LOT 175 Portage Road Redevelopment

Municipal Servicing & Stormwater Management Report

Project Location:
Portage Road & McLeod Road, Niagara Falls

Prepared for:
Rudanco Inc.
3767 Portage Road, Niagara Falls, ON

Prepared by:
MTE Consultants
1016 Sutton Drive, Unit A
Burlington, ON L7L 6B8

August 10, 2022

MTE File No.: 50869-100

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. were retained by Rudan Hospitality corporation to complete the site grading, servicing, stormwater management design as well as the Municipal Servicing Study for the proposed development located in Niagara Falls at Lot 175 Portage Road between Marineland Parkway and McLeod Road (see Figure 1.0 for Location Plan). This design will be in support of Zoning By-law Amendment (ZBA), Official Plan Amendment (OPA) and Site Plan Approval (SPA). The proposed development is a three-storey podium with two high-rise towers extending to 25 and 35 storeys of residential units. The proposed development will be 623 condominium units. The total site is approximately 1.28ha. If Portage Road is stated to run 'north- south', the site is bounded by a vacant lot and then McLeod Road to the north, Portage Road to the east, an abandoned railway line to the west and hydro "Station 11" (Canadian Niagara Power Co. Ltd.) to the south. Under existing conditions, the site is partially developed and consists of mostly grassed areas with a paved parking lot, a cell tower and a gravel parking area used for trailer storage. The existing cell tower is a lease with a telecom company and will be removed prior to site development.

The servicing described in this report will provide additional detailed information on the proposed servicing scheme for the development. Please refer to the Architectural Site Plan and the enclosed civil drawings prepared by MTE for additional information.

1.2 Background Information

The following documents were referenced in the preparation of this report:

- Ref. 1: *Engineering Design Guidelines Manual* (The City of Niagara Falls, April 2016).
- Ref. 2: *Niagara Region Project Design and Technical Specifications Manual*, January 2013).
- Ref. 3: *Ontario Building Code* (2012).
- Ref. 4: *Design Guidelines for Sewage Works* (Ministry of the Environment, 2008).
- Ref. 5: *Design Guidelines for Drinking-Water Systems* (Ministry of the Environment, 2008).
- Ref. 6: *Erosion & Sediment Control Guideline for Urban Construction (December, 2006).*
- Ref. 7: *MOE Stormwater Management Practices Planning and Design Manual* (Ministry of the Environment, March 2003).

  Ref. 8: *Water Supply for Public Fire Protection* (Fire Underwriters Survey, 1999).

FIGURE 1.0
Date: MAY 25/22
Scale: N.T.S.

LOCATION PLAN

MTE
Engineers, Scientists, Surveyors

Project No.: 50869-100

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2.0 Stormwater Management

The following sections will describe the stormwater management (SWM) plan for the proposed development.

2.1 Stormwater Management Criteria

The stormwater management design criteria for the subject site as established by the City of Niagara Falls and Niagara Peninsula Conservation Authority (NPCA) are as follows:

2.1.1 Quantity Control

- Control drainage to Portage Road such that the proposed condition 100-year peak flow is attenuated to the existing 5-year storm event and limit any drainage to the rail lands to not exceed existing conditions.

2.1.2 Quality Control

- Achieve “Normal” (70% TSS removal) quality treatment.

2.2 Existing Conditions

In the existing condition, the site is predominately grassed and also contains a small asphalt driveway and parking lot. There is an existing 300mm diameter storm sewer within the Portage Road Right-of-Way (ROW) at a slope of 0.4%. There are no existing catchbasins on site and the entire site ultimately drains to the railway lands west of the site and ultimately discharges to the existing 750mm diameter storm sewer within Marineland Parkway via overland flow through the railway lands. There are no known existing stormwater management quantity or quality controls on site. The existing condition has been delineated with two (2) catchment areas (see Table 2.1 and Figure 2.0).

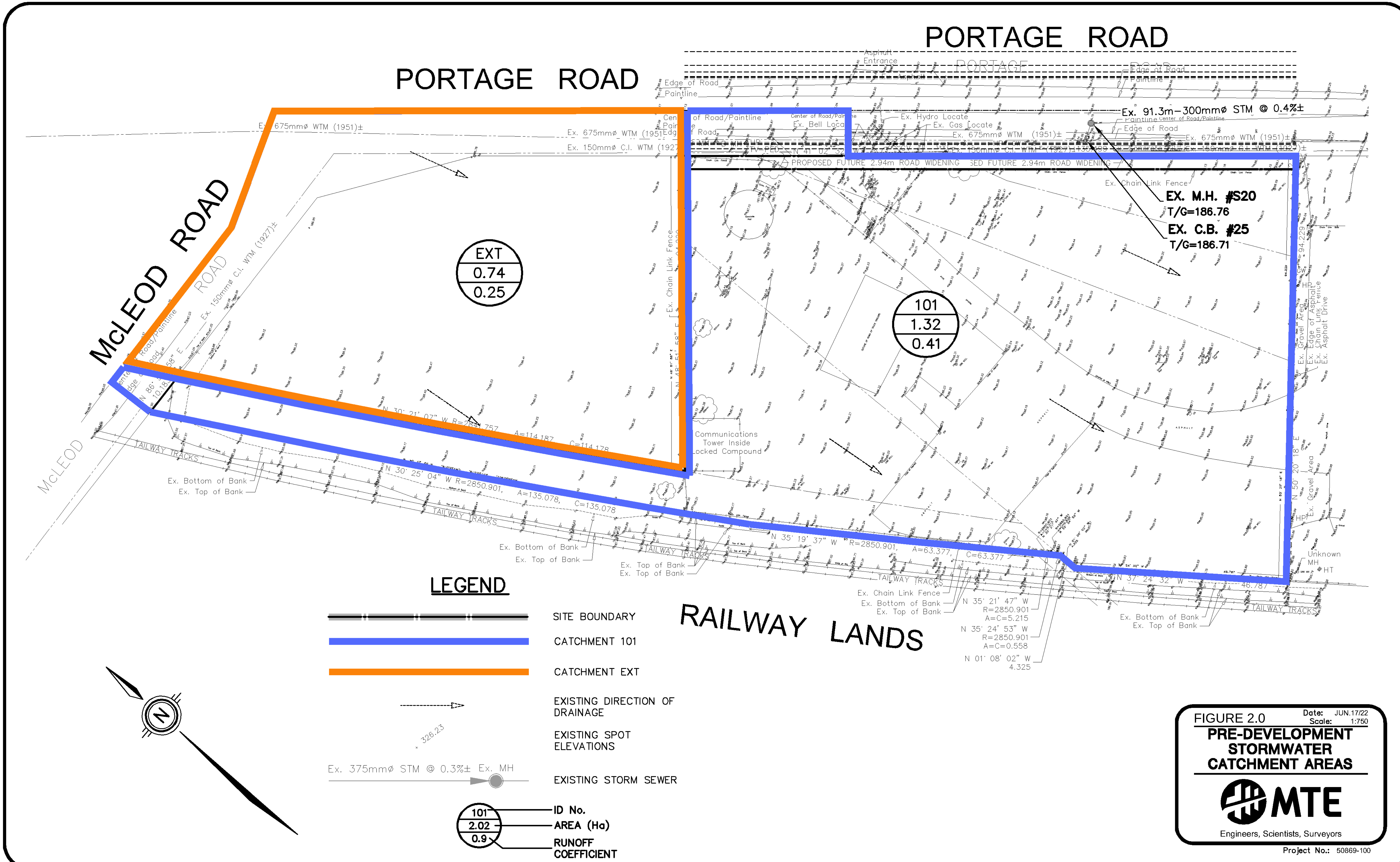

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Table 2.1 - Existing Conditions Catchment Area Parameters

Catchment ID	Description	Area (ha)	% Imp.	Runoff Coef.
101	Existing site (Discharge to Railway Lands)	1.32	24	0.41
EXT	Adjacent North Property (Discharge to Railway Lands)	0.74	0	0.25
	TOTAL	**2.06**	**16**	**0.35**

The existing condition was assessed using the Rational Method and the 5-year IDF parameters for the Niagra Peninsula Conservation Authority design storm event. Table 2.2 summarizes the site allowable release rate for the 5-year design storm event which was calculated as follows:

$$Q = 0.00278CiA$$

Where:
Q = runoff rate (m^3/s)
C = runoff coefficient; C_{pre} = 0.41 (Catchment 101), 0.25 (Catchment EXT)
i = rainfall intensity (mm/hr) = 84.02 mm/hr
A = drainage area (ha) = 1.32 (Catchment 101), 0.74 (Catchment EXT)

Table 2.2 – Existing Conditions 5-Year Peak Flow Rate

Catchment	IDF Parameters [A]			Allowable Release Rate Q (m^3/s) [B]
	A	B	C	
101	719.5	6.34	0.7687	0.126
EXT				0.043
			TOTAL	**0.169**

[A] IDF parameters from NPCA Stormwater Management Guidelines Table 8.1.2 provided in Appendix C

[B] $i=\frac{a}{(T_c+b)^c}$, T_c= 10 min, Q = 0.00278CiA

2.3 Proposed Conditions

In the proposed condition, the proponent plans to construct a three-storey podium with two high-rise towers extending to 25 and 35 storeys for a new residential development.

The proposed condition drainage area is delineated by four (4) catchment areas. Since the proposed building comprises the majority of the site, stormwater will be collected by area drains and an internal storm piping system within the building that will capture and convey flows to the existing 300mm diameter storm sewer along Portage Road. A proposed storm tank complete with a pump within the underground level of the proposed building will be constructed to control the proposed conditions 100-year discharge rate to the existing 5-year release rate.

Table 2.3 provides a brief description of each catchment area as well as the size and impervious cover associated with each. Figure 3.0 provides an illustration of the post-development catchment areas. Appendix A contains detailed information pertaining to the stormwater management model.

Table 2.3 - Proposed Conditions Catchment Areas Parameters

Catchment ID	Description	Area (ha)	%Imp.	Runoff Coef.
201	Controlled (Storm Tank) to Portage Road	0.78	89	0.83
202	Uncontrolled to Portage Road	0.35	14	0.34
203	Uncontrolled to Railway Lands	0.19	46	0.55
EXT	Adjacent North Property (Discharge to Railway Lands)	0.74	0	0.25
	Total	**2.06**	**40**	**0.51**

Catchment 201

Catchment 201 represents the building roof and driveway. Stormwater runoff from this area will be collected by area drains and an internal storm piping system within the building that will capture and convey flows to the existing 300mm diameter storm sewer on Portage Road. A proposed storm tank complete with a pump at a constant rate within the underground level of the proposed building will be constructed to control the proposed condition discharge rates to the allowable discharge rate.

Catchment 202

Catchment 202 represents perimeter areas along the east face of the building. This area will include landscaped areas and pedestrian walkways. Stormwater runoff from the landscaped areas and walkways will drain uncontrolled via overland sheet flow to Portage Road.

Catchment 203

Catchment 203 represents the west side of the proposed building. This area will include landscaped areas and pedestrian walkways. As per existing conditions, stormwater runoff from this area will drain uncontrolled via overland sheet flow to the railway lands. As noted, all stormwater runoff draining to the railway lands ultimately discharges to the existing 750mm diameter storm sewer within Marineland Parkway.

Catchment EXT

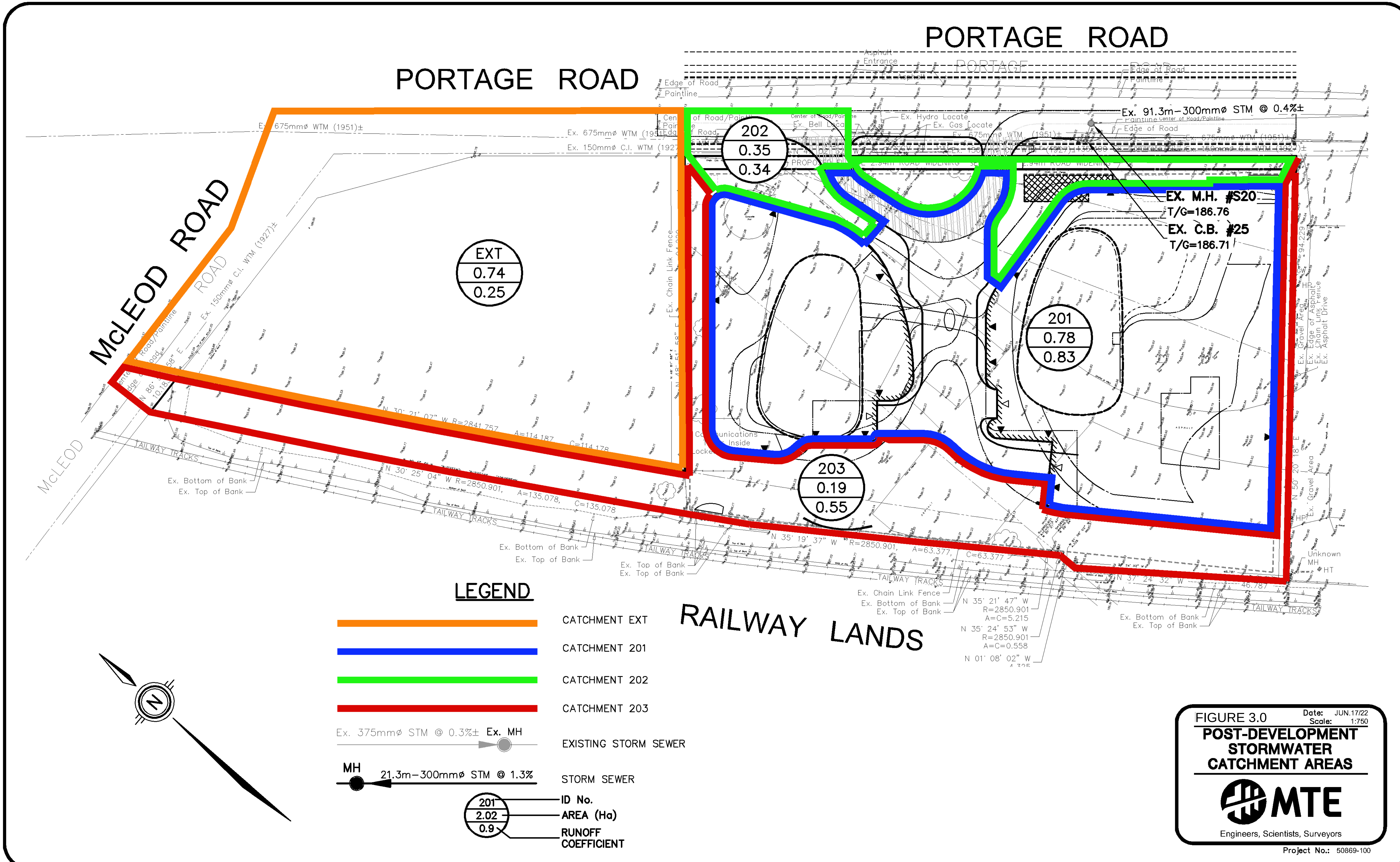
Catchment EXT represents the external drainage from the adjacent property to the north. This area will be captured via a cut-off swale along the north property line and continue to be directed to the railway lands uncontrolled.

Table 2.4 summarizes the stage-storage-discharge relationship for the underground storm tank and pump control.

Table 2.4 - Stage-Storage-Discharge Calculations for Underground Storm Tank (Catchment 201)

Elevation (m)	Head, H (m)	Cumulative Storage Volume (m^3)[A]	Discharge Q (m^3/s)[B]	Comments
183.22	0.00	0.0	0.0000	Inside Bottom of Tank
183.37	0.15	0.0	0.0800	Beginning of Pump Control
186.00	2.78	256	0.0800	Top of Tank

[A] Storage volume based on tank with internal footprint of 92 m^2. See Appendix A and drawing C2.3 for more details.
[B] Selected pump rate to meet maximum flow requirements



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The proposed conditions were assessed using modified rational method. Appendix A contains detailed calculations for the proposed conditions.

Table 2.5 summarizes the proposed condition 100-year peak discharge rate for catchment areas 201 and 202 draining towards Portage Road with the aforementioned stormwater management controls and compares it to the 5-year existing condition discharge rate (i.e. allowable discharge rate). Table 2.6 summarizes the proposed condition 100-year peak discharge rate for catchments 203 and EXT draining towards the railway lands via overland sheet flow and compares it to the 5-year existing condition discharge rate.

Table 2.5 - Proposed Conditions Peak Discharge Rate to Portage Road (Catchment Area 201 + 202)

Storm Event	Proposed Condition			Allowable 5-Year Existing Condition Peak Discharge Rate (Catchment 101) (m^3/s) [C]
	Peak Discharge Rate (Catchment 201) (m^3/s) [A]	Peak Discharge Rate (Catchment 202) (m^3/s) [B]	Total Peak Discharge Rate from Site to Portage Road (Catchment 201+202) (m^3/s)	
100-yr	0.080	0.044	**0.124**	**0.126**

[A] Selected pump rate to meet flow requirements
[B] $i=\frac{a}{(T_c+b)^C}$, T_c= 10 min, Q = 0.00278CiA
100 year IDF parameters: A=1264.57, B=7.72, C=0.7814
[C] See Table 2.2

Table 2.6 - Proposed Conditions Peak Discharge Rate to Railway Lands (Catchment Area 203+EXT)

Storm Event	Proposed Condition	5-Year Existing Condition Peak Discharge Rate (Catchment 101+EXT) (m^3/s) [B]
	Peak Discharge Rate (Catchment 203+EXT) (m^3/s) [A]	
100-yr	**0.108**	**0.169**

[A] $i=\frac{a}{(T_c+b)^C}$, T_c= 10 min, Q = 0.00278CiA
100 year IDF parameters: a=1264.57, b=7.72, c=0.7814
[B] See Table 2.2

The 100-year proposed condition peak discharge rate draining to Portage Road is less than the allowable 5-year release rate as illustrated in Table 2.5. The 100-year proposed condition peak discharge rate draining to the railway lands, is also less than the existing 5-year release rate as illustrated in Table 2.6. Therefore, the overland sheet flow to the railway lands from catchment 203 will not detrimentally impact the railway lands and also improves the existing condition.

Table 2.7 summarizes the proposed condition storage volume requirements and storage volume provided by the underground storm tank. The tank details will be finalised at the detailed design stage. The underground storm tank will provide sufficient storage volume to retain stormwater runoff up to the 100-year storm event prior to being released into the existing 300mm diameter storm sewer along Portage Road. Major flows (over the 100 year event) will be safely conveyed to the ROW.

Table 2.7 - Proposed Conditions Storage Volume Requirements Summary (Storm Tank)

Storm Event	Storm Tank (Catchment 201)	
	Storage Volume Req. [A] (m^3)	Total Storage Volume Provided (m^3)[B]
100-yr	146	256
[A] Storage volume taken from modified rational method (see Appendix A). [B] See Table 2.4		

The analysis indicates the following:

- The total proposed condition 100-year storm peak discharge rate to Portage Road is less than the existing condition 5-year storm event peak discharge rate as illustrated in Table 2.5.
- The total proposed condition 100-year storm peak discharge rate to the railway lands is less than the existing condition 5-year storm event peak discharge rate as illustrated in Table 2.6.
- Sufficient storage volume is provided within the underground storm tank to contain the 100-year storm event for the contributing catchment area 201. The final storage volume provided will be refined in the detailed design stage.

2.3.1 Private Storm Service Connection

A proposed 300mm diameter private storm service at a slope of 2.0% will outlet into the existing 300mm diameter sewer within the Portage Road ROW. The proposed storm service will have a full flow capacity of approximately 137L/s which is greater than the proposed 100-year controlled peak discharge rate of 80L/s from the proposed control pump. Therefore, the proposed storm service will have sufficient capacity to convey the proposed 100-year controlled peak flow from the site. A backflow valve will also be installed on the service lateral at the building to ensure municipal storm drainage does not back up into the building. Please see Drawing C2.3 for further site servicing details.

2.3.2 Water Quality Control

Stormwater quality control for the site will be provided by a Stormceptor oil-grit separator (OGS) unit (or approved equivalent) and that will be installed to treat the runoff produced from the asphalt surfaces that vehicles drive on. The OGS unit is to be installed prior to stormwater entering the underground stormwater tank within the building basement. The building roof, landscape and sidewalks that are used for foot traffic can generally be considered clean.

The following parameters were used to size the OGS unit:

- Catchment area = 0.14Ha (AD1 to AD6)
- % Impervious = 100%
- Particle Distribution = Fine
- TSS Removal Efficiency = 70%

The analysis indicates that a Stormceptor EF04 will provide 96% TSS removal, the Stormceptor sizing information is included in the Appendix A of this report.

Due to grading constraints and the nature of the proposed development with the underground parking and building covering the majority of the subject site, there are limited opportunities for proposed low impact development (LID) features on the site.

2.4 Sediment and Erosion Control

Sediment and erosion control measures will be implemented on site during construction and will conform to the Erosion & Sediment Control Guideline for Urban Construction (Ref 6).

Sediment and erosion control measures will include:

- Installation of silt control fencing at strategic locations around the perimeter of the site where feasible;
- Preventing silt or sediment laden water from entering inlets (area drains, catchbasins / catchbasin manholes) by installing silt sacks;
- Construction of 6m x 12m mud mat at the exit from the site to Portage Road to mitigate the transportation of sediments to the surrounding roads; and,
- Maintaining sediment and erosion control structures in good repair (including periodic cleaning as required) until such time that the Engineer or City of Niagara Falls approves their removal. Erosion control measures to be inspected daily and after any rainfall event.

Additional details will be provided on the engineering drawings at the time of detailed design.

3.0 Sanitary Sewer Servicing

3.1 Existing Conditions

There are no existing sanitary sewers fronting the site or on this segment of Portage Road. In discussions with the City and Region and review of background drawings, it was determined the closest sanitary sewer is that which services Oak Hall at 7400 Portage Road (and 7500 Portage Road), approximately 280m away. The most logical connection point to this existing sewer would be at "MHJ" within Portage Road at the intersection of the driveway entrance to Oak Hall (Refer to MTE drawing 50869-100 C2.5). As such, an extension of the sanitary sewer within the municipal ROW to the subject site is proposed. A set of Plan-and-Profiles showing a sanitary sewer design was prepared to demonstrate the feasibility of bringing a gravity connection to the site frontage (Refer to MTE drawings 50869-100 PP1 & PP2). The pipe immediately downstream of MHJ is an existing 250mm diameter sanitary sewer flowing southwest into the Marineland property at a slope of approximately 0.4%. This sewer has a full flow capacity of approximately 37.6L/s. Capacities are based on Manning's Roughness of 0.013.

3.2 Sanitary Demands

The anticipated sanitary discharge rate from the proposed development was estimated using the Ontario Building Code (OBC) (Ref.3). The estimated population count is summarized in Table 3.1. The estimated population count is used to calculate the peaking factor. The sanitary sewer discharge rates from the development are summarized in Table 3.2 and detailed calculations are found in Appendix B.

Table 3.1 – Population Estimate

Occupancy Types	Total Number of Units[A]	People per unit [B]	Occupancy Factor	Population (people)
Proposed Condo Mix				
Studio units	108	2	-	216[C]
1 Bedroom units	342	2	-	684[C]
2 Bedroom units	173	4	-	692[C]
			Total Estimated Population	**1592**

[A] Number of units provided in Giannone Petricone Associates Inc. Architects email on May 12, 2022
[B] Population density based on OBC Occupancy Loads Section 3.1.17.1. clause 1b) (2 persons per bedroom)
[C] Population calculated as (Total # of Units) X (Persons per Unit)

Table 3.2 - Sanitary Sewer Discharge from Site

Occupancy Types	Total Number of Rooms [A]	Average Flow (L/s)[B]	Peak Flow (L/s)[C]
Proposed Condo			
Studio	108	0.69	2.52
1 bedroom units	342	2.18	7.97
2 bedroom units	173	2.20	8.06
		Total Peak Sanitary Demand for Site	18.55
		Total Peak Sanitary Demand for Site (with infiltration allowance)	**18.78** [D]

[A] Room and population estimate: see Table 3.1
[B] Average flow for residential based on 275 L/d/person. (OBC Table 8.2.1.3.A)
[C] Peak flow = Average Flow*PF, where Harmon Peaking Factor (PF) = 1+(14/(4+P^(1/2))) where P = design population in thousands
Condo Mix Harmon Peaking Factor (PF) = 3.7
[D] Total Peak flow with infiltration = Total Peak flow + infiltration allowance = 18.55 + 0.23 = 18.78 L/s
Where infiltration is based on 0.18 l/s/ha (City of Niagara Falls). Area site area (1.28 ha), I = 0.18*1.28= 0.23 L/s

3.3 Proposed Sanitary Servicing Plan and Capacity Analysis

As calculated in Table 3.2, the total peak sanitary discharge from the site is 18.78 L/s.

The proposed building will be serviced by a 250mm diameter sanitary service at 1.0% slope with a full flow capacity of 59.5 L/s that will connect to the proposed 250mm diameter sanitary sewer within the Portage Road ROW. The proposed sanitary sewer designed within Portage Road have slopes of 0.5% and 0.35% with full flow capacities of 42.0 L/s and 35.2 L/s respectively. The existing pipe downstream of MHJ servicing the Oak Hall property is a 250mm diameter sanitary sewer at 0.40% with a full flow capacity of 37.6 L/s. The calculated sanitary peak discharge rate of 18.78 L/s (per Table 3.2) is about 50% of this pipe's capacity and it is likely the Oak Hall site generates far less than 50% of the flows. Therefore, we believe the existing infrastructure beyond MHJ has the capacity to accept the flow from this development. As with previous projects in the City of Niagara Falls, it is understood that the City will provide these flow rates to their consultant to input into the City wastewater model and verify capacity. The proposed alignment was discussed with City staff as a potential connection location during various consultation meetings.

4.0 Domestic and Fire Water Supply Servicing

4.1 Existing Conditions

The existing municipal water distribution system around the site consists of 150mm diameter C.I. watermain (1927) and 675mm diameter concrete watermain (1951) within the Portage Road ROW in the west boulevard. The 675mm diameter concrete transmission watermain is owned by Niagara Region and the 150mm diameter watermain is owned by the City of Niagara. There are no municipal hydrants on this section of Portage Road, the nearest hydrant is on McLeod Road just west of the intersection. There is a private hydrant on the neighbouring Niagara Power property to the south, which appears in the City's infrastructure database.

4.2 Domestic Water Demands

The expected domestic water demand for the proposed development was estimated using the Niagara Region design criteria and Ontario Building Code. Table 4.1 summarizes the domestic water demand requirements for the Average Day, Maximum Day and Peak Hour demand scenarios.

Table 4.1 - Domestic Water Demands

Proposed Condo Demands		
Population:	1592 people (see Table 3.1)	
Average Day Demand: [1]	0.229 m^3/day/person x 1592 people =	***4.22 L/s***
Maximum Day Demand: [1]	1.58 x 4.22 L/s =	***6.67 L/s***
Peak Hour Demand: [1]	4.00 x 4.22 L/s =	***16.88 L/s***
[1] Refer to Appendix B for detailed calculations.		

4.3 Fire Flow Demands

Fire flow demands for the proposed development were determined using the methodology outlined in Water Supply for Public Fire Protection (Fire Underwriters Survey (FUS), 1999). The fire flow for the proposed building was evaluated. The fire demand is summarized in Table 4.2 and detailed calculations are provided in Appendix C.

Table 4.2 - FUS Fire Flow Requirements

Building	Fire Underwriters Survey (FUS) Flow Rate
Proposed building	350 L/s (21,000 L/min)

4.4 Proposed Water Servicing Plan and Analysis

The water service for the site will connect to the existing 150mm watermain within the Portage Road ROW. The services for the proposed building will split into a dual 150mm diameter fire service and 100mm diameter domestic service at the eastern property line. At the detailed design stage, the Mechanical consultant will confirm the watermain size requirements. The City of Niagara Falls requires water distribution systems to maintain a minimum residual pressure of 140kPa (20psi) when subject to fire flow demands and 275kPa (40psi) when subject to normal operating conditions. A hydrant flow test will be required during detailed design to confirm that the available system pressure meets these requirements.

However, we note a consultant specializing in testing water infrastructure and experienced in the City of Niagara has expressed concerns of the age of this cast iron watermain and that its capacity has likely been significantly reduced by internal corrosion. The consultant also suggested it may be difficult to perform a test on a hydrant of this era for fear of it falling apart during testing. As such, the 150mm diameter watermain within Portage Road ROW will potentially need to be replaced or permission from the Region is required to connect to the 675mm diameter watermain to ensure the site can be serviced adequately.

5.0 Conclusions

Based on the information provided herein, it is concluded that the development can be constructed to meet the requirements of the City of Niagara Falls and Niagara Region. Therefore, it is recommended that:

i. Underground storage with pump control be provided to control the proposed condition stormwater site discharge rate to the allowable release rate as described in Section 2.3 of this report;

ii. Erosion and sediment controls be installed as described in Section 2.4 of this report;

iii. Sanitary servicing for the development be installed as described in Section 3.3 of this report;

iv. Water servicing for the development be installed as described in Section 4.4 of this report; and,

v. The proposed stormwater management plan presented in this report and the site servicing works described in this report be accepted in support of the Zoning By-law Application.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

All of which is respectfully submitted,

MTE Consultants Inc.

LICENSED PROFESSIONAL ENGINEER
Digital Original
K.R.RAMSEWAK
100100928
2022-08-10
50869-100
PROVINCE OF ONTARIO

Rosie Calogero, B.Eng
Designer
905-639-2552 ext. 2425
rcalogero@mte85.com

Kayam Ramsewak, C.E.T., P.Eng
Operational Director
905-639-2552 ext. 2421
kramsewak@mte85.com

RNC:rla

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Appendix A

Stormwater Management

The rainfall intensity is generally taken from Intensity Duration Frequency (IDF) curves derived for the study area from historical rainfall data (see Section 8.3) at a nearby rain gauge. **Table 8.2** gives some sample standard IDF coefficients (a, b, c) for three locations in the Niagara Region where the intensity can be calculated using:

$$i = \frac{a}{(t_c + b)^c}$$

Table 8.1.2
Sample IDF coefficients in the Niagara Region

Location	**Storm Frequency (years)**	**a**	**b**	**c**
St. Catherines	2	567	5.2	0.746
	5	664	4.7	0.744
	10	724	4.3	0.739
	25	821	4.0	0.735
	50	900	3.8	0.734
	100	980	3.7	0.732
Welland	2	755	8	0.789
	5	830	7.3	0.777
	10	860	6.5	0.763
	25	900	5.2	0.745
	50	960	5.1	0.736
	100	1020	4.7	0.731
Niagara Falls	2	521.97	5.28	0.7588
	5	719.50	6.34	0.7687
	10	577.93	2.483	0.669
	25	1020.69	7.29	0.779
	100	1264.57	7.72	0.7814
Grimsby	2	603.25	6.00	0.79
	5	785.59	6.00	0.79
	10	953.64	7.00	0.79
	25	1119.02	7.00	0.79
	50	1301.80	8.00	0.80
	100	1426.13	8.00	0.80

Additional IDF curves generated by Environment Canada can be found on the following pages.

STORMWATER STORAGE REQUIREMENTS

Project: **LOT 175 Portage Road**
Niagara, Ontario

Chicago Storm Rainfall Information		
City/Town:	**Niagara**	
Return Period:	**100**	Years
A =	**1264.57**	
B =	**7.72**	
C =	**0.7814**	
Tc =	**10**	minutes
	600	seconds

Area of site being investigated (ha) = **0.7800** (Catchment 201)
Composite Runoff Coeff. (C) = **0.83**
Release Rate - Q_{ALLOW} (m^3/s) = **0.080**

Flows from parking area calculated from area indicated above

Roof flows (Q_{ROOF}) added in as a constant flow rate into the orifice controlled system (if applicable)

Duration (T_D)		Rainfall Intensity		Post-Development Runoff			Runoff Volume	Release Volume	Storage Volume
				Parking	Roof	Total "Q_{POST}"			
(min)	(sec)	(mm/hr)	(m/s)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)
5	300	173.339	0.0000481	0.312	0.00000	0.3117	93.52	36.00	57.52
10	600	133.781	0.0000372	0.241	0.00000	0.2406	144.35	48.00	96.35
15	900	110.165	0.0000306	0.198	0.00000	0.1981	178.30	60.00	118.30
20	1200	94.307	0.0000262	0.170	0.00000	0.1696	203.51	72.00	131.51
25	1500	82.845	0.0000230	0.149	0.00000	0.1490	223.48	84.00	139.48
30	1800	74.133	0.0000206	0.133	0.00000	0.1333	239.97	96.00	143.97
35	2100	67.262	0.0000187	0.121	0.00000	0.1210	254.01	108.00	146.01
40	2400	61.689	0.0000171	0.111	0.00000	0.1109	266.25	120.00	146.25
45	2700	57.068	0.0000159	0.103	0.00000	0.1026	277.09	132.00	145.09
50	3000	53.167	0.0000148	0.096	0.00000	0.0956	286.84	144.00	142.84
55	3300	49.825	0.0000138	0.090	0.00000	0.0896	295.69	156.00	139.69
60	3600	46.927	0.0000130	0.084	0.00000	0.0844	303.80	168.00	135.80
65	3900	44.386	0.0000123	0.080	0.00000	0.0798	311.30	180.00	131.30
70	4200	42.139	0.0000117	0.076	0.00000	0.0758	318.27	192.00	126.27
75	4500	40.135	0.0000111	0.072	0.00000	0.0722	324.79	204.00	120.79
80	4800	38.336	0.0000106	0.069	0.00000	0.0689	330.92	216.00	114.92
85	5100	36.711	0.0000102	0.066	0.00000	0.0660	336.69	228.00	108.69
90	5400	35.235	0.0000098	0.063	0.00000	0.0634	342.16	240.00	102.16
95	5700	33.887	0.0000094	0.061	0.00000	0.0609	347.36	252.00	95.36
100	6000	32.652	0.0000091	0.059	0.00000	0.0587	352.31	264.00	88.31
105	6300	31.514	0.0000088	0.057	0.00000	0.0567	357.04	276.00	81.04
110	6600	30.464	0.0000085	0.055	0.00000	0.0548	361.57	288.00	73.57
115	6900	29.489	0.0000082	0.053	0.00000	0.0530	365.92	300.00	65.92
120	7200	28.583	0.0000079	0.051	0.00000	0.0514	370.10	312.00	58.10
125	7500	27.738	0.0000077	0.050	0.00000	0.0499	374.12	324.00	50.12
130	7800	26.948	0.0000075	0.048	0.00000	0.0485	378.00	336.00	42.00
135	8100	26.208	0.0000073	0.047	0.00000	0.0471	381.75	348.00	33.75
140	8400	25.512	0.0000071	0.046	0.00000	0.0459	385.38	360.00	25.38
145	8700	24.857	0.0000069	0.045	0.00000	0.0447	388.90	372.00	16.90
150	9000	24.239	0.0000067	0.044	0.00000	0.0436	392.31	384.00	8.31
155	9300	23.655	0.0000066	0.043	0.00000	0.0425	395.62	396.00	-0.38
160	9600	23.102	0.0000064	0.042	0.00000	0.0415	398.84	408.00	-9.16
165	9900	22.578	0.0000063	0.041	0.00000	0.0406	401.97	420.00	-18.03
170	10200	22.080	0.0000061	0.040	0.00000	0.0397	405.01	432.00	-26.99
175	10500	21.606	0.0000060	0.039	0.00000	0.0389	407.98	444.00	-36.02
180	10800	21.155	0.0000059	0.038	0.00000	0.0380	410.88	456.00	-45.12

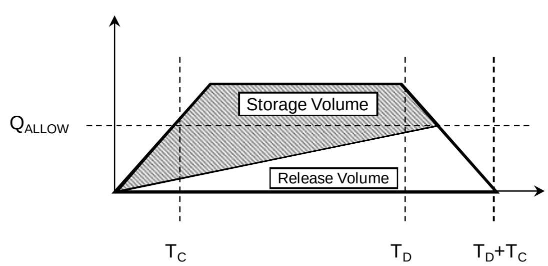
Max. required storage volume = **146.25** **m^3**

Q_{POST} = (C i A) x 10000 m^2/ha (Rational Method)

Runoff Volume = Area under trapezoidal hydrograph
= $(T_D - T_C)Q_{POST} + (T_C\,Q_{POST})$

Release Volume = Area under triangular outflow hydrograph
= ½ $(T_D + T_C)\,Q_{ALLOW}$

Storage Volume = Runoff Volume - Release Volume



Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

06/24/2022

Province:	Ontario
City:	Niagara
Nearest Rainfall Station:	ST CATHARINES AP
Climate Station Id:	6137287
Years of Rainfall Data:	33
Site Name:	LOT 175 Portage Road
Drainage Area (ha):	0.14
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	3.92
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	LOT 175 Portage Road
Project Number:	50869-100
Designer Name:	Rosie Calogero
Designer Company:	MTE Consultants
Designer Email:	rcalogero@mte85.com
Designer Phone:	905-580-2133
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	96
EFO6	99
EFO8	100
EFO10	100
EFO12	100

Recommended Stormceptor EFO Model: EFO4
Estimated Net Annual Sediment (TSS) Load Reduction (%): 96
Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

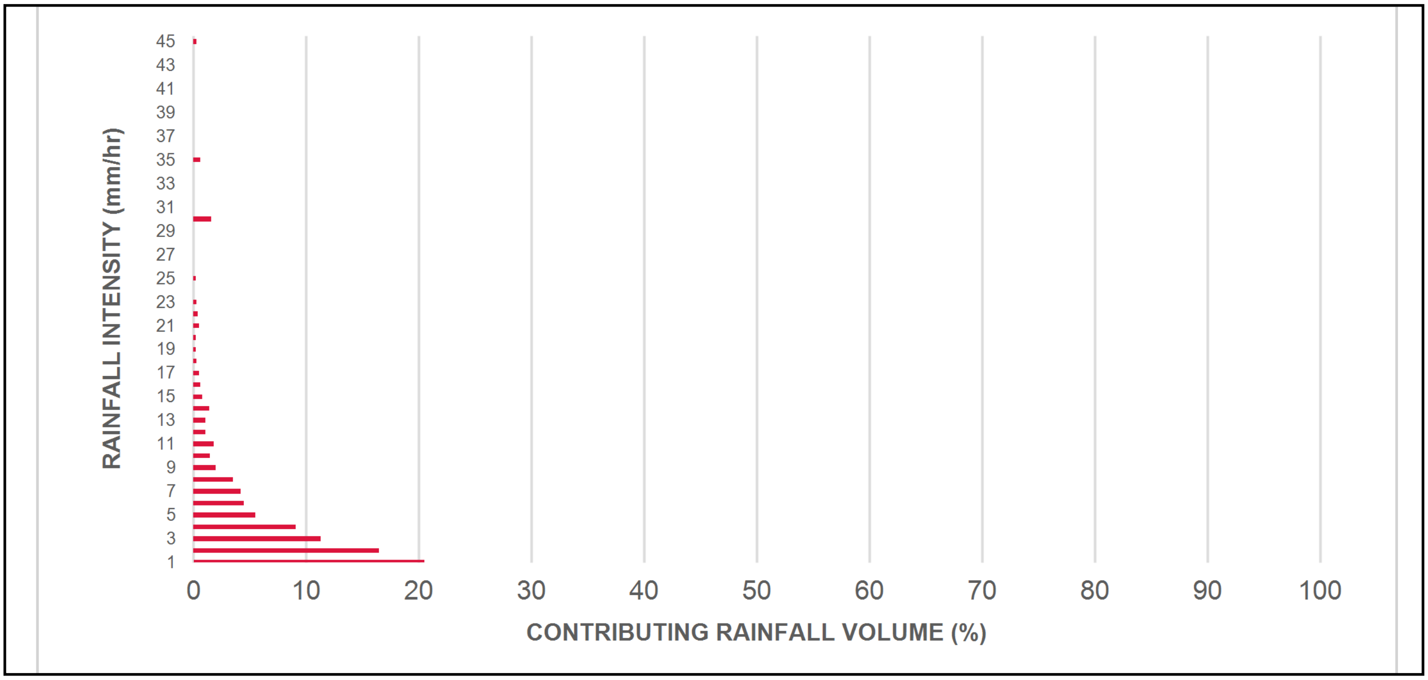
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

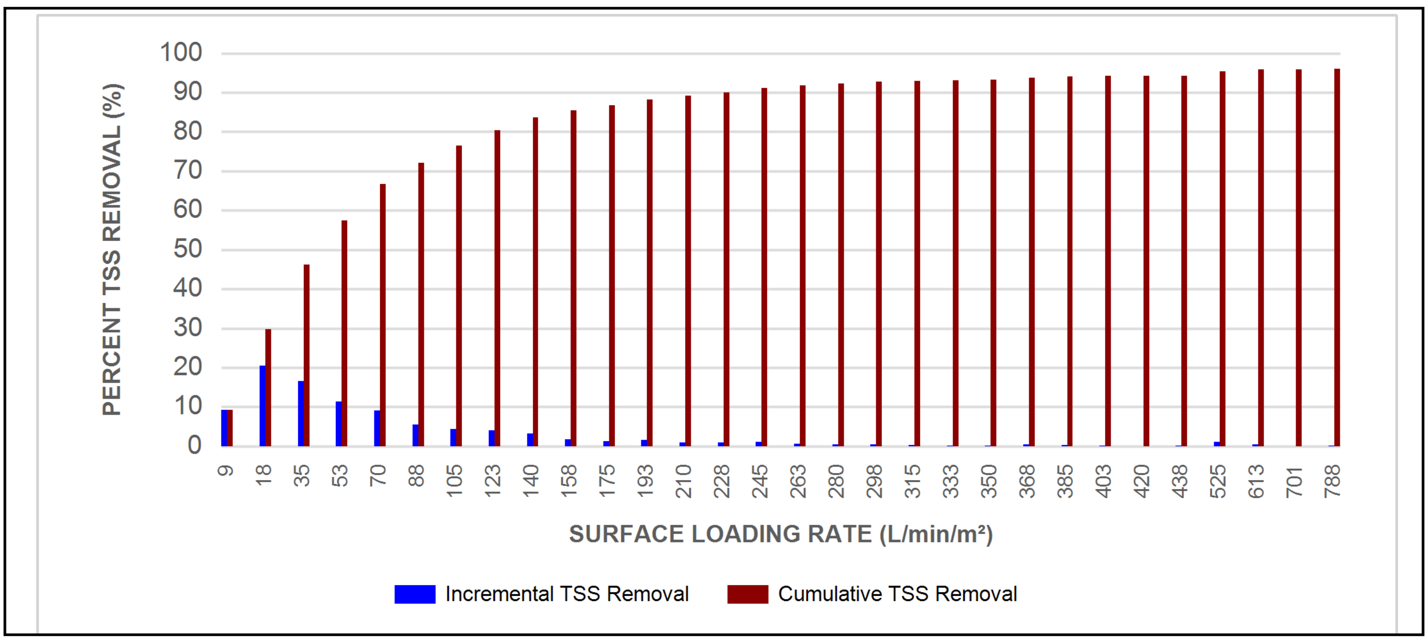
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	9.2	9.2	0.18	11.0	9.0	100	9.2	9.2
1	20.5	29.7	0.35	21.0	18.0	100	20.5	29.7
2	16.5	46.2	0.70	42.0	35.0	100	16.5	46.2
3	11.3	57.5	1.05	63.0	53.0	100	11.3	57.5
4	9.1	66.7	1.40	84.0	70.0	100	9.1	66.7
5	5.5	72.2	1.75	105.0	88.0	98	5.4	72.1
6	4.5	76.7	2.10	126.0	105.0	96	4.3	76.4
7	4.2	80.9	2.45	147.0	123.0	93	4.0	80.4
8	3.5	84.4	2.80	168.0	140.0	91	3.2	83.6
9	2.0	86.5	3.15	189.0	158.0	89	1.8	85.4
10	1.5	88.0	3.50	210.0	175.0	87	1.3	86.7
11	1.8	89.8	3.85	231.0	193.0	84	1.6	88.2
12	1.1	90.9	4.20	252.0	210.0	83	0.9	89.1
13	1.1	92.0	4.55	273.0	228.0	82	0.9	90.0
14	1.4	93.4	4.90	294.0	245.0	81	1.2	91.2
15	0.8	94.2	5.25	315.0	263.0	80	0.6	91.8
16	0.6	94.8	5.60	336.0	280.0	79	0.5	92.3
17	0.5	95.3	5.95	357.0	298.0	79	0.4	92.7
18	0.3	95.6	6.31	378.0	315.0	78	0.3	93.0
19	0.2	95.9	6.66	399.0	333.0	77	0.2	93.1
20	0.2	96.1	7.01	420.0	350.0	76	0.2	93.3
21	0.5	96.6	7.36	441.0	368.0	76	0.4	93.7
22	0.4	97.0	7.71	462.0	385.0	75	0.3	94.0
23	0.3	97.3	8.06	483.0	403.0	74	0.2	94.2
24	0.0	97.3	8.41	504.0	420.0	73	0.0	94.2
25	0.2	97.4	8.76	525.0	438.0	72	0.1	94.3
30	1.6	99.1	10.51	631.0	525.0	68	1.1	95.4
35	0.6	99.7	12.26	736.0	613.0	65	0.4	95.8
40	0.0	99.7	14.01	841.0	701.0	64	0.0	95.8
45	0.3	100.0	15.76	946.0	788.0	63	0.2	96.0
Estimated Net Annual Sediment (TSS) Load Reduction =								**96 %**

Climate Station ID: 6137287 *Years of Rainfall Data*: 33

RAINFALL DATA FROM ST CATHARINES AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL
FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance									
Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

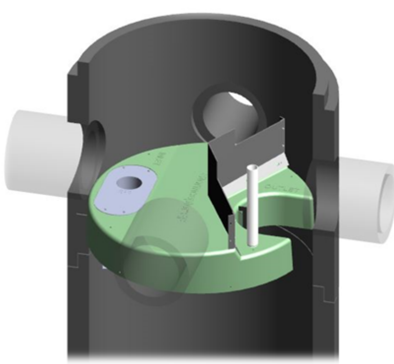
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

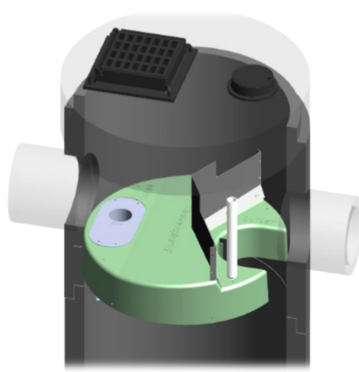
DESIGN FLEXIBILITY

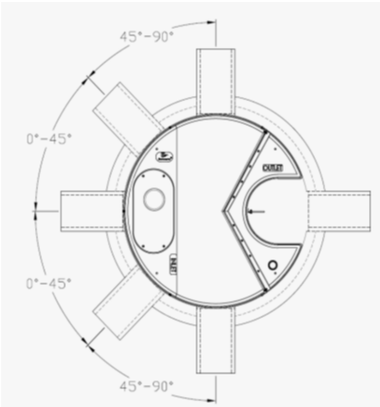
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Appendix B

Sanitary Calculations

Lot 175 Portage Road and McLeod Road
Niagara Falls, Ontario
MTE Project #: 50869-100
7/13/2022

Sanitary Demand Calculations

Land Use	Residential					Totals		
	Units [1]	Population Density [2]	Occupancy	Population (persons)	Demand (L/s)	Total Average Demand (L/s)	Total Peaked Demand (L/s)	Total Peaked Demand + Infiltration (L/s)
Proposed Condo Mix								
Studio	108	2.0	-	216	0.69	0.69	2.52	
1 Bedroom	342	2.0	-	684	2.18	2.18	7.97	
2 Bedroom	173	4.0	-	692	2.20	2.20	8.06	
Total Condo Mix	**623**			**1592**	**5.07**	**5.07**	**18.55**	**18.78**

Sanitary Demand		
Residential Daily Demands[3]	275	L/d/person
	0.0032	L/s/person
Harmon Peaking Factor (Residential) [4]	3.7	
Site Area	1.28	ha
Infiltration Allowance [5]	0.18	L/s/ha
	0.23	L/s

Note 1: Room/Unit count breakdown provided by architect
Note 2: Design population based on the occupant load (Refer to OBC Table 3.1.17.1)
Note 3: Residential daily demands based on 2020 OBC, Table 8.2.1.3.A, Apartments, condominiums, other multi-family dwellings, per person
Note 4: Harmon Peaking Factor Kh = 1+(14/(4+P^(1/2))) where P = Condo Mix population in thousands
Note 5: Infiltration allowance based on City of Niagara Falls Design Standards Ch. 2 Sanitary Sewers

(3) Where a *building* contains more than one establishment, the total daily design *sanitary sewage* flow shall be the sum of the total daily design *sanitary sewage* flow for each establishment.

(4) Where an *occupancy* is not listed in Table 8.2.1.3.B., the highest of metered flow data from at least 3 similar establishments shall be acceptable for determining the total daily design *sanitary sewage* flow.

Table 8.2.1.3.A.
Residential Occupancy

Forming Part of Sentence 8.2.1.3.(1)

Item	Column 1	Column 2
	Residential Occupancy	**Volume, litres**
1.	Apartments, Condominiums, Other Multi-family Dwellings - per person[(1)]	275
2.	Boarding Houses	
	a) Per person,	
	i) with meals and laundry facilities, or,	200
	ii) without meal or laundry facilities, and	150
	b) Per non-resident staff per 8 hour shift	40
3.	Boarding School - per person	300
4.	Dwellings	
	a) 1 bedroom dwelling	750
	b) 2 bedroom dwelling	1100
	c) 3 bedroom dwelling	1600
	d) 4 bedroom dwelling	2000
	e) 5 bedroom dwelling	2500
	f) Additional flow for[(2)]	
	i) each bedroom over 5,	500
	ii) A) each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2 [(3)] ,	100
	B) each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2 [(3)] , and	75
	C) each 10 m^2 (or part of it) over 600 m^2 [(3)] , or	50
	iii) each fixture unit over 20 fixture units	50
5.	Hotels and Motels (excluding bars and restaurants)	
	a) Regular, per room	250
	b) Resort hotel, cottage, per person	500
	c) Self service laundry, add per machine	2500
6.	Work Camp/Construction Camp, semi-permanent per worker	250

Notes to Table 8.2.1.3.A.:

(1) The *occupant load* shall be calculated using Subsection 3.1.17.

(2) Where multiple calculations of *sanitary sewage* volume is permitted, the calculation resulting in the highest flow shall be used in determining the design daily *sanitary sewage* flow.

(3) Total finished area, excluding the area of the finished *basement*.

Appendix C

Water Calculations

Lot 175 Portage Road and McLeod Road

Niagara Falls, Ontario

MTE Project #: 50869-100

7/13/2022

Residential Peaking Factors[1]:	
Avg. Day	1.0
Max. Day	1.58
Peak Hour [5]	4.00

Water Demand Calculations

	Residential					Final Demand		
Location	Units (ea)	Population Density (persons/unit) [2]	Occupancy	Population (persons)	Demand (L/s)	Avg Day Demand Qavg (L/s)	Max Day Demand Qmax.day (L/s)	Peak Hour Demand Qpeak (L/s)
Proposed Condo Mix								
Studio	108	2.0	-	216	0.57	0.57	0.90	2.29
1 Bedroom	342	2.0	-	684	1.81	1.81	2.86	7.25
2 Bedroom	173	4.0	-	692	1.83	1.83	2.90	7.34
						4.22	**6.67**	**16.88**
Total Condo Mix	623					***4.22***	***6.67***	***16.88***

Water Demand		
Average Residential Daily Demands [3]	0.229	m^3/day/person
	0.00265	L/s/person

Max Day + Fire Flow Demand		
Q_{max}.day+fire	356.7	L/s

Fire Flow [4]		
Fire Flow	350	L/s

Note 1: Peaking factor for Residential based on Niagara Region Design criteria (Section 4.2.4 Design Factors)
Note 2: Design population based on 2 people per room (Refer to OBC 3.1.17.1 (b)
Note 3: Residential demands based on Niagara Region Design Criteria (Section 4.2.4 Design Factors)
Note 4: Fire flows calculated using FUS (1999) guidelines - See attached worksheet
Note 5: Peak Hour based on Niagara Region Design Criteria (Section 4.2.4 Design Factors).

4.2.2 Fire Flow

Fire flow shall be provided in accordance with the latest requirements of the:

Risk Management Services
Fire Underwriters Survey
150 Commerce Valley Drive West
Markham, ON L3T 7Z3
http://www.fireunderwriters.ca

or as suggested in the MOE Guidelines for the Design of Water Distribution Systems, whichever is the more stringent.

4.2.3 Equivalent Population

The following equivalent population densities shall be used to estimate the water service demand for the different types of development in the design of water transmission systems:

Equivalent Population Density and Water Service Demand

Type of Development	Equivalent Population Density (Person/Hectare)	Average Day Service Demands (m^3/ha/day)
Single Family	55	15.125
Semi-detached duplex and 4-plex	100	27.500
Townhouse, Maisonette (6 storey apt. or less)	135	37.125
Apartments (over 6 stories high)	285	78.375
Light Commercial Areas	90	24.750
Community Services	40	
Light Industrial Areas	125	34.375
Hospitals	4 persons/bed	

4.2.4 Design Factors

The following design factors are to be used for the design of water transmission systems:

Average Daily Demand (ADD) for the various Area Municipalities is shown below:

Water System	Average Daily Demand m^3/d/person
DeCew Falls	0.427
Rosehill (Fort Erie)	0.473
Grimsby	0.359
Niagara Falls	0.229
Port Colborne	0.553

Lot 175 Portage Road and McLeod Road
Niagara Falls, Ontario
MTE Project #: 50869-100
6/15/2022

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220C\sqrt{A}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

Adjustments to the calculated fire flow can be made based on occupancy, sprinkler protection and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

			(1)		(2)		(3)		(4)		**Final Adjusted**		
Building	Area "A" [A]	C [B]	Fire Flow "F"		Occupancy		Sprinkler		Exposure		**Fire Flow**		
	(m^2)		(l/min)	(l/s)	%	Adjusted Fire Flow (L/min)	%	Adjustment (L/min)	%	Adjustment (L/min)	**(L/min)**	**Rounded(L/min)**	**(L/s)**
Proposed Building	20,952	0.8	25,000	416.7	-15	21,250	-40	-8,500	40%	8,500	21,250	21,000	**350**

Note A: Area "A" represents the Gross Floor Area of two largest adjoinitng floors (floor 1 & 1-Mez.) plus 50 percent of the 8 floors immediately above.
Note [B]: Construction type confirmed by the Architect

(2) Occupancy	
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

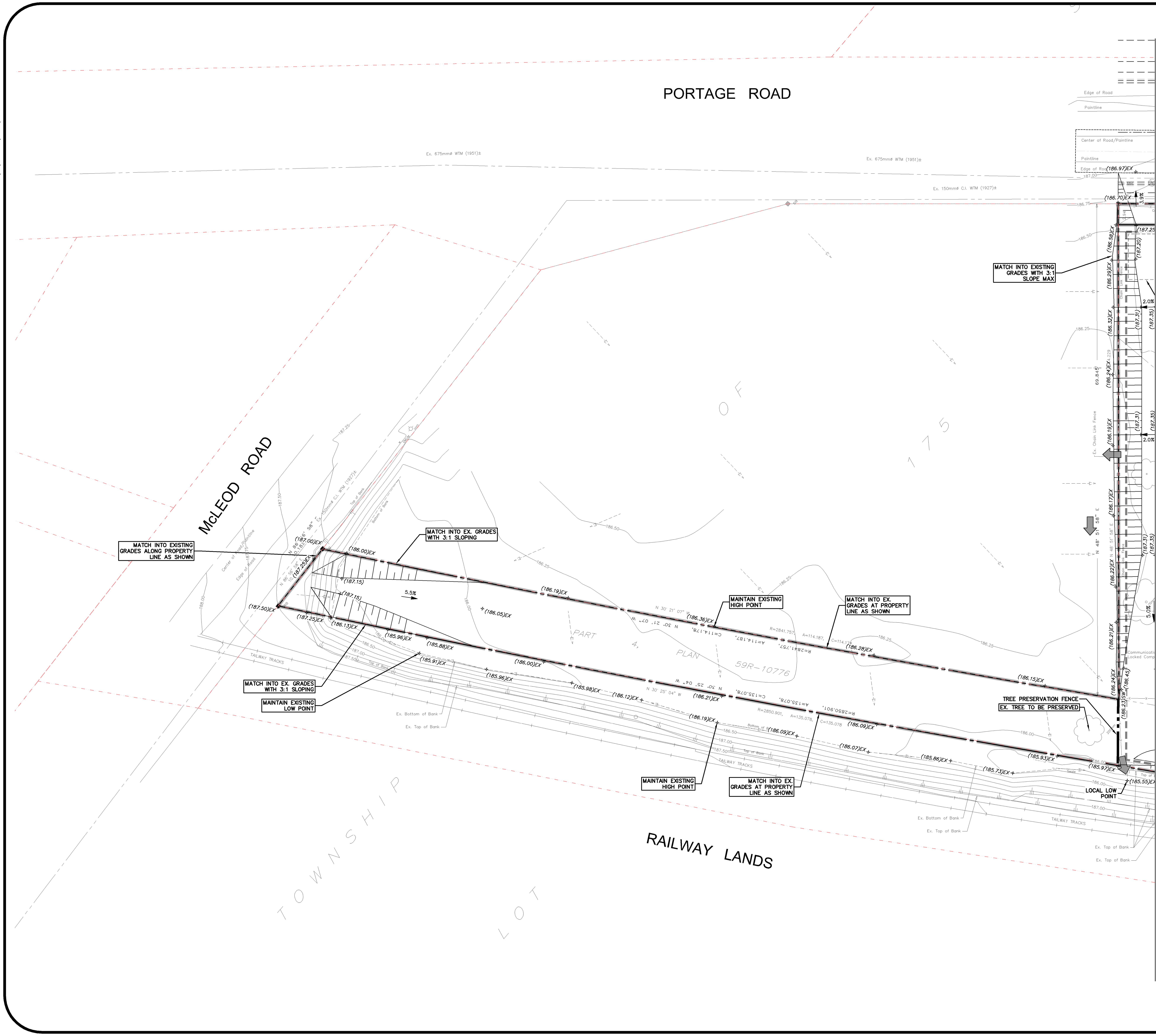
(3) Sprinkler
40% credit for adequately designed system per NFPA 13. Additional 10% if water supply standard for both the system and fire department hose lines.

(4) Exposure		
0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
30.1 to 45m	5%	exceed 75%

Exposure Distances		
N	9m	20%
E	>45m	0%
S	18m	15%
W	31m	5%
	Total	**40%**

Appendix D

Drawings

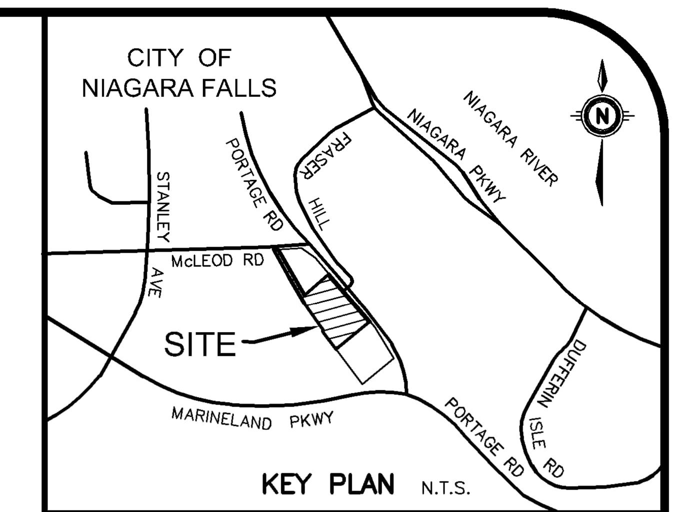


LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- EXISTING SPOT ELEVATIONS/CONTOURS
- EXISTING DIRECTION OF DRAINAGE/SWALE
- EXISTING CURB
- EXISTING EMBANKMENT (SLOPE AS NOTED)
- EXISTING FENCE
- EXISTING TREE
- EXISTING HYDRO POLE
- EXISTING TV PEDESTAL

LEGEND OF PROPOSED FEATURES

- RETAINING WALL
- TREE PRESERVATION FENCE
- FIRE ROUTE
- (326.00) PROPOSED SPOT ELEVATIONS EX =MAINTAIN EXISTING
- 1.0% DIRECTION OF DRAINAGE/SWALE
- DRAINAGE SPLIT (RIDGE)
- (TOP) 3:1 (BOTTOM) EMBANKMENT (SLOPE AS NOTED)



GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = 186.42m
IRON MONUMENT AT THE NORTHEAST CORNER OF PART 4, PLAN 59-10776. ELEVATION=186.42 METERS

NOTE TO CONTRACTOR :

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CLIENT
RUDANCO HOSPITALITY CORPORATION

PROJECT
PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
SITE GRADING AND SERVICING PLAN PART 1

Project Manager K. RAMSEWAK	Project No. 50869-100
Design By CNF/RNC	Checked By CNF
Drawn By SDU	Checked By CNF/KRR
Surveyed By BY OTHERS	Drawing No. C2.1
Date Apr.25/22	
Scale 1:250	Sheet 1 of 7

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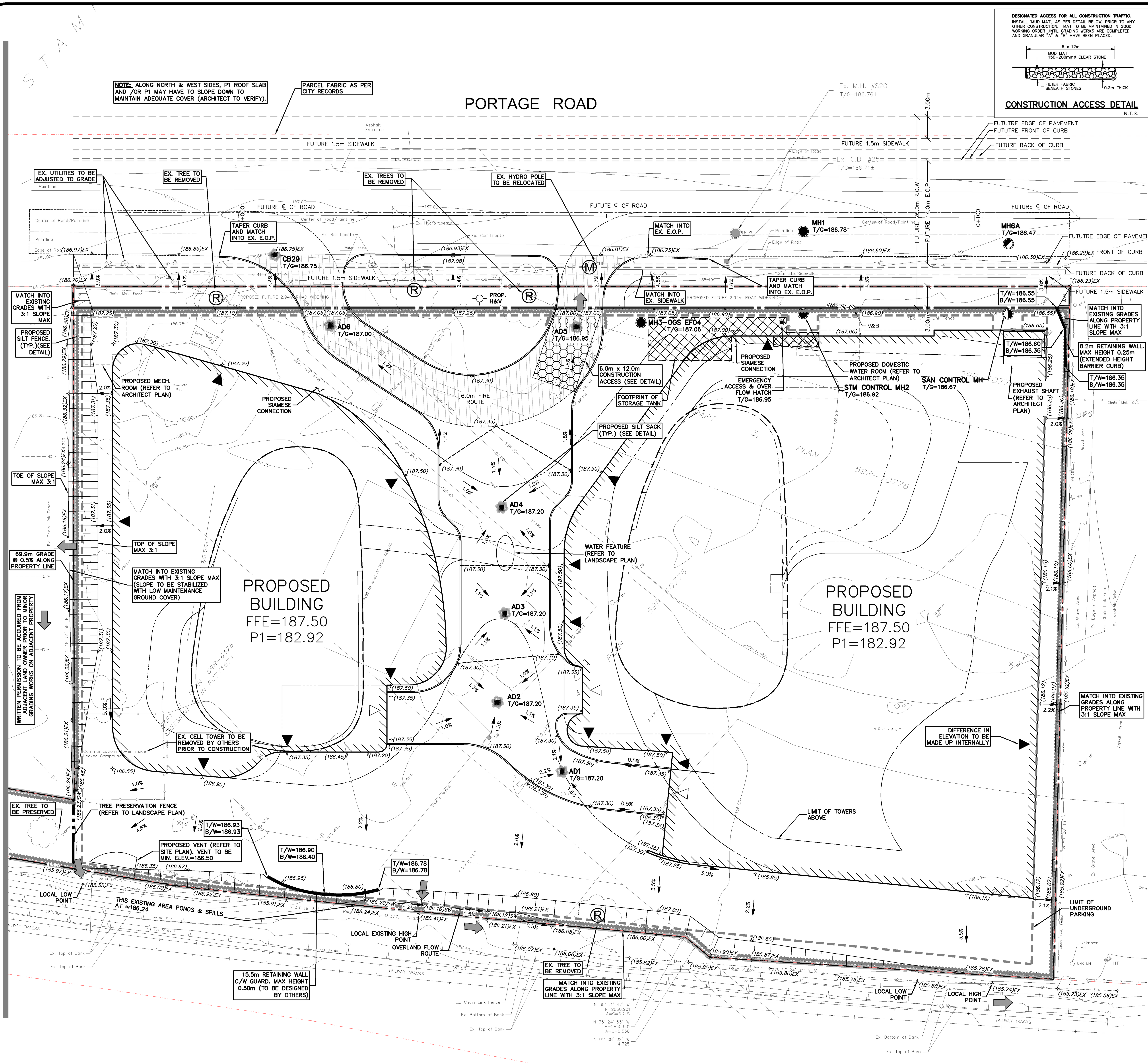
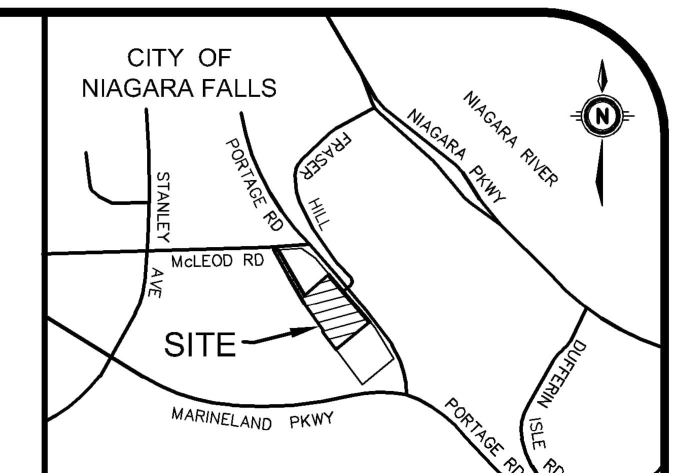




KEY PLAN N.T.S.

DESIGNATED ACCESS FOR ALL CONSTRUCTION TRAFFIC.
INSTALL 'MUD MAT', AS PER DETAIL BELOW, PRIOR TO ANY OTHER CONSTRUCTION. MAT TO BE MAINTAINED IN GOOD WORKING ORDER UNTIL GRADING WORKS ARE COMPLETED AND GRANULAR "A" & "B" HAVE BEEN PLACED.

6 x 12m
MUD MAT 150-200mmø CLEAR STONE
FILTER FABRIC BENEATH STONES
0.3m THICK

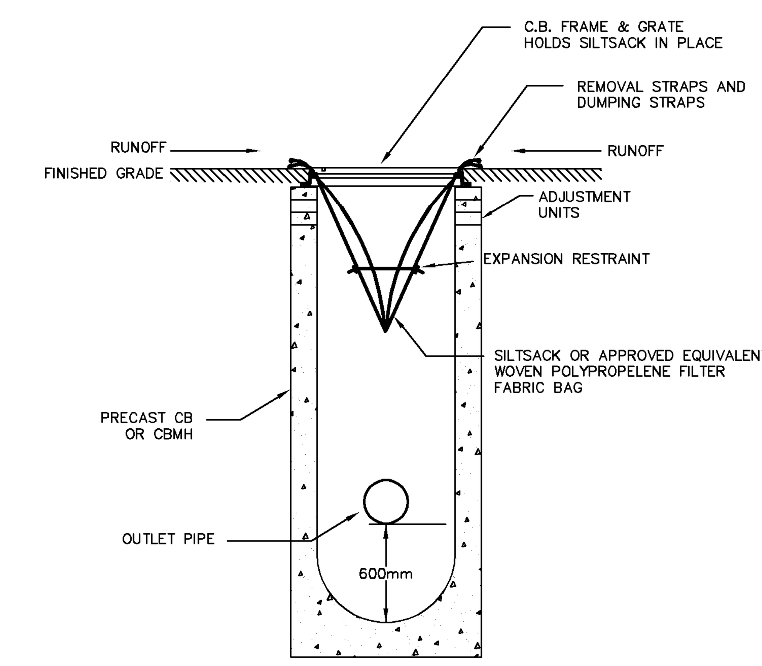
CONSTRUCTION ACCESS DETAIL
N.T.S.

LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- EXISTING SPOT ELEVATIONS/CONTOURS
- EXISTING DIRECTION OF DRAINAGE/SWALE
- EXISTING CURB
- EXISTING EMBANKMENT (SLOPE AS NOTED)
- EXISTING FENCE
- EXISTING TREE
- EXISTING HYDRO POLE
- EXISTING TV PEDESTAL

LEGEND OF PROPOSED FEATURES

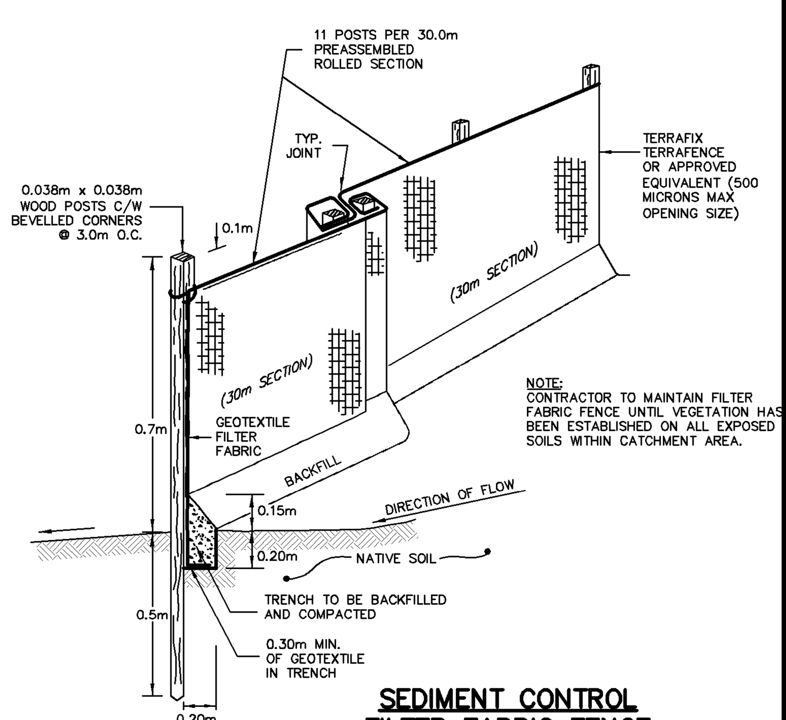
- +(326.00) T/G=326.00 FFE=326.00 — PROPOSED SPOT ELEVATIONS; EX =MAINTAIN EXISTING; T/G =TOP OF CASTING/GRATE; INV =INVERT ELEVATION; FFE =FINISHED FLOOR ELEVATION
- 1.0% — DIRECTION OF DRAINAGE/SWALE
- DRAINAGE SPLIT (RIDGE)
- (TOP) 3:1 (BOTTOM) — EMBANKMENT (SLOPE AS NOTED)
- PROPOSED BUILDING
- MAN DOOR
- VEHICLE DOOR
- (DROP CURB) — CONCRETE CURB
- GUARDRAIL
- RETAINING WALL
- OVERLAND FLOW ROUTE (MAJOR STORM)
- SEDIMENT CONTROL FENCE (SEE DETAIL)
- SILT SACK (SEE DETAIL)
- CONSTRUCTION ACCESS (SEE DETAIL)
- TREE PRESERVATION FENCE
- FIRE ROUTE



MAINTENANCE SCHEDULE

- INSPECT AFTER EVERY MAJOR RAIN EVENT.
- INSPECT EVERY 3 WEEKS MINIMUM.
- SILTSACK SHOULD NEVER BE OVER HALF FULL.
- FULL BAG CAN BE REMOVED, DUMPED, CLEANED AND REUSED (TO REMOVE INSERT 25mm REBAR INTO REMOVAL FLAP POCKETS) (TO DUMP INSERT 25mm REBAR INTO BOTH DUMPING STRAPS)

TEMPORARY SILTSACK SILTATION CONTROL IN CB
N.T.S.



NOTE: CONTRACTOR TO MAINTAIN FILTER FABRIC FENCE UNTIL VEGETATION HAS BEEN ESTABLISHED ON ALL EXPOSED SOILS WITHIN CATCHMENT AREA.

SEDIMENT CONTROL FILTER FABRIC FENCE
N.T.S.

GEODETIC BM ELEV. = m

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IRON MONUMENT AT THE NORTHEAST CORNER OF PART 4, PLAN 59-10776, ELEVATION=186.42 METERS

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RUDANCO HOSPITALITY CORPORATION

PROJECT
PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
SITE GRADING PLAN PART 2

Project Manager K. RAMSEWAK	Project No. 50869-100
Design By CNF/RNC	Checked By CNF
Drawn By SDU	Checked By CNF/KRR
Surveyed By BY OTHERS	Drawing No. C2.2
Date Apr.25/22	
Scale 1:250	Sheet 2 of 7

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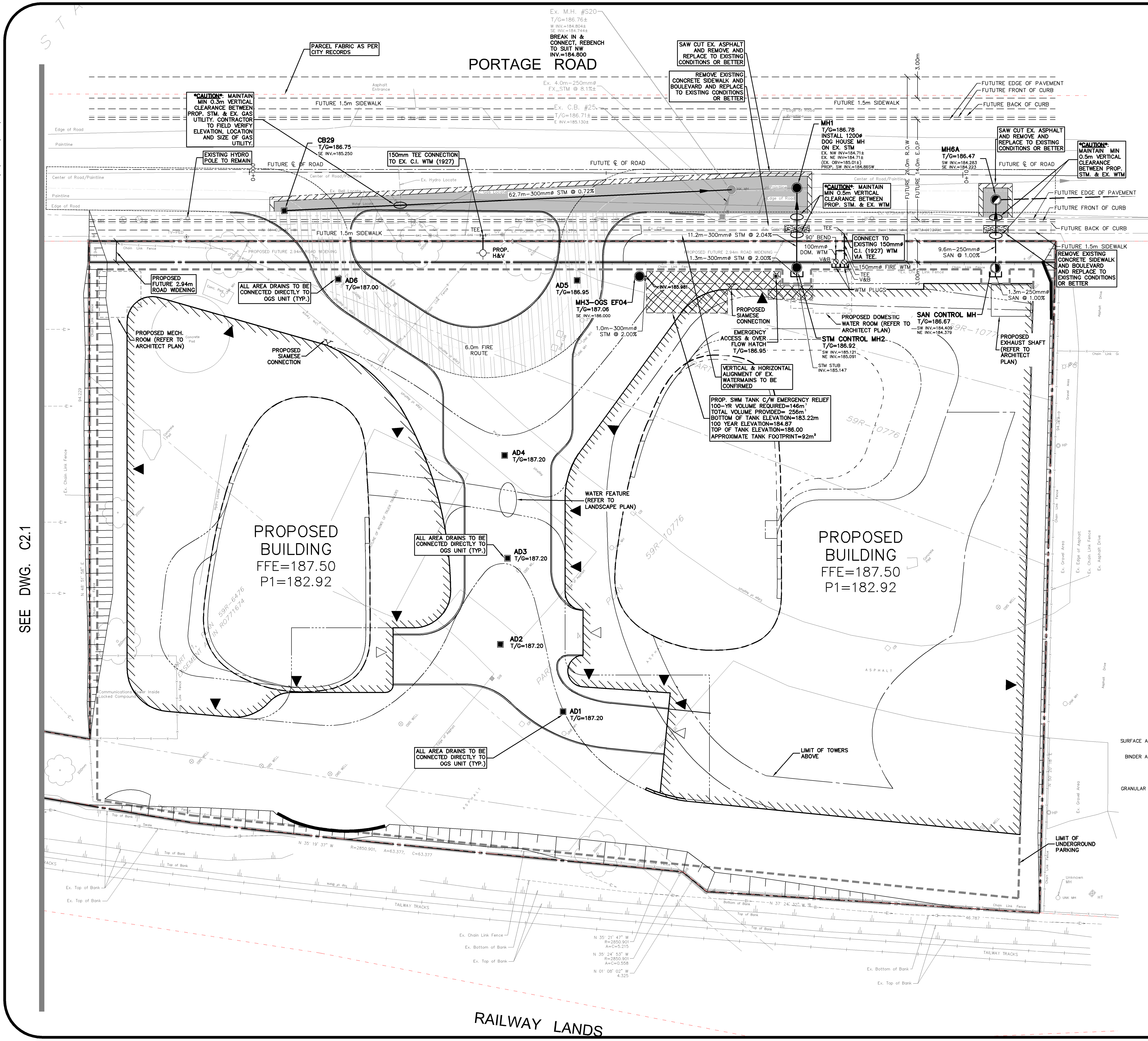
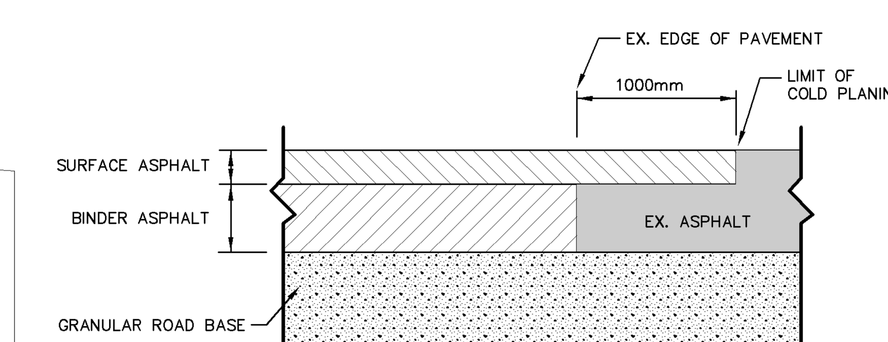


LEGEND OF EXISTING FEATURES

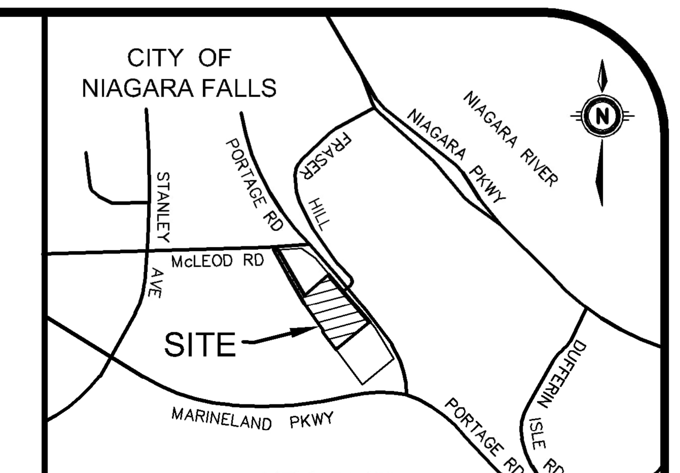
- SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- EXISTING STORM SEWER
- EXISTING CURB
- EXISTING EMBANKMENT (SLOPE AS NOTED)
- EXISTING FENCE
- EXISTING U/G GAS
- EXISTING U/G HYDRO
- EXISTING U/G BELL
- EXISTING TREE
- EXISTING HYDRO POLE
- EXISTING TV PEDESTAL

LEGEND OF PROPOSED FEATURES

- EMBANKMENT (SLOPE AS NOTED)
- SANITARY SEWER
- STORM SEWER
- PERFORATED BIG 'O' SUBDRAIN (SEE DETAIL)
- WATERMAIN
- SEWER CROSSING (REFER TO CROSSING CHART)
- PROPOSED BUILDING
- MAN DOOR
- VEHICLE DOOR
- CONCRETE CURB
- GUARDRAIL
- RETAINING WALL
- FIRE ROUTE
- CONCRETE AREA RESTORATION
- ASPHALT AREA RESTORATION
- SAW CUT c/w LAP JOINT (SEE DETAIL)
- LIMIT OF UNDERGROUND PARKING
- LIMIT OF TOWERS ABOVE (REFER TO ARCHITECT PLANS)



ASPHALT JOINT DETAIL
N.T.S.



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PROJECT
PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
SITE SERVICING PLAN PART 2

Project Manager: K. RAMSEWAK	Project No.: 50869-100
Design By: CNF/RNC	Checked By: CNF
Drawn By: SDU	Checked By: CNF/KRR
Surveyed By: BY OTHERS	Drawing No.: C2.3
Date: Apr.25/22	
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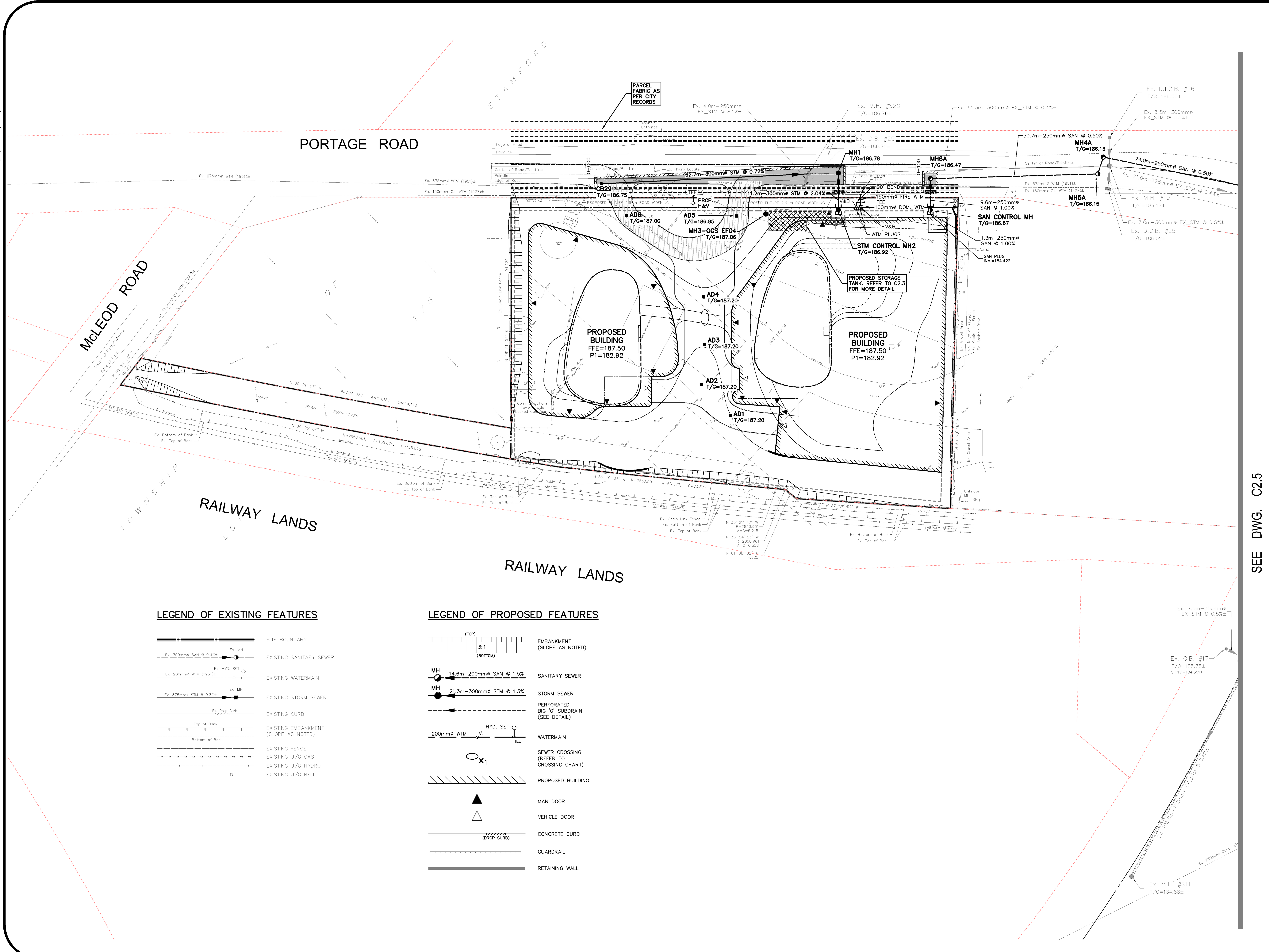

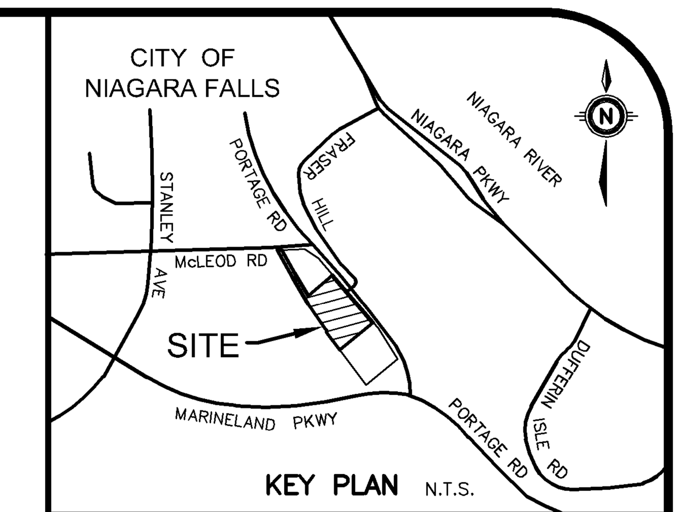

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PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
GENERAL PLAN PART 1

Project Manager: K. RAMSEWAK	Project No.: 50869-100
Design By: CNF/RNC	Checked By: CNF
Drawn By: SDU	Checked By: CNF/KRR
Surveyed By: BY OTHERS	Drawing No.: C2.4
Date: Apr.25/22	
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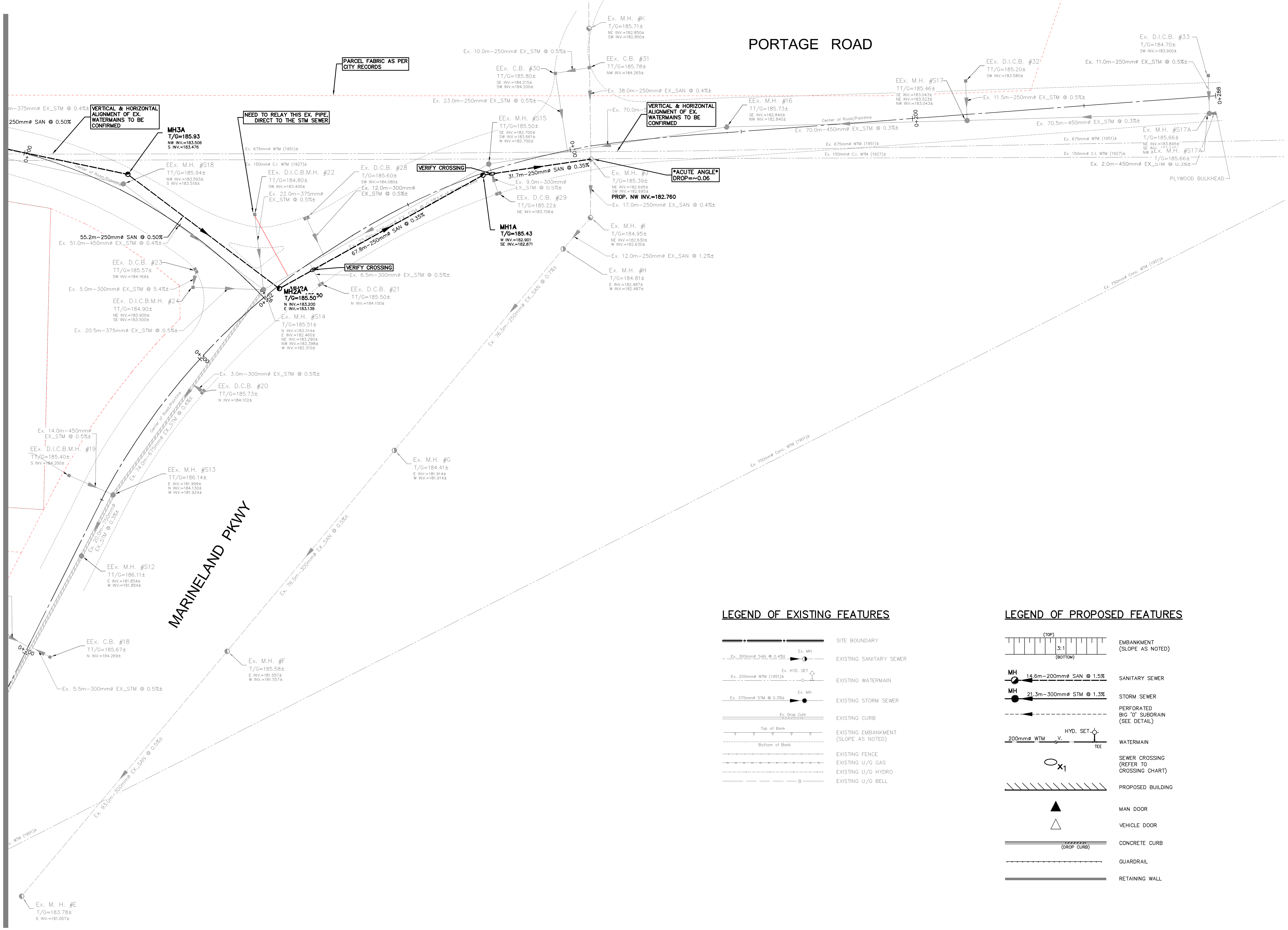

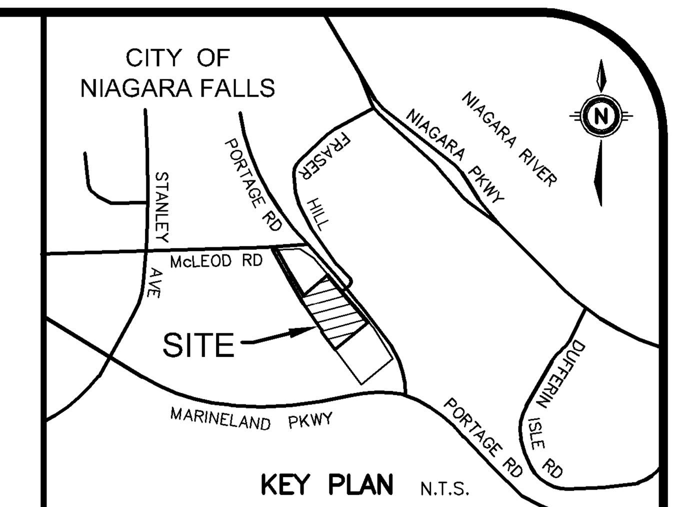

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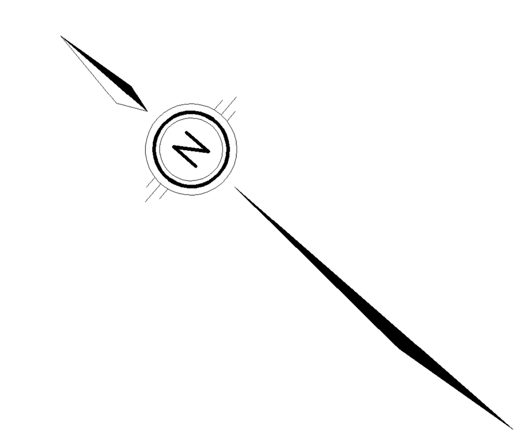

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PROJECT
PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
GENERAL PLAN PART 2

Project Manager K. RAMSEWAK	Project No. 50869-100
Design By CNF/RNC	Checked By CNF
Drawn By SDU	Checked By CNF/KRR
Surveyed By BY OTHERS	Drawing No. C2.5
Date Apr.25/22	
Scale 1:500	Sheet 5 of 7

LEGEND OF EXISTING FEATURES

	SITE BOUNDARY
Ex. 300mmø SAN @ 0.4%± / Ex. MH	EXISTING SANITARY SEWER
Ex. 200mmø WTM (1951)± / Ex. HYD. SET	EXISTING WATERMAIN
Ex. 375mmø STM @ 0.3%± / Ex. MH	EXISTING STORM SEWER
Ex. Drop Curb	EXISTING CURB
Top of Bank / Bottom of Bank	EXISTING EMBANKMENT (SLOPE AS NOTED)
	EXISTING FENCE
	EXISTING U/G GAS
	EXISTING U/G HYDRO
B	EXISTING U/G BELL

LEGEND OF PROPOSED FEATURES

(TOP) 3:1 (BOTTOM)	EMBANKMENT (SLOPE AS NOTED)
MH 14.6m–200mmø SAN @ 1.5%	SANITARY SEWER
MH 21.3m–300mmø STM @ 1.3%	STORM SEWER
	PERFORATED BIG 'O' SUBDRAIN (SEE DETAIL)
200mmø WTM V. HYD. SET TEE	WATERMAIN
X_1	SEWER CROSSING (REFER TO CROSSING CHART)
	PROPOSED BUILDING
▲	MAN DOOR
△	VEHICLE DOOR
(DROP CURB)	CONCRETE CURB
	GUARDRAIL
	RETAINING WALL

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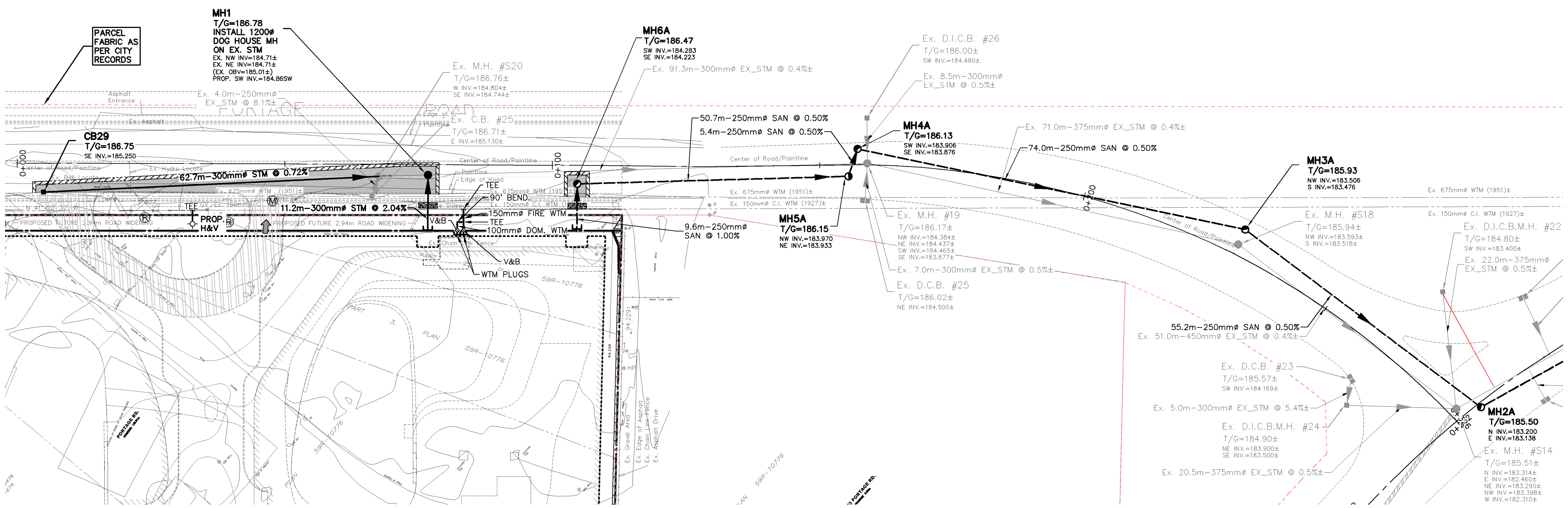
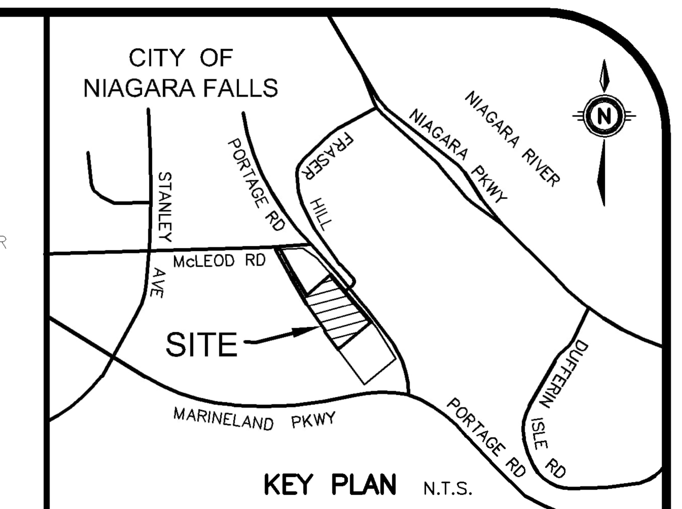


LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- EXISTING STORM SEWER
- EXISTING CURB

LEGEND OF PROPOSED FEATURES

- EMBANKMENT (SLOPE AS NOTED)
- SANITARY SEWER (14.6m–200mmø SAN @ 1.5%)
- STORM SEWER (21.3m–300mmø STM @ 1.3%)
- PERFORATED BIG 'O' SUBDRAIN (SEE DETAIL)
- WATERMAIN
- SEWER CROSSING (REFER TO CROSSING CHART)
- PROPOSED BUILDING
- MAN DOOR
- VEHICLE DOOR
- CONCRETE CURB
- GUARDRAIL
- RETAINING WALL

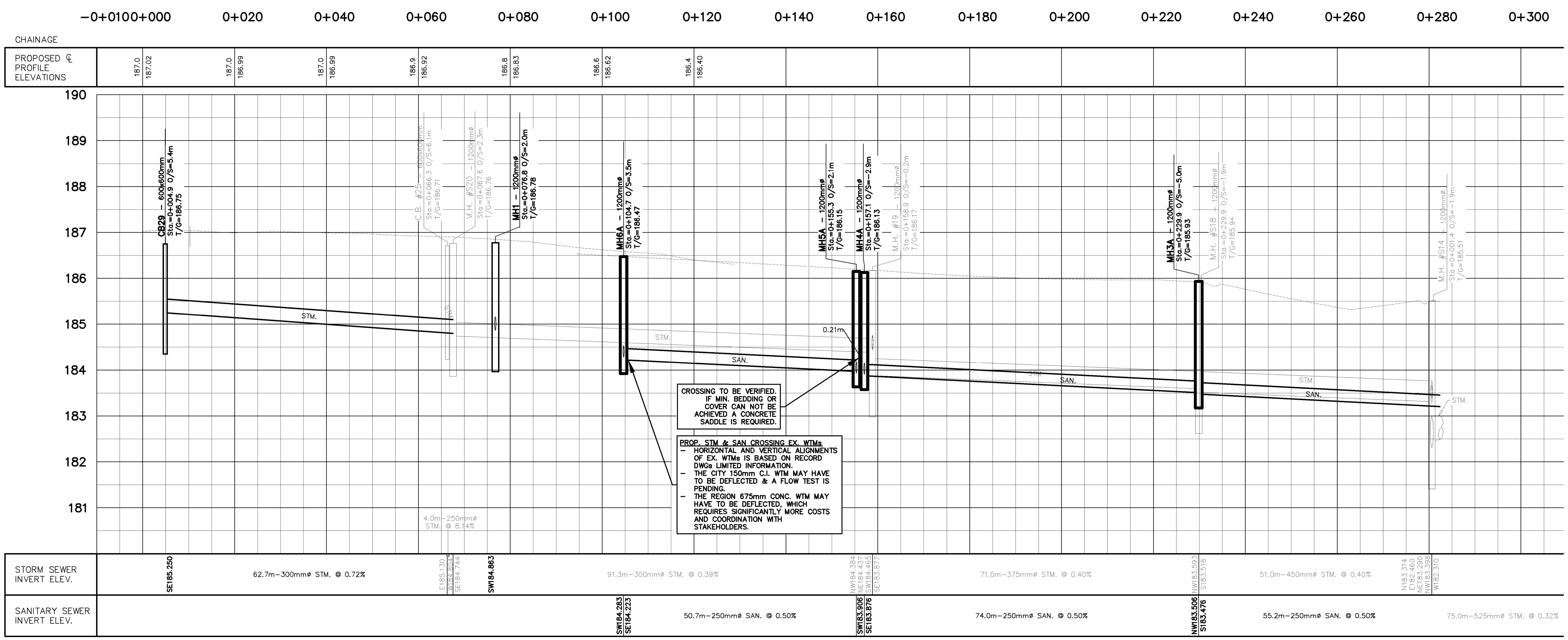


GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = 186.42m
IRON MONUMENT AT THE NORTHEAST CORNER OF PART 4, PLAN 59–10776, ELEVATION=186.42 METERS

NOTE TO CONTRACTOR :
DO NOT SCALE DRAWINGS.
CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.
THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

PORTAGE ROAD 1 PROFILE



No.	REVISION	BY	YYYY-MM-DD
8.			
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1.	ISSUED FOR ZBA	KRR	2022-08-10

MTE
Engineers, Scientists, Surveyors
905-639-2552

NOT FOR CONSTRUCTION

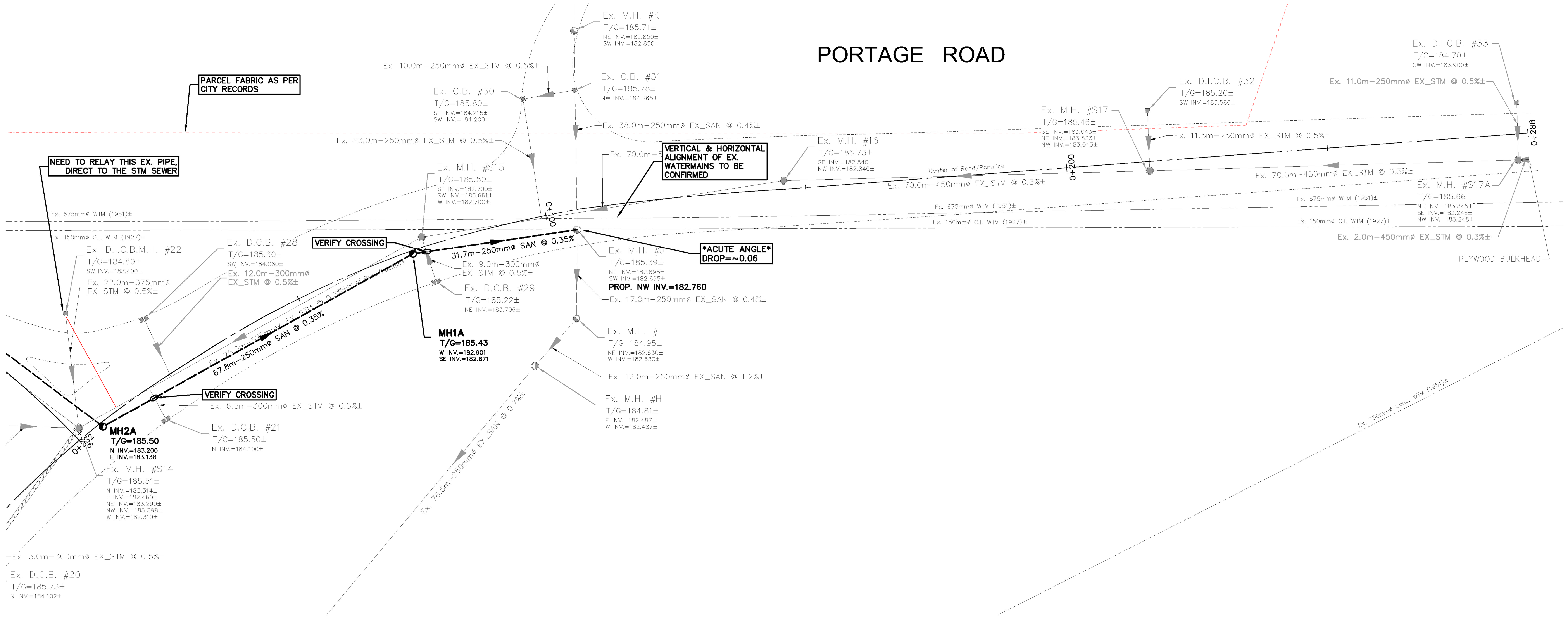
CLIENT
RUDANCO HOSPITALITY CORPORATION

PROJECT
PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
PORTAGE ROAD PART 1
STA. 0+000 TO STA. 0+280

Project Manager: K. RAMSEWAK	Project No.: 50869-100
Design By: CNF/RNC	Checked By: CNF
Drawn By: SDU	Checked By: CNF/KRR
Surveyed By: BY OTHERS	Drawing No.: PP1
Date: Apr.25/22	
Scale: 1:500	Sheet 6 of 7

PORTAGE ROAD

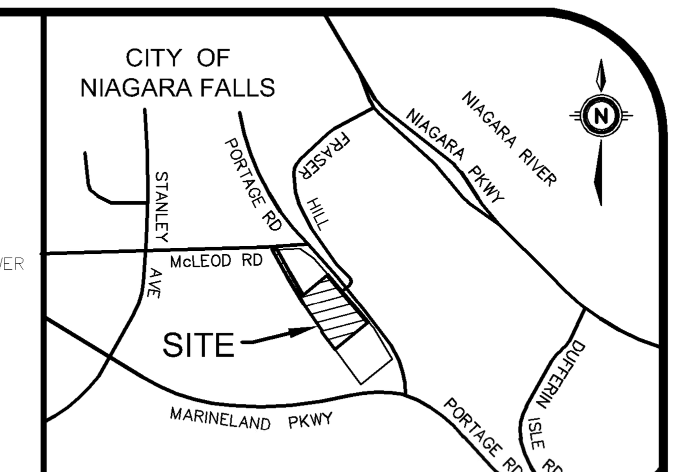


LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- EXISTING SANITARY SEWER (Ex. 300mmø SAN @ 0.4%±, Ex. MH)
- EXISTING WATERMAIN (Ex. 200mmø WTM (1951)±, Ex. HYD. SET)
- EXISTING STORM SEWER (Ex. 375mmø STM @ 0.3%±, Ex. MH)
- EXISTING CURB (Ex. Drop Curb)

LEGEND OF PROPOSED FEATURES

- EMBANKMENT (SLOPE AS NOTED) — (TOP) 3:1 (BOTTOM)
- SANITARY SEWER — MH 14.6m–200mmø SAN @ 1.5%
- STORM SEWER — MH 21.3m–300mmø STM @ 1.3%
- PERFORATED BIG 'O' SUBDRAIN (SEE DETAIL)
- WATERMAIN — 200mmø WTM, V., HYD. SET, TEE
- SEWER CROSSING (REFER TO CROSSING CHART) — X1
- PROPOSED BUILDING
- MAN DOOR
- VEHICLE DOOR
- CONCRETE CURB (DROP CURB)
- GUARDRAIL
- RETAINING WALL



KEY PLAN N.T.S.

GEODETIC BM	ELEV. = m
SITE BENCHMARK	ELEV. = 186.42m

IRON MONUMENT AT THE NORTHEAST CORNER OF PART 4, PLAN 59-10776, ELEVATION=186.42 METERS

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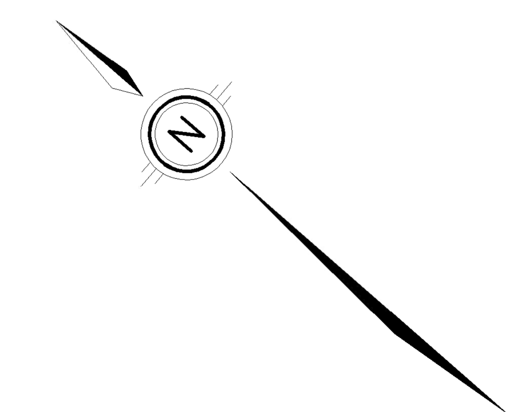
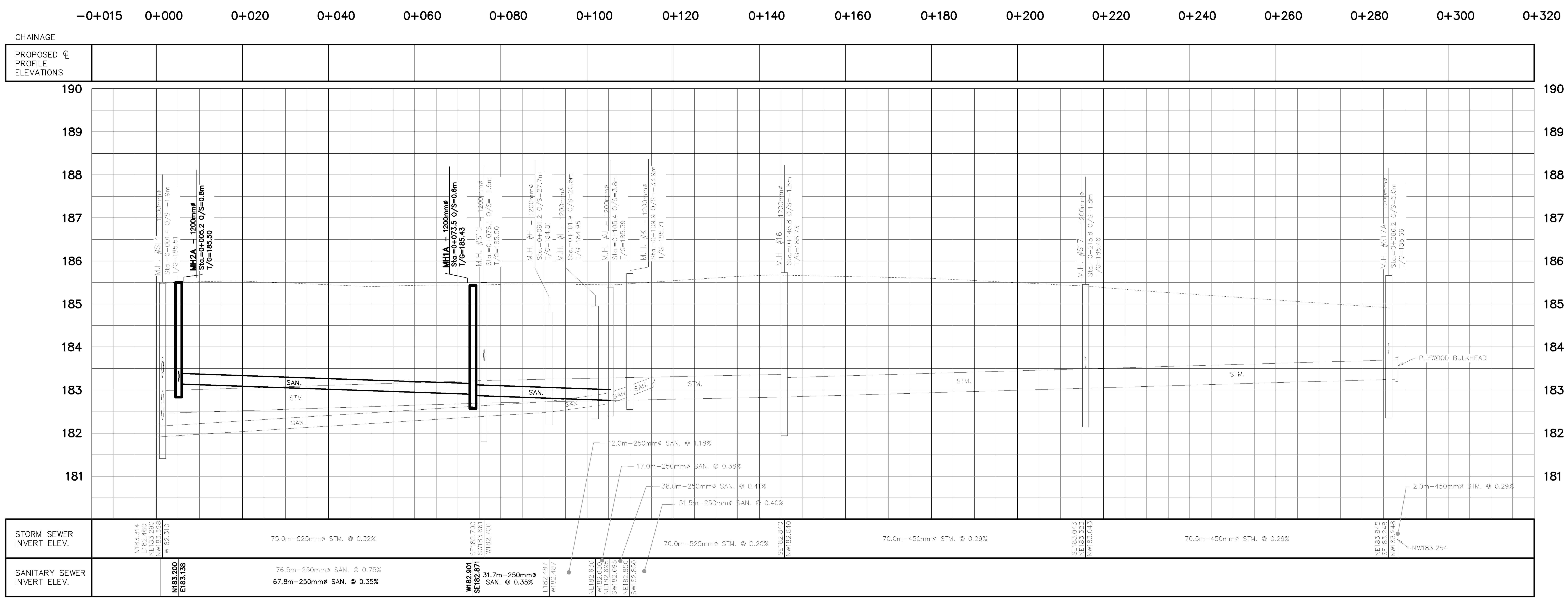


PORTAGE ROAD 2 PROFILE



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CLIENT
RUDANCO HOSPITALITY CORPORATION

PROJECT
PORTAGE ROAD NEW 2 TOWER HIGHRISE
PART LOT 175; PARTS2-4 50R-10776 NIAGARA FALLS

DRAWING
PORTAGE ROAD PART 2
STA. 0+000 TO STA. 0+320

Project Manager: K. RAMSEWAK	Project No.: 50869-100
Design By: CNF/RNC	Checked By: CNF
Drawn By: SDU	Checked By: CNF/KRR
Surveyed By: BY OTHERS	Drawing No.: PP2
Date: Apr.25/22	
Scale: 1:500	Sheet 7 of 7