BURNSIDE

Rail Safety Report and Development Viability Assessment 800 Burloak Drive

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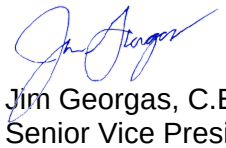
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Table of Contents

1.0 Introduction 1
2.0 Guidelines and Methodology 2
2.1 FCM / RAC Guidelines 2
2.1.1 Setbacks 2
2.1.2 Berms 3
2.1.3 Crash Berms 3
2.1.4 Crash Walls 4
2.1.5 Security Fencing 4
2.2 AECOM Crash Wall Guidelines 5
2.2.1 Method 1 5
2.2.2 Method 2 5
2.3 Metrolinx Guidelines 6
2.3.1 Setbacks 7
2.3.2 Anti-Trespassing Measures 7
2.3.3 Vegetation 7
3.0 Site Description 7
3.1 Site Plan 7
3.2 Rail Corridor 9
3.3 Accident / Incident History 12
3.4 Local Winds 13
4.0 Evaluation and Mitigation Measures 14
4.1 Setbacks 14
4.2 Derailment Calculation 14
4.3 Risk Mitigation 14
4.3.1 Crash Berm 14
4.3.2 Fencing 15
5.0 Risk Assessment 15
6.0 Conclusion 18

Tables

Table 1: Setback Recommendations 2
Table 2: Berm Specifications 3
Table 3: Rail Corridor Information 9
Table 4: Rail Accident / Incident History 12
Table 5: Risk Evaluation Matrix 16
Table 6: Risk Factors 16
Table 7: Risk Assessment with Proposed Mitigating Measures 17

Figures

Figure 1: Site Location 1
Figure 2: Example Berm Design 3
Figure 3: Example Crash Berm Design 4
Figure 4: Example Crash Wall Design 4
Figure 5: Site Plan 8
Figure 6: Track Location (Railway Association of Canada) 10
Figure 7: Burloak Drive Grade Separated Crossing (Source: Metrolinx) 11
Figure 8: Future Burloak Drive Grade Separated Crossing Location 12
Figure 9: Wind Rose Diagram 13
Figure 10: Plan View - Horizontal Setback Measurements 14
Figure 11: Crash Berm Location and Extent 15
Figure 12: Fence Location 15

Appendices

Appendix A Rail Corridor Details
Appendix B Crash Berm Detail
Appendix C Risk Assessment

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) was retained by Emshih Developments Inc. (Emshih) to provide a Development Viability Assessment and Rail Safety Report for the property at 800 Burloak Drive in Burlington, Ontario. The site is located at approximately Mile 27.0 of the Oakville subdivision rail corridor. This rail corridor is also known as the Metrolinx Lakeshore West line.

Figure 1: Site Location



The purpose of this report is to assess the risks associated with development near the adjacent rail corridor and summarize the mitigation measures that are proposed. This report does not address noise, vibration, stormwater, or drainage, all of which are reviewed separately.

This study evaluates the site in relation to the adjacent rail corridor, identifies risk mitigation measures to reduce potential risks to a tolerable level or better. Safety issues within a 10-mile radius of the site of the past ten years will be reviewed to better understand the risks associated with development near the rail corridor.

This Rail Safety Report will act as proof of concept for submission to the local Municipality and Rail Operator(s) for review and comment. It is the developer's responsibility to ensure the proposed mitigation measures are constructed and maintained.

2.0 Guidelines and Methodology

All new development proposals within proximity of railway lands should consider the rail safety requirements set out by governing authorities and the local Municipality. The guidelines reviewed for this report are outlined in the sections that follow.

2.1 FCM / RAC Guidelines

The Federation of Canadian Municipalities (FCM) and the Railway Association of Canada (RAC) entered into a 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. Through this partnership, the Guidelines for New Development in Proximity to Rail Operations (FCM / RAC Guidelines) were created; this document provides guidelines and best practices for development near rail corridors.

The following principles for mitigation design should be considered when applying the FAC / RAC Guidelines:

- Standard mitigation measures are desired as a minimum requirement.
- In instances where standard mitigation measures are not viable, alternative development solutions may be introduced.
- All mitigation measures should be designed to the highest possible urban design standards. Mitigation solutions should not create an onerous, highly engineered condition that overwhelms the aesthetic quality of an environment.

2.1.1 Setbacks

A setback from the railway corridor, or railway freight yard, is a highly desirable development condition. The FCM / RAC Guidelines recommend the following setbacks:

Table 1: Setback Recommendations

Classification	Setback
Freight Rail Yard	300 m
Principle Main Line	30 m
Secondary Main Line	30 m
Principle Branch Line	15 m
Secondary Branch Line	15 m
Spur Line	15 m

2.1.2 Berms

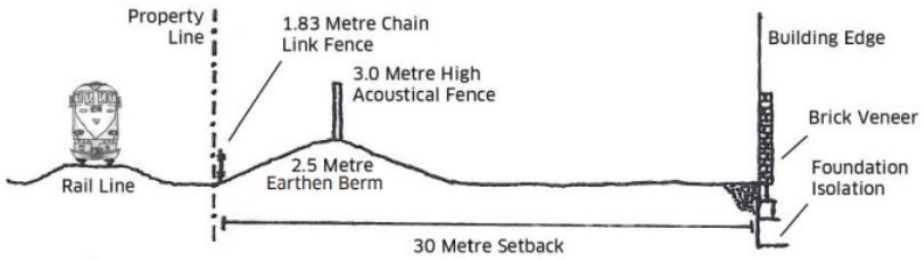
Safety barriers reduce the risks associated with railway incidents by intercepting or deflecting derailed trains and debris. The standard safety barrier is an earthen berm, which is intended to absorb the energy of derailed train cars, limiting the distance they travel outside of the railway right-of-way. Where full setbacks are provided, berms compacted to 95% modified proctor should be provided to afford a maximum level of risk mitigation. Berms should be constructed parallel to the rail corridor, with returns at the ends and to the following specifications:

Table 2: Berm Specifications

Classification	Berm Height (Measured at Grade of Property Line)	Berm Side Slopes
Principle Main Line	2.5 m above grade	Not steeper than 2.5 to 1
Secondary Main Line	2.0 m above grade	Not steeper than 2.5 to 1
Principle Branch Line	2.0 m above grade	Not steeper than 2.5 to 1
Secondary Branch Line	2.0 m above grade	Not steeper than 2.5 to 1
Spur Line	No requirement	

A typical berm design is pictured in Figure 2.

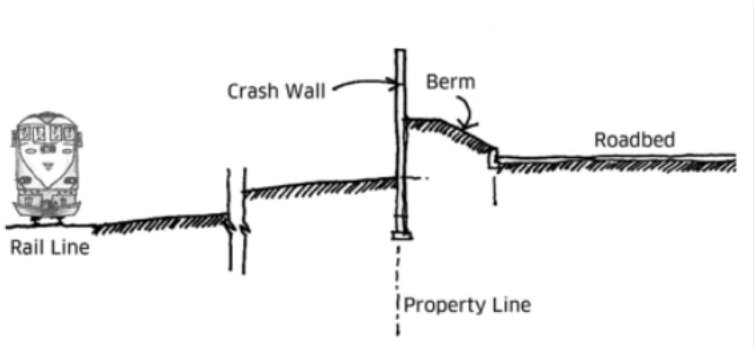
Figure 2: Example Berm Design



2.1.3 Crash Berms

Crash berms are reinforced berms that can be useful in spatially constrained sites where a full berm cannot be accommodated. Crash berms are typically concrete wall structures retaining more earth behind the wall which in-turn provides more energy absorption. A typical crash berm design is pictured in Figure 3.

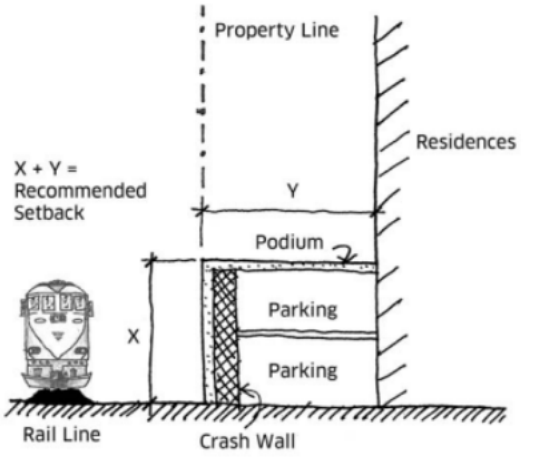
Figure 3: Example Crash Berm Design



2.1.4 Crash Walls

Crash walls are concrete structures that are designed to provide the equivalent resistance as the standard berm. The design of a crash wall is dependent on variables such as train speed, weight, and angle of impact. The crash wall design guidelines have been created by AECOM and will be explained further in this report. Horizontal setback requirements may be reduced with the construction of a crash wall. An example of a crash wall is shown in Figure 4.

Figure 4: Example Crash Wall Design



2.1.5 Security Fencing

Trespassing onto a railway corridor can have dangerous consequences, and every effort should be made to discourage it. All new developments in proximity to railway corridors must include a 1.83-metre-high chain link fence along the mutual property line, at a minimum.

2.2 AECOM Crash Wall Guidelines

In 2014, AECOM produced the Development of Crash Wall Design Loads from Theoretical Impact (AECOM Crash Wall Guidelines). As noted in section 2.1.4, the FCM / RAC Guidelines refer designers to the AECOM Crash Wall Guidelines to derive the appropriate load a crash wall is required to withstand.

The use of an earthen berm is not practical for every site; in those cases, a reinforced crash wall may be used. There are two possible modes of impact that should be considered when designing a crash wall: a glancing blow from a derailed train running in the direction of the track; and a direct impact as a result of cars piling up in an accordion fashion.

For the design of a crash wall adjacent to a railway track, one of the following methods may be used. The simplified design approach of Method 1 may be used in many cases. Method 2 may be used to optimize the design, or where factors such as distance from the track to the wall, track speeds, side sloped along the track, and consequences of collision may justify a different load.

2.2.1 Method 1

The wall shall be designed for a minimum point load of 600 kip (2,700 kN) applied horizontally and normal to the face at any point along the wall. The point load shall be applied at a height of 6 ft (1.8 m) above the top of rail for walls up to 25 ft (7.6 m) from the centreline of track, or a height of 6 ft (1.8 m) above groundline for walls farther than 25 ft (7.6 m) from the centreline of track. This method may be applied where track speeds do not exceed 50 mph (80 km/h) for freight or 70 mph (112 km/h) for passenger trains; where speeds exceed these limits, Method 2 shall be used.

2.2.2 Method 2

An energy balance approach considering collision by glancing blow and single car rotation may be used to determine the design load for a wall at a distance d_{CL} from the centreline of track. The closest existing or future/proposed track is to be used. The following four cases shall be considered:

Freight Train Load Case 1 – Glancing Blow: nine cars weighing 143 tons (129,700 kg) each, impacting the wall at an angle. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.

Freight Train Load Case 2 – Single Car Impact: single car weighing 143 tons (129,700 kg) impacting the wall as it undergoes rotation about its centre. Where d_{CL} is greater than 28 ft (8.5 m), this load case need not be considered.

Passenger Train Load Case 3 – Glancing Blow: eight cars weighing 74 tons (67,120 kg) each impacting the wall at an angle. The angle of impact will be a function of track curvature, and for tangent track may be taken as 3.5 degrees.

Passenger Train Load Case 4 – Single Car Impact: single car weighing 74 tons (67,120 kg) impacting the wall as it undergoes rotation about its centre. Where d_{CL} is greater than 42'-6" (13 m), this load case need not be considered.

Regardless of the method selected, the following guidelines must be followed:

- Minimum thickness of:
  - 2'-6" (0.760 m) for crash walls up to 25 ft (7.6 m) from the centreline of track.
  - 18 inches (0.45 m) for crash walls farther than 25 ft (7.6 m) from the centreline of the track.
- Minimum height of:
  - 12 ft (3.6 m) above the top of rail for crash walls less than 12 ft (3.6 m) from the centreline of track.
  - 7 ft (2.135 m) above the top of rail for crash walls between 12 ft (3.6 m) and 25 ft (7.6 m) from the centreline of track.
  - 7 ft (2.135 m) above the adjacent groundline for crash walls greater than 25 ft (7.6 m) from the centreline of track.
- The face of the crash wall shall be smooth and continuous and shall extend a minimum of six inches (0.15 m) beyond the face of the structure (such as a building column or bridge pier) parallel to the track.
- The design must incorporate horizontal and vertical continuity to distribute the loads from the derailed train.
- The wall must be of solid, heavy construction, and separate precast blocks or stones will not be permitted.

2.3 Metrolinx Guidelines

Any party engaged with planning and development activities for lands within 300 m of Metrolinx heavy rail (GO Transit) corridors, should consider the Metrolinx Adjacent Development Guidelines GO Transit Heavy Rail Corridors (Metrolinx Guidelines) document. While Metrolinx reviews applications along corridors owned and operated by Canadian National (CN) and Canadian Pacific Kansas City Southern (CPKC) Railways where passenger train service operates, the corridor owners are the primary commenting agencies for those lines and development-oriented feedback must be obtained directly from those entities.

In addition to considering the FCM / RAC and AECOM Guidelines, the Metrolinx Guidelines (2023) describe the design considerations that follow.

2.3.1 Setbacks

Building setback requirements are established to provide a buffer zone that contains the impacts associated with a potential train derailment, and other safety considerations. The following provides an overview of typical building setback requirements by land use:

- Residential, Commercial, Institutional, Industrial (high occupancy), Programmed Open Space: 30 m.
- Industrial (low occupancy): 15 m.
- Limited occupancy / passively used spaces: no setback required.

2.3.2 Anti-Trespassing Measures

The current Metrolinx minimum fencing standard is a 2.4 m high security / anti-trespassing fence. Noise barriers and crash barriers are acceptable substitutes for standard fencing; however, if the selected fencing is a solid surface, Metrolinx requires an anti-graffiti silicone coating be applied to the railway side of the barrier.

2.3.3 Vegetation

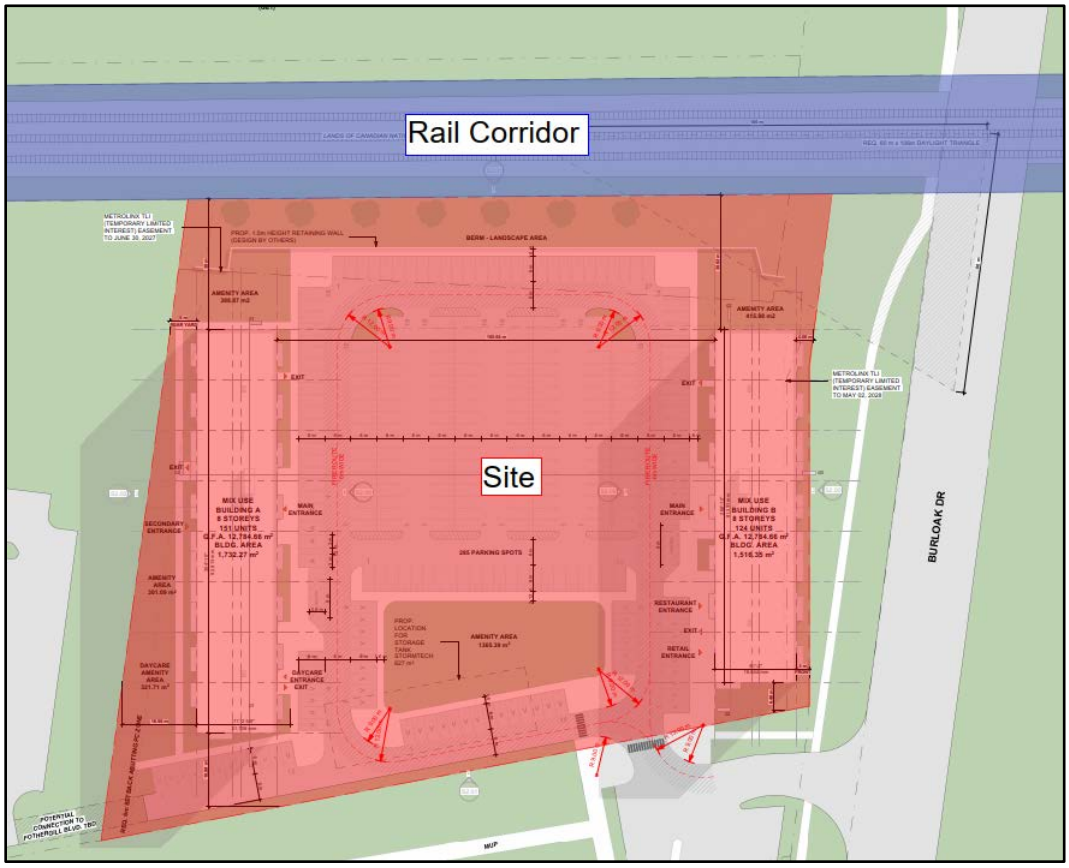
A 3.5 m low-vegetation buffer has been established as part of the Metrolinx GO Expansion program. The buffer is measured from the property line, and only low-lying vegetation are permitted in this area.

3.0 Site Description

3.1 Site Plan

The proposed development site is located adjacent to the Metrolinx-owned rail corridor, within the Oakville subdivision at Mile 27.0. the development is proposed as two, eight-storey mixed-use buildings with ground floor commercial (restaurants and retail) and floors two through seven containing residential units. The proposed site plan and its relationship to the rail corridor is illustrated in Figure 5.

Figure 5: Site Plan



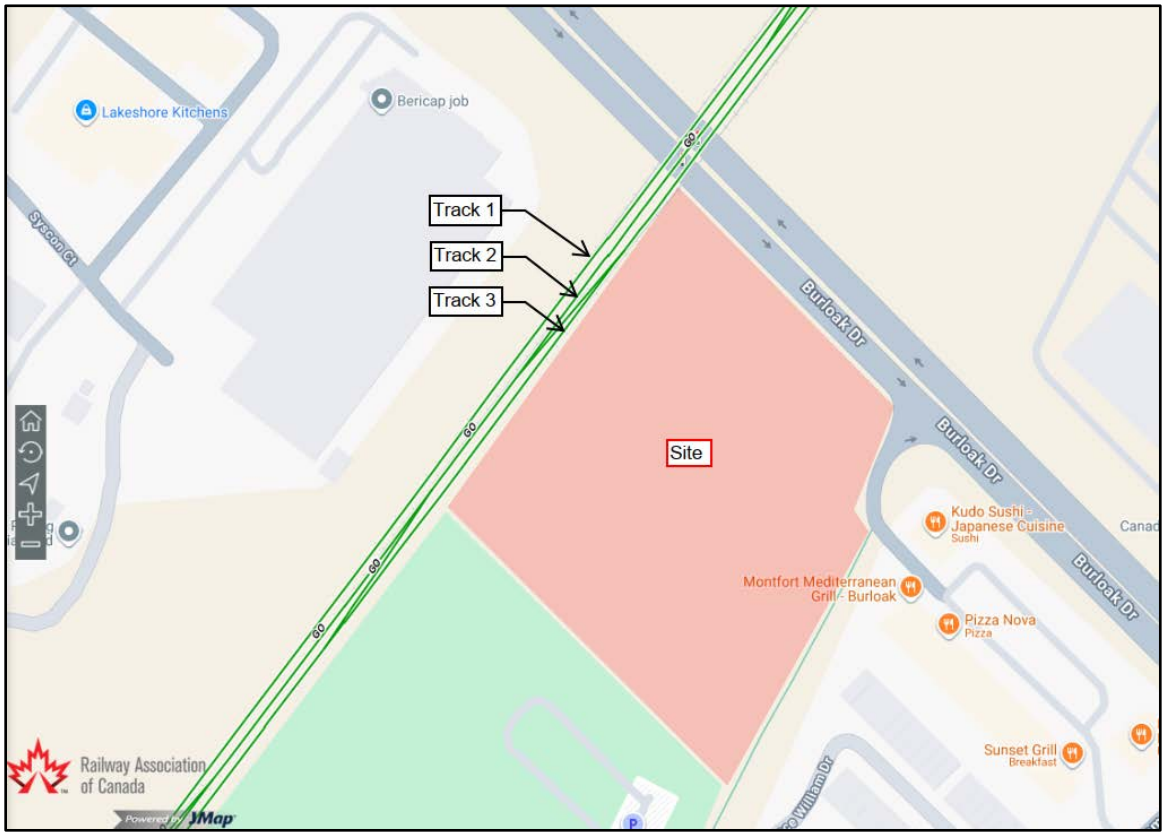
3.2 Rail Corridor

The following section provides a summary of the relationship between the site and rail corridor. Additional rail corridor information is presented in Appendix A.

Table 3: Rail Corridor Information

Category	Data / Information
Rail Corridor Subdivision	Oakville
Site Location Mile	27.0
Number of Tracks at Site Location	3 total
Track Classification	Class 5 track
Track Speed Track 1 (Passenger Only) Track 2 (Feight and Passenger) Track 3 (Freight and Passenger)	 Passenger = 80 mph Freight = 60 mph; Passenger = 95 mph Freight = 60 mph; Passenger = 95 mph
Train Traffic	110 movements per day.
Alignment	Straight in the immediate vicinity (in relation to the site's property line).
Elevation	The grade of the rail corridor is approximately 1.56 m higher than the grade of the site.

Figure 6: Track Location (Railway Association of Canada)



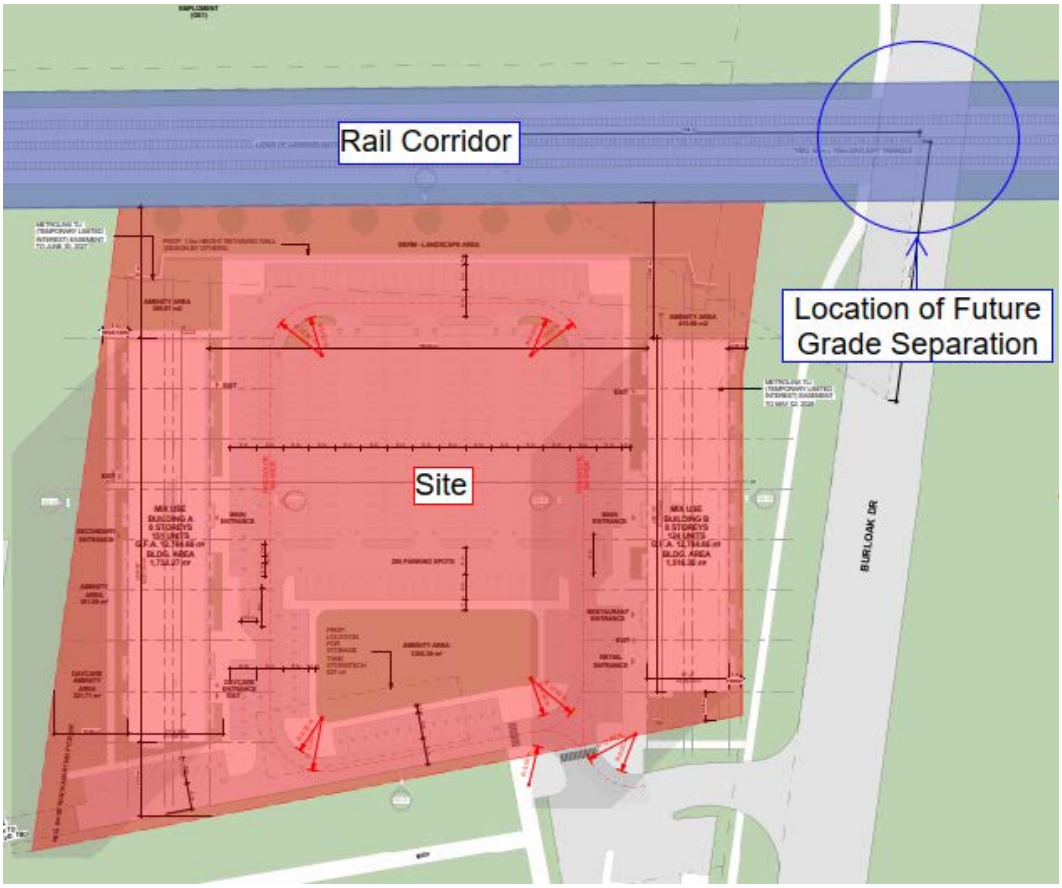
As part of the GO Expansion program additional train service is being provided along the Lakeshore West line. As part of the expansion and to accommodate the increased train traffic, Metrolinx is working alongside the City of Burlington and Town of Oakville to implement a grade separated crossing at Burloak Drive. The grade separated crossing will provide optimized traffic, allow for widening of Burloak Drive, and increase safety at the crossing through minimizing conflict potential. The construction of the grade separated crossing is proposed to be completed by summer 2027. Figure 7 is a rendering of the grade separation that is being implemented.

Figure 7: Burloak Drive Grade Separated Crossing (Source: Metrolinx)



Given the proximity of the subject site to the Burloak Drive crossing, the grade separation will provide an additional level of safety mitigation for derailment of westbound trains. If a train travelling in the westbound direction toward the site were to derail, the train would make contact with the edge of the bridge and/or fall off the side of the bridge prior to reaching the subject site. The location of the grade separation is shown in Figure 8.

Figure 8: Future Burloak Drive Grade Separated Crossing Location



3.3 Accident / Incident History

The following section assesses the rail corridor based on information published by the Transportation Safety Board (TSB). The TSB dataset has been filtered for information relevant to this site. The following data shows all accidents and incidents within the last 10 years and within 10 miles (16 km) of the proposed development site. This information will be used when performing the Risk Assessment in Section 5.0.

Table 4: Rail Accident / Incident History

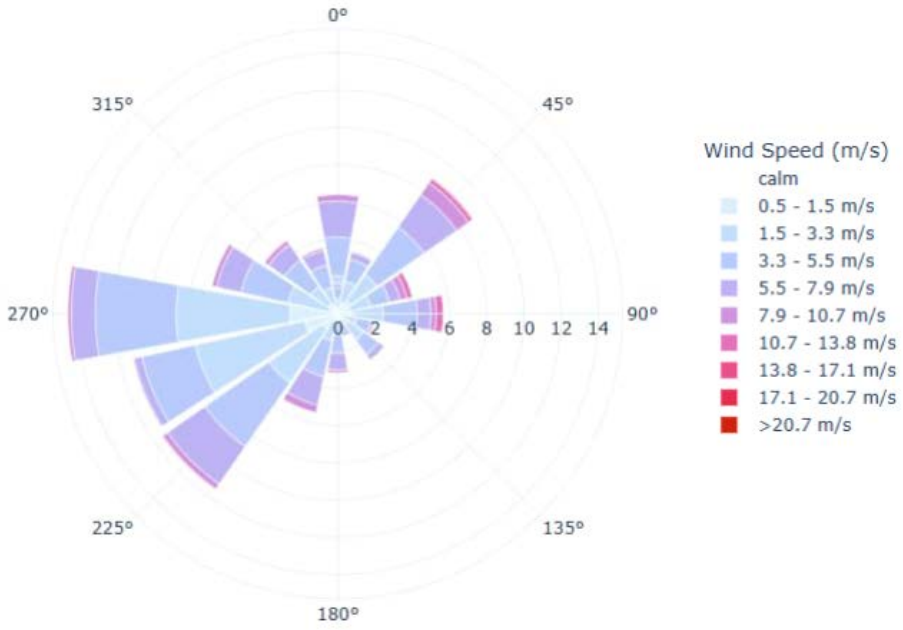
Accident / Incident Type	Number of Accidents / Incidents
Non-Main-Track Train Collision	1
Movement Exceeds Limits of Authority	14
Non-Main-Track Train Derailment	18
Crossing	5
Non-Main-Track Train Derailment (No Damage)	4
Main-Track Train Derailment	3

Accident / Incident Type	Number of Accidents / Incidents
Trespasser	8
Fire On-Board Rolling Stock	1
Derailment Involving Track Unit	1
Main-Track Train Collision	1
Passenger	1

3.4 Local Winds

Based on the Wind Rose diagram for the year 1988 to 2021, the site location typically experiences winds from the west to east direction. The data shown in the diagram below was collected at the Burlington Pier, approximately 16 kilometres away from the site. This information will be used when performing the Risk Assessment in Section 5.0.

Figure 9: Wind Rose Diagram

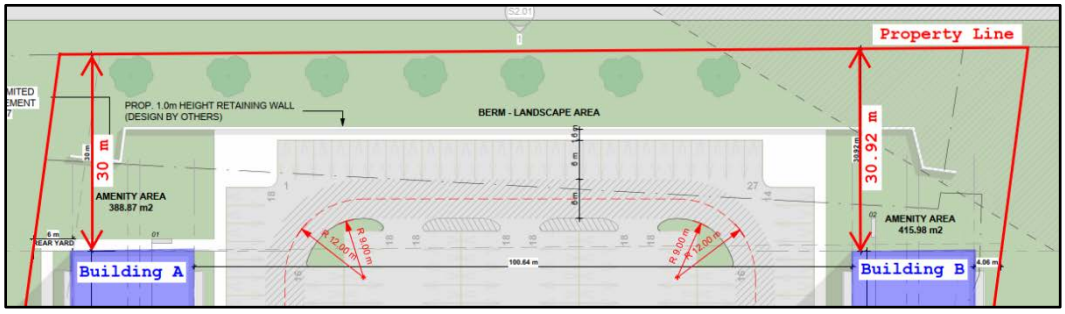


4.0 Evaluation and Mitigation Measures

4.1 Setbacks

The setbacks to sensitive use spaces have been measured and are identified below. As shown in the setback measurements, all sensitive use spaces will be located at least 30 m from the property line shared by the rail corridor.

Figure 10: Plan View - Horizontal Setback Measurements



4.2 Derailment Calculation

The table below shows the derailment scenarios defined in the AECOM Guidelines and the maximum distance from the centreline of track where a derailed train would come to rest. The analysis included freight trains travelling at a speed of 60 mph and passenger trains travelling at a speed of 95 mph. A derailment angle of 3.5 ^{o} was used, and a grade separation of 1.56 m. These calculations will be considered when performing the Risk Assessment in Section 5.0.

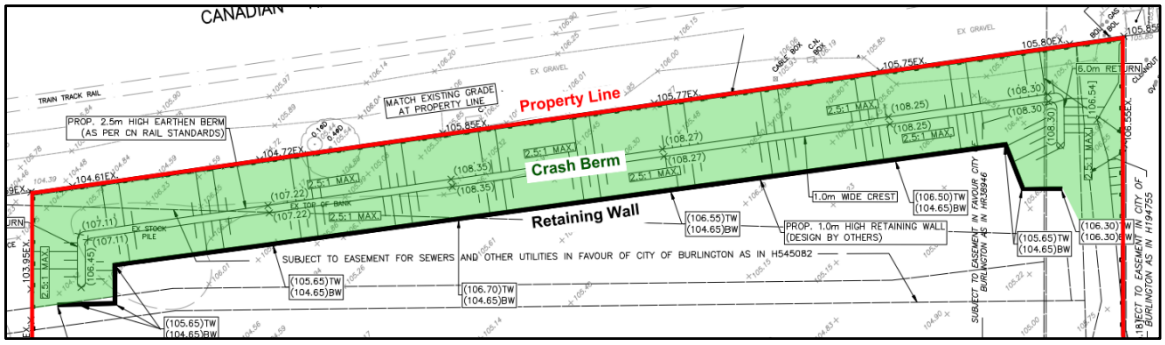
Derailment Scenario	Maximum Distance from Centreline of Track Where Train Comes to Rest
Freight Train Glancing Blow	≤ 12.5 m
Freight Train Single Car	≤ 8.5 m
Passenger Train Glancing Blow	≤ 26.5 m
Passenger Train Single Car	≤ 13.0 m

4.3 Risk Mitigation

4.3.1 Crash Berm

Since the proposed development has ample setback to the rail corridor, we recommend a 2.5 m high crash berm (per the FCM / RAC Guidelines) be located within the 30 m setback to mitigate the risks associated with the rail corridor. The suggested crash berm location and extent is shown below.

Figure 11: Crash Berm Location and Extent

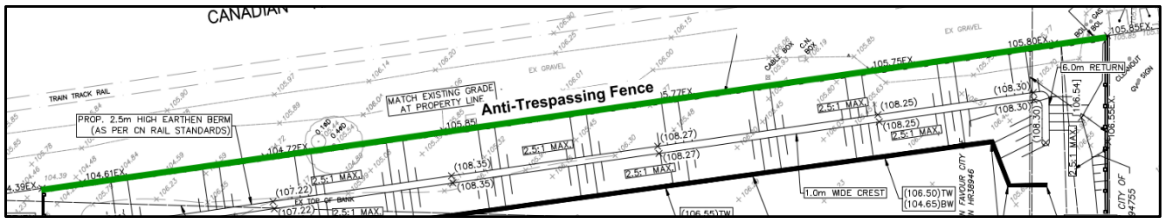


At the south side of the proposed 2.5 m high berm, there is a proposed 1.0 m high concrete cast in place retaining wall. The proposed retaining wall will allow the developers to design a berm in less space than typically required. This crash berm will be over 11 m wide, with 6 m returns on either side of the site. The slope of the crash berm will not exceed 2.5:1. Crash berm details are provided in Appendix B.

4.3.2 Fencing

Since the site is adjacent to a Metrolinx-owned rail corridor, this development must adhere to Metrolinx's fencing requirements. A 2.4 m high security / anti-trespassing fence will be constructed along the site's property line to discourage any trespassing. The location of the fence is shown below.

Figure 12: Fence Location



5.0 Risk Assessment

Risk is a function of both frequency and severity. A Risk Assessment Matrix can be a useful tool to evaluate the magnitude of effort required to address the perceived risks. For the purpose of this report, we have reviewed the potential risks in accordance with Table 5 and Table 6 below.

Table 5: Risk Evaluation Matrix

Frequency of Event	Class	Severity of Event				
		Negligible	Marginal	Serious	Critical	Catastrophic
		1	2	3	4	5
Improbable	1	1	2	3	4	5
Remote	2	2	4	6	8	10
Occasional	3	3	6	9	12	15
Probably	4	5	8	12	16	20
Frequent	5	5	10	15	20	25

Table 6: Risk Factors

Risk (Frequency x Severity)		Risk Assessment Category	Mitigation Measures Approach
Low	1 to 5	Acceptable	No further mitigation is required.
Medium	6 to 10	Tolerable	Tolerable if risk is considered as low as reasonably possible.
High	11 to 25	Intolerable	Risk shall be eliminated / reduced.

Based on the analysis and mitigation measures proposed in this report, the following Risk Assessment has been created. The table below shows 13 hazards associated with the rail corridor and the residual level of risk with the proposed mitigation measures. The detailed Risk Assessment, including the current risks, are shown in Appendix C.

Table 7: Risk Assessment with Proposed Mitigating Measures

Hazard	Frequency	Severity	Residual Risk	Classification
Freight Train Derailment – Glancing Blow Multi-car derailment off freight train	2	2	4	Acceptable
Freight Train Derailment – Single Car Single car derailment of freight train	2	1	2	Acceptable
Freight Train Derailment – Above Speed Limit Derailment of freight train travelling faster than the proposed speed limit	2	2	4	Acceptable
Passenger Train Derailment – Glancing Blow Multi-car derailment of passenger train	2	2	4	Acceptable
Passenger Train Derailment – Single Car Single car derailment of passenger train	2	1	2	Acceptable
Passenger Train Derailment – Above Speed Limit Derailment of passenger train travelling faster than the posted speed limit	2	2	4	Acceptable
Freight Train Derailment – Dangerous Goods Derailment of freight train carrying dangerous goods	1	3	3	Acceptable
Airborne Debris – Freight Train Part of freight train becomes projectile during derailment	1	3	3	Acceptable
Groundborne Debris – Freight Train Part of freight train becomes rolling or sliding debris on ground	1	3	3	Acceptable
Airborne Debris – Passenger Train Part of passenger train becomes projectile during derailment	1	3	3	Acceptable
Groundborne Debris – Passenger Train Part of passenger train becomes rolling or sliding debris on ground	1	3	3	Acceptable
Smoke / Exhaust Ingestion of smoke or exhaust into development	2	2	4	Acceptable
Trespassing Unauthorized person enters rail corridor	2	4	8	Tolerable

6.0 Conclusion

This Rail Safety Report has been developed to review the site-specific concerns in relation to developing adjacent to a rail corridor. The risk mitigation measures include:

- A 30 m setback from the property line to the closest sensitive-use space.
- A crash berm constructed within the 30 m setback area.
- The crash berm will be designed to satisfy the FCM / RAC Guidelines.
- A 2.4 m high anti-trespassing fence will follow the requirements set by the Metrolinx Guidelines.

The risks associated with train derailment have been assessed for the proposed development at 800 Burloak Drive. This assessment follows all applicable guidelines and proposes an appropriate solution for risk mitigation.

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Appendix A

Rail Corridor Details

RTC: CH8T1
*5-460#

CN Burloak

27.1

No. 1 Track
No. 2 Track
No. 3 Track

G

X

27.18
27.10
27.11
27.06
27.05
26.96
26.88
26.71
26.21
26.20
(McPherson Rd.)
25.87

NOTE: PSO **No. 1 Track**
Psgr Trains = 80 MPH between
Mile 22.2 and Mile 36.4

PSO T1 = 80 MPH Psgr.
PSO T1 = 80 MPH Psgr.
PSO T1 = 80 MPH Psgr.

272T1
272T2
272T3

269T1
269T2
269T3

Site
ALL
Culvert
27.13
26.98
26.95

Burloak Drive

26.70
(EL 267)

Sheldon Creek East 30 ft.

Petro-Canada Service Track
OC60 3943'

25.94
(EL 260)

Culvert
Emergency Fire Crossing

OC66
1958'

PETRO CANADA

OC67-840'
OC68-662'

Rack Tracks

OC70
1040'

OC69
1947'

Bronte Creek
558 ft.
(AKA: 12 Mile Creek)

CURVE DATA

L
R

27.30
27.25
26.75
26.50
26.25
25.75
95
60
27
26

R1-25.75 - 27.30
Oakville Sub.
13111101dmn

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Appendix B

Crash Berm Detail

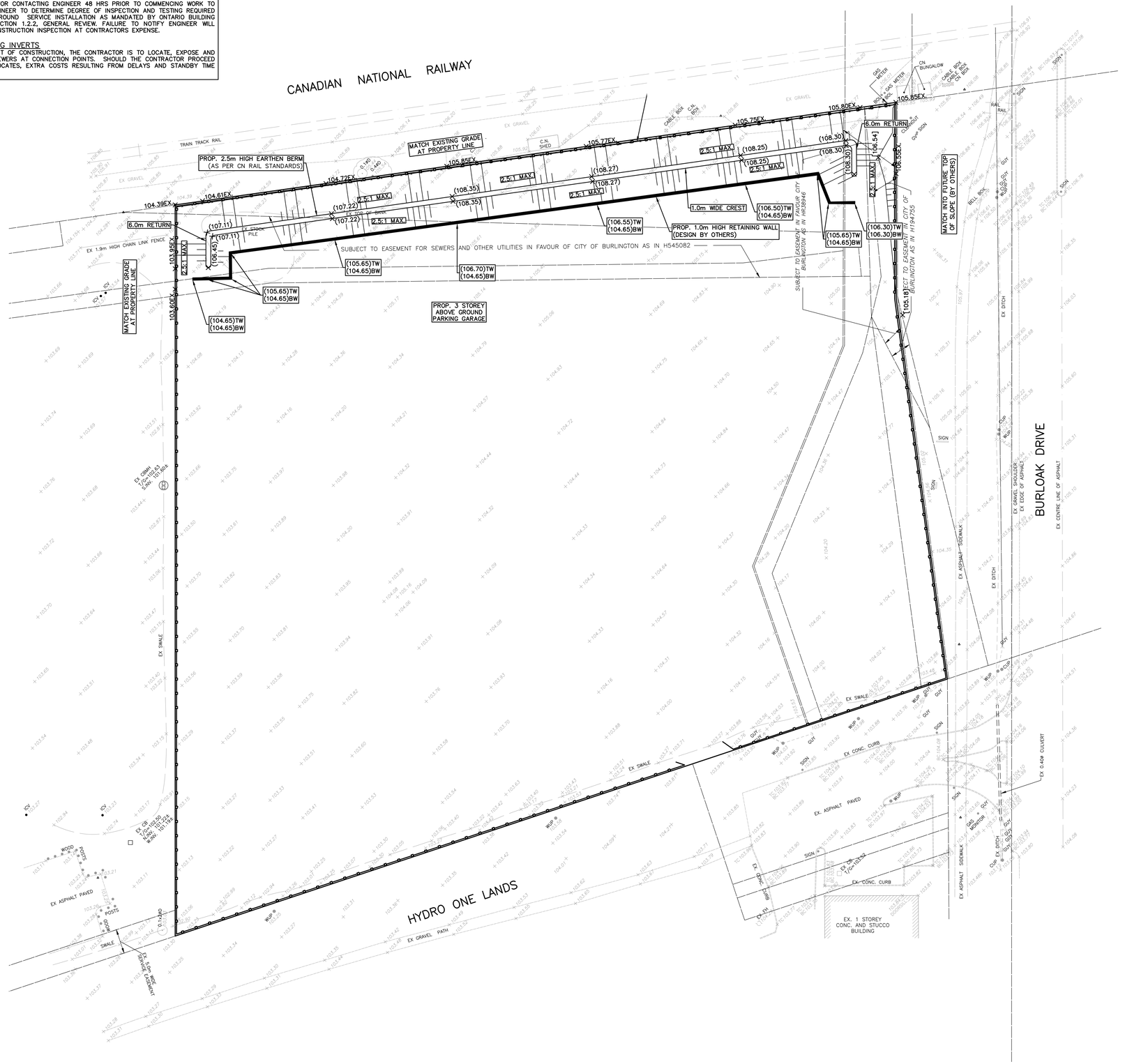
DWG No.: -C101

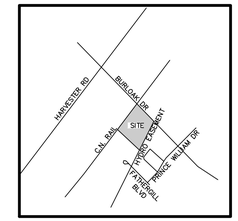
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NOTES TO CONTRACTOR:

1. INSPECTION
   CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HRS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.

2. CONFIRMATION OF EXISTING INVERTS
   72 HOURS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE AND VERIFY INVERTS OF EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.





KEY MAP
N.T.S.

LEGEND:

(100.00)	EXISTING GROUND ELEVATION
×(100.00)	PROPOSED GROUND ELEVATION
×(100.00)EX	PROPOSED ELEVATION TO MATCH EXISTING
2.0%	PROPOSED DIRECTION OF SHEET FLOW
	EXISTING CATCHBASIN
	EXISTING STORM/SANITARY MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED STORM/SANITARY MANHOLE
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED SILTATION CONTROL FENCE
	PROPOSED CATCHBASIN SILT SACK
	EMERGENCY OVERLAND FLOW ROUTE
	PROPOSED CURB STOP/GATE VALVE
	PROPOSED DRAINAGE BREAK LINE
	EXISTING DIRECTION OF SHEET FLOW

BENCH MARK NOTE:

ELEVATIONS ARE REFERRED TO GEODETIC DATUM AND WERE DERIVED FROM CITY OF BURLINGTON BENCHMARK No. 188, HAVING A PUBLISHED ELEVATION OF 101.334 metres.

NO.	DATE	BY	REVISIONS

NOTES TO CONTRACTOR:

1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

DESIGN	AS	CHK'D	AP	DATE Dec. 15, 25
DRAWN	AS	CHK'D	AP	

SCALE 1:400 (0, 5, 10, 25, 40)

APPROVALS

STAMP

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3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT

EMSHIH DEVELOPMENTS INC.
895 BRANT ST., UNIT 7, BURLINGTON

PROJECT NAME

800 BURLOAK DRIVE
BURLINGTON, ONTARIO

TITLE

DRAFT CN BERM GRADING

PROJECT No.	DRAWING No.
24012	C101

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Plotted: December 15, 2025 5:01:18 PM By: Alyssa Stiletto

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Risk Assessment

	Existing Conditions				Proposed Mitigating Measures					
Hazard	**Frequency**	**Severity**	**Residual Risk**	**Classification**	**Frequency**	**Severity**	**Residual Risk**	**Classification**	**Change in Risk**	**Comments**
Freight Train Derailment - Glancing Blow *Multi-car derailment of freight train*	2	5	10	Intolerable	2	2	4	Acceptable	-6	Crash berm and setback mitigates the risk associated with derailment.
Freight Train Derailment - Single Car *Single car derailment of freight train*	2	2	4	Acceptable	2	1	2	Acceptable	-2	Crash berm and setback mitigates the risk associated with derailment.
Freight Train Derailment - Above Speed Limit *Derailment of freight train travelling faster than the posted speed limit*	2	5	10	Intolerable	2	2	4	Acceptable	-6	Crash berm and setback mitigates the risk associated with derailment.
Passenger Train Derailment - Glancing Blow *Multi-car derailment of passenger train*	3	5	15	Intolerable	2	2	4	Acceptable	-11	Crash berm and setback mitigates the risk associated with derailment.
Passenger Train Derailment - Single Car *Single car derailment of passenger train*	3	2	6	Tolerable	2	1	2	Acceptable	-4	Crash berm and setback mitigates the risk associated with derailment.
Passenger Train Derailment - Above Speed Limit *Derailment of passenger train travelling faster than the posted speed limit*	3	5	15	Intolerable	2	2	4	Acceptable	-11	Crash berm and setback mitigates the risk associated with derailment.
Freight Train Derailment - Dangerous Goods *Derailment of freight train carrying dangerous goods*	1	5	5	Tolerable	1	3	3	Acceptable	-2	Crash berm and setback mitigates the risk of train derailment with dangerous goods.
Airborne Debris - Freight Train *Part of freight train becomes projectile during derailment*	1	5	5	Tolerable	1	3	3	Acceptable	-2	Crash berm and setback mitigates the risk of debris.
Groundborne Debris - Freight Train *Part of freight train becomes rolling or sliding debris on ground*	1	5	5	Tolerable	1	3	3	Acceptable	-2	Crash berm and setback mitigates the risk of debris.
Airborne Debris - Passenger Train *Part of passenger train becomes projectile during derailment*	1	5	5	Tolerable	1	3	3	Acceptable	-2	Crash berm and setback mitigates the risk of debris.
Groundborne Debris - Passenger Train *Part of passenger train becomes rolling or sliding debris on ground*	1	5	5	Tolerable	1	3	3	Acceptable	-2	Crash berm and setback mitigates the risk of debris.
Smoke / Exhaust *Ingestion of smoke or exhaust into development*	2	2	4	Acceptable	2	2	4	Acceptable	0	The setback distance and historical direction of wind will mitigate this risk.
Trespassing *Unauthorized person enters rail corridor*	3	4	12	Intolerable	2	4	8	Tolerable	-4	Anti-trespassing fence will prevent trespassing onto rail corridor.

Frequency Rating	Description
1. Improbable	Extremely unlikely to occur
2. Remote	Unlikely to occur in rail lifecycle
3. Occasional	Likley to occur several times in rail lifecycle
4. Probable	Expected to occur
5. Frequent	Expected to occur continuous

Severity Rating	Consequence to Person/Public	Consequence to Environment
1. Negligible	Non-reportable injury	None
2. Marginal	Single minor injury	Reversible minor environmental impact
3. Serious	Single permanent partial or tempory total disabling injury; multiple minor injury	Reversible moderate environmental impact
4. Critical	Single fatality; Single permanent total disability; Multiple permanent partial or temporay total disabling injury	Reversible significant environmental impact
5. Catastrophic	Multiple fatalities; Multiple permanent total disabling injuries	Irreversible significant environmental impact