWY 401 & JAMES SNOW PARKWAY (NORTH RAMP)
Site ID: 1476950000
Count Date: 08/26/2017

Time			APPROACH			
			North	East	South	West
06:00	to	06:15				
06:15	to	06:30				
06:30	to	06:45				
06:45	to	07:00				
07:00	to	07:15				
07:15	to	07:30				
07:30	to	07:45				
07:45	to	08:00				
08:00	to	08:15				
08:15	to	08:30				
08:30	to	08:45				
08:45	to	09:00				
09:00	to	09:15				
09:15	to	09:30				
09:30	to	09:45				
09:45	to	10:00				
10:00	to	10:15				
10:15	to	10:30				
10:30	to	10:45				
10:45	to	11:00				
11:00	to	11:15				
11:15	to	11:30				
11:30	to	11:45				
11:45	to	12:00				
12:00	to	12:15				
12:15	to	12:30				
12:30	to	12:45				
12:45	to	13:00				
13:00	to	13:15				
13:15	to	13:30				
13:30	to	13:45				
13:45	to	14:00				
14:00	to	14:15				
14:15	to	14:30				
14:30	to	14:45				
14:45	to	15:00				
15:00	to	15:15				
15:15	to	15:30				
15:30	to	15:45				
15:45	to	16:00				
16:00	to	16:15				
16:15	to	16:30				
16:30	to	16:45				
16:45	to	17:00				
17:00	to	17:15				
17:15	to	17:30				
17:30	to	17:45				
17:45	to	18:00				
18:00	to	18:15				
18:15	to	18:30				
18:30	to	18:45				
18:45	to	19:00				
19:00	to	19:15				
19:15	to	19:30				
19:30	to	19:45				
19:45	to	20:00				

Bicycle Count Form

Location: HWY 401 & TRAFALGAR RD IC-328 (SOUTH RAMP)
Site ID: 2476900000
Count Date: 11/15/2016

Time	APPROACH			
	North	East	South	West
06:00 to 06:15				
06:15 to 06:30				
06:30 to 06:45				
06:45 to 07:00				
07:00 to 07:15				
07:15 to 07:30				
07:30 to 07:45				
07:45 to 08:00				
08:00 to 08:15				
08:15 to 08:30				
08:30 to 08:45				
08:45 to 09:00				
09:00 to 09:15				
09:15 to 09:30				
09:30 to 09:45				
09:45 to 10:00				
10:00 to 10:15				
10:15 to 10:30				
10:30 to 10:45				
10:45 to 11:00				
11:00 to 11:15				
11:15 to 11:30				
11:30 to 11:45				
11:45 to 12:00				
12:00 to 12:15				
12:15 to 12:30				
12:30 to 12:45				
12:45 to 13:00				
13:00 to 13:15				
13:15 to 13:30				
13:30 to 13:45				
13:45 to 14:00				
14:00 to 14:15				
14:15 to 14:30				
14:30 to 14:45				
14:45 to 15:00				
15:00 to 15:15				
15:15 to 15:30				
15:30 to 15:45				
15:45 to 16:00			1	
16:00 to 16:15				
16:15 to 16:30				
16:30 to 16:45				
16:45 to 17:00				
17:00 to 17:15				
17:15 to 17:30				
17:30 to 17:45				
17:45 to 18:00				
18:00 to 18:15				
18:15 to 18:30				
18:30 to 18:45				
18:45 to 19:00				
19:00 to 19:15				
19:15 to 19:30				
19:30 to 19:45				
19:45 to 20:00				

Bicycle Count Form

Location: HWY 401 & TRAFALGAR RD IC-328 (NORTH RAMP)
Site ID: 1476900000
Count Date: 11/15/2016

Time	APPROACH			
	North	East	South	West
06:00 to 06:15				
06:15 to 06:30				
06:30 to 06:45				
06:45 to 07:00				
07:00 to 07:15	1			
07:15 to 07:30				
07:30 to 07:45				
07:45 to 08:00				
08:00 to 08:15				
08:15 to 08:30				
08:30 to 08:45				
08:45 to 09:00				
09:00 to 09:15				
09:15 to 09:30				
09:30 to 09:45				
09:45 to 10:00				
10:00 to 10:15				
10:15 to 10:30				
10:30 to 10:45				
10:45 to 11:00				
11:00 to 11:15				
11:15 to 11:30				
11:30 to 11:45				
11:45 to 12:00				
12:00 to 12:15				
12:15 to 12:30				
12:30 to 12:45				
12:45 to 13:00				
13:00 to 13:15				
13:15 to 13:30				
13:30 to 13:45				
13:45 to 14:00				
14:00 to 14:15				
14:15 to 14:30				
14:30 to 14:45				
14:45 to 15:00				
15:00 to 15:15				
15:15 to 15:30				
15:30 to 15:45				
15:45 to 16:00				
16:00 to 16:15				
16:15 to 16:30				
16:30 to 16:45				
16:45 to 17:00				
17:00 to 17:15				
17:15 to 17:30				
17:30 to 17:45				
17:45 to 18:00				
18:00 to 18:15				
18:15 to 18:30				
18:30 to 18:45				
18:45 to 19:00				
19:00 to 19:15				
19:15 to 19:30				
19:30 to 19:45				
19:45 to 20:00				

Bicycle Count Form

Location: APPLEBY LINE IC-107 SOUTH RAMPS
Site ID: 7101260000
Count Start Date: 03/02/2017
Count Start Time: 06:00:00

HWY: QEW
Count End Date: 03/02/2017
Count End Time: 19:00:00

Date	Time		North Approach			East Approach			South Approach			West Approach		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
03/02/2017	06:00 to	06:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	06:15 to	06:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	06:30 to	06:45	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	06:45 to	07:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:00 to	07:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:15 to	07:30	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:30 to	07:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:45 to	08:00	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:00 to	08:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:15 to	08:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:30 to	08:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:45 to	09:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:00 to	09:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:15 to	09:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:30 to	09:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:45 to	10:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	10:00 to	10:15	0	0	0	0	0	0	0	0	0	0	0	0
	10:15 to	10:30												
	10:30 to	10:45												
	10:45 to	11:00												
	11:00 to	11:15												
	11:15 to	11:30												
	11:30 to	11:45												
	11:45 to	12:00												
	12:00 to	12:15												
	12:15 to	12:30												
	12:30 to	12:45												
	12:45 to	13:00												
	13:00 to	13:15												
	13:15 to	13:30												
	13:30 to	13:45												
	13:45 to	14:00												
	14:00 to	14:15												
	14:15 to	14:30												
	14:30 to	14:45												
	14:45 to	15:00												
03/02/2017	15:00 to	15:15	0	0	0	0	0	0	0	1	0	0	0	0
03/02/2017	15:15 to	15:30	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	15:30 to	15:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	15:45 to	16:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	16:00 to	16:15	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	16:15 to	16:30	0	1	0	0	0	0	0	1	0	0	0	0
03/02/2017	16:30 to	16:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	16:45 to	17:00	0	0	0	0	0	0	0	1	0	0	0	0
03/02/2017	17:00 to	17:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	17:15 to	17:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	17:30 to	17:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	17:45 to	18:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	18:00 to	18:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	18:15 to	18:30	0	0	0	0	0	0	0	1	0	0	0	0
03/02/2017	18:30 to	18:45	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	18:45 to	19:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	19:00 to	19:15	0	0	0	0	0	0	0	0	0	0	0	0
	19:15 to	19:30												
	19:30 to	19:45												
	19:45 to	20:00												
	Sub Totals		0	7	0	0	0	0	0	4	0	0	0	0
	Total			7			0			4			0	

Bicycle Count Form

Location: APPLEBY LINE IC-107 NORTH RAMPS
Site ID: 6101260000
Count Start Date: 03/02/2017
Count Start Time: 06:00:00

HWY: QEW
Count End Date: 03/02/2017
Count End Time: 19:00:00

Date	Time		North Approach			East Approach			South Approach			West Approach		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
03/02/2017	06:00 to	06:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	06:15 to	06:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	06:30 to	06:45	0	2	0	0	0	0	0	0	0	0	0	0
03/02/2017	06:45 to	07:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:00 to	07:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:15 to	07:30	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:30 to	07:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	07:45 to	08:00	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:00 to	08:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:15 to	08:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:30 to	08:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	08:45 to	09:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:00 to	09:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:15 to	09:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:30 to	09:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	09:45 to	10:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	10:00 to	10:15	0	0	0	0	0	0	0	0	0	0	0	0
	10:15 to	10:30												
	10:30 to	10:45												
	10:45 to	11:00												
	11:00 to	11:15												
	11:15 to	11:30												
	11:30 to	11:45												
	11:45 to	12:00												
	12:00 to	12:15												
	12:15 to	12:30												
	12:30 to	12:45												
	12:45 to	13:00												
	13:00 to	13:15												
	13:15 to	13:30												
	13:30 to	13:45												
	13:45 to	14:00												
	14:00 to	14:15												
	14:15 to	14:30												
	14:30 to	14:45												
	14:45 to	15:00												
03/02/2017	15:00 to	15:15	0	0	0	0	0	0	0	1	0	0	0	0
03/02/2017	15:15 to	15:30	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	15:30 to	15:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	15:45 to	16:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	16:00 to	16:15	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	16:15 to	16:30	0	1	0	0	0	0	0	1	0	0	0	0
03/02/2017	16:30 to	16:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	16:45 to	17:00	0	0	0	0	0	0	0	1	0	0	0	0
03/02/2017	17:00 to	17:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	17:15 to	17:30	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	17:30 to	17:45	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	17:45 to	18:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	18:00 to	18:15	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	18:15 to	18:30	0	0	0	0	0	0	0	1	0	0	0	0
03/02/2017	18:30 to	18:45	0	1	0	0	0	0	0	0	0	0	0	0
03/02/2017	18:45 to	19:00	0	0	0	0	0	0	0	0	0	0	0	0
03/02/2017	19:00 to	19:15	0	0	0	0	0	0	0	0	0	0	0	0
	19:15 to	19:30												
	19:30 to	19:45												
	19:45 to	20:00												
	Sub Totals		0	8	0	0	0	0	0	4	0	0	0	0
	Total			8			0			4			0	

August 20, 2018

ATTACHMENT IR7.12-3
HALTON REGION RESPONSE TO REQUEST FOR CYCLING USAGE INFORAMTION

Public Works
Infrastructure Planning and Policy
1151 Bronte Road
Oakville, ON L6M 3L1

via email

August 2, 2018

Chris Powell
Project Manager, Environmental Planner
Stantec Consulting Ltd.
1-70 Southgate Drive
Guelph, ON N1G 4P5

Re: Proposed CN Milton Logistics Hub
Cycling Information Request

Dear Mr. Powell:

Halton Region is in receipt of your letter (dated July 20, 2018) regarding potential available cycling information in the vicinity of the proposed CN Milton Logistics Hub. At this time the Region does not undertake a cycling count program and has not implemented the pilot project for pedestrian and cycling counts, as referenced in your letter.

The five cycling routes identified (referenced in your letter and included as an attachment, Figure 10), were developed in 2014 by Halton Region's Economic Development Division and are now part of the Cycling Tourism Plan. In the development of this plan, three cycling counts were conducted along Lakeshore Road (Oakville), the Beachway (Burlington) and 15 Side Road (Halton Hills). The Region does not have any cycling data associated with the outlined cycling routes within the Town of Milton.

However, through the Greater Toronto & Hamilton Area (GTHA) Cordon Count Program, cycling counts are included. The most recent data by screenline and station are contained within the 2016 Cordon Count for the Region. The Cordon Count program is conducted every five years and gathers information such as vehicle/bus/cyclists/pedestrians, crossing predetermined screenlines.

This information can be accessed through the University of Toronto's Data Management Group. Below is a link to the website and login page.

https://dmg.utoronto.ca/

If you do not have an existing password, this can be created and access can be obtained. Once you receive access, Halton Region's 2016 data can be queried, including individual station locations for recorded 'bicycles'.

The Region has completed an Active Transportation Master Plan (ATMP) which outlines the required strategy, infrastructure, initiatives and programs to promote increased non-motorized travel (walking and cycling) throughout the Region to 2031. This is a long-term plan in which the majority of the Active Transportation infrastructure is not yet built. The Region's ATMP Study, which shows existing and proposed Regional Cycling and Walking Network Maps (Appendix H – Maps 3 & 4), can be found at the following link and can be used in your analysis and assessment:

www.halton.ca/activetransportation

If you have any questions or require additional information, please contact the undersigned at <contact information removed>

Regards,

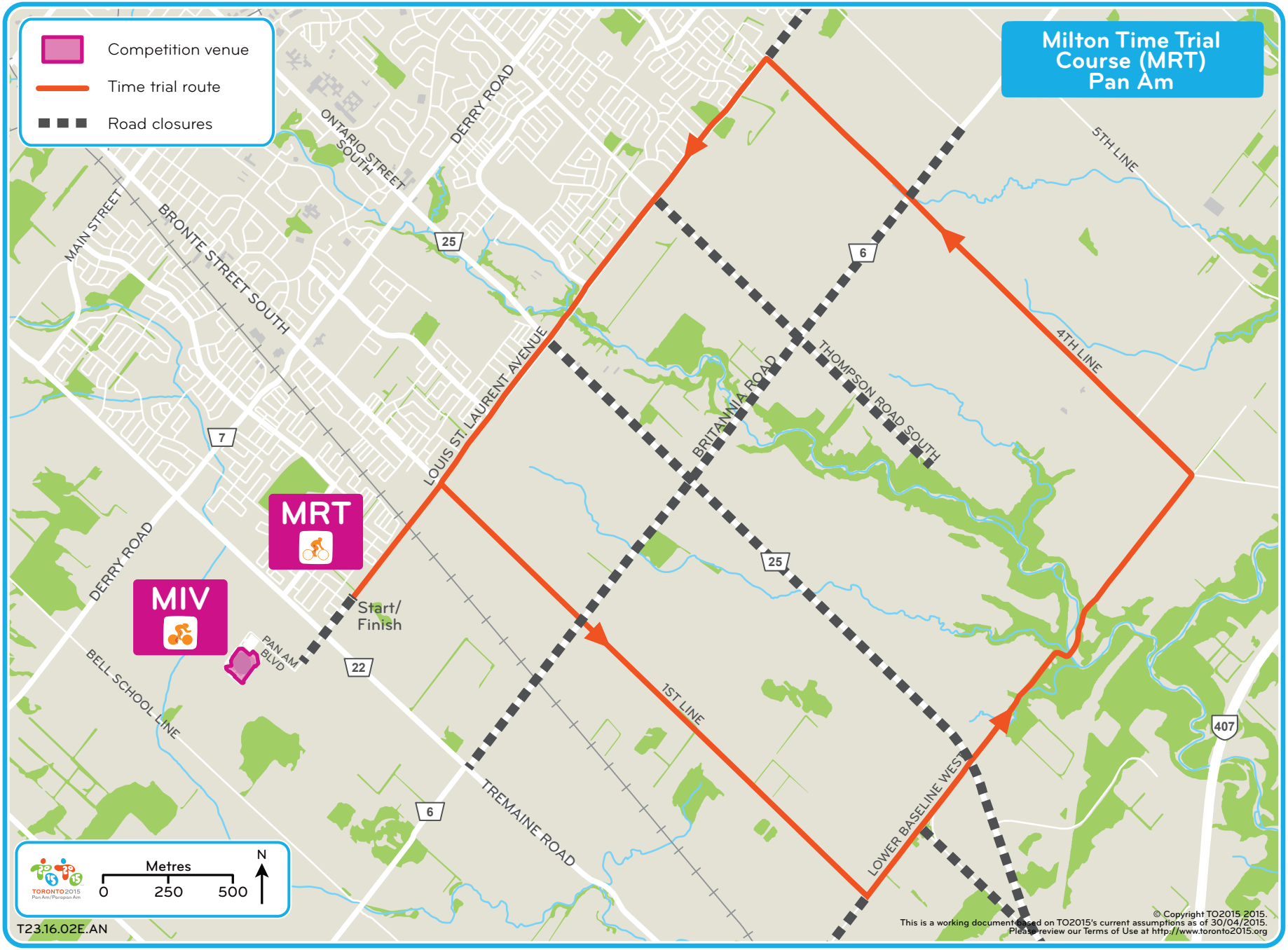
<Original signed by>

Melissa Green-Battiston, P.Eng.
Manager, Infrastructure Planning

cc: Lisa De Angelis – Halton Region
Ann Larkin – Halton Region
Jeffrey Reid – Halton Region

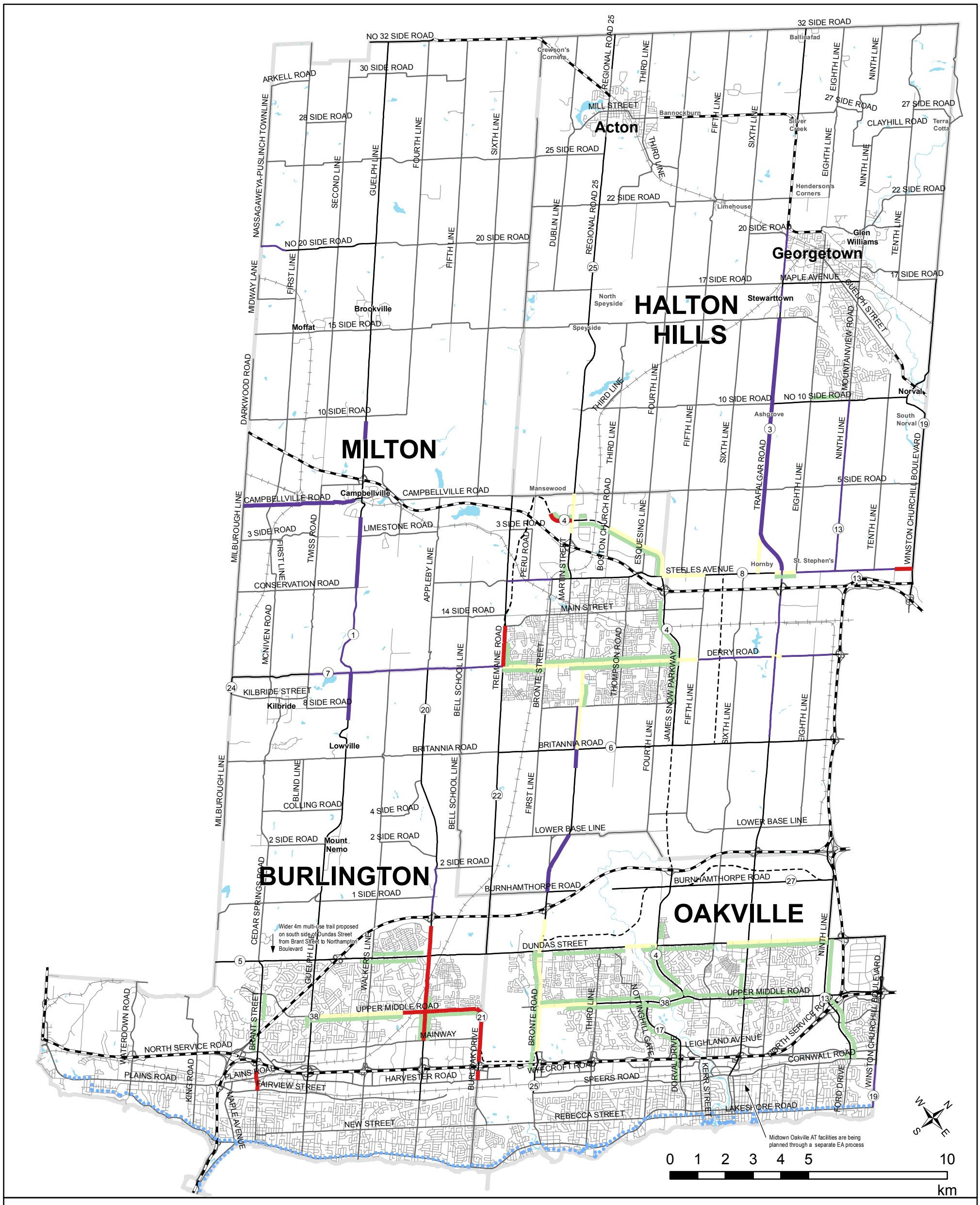
August 20, 2018

ATTACHMENT IR7.12-4
PANAMGAMES ROAD TIME TRIALS COURSE


Competition venue
Time trial route
Road closures
Milton Time Trial Course (MRT) Pan Am
MRT
MIV
Start/ Finish
PAN AM BLVD
ONTARIO STREET SOUTH
DERRY ROAD
MAIN STREET
BRONTE STREET SOUTH
LOUIS ST. LAURENT AVENUE
BRITANNIA ROAD
THOMPSON ROAD SOUTH
5TH LINE
4TH LINE
1ST LINE
BELL SCHOOL LINE
TREMAINE ROAD
LOWER BASELINE WEST
25
6
7
22
407
Metres
0
250
500
N
T23.16.02E.AN
© Copyright TO2015 2015.
This is a working document based on TO2015's current assumptions as of 30/04/2015.
Please review our Terms of Use at http://www.toronto2015.org

August 20, 2018

ATTACHMENT IR7.12-5
ACTIVE TRANSPORTATION MASTER PLAN MAP 1 – EXISTING REGIONAL CYCLING NETWORK



Legend

Existing Regional Cycling Network*

- Bike Lanes
- Boulevard Multi-Use Trail
- Wide Shared Use Lane
- Paved Shoulders
- Partially Paved Shoulders
- Waterfront Trail

Regional Road Network*

- Existing Regional Road
- Proposed Regional Road

Active Transportation Master Plan

MAP 1

Existing Regional Cycling Network

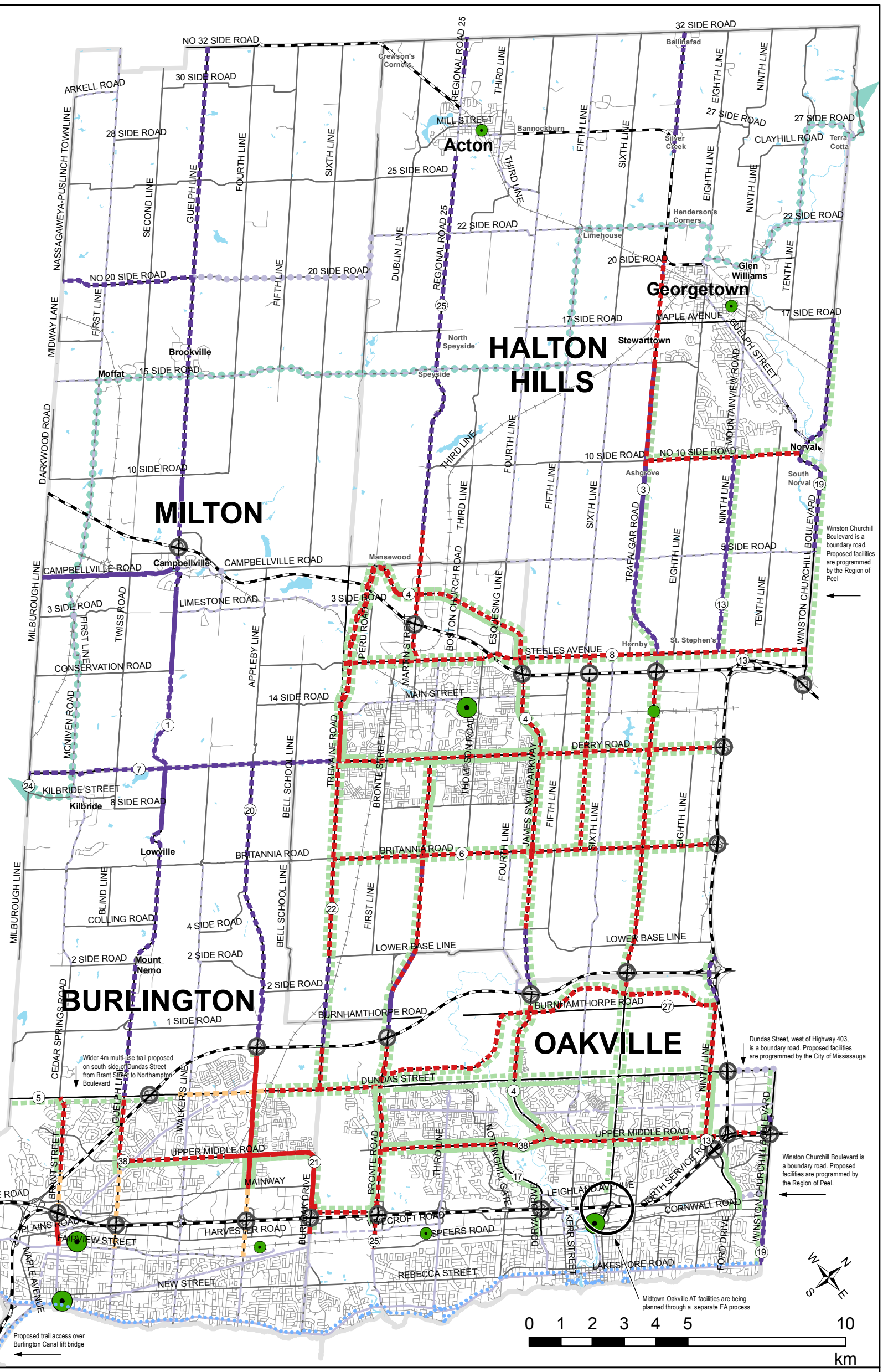
*Note: Existing cycling facilities are shown only for Regional Roads, which are shown in black on the map

Prepared by IBI Group June, 2014

August 20, 2018

ATTACHMENT IR7.12-6
ACTIVE TRANSPORTATION MASTER PLAN MAP 3 – PROPOSED REGIONAL CYCLING NETWORK

Note:
This map must be interpreted together with the network tables in the Halton Active Transportatation Master Plan report



Legend

Proposed Regional Bike Network

- Buffered Bike Lanes
- Bike Lanes
- Boulevard Multi-Use Trail
- Paved Shoulders
- Interchange Improvement*

Routes not on Regional Roads

- Existing Routes that are Regionally Significant
- Planned Routes that are Regionally Significant
- Proposed Routes that are Regionally Significant
- Greenbelt Cycling Route

Existing Regional Bike Network

- Bike Lane
- Boulevard Trail
- Waterfront Trail

Existing and Proposed Major Transit Stations**

- Mobility Hub
- Major Transit Stations
- Proposed GO Stations

Active Transportation Master Plan

MAP 3

Proposed Regional Cycling Network

*Note active transportation facilities at interchanges to be determined in consultation with the MTO.
**Note that some Routes that are Regionally Significant are located near transit stations. Connections to transit are an important part of the Regional Cycling and Walking Network. Transit stations are shown on the map to provide contextual information.

Prepared by IBI Group April, 2015

August 20, 2018

ATTACHMENT IR7.12-7
PROVINCE-WIDE CYCLING NETWORK ROUTES IN THE HALTON REGION

\\Cd1220-f02\101691.active\160960844\drawing\MXD\Socio_Economic\Report_Figures\CEAA_IR7_Response\160960844_ir7_FigIR7_12_5_Province_wide_Cycling_Network_Routes_Halton_Region.mxd
Revised: 2018-07-11 By: pworsell

July 2018
160960844

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery date of Halton Region: 2017.

Legend
- Project Development Area
- Land and Resource Use Local Assessment Area
- Province-wide Cycling Network Route (on-road)
- Lower/Single Tier Municipal Boundary
- Upper Tier Municipal Boundary
- Waterbody

Client/Project
Canadian National Railway
Milton Logistics Hub

Figure No.
IR 7.12-5

Title
Province-wide Cycling Network Routes in the Halton Region