5592 Robinson Street 77 Storey Building

Municipal Servicing & Stormwater Management Report

Project Location:
5592 Robinson Street, Niagara Falls

Prepared for:
Fudzi International Group Inc.
6158 Allendale Avenue, Niagara Falls, ON

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

April 5, 2022
Revised: February 3, 2023

MTE File No.: 50064-100

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. were retained by Fudzi International Group Inc. to complete the site grading, servicing, stormwater management design as well as the Municipal Servicing Study for the proposed development located in downtown Niagara Falls at the intersection of Robinson Street and Allendale Avenue (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 six-storey podium with a high-rise tower extending to 77 storeys for a new residential and commercial development. The proposed development consists of 955 condominium units and 7 townhouse units. The total site is approximately 0.405ha. The site is bounded by residential houses to the east and a parking lot/open field to the north, south and west. Under existing conditions, the site is fully developed and consists of residential houses and commercial building with associated parking.

The servicing described in this report will provide additional detailed information on the proposed servicing scheme for the site. 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: *Niagara Falls Modelling – 5592 Robinson Street*, GM Blue Plan Engineering (2022)
- Ref. 2: *Ontario Building Code* (2020).
- Ref. 3: *Engineering Design Guidelines Manual* (The City of Niagara Falls, April 2016).
- Ref. 4: *Niagara Region Project Design and Technical Specifications Manual*, (January 2013).
- Ref. 5: *Design Guidelines for Sewage Works* (Ministry of the Environment, 2008).
- Ref. 6: *Design Guidelines for Drinking-Water Systems* (Ministry of the Environment, 2008).
- Ref. 7: *Erosion & Sediment Control Guideline for Urban Construction (December, 2006).*
- Ref. 8: *MOE Stormwater Management Practices Planning and Design Manual* (Ministry of the Environment, March 2003).
- Ref. 9: *Water Supply for Public Fire Protection* (Fire Underwriters Survey, 1999).

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2.0 Stormwater Management

The following sections will describe the proposed 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

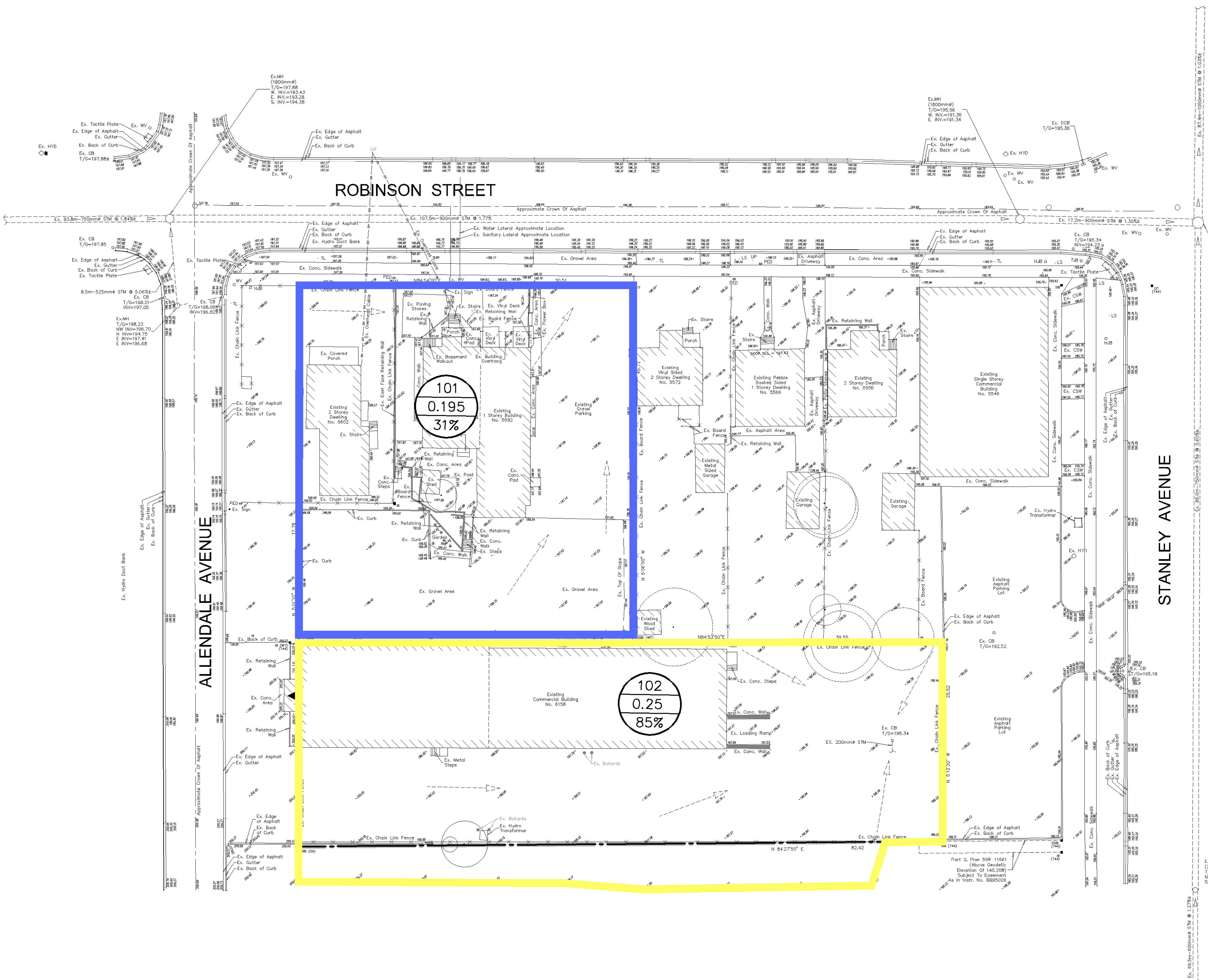
- Attenuation of the proposed condition peak flow to the pre-development peak flow for the 5-year storm event.

2.1.2 Quality Control

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

2.2 Existing Conditions

In the existing condition, the site is comprised of three (3) buildings, landscaped areas and a gravel/asphalt parking lot. There is an existing 900mm diameter storm sewer within the Robinson Street Right-of-Way (ROW) at 1.77%. There is an existing catchbasin on site that collects stormwater and convey drainage to the existing municipal storm system. The entire site ultimately discharges to the existing downstream 1650mm diameter trunk storm sewer within Ferry Street. There are no known existing stormwater management quantity or quality controls on site. The existing condition has been defined by two (2) catchment areas (see Table 2.1 and Figure 2).



LEGEND

CATCHMENT 101

CATCHMENT 102

EXISTING DIRECTION OF DRAINAGE

Ex. 375mmØ STM — Ex. MH — EXISTING STORM SEWER

101 — SUB-CATCHMENT NUMBER
0.18 — AREA (ha.)
93% — % IMPERVIOUS

FIGURE 2 — Date: 2022-01-13 — Scale: 1:500

EXISTING CONDITIONS CATCHMENT AREAS

MTE
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Project No.: 50064-100

Table 2.1 - Existing Condition Catchment Area Parameters

Catchment ID	Description	Area (ha)	% Imp.	Runoff Coef.
101	Drainage to Robinson Street via overland sheet flow	0.195	31	0.42
102	Drainage to existing on site CB	0.250	85	0.80
	TOTAL	**0.445**	**64**	**0.63**

The existing condition was assessed using the Rational Method and the 5-year IDF parameters for the City of Niagara Falls 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
i = rainfall intensity (mm/hr)
A = Catchment area (ha)

Table 2.2 – Existing Conditions 5-Year Peak Flow Rate

Design Storm Event	IDF Parameters [A]			Allowable Release Rate to Robinson Street (Catchment 101) Q (m^3/s)	Allowable Release Rate to Ex. Catchbasin (Catchment 102) Q (m^3/s)
	A	Q (m^3/s)	C		
5-year	719.5	6.34	0.7687	0.019 [B]	0.047 [B]

[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 6-storey podium with a high-rise tower extending to 77 storeys for a new residential and commercial development. The proposed condition drainage pattern is delineated by three (3) catchment areas. Since the proposed building comprises the majority of the site, stormwater will be collected by an internal storm piping system within the building that will capture and convey flows to the existing 900mm diameter storm sewer along Robinson Street. A proposed storm tank complete with orifice controls within the underground level of the proposed building will be constructed to control the proposed condition 5-year discharge rate to the existing condition 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 provides an illustration of the post-development catchment areas. Appendix A contains detailed information pertaining to the stormwater management model.

Table 2.3 - Proposed Condition Catchment Areas Parameters

Catchment ID	Description	Area (ha)	%Imp.	Runoff Coef.
201a	Controlled (Storm Tank) to Robinson Street	0.310	99	0.90
201b	Perimeter Uncontrolled Drainage to Robinson Street	0.010	99	0.9
202	Uncontrolled to Existing Catchbasin on site	0.125	68	0.68
	Total	**0.445**	**90**	**0.83**

Catchment 201a

Catchment 201a represents the building roof and a small portion of driveway that is not covered by roof. Stormwater runoff from this area will be collected by an internal storm piping system within the building that will capture and convey flows to the existing 900mm diameter storm sewer on Robinson Street. A proposed storm tank complete with orifice controls within the underground level of the proposed building will be constructed to control the proposed condition discharge rate to the existing condition discharge rate. The stormwater runoff will be controlled by a 75mm diameter orifice plate located at the outlet of the tank. The proposed tank will be located under the driveway entrance complete with a relief hatch within the driveway.

Catchment 201b

Catchment 201b represents the north side of the proposed building. This area will include landscaped areas and pedestrian walkways. Stormwater runoff from this minor landscaped area and walkways will drain uncontrolled via overland sheet flow to Robinson Street.

Catchment 202

Catchment 202 represents the undeveloped area of the site. This area includes landscaped external drainage south of the site. Per existing conditions, majority of this catchment is paved with the exception of the external landscaped area. To be conservative, it was assumed this area is to remain paved. Per existing conditions, this catchment drains uncontrolled to the existing catchbasin on site. The existing catchbasin on site is to remain.

Table 2.4 summarizes the stage-storage-discharge relationship for the underground storm tank. This information was used in the hydrologic model.

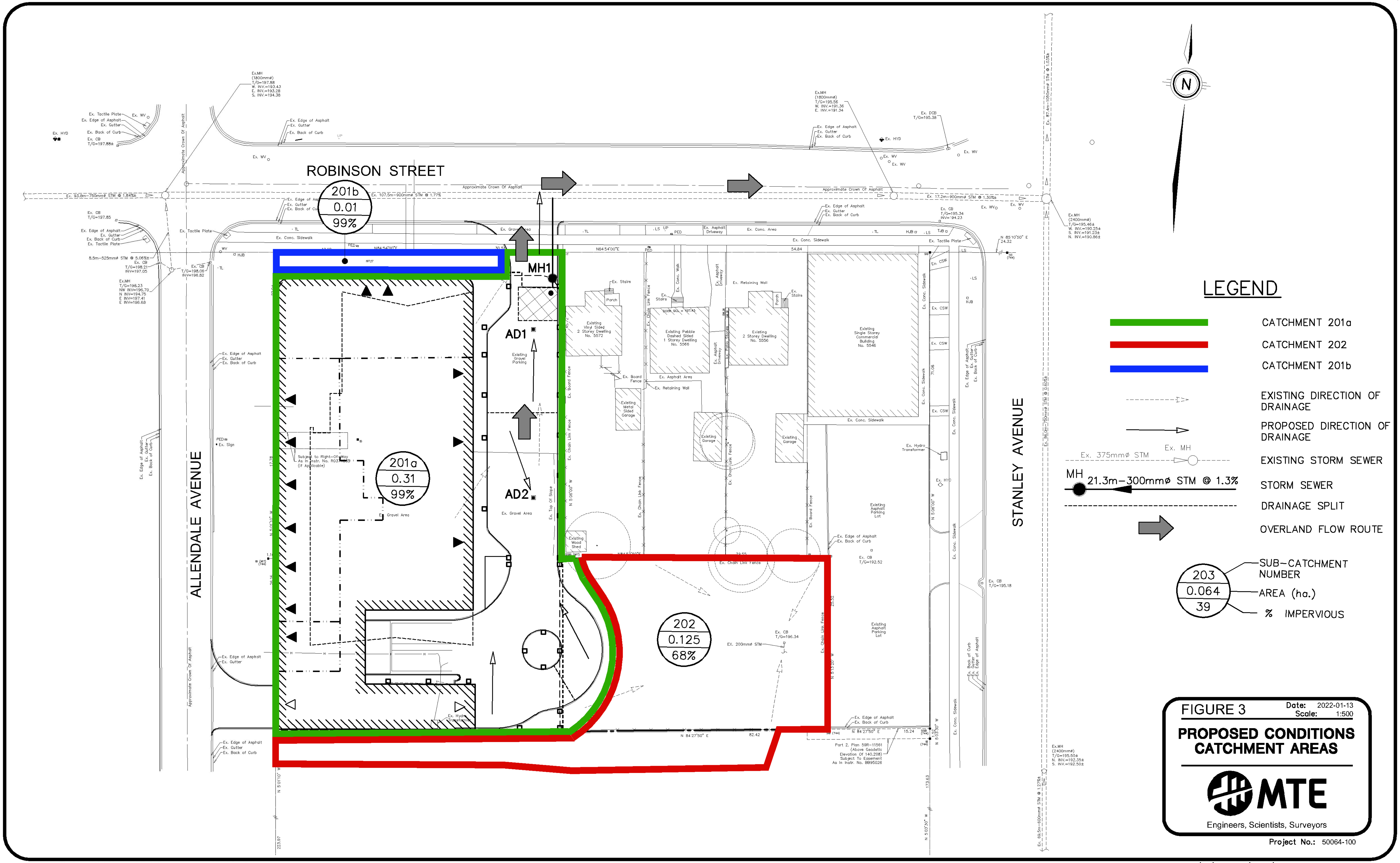

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Table 2.4 - Stage-Storage-Discharge Calculations for Underground Storm Tank (Catchment 201a)

Elevation (m)	Head, H (m)	Cumulative Storage Volume (m^3)[A]	Discharge Q (m^3/s)[B]	Comments
192.94	0.00	0.0	0.0000	Inside Bottom of Tank/Orifice Invert
192.98	0.00	1.1	0.0000	C/L of Orifice
194.00	1.02	31.3	0.0125	
194.94	1.96	59.0	0.0173	Top of Tank

[A] Storage volume based on underground storage tank. See Appendix A for more details.
[B] From orifice equation $Q = CA\,(2gH)^{0.5}$ for a 75mm diameter orifice plate
Where: C = 0.63, A = cross-sectional area, g = 9.81, H = pressure head

The proposed conditions were assessed using the SWMHYMO hydrologic modeling program developed by J.F. Sabourin & Associates for the 5-year City of Niagara Falls design storm. Appendix A contains detailed hydrologic modeling parameters and input/output printouts for the proposed condition.

Table 2.5 and 2.6 summarizes the proposed condition 5-year peak discharge rate for the site with the aforementioned stormwater management controls and compares it to the 5-year existing condition discharge rate (i.e. allowable discharge rate). Table 2.7 summarizes the proposed condition storage volume requirements and storage volume provided by the underground storm tank. The underground storm tank will provide sufficient storage volume to retain stormwater runoff up to the 5-year storm event prior to being released into the existing 900mm diameter storm sewer along Robinson Street. Major flows (over the 5-year event) will be safely conveyed to the ROW.

Table 2.5 - Proposed Condition Peak Discharge Rate to Robinson Street

Storm Event	Proposed Condition			Allowable 5-Year Existing Condition Peak Discharge Rate (Catchment 101) (m^3/s) [B]
	Peak Discharge Rate (Catchment 201A) (m^3/s) [A]	Peak Discharge Rate (Catchment 2021B) (m^3/s) [A]	Total Peak Discharge Rate from Site (Catchment 201A + 201B) (m^3/s) [A]	
5-yr	0.017	0.003	**0.018**	**0.019**

[A] Discharge rate taken from SWMHYMO Output (See Appendix A).
[B] See Table 2.2

Table 2.6 - Proposed Condition Peak Discharge Rate to Existing Catchbasin

Storm Event	Proposed Condition	Allowable 5-Year Existing Condition Peak Discharge Rate (Catchment 102) (m^3/s) [B]
	Peak Discharge Rate (Catchment 202) (m^3/s) [A]	
5-yr	0.026	**0.047**

[A] Discharge rate taken from SWMHYMO Output (See Appendix A).
[B] See Table 2.2

The 5-year proposed condition peak discharge rate for the site are within the 5-year allowable release rate as illustrated in Table 2.5 and 2.6.

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]
5-yr	57.1	59.0

[A] Storage volume taken from SWMHYMO Output (see Appendix A).
[B] See Table 2.4

The analysis indicates the following:

- The total proposed condition peak discharge rate is less than the existing condition peak discharge rate for the 5-year storm event as illustrated in Table 2.5 and 2.6.
- Sufficient storage volume is provided within the underground storm tank to contain the 5-year storm event for the contributing catchment area 201.

2.3.1 Private Storm Service Connection

A proposed 300mm diameter private storm service at a slope of 0.5% will outlet into the existing 900mm diameter sewer within the Robinson Street ROW. The proposed storm service will have a full flow capacity of approximately 68.3L/s which is greater than the proposed 5-year controlled peak discharge rate of 17L/s from the proposed orifice. Therefore, the proposed storm service will have sufficient capacity to convey the proposed 5-year controlled peak flow from the site. Please see Drawing C2.2 for further site servicing details.

2.3.2 Water Quality Control

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

The majority of the site is covered with building roof area. Stormwater runoff generated from rooftops can generally be considered clean. Additionally, there are landscaped areas and pedestrian walkways north of the building that generate clean runoff. As such, no water quality controls are proposed for this site as the development will have a negligible impact on water quality for downstream receivers.

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. 7).

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 (catchbasins / catchbasin manholes) by installing silt sacks;
- Construction of 7m x 14m mud mat at the exit from the site to Robinson Street 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 is an existing 250mm diameter sanitary sewer flowing east within Robinson Street ROW at a slope of 1.34%. This sewer has a full flow capacity of approximately 68.23L/s. Additionally, there is an existing 250mm diameter combined sewer flowing north within Allendale Avenue ROW at a slope of 3.43%, with a full flow capacity of approximately 110.08L/s. All 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 Niagara Falls and Ontario Building Code for the estimated population. 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				
1 Bedroom units	544	2	-	1088[C]
2 Bedroom units	411	4	-	1644[C]
Townhome units (2 bedrooms/unit)	7	4	-	28[C]
Occupancy Types	**Population Density (person/ha) [D]**	**Floor Area (ha)[E]**		**Population (people)[F]**
Proposed Commercial				
Commercial	90	0.040		4
			Total Estimated Population	**2764**

[A] Number of units provided on Chamberlin Architect site plan dated April 4, 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)
[D] Design population based Niagara Region standards, Light Commercial Area, Section 5.2.4
[E] Floor area provided on Chamberlin Architect site plan dated April 4, 2022
[F] Population calculated as (Floor Area) X (Population Density)

Table 3.2 - Sanitary Sewer Discharge from Site

Occupancy Types	Population Estimate [A]	Average Flow (L/s)[B]	Peak Flow (L/s)[D]
Proposed Condo Mix			
1 bedroom units	1088	5.67	23.12
2 bedroom units	1644	8.56	34.95
Townhomes (7 units)	28	0.15	0.60
Occupancy Types	**Floor Area (ha)[E]**	**Average Flow (L/s)[C]**	**Peak Flow (L/s)[D]**
Proposed Commercial			
Commercial	0.040	0.011	0.17
Total Peak Sanitary Demand for Site			58.84 [F]
Total Peak Sanitary Demand for Site (with infiltration allowance)			**58.84 [G]**

[A] Room and population estimate: see Table 3.1
[B] Average flow for residential based on 450 L/d/person. (City of Niagara Standards, Section 3.1)
[C] Average flow for commercial based on 24.75 m^3/ha/day. (Niagara Region, Section 5.2.4)
[D] Peak flow = Average Flow*PF, where Babbitt Peaking Factor (PF) = 5/P^0.2 where P = design population in thousands
Condo Mix Babbitt Peaking Factor (PF) = 4.1
Commercial Babbitt Peaking Factor (PF) = 15.4
[E] Floor Area provided by Chamberlain Architect site plan dated April 4, 2022
[F] Total Peak flow = Peak flow from Condo Mix and Commercial = 58.67+0.17 = 58.84 L/s
[G] Redevelopment of existing area. No new RDII contributions.

3.3 Proposed Sanitary Servicing Plan and Capacity Analysis

As calculated in Table 3.2, the total peak sanitary discharge from the site is 58.84 L/s.

Per City requirements, the calculated discharge was provided to the City to update their infrastructure model to determine if the local sanitary infrastructure servicing the site can sufficiently support the proposed development in conjunction with current flows. GM Blue Plan Engineering has prepared the modelling and analysis and has determined that the existing 250mm diameter sanitary sewer within Robinson Street ROW does not have sufficient capacity for the proposed development, therefore this revised submission reflects the required changes. The results indicate that upgrading the existing 250mm diameter Robinson Street sewer fronting the site to a 300mm diameter sewer is required to accommodate the development. Refer to Appendix B for the report by GM Blue Print Engineering and Site Servicing Plan C2.2 for further details.

The proposed building will be serviced by a 250mm diameter sanitary service at 2.0% slope with a full flow capacity of 84.05 L/s that will connect to the proposed 300mm diameter sanitary sewer within the Robinson Street ROW.

4.0 Domestic and Fire Water Supply Servicing

4.1 Existing Condition

The existing municipal water distribution system around the site consists of 300mm diameter watermains within the Robinson Street ROW. There is also a 150mm diameter watermain within Allendale Avenue ROW.

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 Mix Demands		
Population:	2760 people (see Table 3.1)	
Average Day Demand: [1]	0.229 m3/day/person x 2760 people =	***7.315 L/s***
Maximum Day Demand: [1]	1.58 x 7.315 L/s =	***11.558 L/s***
Peak Hour Demand: [1]	4.00 x 7.315 L/s =	***29.261 L/s***
Proposed Commercial Demands		
Population:	4 people (see Table 3.1)	
Average Day Demand: [1]	24.75 m^3/ha/day x 0.040 ha =	**0.011 L/s**
Maximum Day Demand: [1]	1.58 x 0.011 L/s =	**0.018 L/s**
Peak Hour Demand: [1]	3.00 x 0.011 L/s =	**0.034 L/s**
Total Residential and Commercial Usage		
Maximum Day Demand:	11.558 L/s + 0.018 L/s=	***11.576 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	117 L/s (7,000 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 Allendale Avenue ROW. The services for the proposed building will split into a dual 150mm diameter fire service and 100mm diameter domestic service at the western 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.

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 orifice controls 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 and as shown on Drawings C1.1, C2.1, C2.2 and PP1.1 be accepted in support of the Zoning By-law Application and Official Plan Amendment.

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.

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Appendix A

Stormwater Management

77 Storey Building
NIAGARA FALLS, ONTARIO
STORMWATER MANAGEMENT

PROPOSED CONDITIONS HYDROLOGIC MODELING PARAMETERS

Catchment ID	Catchment Description	Hydrograph Method	Area (ha)	Perv. CN	Perv. Ia (mm)	Impervious (%)		Flow Length (m)		Manning "n"		Slope (%)		Time to Peak Tp (hrs)
						TIMP	XIMP	Perv.	Imperv.	Perv.	Imperv.	Perv.	Imperv.	
201a	Controlled (STM Tank)	STANDHYD	0.310	74	5.00	99	99	1	10	0.250	0.013	1.0	1.0	
202b	Uncontrolled to Robinson Street	STANDHYD	0.010	74	5.00	99	99	5	5	0.250	0.013	2.0	2.0	
202	Uncontrolled to Existing CB	STANDHYD	0.125	74	5.00	68	68	50	33	0.250	0.013	3.0	2.0	
Total			**0.445**											

- Pervious Initial Abstraction (Perv. Ia) = 0.1 x S ,   where S = (25400 / CN) - 254
- Depression Storage over Impervious areas (DPSI) = 1.0 mm

77 Storey Building
NIAGARA FALLS, ONTARIO
STORMWATER MANAGEMENT

Design Storm Information and Allowable Release Rate

Design storm information used in the hydrologic modeling was based on Chicago Storm distribution Intensity-Duration-Frequency (IDF) equations for the City of Niagara Falls [A] in the form:

$$i = \frac{A}{(t+B)^C}$$

Where: i = Rainfall intensity (mm/hr)
t = Time of duration (min)
A, B and C = Constant (see below)

The value of the parameters for the various storm events is provided below:

Constant	2-Yr. [B]	5-Yr.	10-Yr.	25-Yr.	100-Yr.
A	522	720	578	1021	1265
B	5.3	6.3	2.5	7.3	7.7
C	0.76	0.77	0.67	0.78	0.78

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

[B] IDF equations used to generate rainfall files with Duration (TD) = 3 hours

$$Q = 0.002778\,CiA$$

To Robinson Street (Catchment 101)
Site Area= 0.195 ha
C = 0.42

Existing Conditions Peak Flow Rates (Robinson Street)

	2-Yr. [B]	5-Yr.	10-Yr.	25-Yr.	100-Yr.
i (mm/hr)	66.08152	84.18859	106.7844	110.073	133.9346
Q (m^3/s)	0.015	0.019	0.024	0.025	0.030

To Existing CB on Site (Catchment 102)
Site Area= 0.25 ha
C = 0.8

Existing Conditions Peak Flow Rates (Exisitng CB on site)

	2-Yr. [B]	5-Yr.	10-Yr.	25-Yr.	100-Yr.
i (mm/hr)	66.08152	84.18859	106.7844	110.073	133.9346
Q (m^3/s)	0.037	0.047	0.059	0.061	0.074

77 Storey Building
Niagara Falls, Ontario
STORMWATER MANAGEMENT

Project Number:	50064-100
Date:	April 5, 2022
File:	Q:\50064\100\SWM\50064-100 SWM Calculations.xlsx

Orifice Calculations for Catchment 201a

$Q_o=C_d*A_o*(2*g*H_o)$^0.5

	Orifice	Description
C_d	0.63	Orifce Plate
Invert (m)	192.94	
CL elevation (m)	192.98	
Diameter (mm)	75	
Type (H/V)	V	

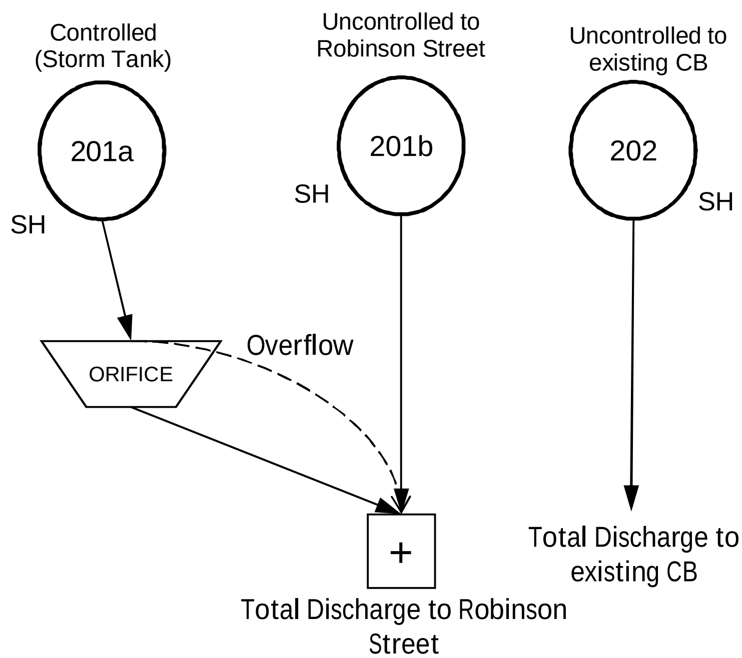
STAGE-STORAGE-DISCHARGE RELATIONSHIP

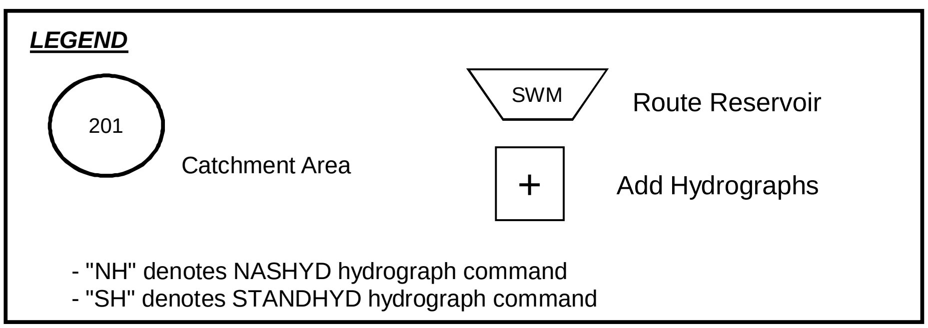
Description	Stage	Incremental Volume	Cumulative Volume	Orifice		
				Orifice Area	H_o	Flow
	m	m^3	m^3	m^2	*m*	m^3/s
Bottom of Tank/Orifice Invert	192.94	0.0	0.0	0.004	0.00	0.0000
C/L of Orifice	192.98	1.1	1.1	0.004	0.00	0.0000
	194.00	30.2	31.3	0.004	1.02	0.0125
Top of Tank	194.94	27.7	59.0	0.004	1.96	0.0173

Stormwater Tank Details	
Inside Dimensions in Tanks	Tank
Surface area (m^2)	29.5
height (m)	2.00
Vol provided (m^3)	59

77 Storey Building
Niagara Falls, Ontario
STORMWATER MANAGEMENT

PROPOSED CONDITIONS MODEL SCHEMATIC





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2     Metric units
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*#                NIAGARA FALLS, ONTARIO
*#  JOB NUMBER  : 50064-100
*#       Date   : MARCH 2022
*#  Modeller    : RNC
*#    Company   : MTE CONSULTANTS INC.
*#       File   : 50064-100.DAT
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*#
*#                     POST DEVELOPMENT HYDROLOGIC MODELING
*#               ====================================================
*#
*##########################################################################|
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*#*************************************************************************|
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                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[74],
                    Pervious   surfaces: IAper=[5.00](mm), SLPP=[1.0](%),
                                         LGP=[1](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1](mm), SLPI=[1.0](%),
                                         LGI=[10](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|----------------------------------------------------------|
*#CONTROL FLOW FROM 201 Through Tank Orifice Plate
ROUTE RESERVOIR     IDout=[2],   NHYD=["201a"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
 0.00000   0.00000
 0.00000   0.00011
 0.01247   0.00313
 0.01727   0.00590

                                       -1       -1   (max twenty pts)
                          IDovf=[3], NHYDovf=["201OVF"]
*%-----------------|----------------------------------------------------------|
*#*************************************************************************|
*# CATCHMENT 201b - Uncontrolled to Robinson Street
*#*************************************************************************|
CALIB STANDHYD      ID=[4], NHYD=["201b"], DT=[1.0](min), AREA=[0.01](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[74],
                    Pervious   surfaces: IAper=[5.00](mm), SLPP=[2.0](%),
                                         LGP=[5](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[5](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|----------------------------------------------------------|
*#*************************************************************************|
*# CATCHMENT 202 - Uncontrolled to EXISTING CB ON SITE
*#*************************************************************************|
CALIB STANDHYD      ID=[6], NHYD=["202"], DT=[1.0](min), AREA=[0.125](ha),
                    XIMP=[0.68], TIMP=[0.68], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[74],
                    Pervious   surfaces: IAper=[5.00](mm), SLPP=[3.0](%),
                                         LGP=[50](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
                                         LGI=[33](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*#*************************************************************************|
*%-----------------|----------------------------------------------------------|
*TOTAL FLOW TO ROBINSON STREET
ADD HYD             IDsum=[5], NHYD=["ROB_ST"], IDs to add=[2,3,4]
*%-----------------|----------------------------------------------------------|
*%-----------------|----------------------------------------------------------|
*TOTAL FLOW LEAVING SITE
ADD HYD             IDsum=[7], NHYD=["TOTAL"], IDs to add=[5,6]
*%-----------------|----------------------------------------------------------|
*
* RUN REMAINING DESIGN STORMS (City of Niagara Falls 3-hour 5 -YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    ["3H_005.stm"]
*%-----------------|----------------------------------------------------------|
FINISH
```

```
===============================================================================
  SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999    999    =========
  S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
  SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O ##  9   9  9   9   Ver  4.05
      S   W W   M   M  H   H    Y    M   M  O   O      9999   9999   Sept 2011
  SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9   =========
                                                      9   9  9   9   # 3053466
       StormWater Management HYdrologic Model          999    999    =========
 *****************************************************************************
 ***************************** SWMHYMO Ver/4.05  ******************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 *****************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884          *********
 *********                  Gatineau, Quebec: (819) 243-6858          *********
 *********                  E-Mail: swmhymo@jfsa.Com                  *********
 *****************************************************************************
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: MTE Consultants Inc.                        +++++++++
 +++++++++                Burlington            SERIAL#:3053466      +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 *****************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 *****************************************************************************
 *********************   D E T A I L E D   O U T P U T   *********************
 *****************************************************************************
 *        DATE: 2022-04-05     TIME: 11:04:20     RUN COUNTER: 000178        *
 *****************************************************************************
 * Input   filename: Q:\50064\100\SWM\SWMHYMO\50064-~1.DAT                   *
 * Output  filename: Q:\50064\100\SWM\SWMHYMO\50064-~1.out                   *
 * Summary filename: Q:\50064\100\SWM\SWMHYMO\50064-~1.sum                   *
 * User comments:                                                            *
 * 1:________________________________________________________________________*
 * 2:________________________________________________________________________*
 * 3:________________________________________________________________________*
 *****************************************************************************
-------------------------------------------------------------------------------
001:0001-----------------------------------------------------------------------
*#****************************************************************************|
*#  Project Name: 77 STOREY BUILDING
*#                NIAGARA FALLS, ONTARIO
*#  JOB NUMBER  : 50064-100
*#       Date   : MARCH 2022
*#  Modeller    : RNC
*#    Company   : MTE CONSULTANTS INC.
*#       File   : 50064-100.DAT
*
  ** END OF RUN :   1
******************************************************************************
--------------------
| START            |  Project  dir.: Q:\50064\100\SWM\SWMHYMO\
--------------------  Rainfall dir.: Q:\50064\100\SWM\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=3H_005.stm
-------------------------------------------------------------------------------
002:0002-----------------------------------------------------------------------
*#****************************************************************************|
*#  Project Name: 77 STOREY BUILDING
*#                NIAGARA FALLS, ONTARIO
*#  JOB NUMBER  : 50064-100
*#       Date   : MARCH 2022
*#  Modeller    : RNC
*#    Company   : MTE CONSULTANTS INC.
*#       File   : 50064-100.DAT
*
-------------------------------------------------------------------------------
002:0002-----------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: 3 HOUR 5 YEAR CHICAGO STORM
| Ptotal=  38.81 mm|    Comments: 3 HOUR 5 YEAR CHICAGO STORM
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   3.603 |    .83  18.297 |   1.58   9.701 |   2.33   4.686
               .17   3.913 |    .92  40.363 |   1.67   8.605 |   2.42   4.449
               .25   4.289 |   1.00 111.263 |   1.75   7.746 |   2.50   4.237
               .33   4.759 |   1.08  51.420 |   1.83   7.055 |   2.58   4.047
               .42   5.363 |   1.17  29.796 |   1.92   6.486 |   2.67   3.875
               .50   6.170 |   1.25  20.894 |   2.00   6.010 |   2.75   3.719
               .58   7.307 |   1.33  16.119 |   2.08   5.605 |   2.83   3.577
               .67   9.039 |   1.42  13.160 |   2.17   5.256 |   2.92   3.446
               .75  12.007 |   1.50  11.152 |   2.25   4.953 |   3.00   3.325
-------------------------------------------------------------------------------
002:0003-----------------------------------------------------------------------
*#############################################################################|
*#
*#                     POST DEVELOPMENT HYDROLOGIC MODELING
*#               ====================================================
*#
*#############################################################################|
*#****************************************************************************|
*# CATCHMENT 201a - Building Roof, driveway drop off (Controlled with undergroun
*#****************************************************************************|
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .31
| 01:201a   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .31           .00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        1.00          1.00
     Length            (m)=       10.00          1.00
     Mannings n          =         .013          .250

     Max.eff.Inten.(mm/hr)=      111.26         24.80
               over (min)         1.00          2.00
     Storage Coeff.  (min)=         .61 (ii)     2.27 (ii)
     Unit Hyd. Tpeak (min)=        1.00          2.00
     Unit Hyd. peak  (cms)=        1.36           .51
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .09           .00         .095 (iii)
     TIME TO PEAK    (hrs)=        1.00          1.02        1.000
     RUNOFF VOLUME    (mm)=       37.81          9.29       37.522
     TOTAL RAINFALL   (mm)=       38.81         38.81       38.808
     RUNOFF COEFFICIENT   =         .97           .24         .967

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
002:0004-----------------------------------------------------------------------
*#CONTROL FLOW FROM 201 Through Tank Orifice Plate
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(201a  )   |
| OUT<02:(201a  )   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .012  .3130E-02
                            .000  .1100E-03   |     .017  .5900E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201a  )        .31      .095     1.000     37.522
     OUTFLOW<02: (201a  )        .31      .017     1.250     37.168
    OVERFLOW<03: (201OVF)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   17.836
                   TIME SHIFT OF PEAK FLOW         (min)=    15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5714E-02

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
002:0005-----------------------------------------------------------------------
*#****************************************************************************|
*# CATCHMENT 201b - Uncontrolled to Robinson Street
*#****************************************************************************|
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .01
| 04:201b    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .01           .00
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        2.00          2.00
     Length            (m)=        5.00          5.00
     Mannings n          =         .013          .250

     Max.eff.Inten.(mm/hr)=      111.26         21.45
               over (min)         1.00          4.00
     Storage Coeff.  (min)=         .33 (ii)     4.08 (ii)
     Unit Hyd. Tpeak (min)=        1.00          4.00
     Unit Hyd. peak  (cms)=        1.62           .29
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .00           .00         .003 (iii)
     TIME TO PEAK    (hrs)=         .98          1.05        1.000
     RUNOFF VOLUME    (mm)=       37.81          9.29       37.522
     TOTAL RAINFALL   (mm)=       38.81         38.81       38.808
     RUNOFF COEFFICIENT   =         .97           .24         .967

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
002:0006-----------------------------------------------------------------------
*#****************************************************************************|
*# CATCHMENT 202 - Uncontrolled to EXISTING CB ON SITE
*#****************************************************************************|
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .13
| 06:202    DT= 1.00 |   Total Imp(%)=   68.00   Dir. Conn.(%)=   68.00
---------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .09           .04
     Dep. Storage     (mm)=        1.00          5.00
     Average Slope     (%)=        2.00          3.00
     Length            (m)=       33.00         50.00
     Mannings n          =         .013          .250

     Max.eff.Inten.(mm/hr)=      111.26         13.73
               over (min)         1.00         17.00
     Storage Coeff.  (min)=        1.02 (ii)    16.83 (ii)
     Unit Hyd. Tpeak (min)=        1.00         17.00
     Unit Hyd. peak  (cms)=        1.06           .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .03           .00         .026 (iii)
     TIME TO PEAK    (hrs)=        1.00          1.35        1.000
     RUNOFF VOLUME    (mm)=       37.81          9.29       28.681
     TOTAL RAINFALL   (mm)=       38.81         38.81       38.808
     RUNOFF COEFFICIENT   =         .97           .24         .739

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
002:0007-----------------------------------------------------------------------
*#****************************************************************************|
*TOTAL FLOW TO ROBINSON STREET
-----------------------
| ADD HYD (ROB_ST    ) | ID: NHYD         AREA     QPEAK   TPEAK  R.V.    DWF
-----------------------                   (ha)     (cms)   (hrs)  (mm)   (cms)
                    ID1 02:201a            .31      .017    1.25  37.17    .000
                   +ID2 03:201OVF          .00      .000     .00    .00    .000
                   +ID3 04:201b            .01      .003    1.00  37.52    .000
                    ==========================================================
                    SUM 05:ROB_ST          .32      .018    1.17  37.18    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
002:0008-----------------------------------------------------------------------
*TOTAL FLOW LEAVING SITE
```

```
 -----------------------
 | ADD HYD (TOTAL     ) | ID: NHYD        AREA    QPEAK   TPEAK   R.V.    DWF
 -----------------------                  (ha)    (cms)   (hrs)   (mm)   (cms)
                      ID1 05:ROB_ST        .32     .018    1.17  37.18    .000
                     +ID2 06:202           .13     .026    1.00  28.68    .000
                      =======================================================
                      SUM 07:TOTAL         .44     .044    1.00  34.79    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ----------------------------------------------------------------------------
 002:0009--------------------------------------------------------------------
 *
 * RUN REMAINING DESIGN STORMS (City of Niagara Falls 3-hour 5 -YR)
 *
   ** END OF RUN :   4

 ***************************************************************************





 -------------------
 | START             |  Project  dir.: Q:\50064\100\SWM\SWMHYMO\
 -------------------   Rainfall dir.: Q:\50064\100\SWM\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
            #  1=3H_005.stm
 ----------------------------------------------------------------------------
 005:0002--------------------------------------------------------------------
 *#*************************************************************************|
 *#  Project Name: 77 STOREY BUILDING
 *#              NIAGARA FALLS, ONTARIO
 *#  JOB NUMBER  : 50064-100
 *#       Date   : MARCH 2022
 *#  Modeller    : RNC
 *#    Company   : MTE CONSULTANTS INC.
 *#       File   : 50064-100.DAT
 *
 ----------------------------------------------------------------------------
 005:0002--------------------------------------------------------------------
 -------------------
 | READ STORM        |    Filename: 3 HOUR 5 YEAR CHICAGO STORM
 | Ptotal=  38.81 mm|    Comments: 3 HOUR 5 YEAR CHICAGO STORM
 -------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   3.603 |    .83  18.297 |   1.58   9.701 |   2.33   4.686
               .17   3.913 |    .92  40.363 |   1.67   8.605 |   2.42   4.449
               .25   4.289 |   1.00 111.263 |   1.75   7.746 |   2.50   4.237
               .33   4.759 |   1.08  51.420 |   1.83   7.055 |   2.58   4.047
               .42   5.363 |   1.17  29.796 |   1.92   6.486 |   2.67   3.875
               .50   6.170 |   1.25  20.894 |   2.00   6.010 |   2.75   3.719
               .58   7.307 |   1.33  16.119 |   2.08   5.605 |   2.83   3.577
               .67   9.039 |   1.42  13.160 |   2.17   5.256 |   2.92   3.446
               .75  12.007 |   1.50  11.152 |   2.25   4.953 |   3.00   3.325

 ----------------------------------------------------------------------------
 005:0003--------------------------------------------------------------------
 *##########################################################################|
 *#
 *#                    POST DEVELOPMENT HYDROLOGIC MODELING
 *#                ==================================================
 *#
 *##########################################################################|
 *#*************************************************************************|
 *# CATCHMENT 201a - Building Roof, driveway drop off (Controlled with undergroun
 *#*************************************************************************|
 ---------------------
 | CALIB STANDHYD     |   Area    (ha)=     .31
 | 01:201a   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
 ---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .31          .00
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     10.00         1.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=    111.26        24.80
                over (min)       1.00         2.00
     Storage Coeff.  (min)=       .61 (ii)    2.27 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.36          .51
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .09          .00          .095 (iii)
     TIME TO PEAK    (hrs)=      1.00         1.02         1.000
     RUNOFF VOLUME    (mm)=     37.81         9.29        37.522
     TOTAL RAINFALL   (mm)=     38.81        38.81        38.808
     RUNOFF COEFFICIENT  =        .97          .24          .967

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ----------------------------------------------------------------------------
 005:0004--------------------------------------------------------------------
 *#CONTROL FLOW FROM 201 Through Tank Orifice Plate
 --------------------
 | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 |  IN>01:(201a  )    |
 | OUT<02:(201a  )    |    =========  OUTFLOW STORAGE TABLE  =========
 --------------------      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)    |   (cms)    (ha.m.)
                             .000  .0000E+00    |     .012  .3130E-02
                             .000  .1100E-03    |     .017  .5900E-02

     ROUTING RESULTS              AREA     QPEAK      TPEAK        R.V.
     --------------------         (ha)     (cms)      (hrs)        (mm)
     INFLOW >01: (201a  )          .31      .095      1.000      37.522
     OUTFLOW<02: (201a  )          .31      .017      1.250      37.168
    OVERFLOW<03: (201OVF)          .00      .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   17.836
                   TIME SHIFT OF PEAK FLOW          (min)=    15.00
                   MAXIMUM  STORAGE   USED        (ha.m.)=.5714E-02

      *** WARNING: Outflow volume is less than inflow volume.
 ----------------------------------------------------------------------------
 005:0005--------------------------------------------------------------------
 *#*************************************************************************|
 *# CATCHMENT 201b - Uncontrolled to Robinson Street
 *#*************************************************************************|
 ---------------------
 | CALIB STANDHYD     |   Area    (ha)=     .01
 | 04:201b   DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
 ---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .01          .00
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      2.00         2.00
     Length            (m)=      5.00         5.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=    111.26        21.45
                over (min)       1.00         4.00
     Storage Coeff.  (min)=       .33 (ii)    4.08 (ii)
     Unit Hyd. Tpeak (min)=      1.00         4.00
     Unit Hyd. peak  (cms)=      1.62          .29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .00          .00          .003 (iii)
     TIME TO PEAK    (hrs)=       .98         1.05         1.000
     RUNOFF VOLUME    (mm)=     37.81         9.29        37.522
     TOTAL RAINFALL   (mm)=     38.81        38.81        38.808
     RUNOFF COEFFICIENT  =        .97          .24          .967

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ----------------------------------------------------------------------------
 005:0006--------------------------------------------------------------------
 *#*************************************************************************|
 *# CATCHMENT 202 - Uncontrolled to EXISTING CB ON SITE
 *#*************************************************************************|
 ---------------------
 | CALIB STANDHYD     |   Area    (ha)=     .13
 | 06:202    DT= 1.00 |   Total Imp(%)=   68.00   Dir. Conn.(%)=   68.00
 ---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .09          .04
     Dep. Storage     (mm)=      1.00         5.00
     Average Slope     (%)=      2.00         3.00
     Length            (m)=     33.00        50.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=    111.26        13.73
                over (min)       1.00        17.00
     Storage Coeff.  (min)=      1.02 (ii)   16.83 (ii)
     Unit Hyd. Tpeak (min)=      1.00        17.00
     Unit Hyd. peak  (cms)=      1.06          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .026 (iii)
     TIME TO PEAK    (hrs)=      1.00         1.35         1.000
     RUNOFF VOLUME    (mm)=     37.81         9.29        28.681
     TOTAL RAINFALL   (mm)=     38.81        38.81        38.808
     RUNOFF COEFFICIENT  =        .97          .24          .739

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ----------------------------------------------------------------------------
 005:0007--------------------------------------------------------------------
 *#*************************************************************************|
 *TOTAL FLOW TO ROBINSON STREET
 -----------------------
 | ADD HYD (ROB_ST    ) | ID: NHYD        AREA    QPEAK   TPEAK   R.V.    DWF
 -----------------------                  (ha)    (cms)   (hrs)   (mm)   (cms)
                      ID1 02:201a          .31     .017    1.25  37.17    .000
                     +ID2 03:201OVF        .00     .000     .00    .00    .000
                     +ID3 04:201b          .01     .003    1.00  37.52    .000
                      =======================================================
                      SUM 05:ROB_ST        .32     .018    1.17  37.18    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ----------------------------------------------------------------------------
 005:0008--------------------------------------------------------------------
 *TOTAL FLOW LEAVING SITE
 -----------------------
 | ADD HYD (TOTAL     ) | ID: NHYD        AREA    QPEAK   TPEAK   R.V.    DWF
 -----------------------                  (ha)    (cms)   (hrs)   (mm)   (cms)
                      ID1 05:ROB_ST        .32     .018    1.17  37.18    .000
                     +ID2 06:202           .13     .026    1.00  28.68    .000
                      =======================================================
                      SUM 07:TOTAL         .44     .044    1.00  34.79    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ----------------------------------------------------------------------------
 005:0009--------------------------------------------------------------------
 *
 * RUN REMAINING DESIGN STORMS (City of Niagara Falls 3-hour 5 -YR)
 *
 ----------------------------------------------------------------------------
 005:0002--------------------------------------------------------------------
       FINISH
 ----------------------------------------------------------------------------
 ****************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
  002:0004 ROUTE RESERVOIR
        *** WARNING: Outflow volume is less than inflow volume.
        *** WARNING: Outflow volume is less than inflow volume.
    Simulation ended on 2022-04-05     at 11:04:22
 ============================================================================
```

Appendix B

Sanitary Calculations

Niagara 77 - Condo
Niagara Falls, Ontario
MTE Project #: 50064-100
2/1/2023

Sanitary Demand Calculations

Land Use	Residential					Commercial		Totals (Residential + Commercial)		
	Units [1]	Population Density [2]	Occupancy	Population (persons)	Demand (L/s)	Floor Area (ha)	Demand (L/s)	Total Average Demand (L/s)	Total Peaked Demand (L/s)	Total Peaked Demand + Infiltration (L/s)
Proposed Condo Mix										
1 Bedroom	544	2.0	-	1088	5.667			5.667	23.127	
2 Bedroom	411	4.0	-	1644	8.563			8.563	34.945	
Townhome	7	4.0	-	28	0.146			0.146	0.595	
Proposed Commercial		90 [8]		4		0.040	0.011	0.011	0.169	
Total Condo Mix + Commercial				**2764**	**14.38**		**0.01**	**14.39**	**58.84**	**58.84**

Sanitary Demand		
Residential Daily Demands[4]	450	L/d/person
	0.0052	L/ca/s
Babbitt Peaking Factor (Residential) [5]	4.1	
Babbitt Peaking Factor (Commercial)[6]	15.4	
Commercial Daily Demands [3]	24.75	m3/ha/day
	0.2865	L/ha/s
Site Area	0.40	ha
Infiltration Allowance [7]	0.28	L/s/ha
	0 [9]	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: Commercial daily demands based on Niagara Region standards, Light Commercial Area, Section 5.2.4
Note 4: Domestic flow allowance as per City of Niagara Falls standards, Section 3.1
Note 5: Babbitt Formula= 5/P^0.2 where P = Condo Mix population in thousands
Note 6: Babbitt Formula= 5/P^0.2 where P = Commercial population in thousands
Note 7: Infiltration allowance based on City of Niagara Falls Design Standards Ch. 2 Sanitary Sewers
Note 8: Population density for commercial based on Niagara Region Standards (person/hectare), Section 5.2.4
Note 9: Redevelopment of existing area = no new RDII contributions

Commercial, Industrial, and Community Dry Weather Flow

Type of Development	Equivalent Population Density (persons/hectare)	Unit Sewage Flow	
		m^3/ha/day	m^3/ha/s
Light Commercial Areas	90	24.750	0.28646×10^{-3}
Community Services	40	11.000	0.12732×10^{-3}
Light Industrial Areas	125	34.375	0.39786×10^{-3}
Hospitals	4 persons per bed	1.1 m^3/bed/day	0.01273×10^{-3} m^3/bed/s

Notes: i) m^3pcd = metres³ per capita per day
ii) m^3/ha/s = metres³ per hectare per second
iii) m^3/ha/day = metres³ per hectare per day

5.2.5 Peak Wastewater Flow Factor

5.2.5.1 Residential and Community Services Land Use

For residential and community services land use, the peak wastewater flow shall be derived by applying the ratio established by the Harmon Formula to the average wastewater flow for residential and community services areas as follow:

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

where, M = ratio of peak flow to average flow

P = tributary population in thousands

5.2.5.2 Commercial and Industrial Land Uses

For commercial and industrial land uses, the peaking factor shall be determined from a modified Harmon Formula as follow:

$$M_e = 0.80 \cdot \left(1 + \frac{14}{4 + \sqrt{P_e}}\right)$$

where, M_e = ratio of peak flow to average flow

P_e = equivalent tributary population in thousands

5.2.5.3 Combined Land Use

When a tributary area consists of residential, industrial and commercial land uses, the peaking factor for the combined land use shall be calculated using the modified Harmon Formula as follow:

$$M_{av} = K_{av} \cdot \left(1 + \frac{14}{4 + \sqrt{P + P_e}}\right)$$

Niagara Falls – 5592 Robinson Street

Organization: City of Niagara Falls	GM BluePlan Project No: 621014
Attention: Josiah Jordan	Date: June 8, 2022
Project: 5592 Robinson Street	Assignment: 013

Prepared by:

GM BluePlan Engineering Limited
1266 S Service Rd Unit C3-1, Stoney Creek, ON L8E 5R9
P: 519.748.1440   F: 519.748.1445   www.gmblueplan.ca

Table of Contents

1 Project Scope

The City of Niagara Falls has retained GM BluePlan Engineering to assess the impacts of a proposed development on the City's existing wastewater system. This study is following a Municipal Servicing Report by MTE Consultants (2022) to confirm the available capacity of the system with the proposed sanitary servicing design as outlined in the report. The proposed 77-storey development would consist of 955 condominium units and 7 townhouse units on a 0.4ha site at 5592 Robinson Street, as shown in **Figure 1**.

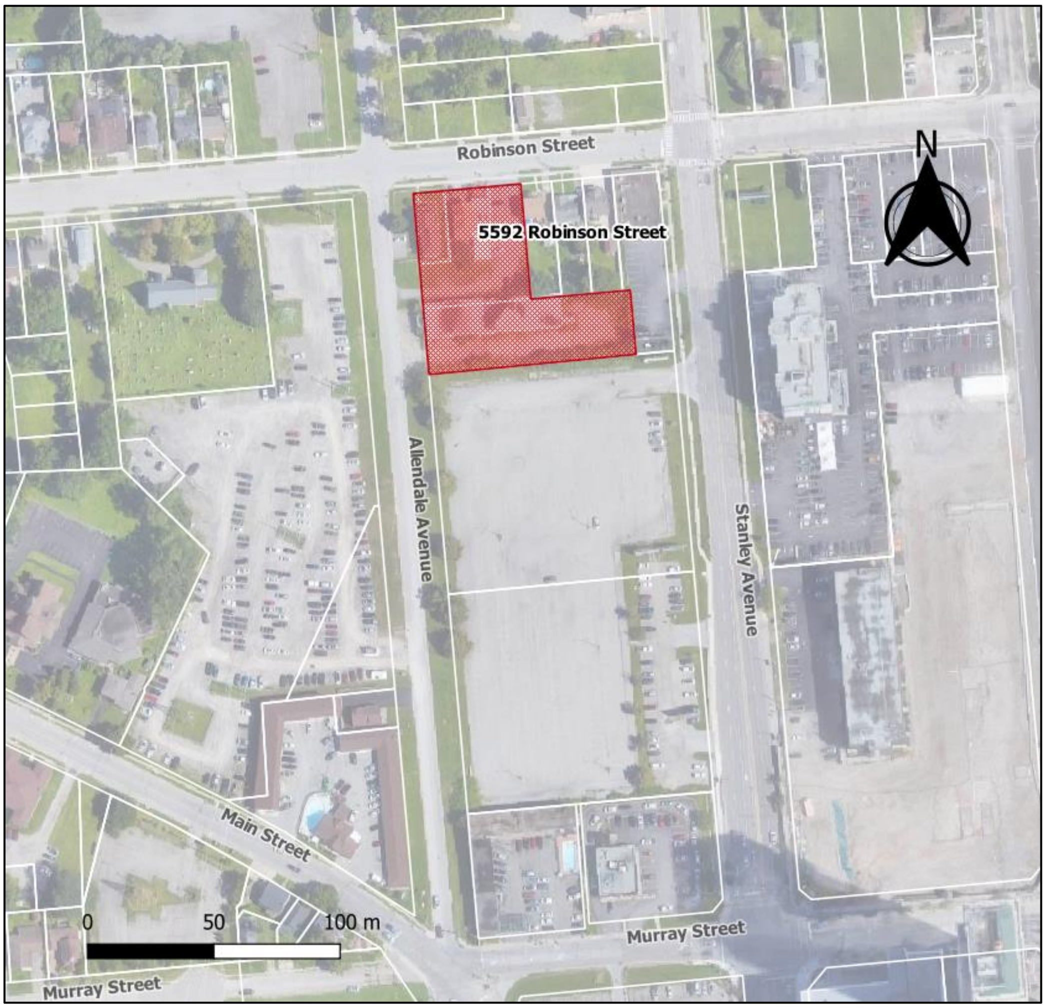


Figure 1: Development Location

The system was assessed using the City's existing wastewater model that was developed as part of the City's Pollution Prevention Control Plan (2016) and updated as part of the Region's Master Servicing Plan Update (MSPU) (2022). Under the context of the MSPU, the projected 2051 growth in the sewage pump station (SPS) catchment of this development is 7,361 people and 3,214 jobs. This single development represents 25% of the projected growth to 2051.

2 Sanitary System Review

2.1 Local System

The re-development will discharge to an existing 250mm sanitary sewer within the property's right-of-way on Robinson Street. Downstream of the tie-in, the flows would follow the sewer alignment as shown on **Figure 2**, through the Central Sewage Pumping Station (SPS), before ultimately discharging into the Niagara Falls Wastewater Treatment Plant through:

- 125m of 250mm gravity sewer on Robinson Street
- 370m of 300mm with a 600mm overflow inline storage on Stanley Avenue
- 610m of 900/1050/1350mm gravity sewer on Stanley Avenue
- 430m of 1650mm with a 600mm overflow inline storage on Stanly Avenue
- 2470m of a combined sewer ranging from 1200mm to 2100mm on Twidale Avenue and Valley Way flowing to Central SPS

GMBP notes that the sewer upstream of the development is 375 mm at Culp Street and Robinson Street and the sewer on Robinson Street is 250 mm. The sewer upsizes again at Stanley Avenue.

Figure 2: Wastewater Flow Route

2.2 Wastewater Flow Analysis

The system was evaluated under both existing and post development conditions to gauge the development impact holistically on the sanitary system. Post-development sanitary flows were calculated by MTE Consultants and are supplied in Section 3 of their *Municipal Servicing & Stormwater Management Report* (2022). Through the review, the MTE Consultants flow rates were reviewed against City of Niagara Falls Engineering Design Standards Manual *Section 3: Sanitary Drainage Systems* methodology as outlined below:

$$Q(d) = \frac{PqM}{86.4} + (I\ A)$$

Where:
P = design population in thousands
q = avg. daily per capita flow in l/cap.day
M = peaking factor = 5 / $P^{0.2}$)) (Babbitt Formula)
I = infiltration in l/ha. sec
A= tributary area in ha
Q(d) = peak domestic sewage flow in l/sec (including extraneous flows)

a) for design purposes a maximum infiltration allowance of 0.28 l/ha.sec has been provided
b) for design purposes a maximum avg. domestic flow allowance of 450 l/cap.day has been provided
c) check with Municipal staff when designing sewers in areas where high I/I has been identified

Table 1 below summarizes the MTE Consultants calculated flows against the methodology outlined in the City Design Standards Manual. It is noted that the MTE Consultants report used a mixture of the Niagara Region and City of Niagara Falls design criteria to estimate development sanitary flows. The flow value estimated by MTE is nearly half that of the value estimated using only City criteria, mainly due to the difference in the per capita flow criteria between the two standards. The GM BluePlan system review was completed using the flow results generated using the City criteria.

Table 1: Sanitary Flows

	MTE Servicing Report	Niagara Falls Standards	Units
Lot Area	0.405	0.405	ha
Population	2,764 people: 544 units @ 2 ppu 418 units @ 4 ppu 0.04 ha @ 90 ppha	2,764 people: 544 units @ 2 ppu 418 units @ 4 ppu 0.04 ha @ 90 ppha	pop
Per Capita Flow	275	450	L/cap/day
Avg Domestic Flow	8.791	14.4	L/s
Peaking Factor	Harmon PF Condo Mix = 3.5 Commercial = 4.4	Babbitt Condo Mix = 4.1 Commercial = 15.4	
Peak Domestic Flow	30.55	58.8	L/s
Infiltration Allowance	0.18	0.28	L/s/ha
RDII	0.07	0	L/s
Design Flow	**30.62**	**58.8**	**L/s**

*Redevelopment of existing area. No new RDII contributions.

2.3 Impact on Sanitary Sewer System Performance

2.3.1 Sewer System Capacity

For existing sewer capacities, sewer surcharging conditions were defined and assessed when peak system hydraulic grade line (HGL) within a pipe satisfied both of the following conditions:

- Depth of flow in pipe is equal to or less than obvert elevation ($d/D \leq 1$); and,
- HGL elevation is less than 1.8 meters below grade.

The system performance was reviewed under a variety of design storm conditions under the 2-year, 5-year, and 10-year design storm using the City's existing wastewater model. **Table 2** below summarizes the sewer system performance before and after development.

As seen in Table 2:

- The existing the Robinson Street sewer is surcharging under the existing 5-year and 10-year design storm; however, surcharging is below the basement flooding risk level of 1.8 m below grade.
- When the proposed growth is applied, the Robinson Street sewer capacity is further exceeded and surcharging above the basement flooding risk level of 1.8 m below grade under the 2-year, 5-year, and 10-year design storms. Upgrading the Robinson Street sewer to 300 mm is required to accommodate the development.
- The existing 600 mm sewer on Stanley Ave at McRae Street is surcharging under the existing 10-year design storm, but surcharging remains below the basement flooding risk level of 1.8m below grade. With the proposed growth flows, the sewer surcharges above basement flooding risk level, however, the existing sewer is shallow (less than 1.8m of cover) and the surcharge elevation is less than 10 cm above sewer obvert. It is noted that the Stanley Ave at McRae Street has sufficient capacity to manage post-development flows under a 2-year and 5-year design storm.
- The existing sewer downstream of Stanley Ave at McRae Street has sufficient capacity to accommodate existing and post-development under the 2-year and 5-year design storms without surcharging. The sewer downstream of Stanley Ave at McRae surcharges under the 10-year design storm; however, surcharging remains below the basement flooding risk level of 1.8m below grade.

Table 2: Wastewater Surcharge Depth & HGL Results

Scenario		Development to Robinson St at Stanley Ave				Robinson at Stanley Ave to Central SPS, except Stenley Ave at McRae Street				Stanley Ave at McRae Street (600mm)			
		Sewer Depth (d/D)		System HGL (m below surface)		Sewer Depth (d/D)		System HGL (m below surface)		Sewer Depth (d/D)		System HGL (m below surface)	
		Peak	Avg.	Min	Avg.	Peak	Avg.	Min	Avg.	Peak	Avg.	Min	Avg.
1:2 Year	Pre-Dev.	97%	70%	Within Obvert		82%	42%	Within Obvert		73%	70%	Within Obvert	
	Post-Dev.	100%	75%	1.25	1.25	83%	42%	Within Obvert		75%	72%	Within Obvert	
1:5 Year	Pre-Dev.	100%	73%	2.02	2.02	95%	51%	Within Obvert		94%	91%	Within Obvert	
	Post-Dev.	100%	76%	1.02	1.02	95%	51%	Within Obvert		95%	92%	Within Obvert	
1:10 Year	Pre-Dev.	100%	73%	1.88	1.88	100%	56%	3.93	3.93	100%	99%	2.15	2.15
	Post-Dev.	100%	76%	1.01	1.01	100%	56%	2.17	2.86	100%	99%	1.54	1.54

2.3.2 Pump Station Performance

Flows ultimately discharge to the Region's Central SPS. It is noted that the existing peak flows exceed the capacity of the Central SPS resulting in overflows under the design 2-year, 5-year, and 10-year design storm; however, the majority of the flows are treated by the high-rate treatment facility. The flows from the proposed 5592 Robin Street development, represent approximately 25% of the projected growth to 2051. The Region's Draft 2021 MSP is recommending that the station's ECA capacity of 1000 L/s is sufficient to support 2051 growth capacity.

3 Summary and Recommendations

Based on the above findings, the impact of the proposed 77-storey condominium complex is as follows:

- When the proposed growth is applied, the Robinson Street sewer capacity is further exceeding and surcharging above the basement flooding risk level of 1.8 m below grade under the 2-year, 5-year, and 10-year design storms. Upgrading the Robinson Street sewer to 300 mm is required to accommodate the development.
- The Stanley Ave sewer has capacity to accommodate the proposed development under the 2-year and 5-year design storm without surcharging.
- There is minor surcharging (<10 cm) in the existing 600 mm sewer on Stanley Ave at McRae Street under the 10-year design storm, which does exceed the basement flooding risk level of 1.8 m below grade due to the shallow sewer depth (< 1.8 m of cover). When the proposed growth is applied, the existing surcharging on Stanley Ave at McRae Street sewer is not significantly increased (<2 cm increase).
- The flows from the proposed 5592 Robin Street development, represent approximately 25% of the Region's projected growth to 2051 to the Central SPS.

Based on the above findings, upgrade the existing 250 mm sewers from the development tie in point on Robinson Street to Stanley Ave to 300 mm to accommodate the development and reduce basement flooding risks. Further, the proposed development is not expected to have a significant impact on the remaining downstream systems.

Appendix C

Water Calculations

Niagara 77 - Condo
Niagara Falls, Ontario
MTE Project #: 50064-100
4/4/2022

Residential Peaking Factors[2]:		Commercial Peaking Factors[3]:	
Avg. Day	1.0	Avg. Day	1.0
Max. Day	1.58	Max. Day	1.58
Peak Hour	4.00	Peak Hour	3.00

Water Demand Calculations

	Residential					Commercial				Final (Residential + Commercial) Demand		
Location	Units (ea)	Population Density (persons/unit) [4]	Occupancy	Population (persons)	Demand (L/s)	Floor Area (ha)	Population Density (person/ha) [5]	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												
1 Bedroom	544	2.0	-	1088	2.884					2.884	4.556	11.535
2 Bedroom	411	4.0	-	1644	4.357					4.357	6.885	17.429
Townhomes (Units)	7	4.0	-	28	0.074					0.074	0.117	0.297
										7.315	**11.558**	**29.261**
Proposed Commercial						0.040	90.00	4	0.011	**0.011**	**0.018**	**0.034**
Total Condo Mix + Commercial										***7.327***	***11.576***	***29.295***

Water Demand		
Average Residential Daily Demands [6]	0.229	m3/day/person
	0.0027	L/s/person
Average Commercial Daily Demands [7]	24.75	m3/ha/day
	0.2865	L/ha/s

Max Day + Fire Flow Demand		
Qmax.day+fire	128.24	L/s

Fire Flow [1]		
Fire Flow	117	L/s

Note 1: Fire flows calculated using FUS (1999) guidelines - See attached worksheet
Note 2: Peaking factor for Residential based on Niagara Region Design criteria (Section 4.2.4 Design Factors)
Note 3: Peaking factor for commercial based on Niagara Region Design criteria (Section 4.2.4 Design Factors)
Note 4: Design population based on 2 people per room (Refer to OBC 3.1.17.1 (b)
Note 5: Population density for commercial based on Niagara region Standards (person/hectare),Section 5.2.4
Note 6: Residential demands based on Niagara Region Design Criteria (Section 4.2.4 Design Factors)
Note 7: Commercial daily demands based on Niagara Region Design Criteria (Section 4.2.3 Equivalent Population)

Niagara 77 - Condo
Niagara Falls, Ontario
MTE Project #: 50064-100
4/4/2022

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:

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

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] (m^2)	C [B]	Fire Flow "F"		Occupancy		Sprinkler		Exposure		**Fire Flow**		
			(l/min)	(l/s)	%	Adjusted Fire Flow (L/min)	%	Adjustment (L/min)	%	Adjustment (L/min)	**(L/min)**	**Rounded(L/min)**	**(L/s)**
Proposed Building	10,000	0.6	13,000	216.7	-15	11,050	-40	-4,420	25%	28	6,658	7,000	**117**

Note A: Area "A" represents the Gross Floor Area of two largest adjoinitng floors (floor 7 & 8) 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	>45m	0%
E	2m	25%
S	>45m	0%
W	>45m	0%
	Total	**25%**

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

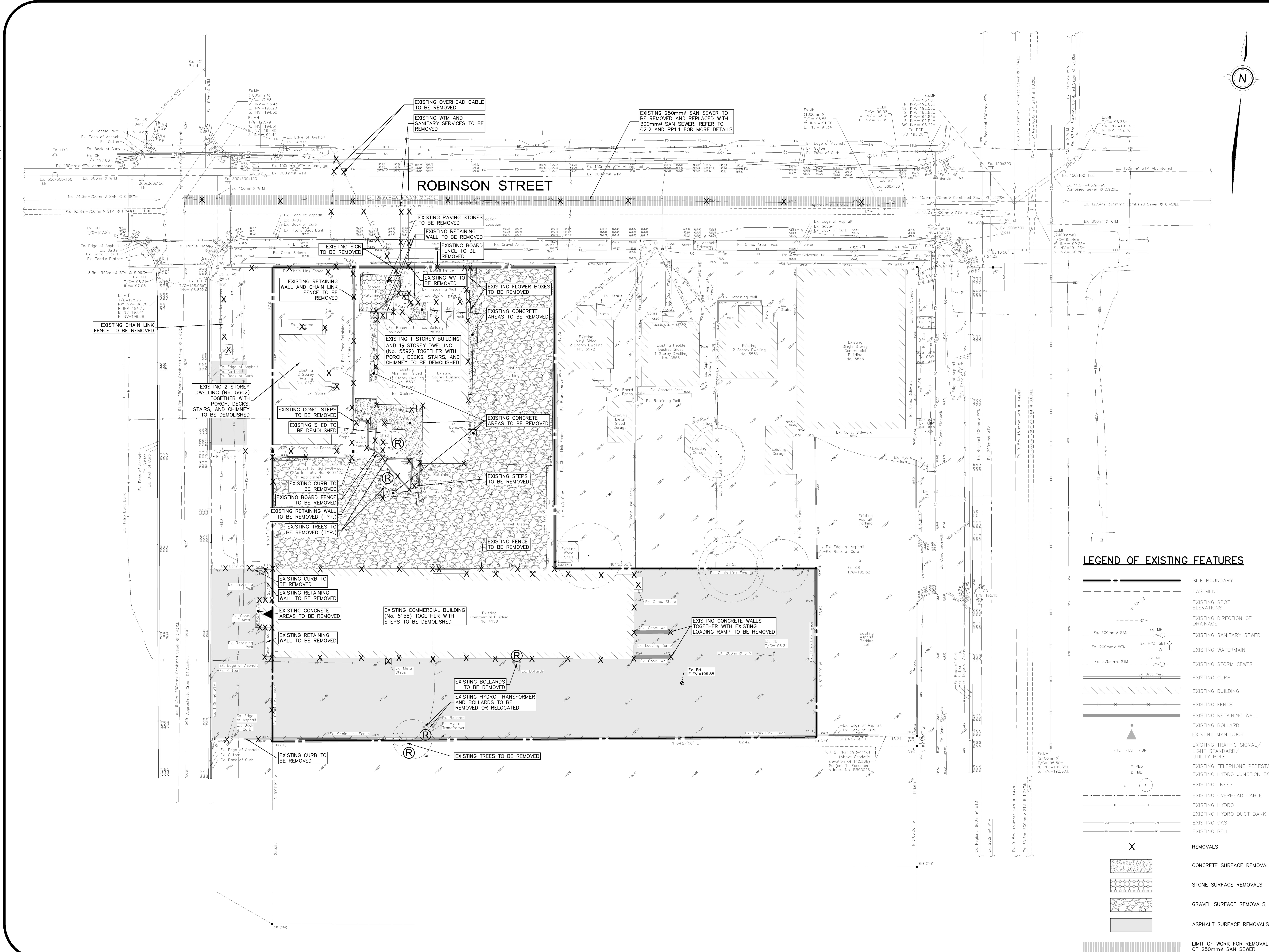
The following design factors are to be used for the design of water transmission systems:

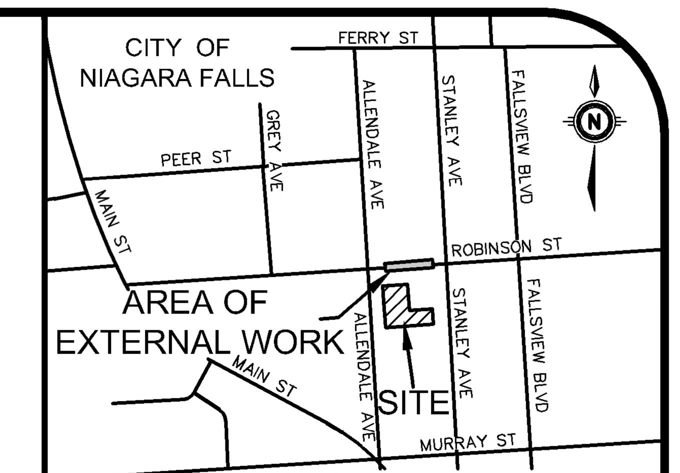
Average Daily Demand (ADD) for the various Area Municipalities is shown below:

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

Appendix D

Drawings





KEY PLAN N.T.S.

GEODETIC BM ELEV. = NA m
ELEVATIONS ARE OF GEODETIC ORIGIN (CGVD-1928:78), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0

SITE BENCHMARK ELEV. = NA m

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.

NOTE:

1. PROPERTY-LINE IS APPROXIMATE ONLY.
2. EXISTING TOPOGRAPHICAL INFORMATION PROVIDED BY J.D.BARNES.
3. INVERTS ARE TAKEN FROM PLAN SURVEY COMPLETED BY J.D.BARNES AND ARE CONSIDERED APPROXIMATE ONLY. CONTRACTOR TO FIELD VERIFY AND REPORT ANY DISCREPANCIES TO ENGINEER.
4. THIS PLAN IS PART OF A SET OF PLANS WHICH COMPRISE OF THE FOLLOWING: C1.1, C2.1, C2.2, THE MUNICIPAL SERVICING REPORT AND THE SWM REPORT.
5. EXISTING WATERMAIN AND UTILITIES INFORMATION TAKEN FROM ROBINSON STREET ROAD CONSTRUCTION PLAN AND PROFILE (CC-8414, CC-8415) PREPARED BY AMEC (AS CONSTRUCTED, 2016-05-08)

No.	REVISION	BY	YYYY-MM-DD
8.			
7.			
6.			
5.			
4.			
3.			
2.	RE-ISSUED FOR ZBA & OPA	KRR	2023-02-03
1.	ISSUED FOR ZBA & OPA	KRR	2022-04-05

MTE
Engineers, Scientists, Surveyors
905-639-2552

NOT FOR CONSTRUCTION

CLIENT
FUDZI INTERNATIONAL GROUP INC.
6158 ALLENDALE AVE NIAGARA FALLS, ON

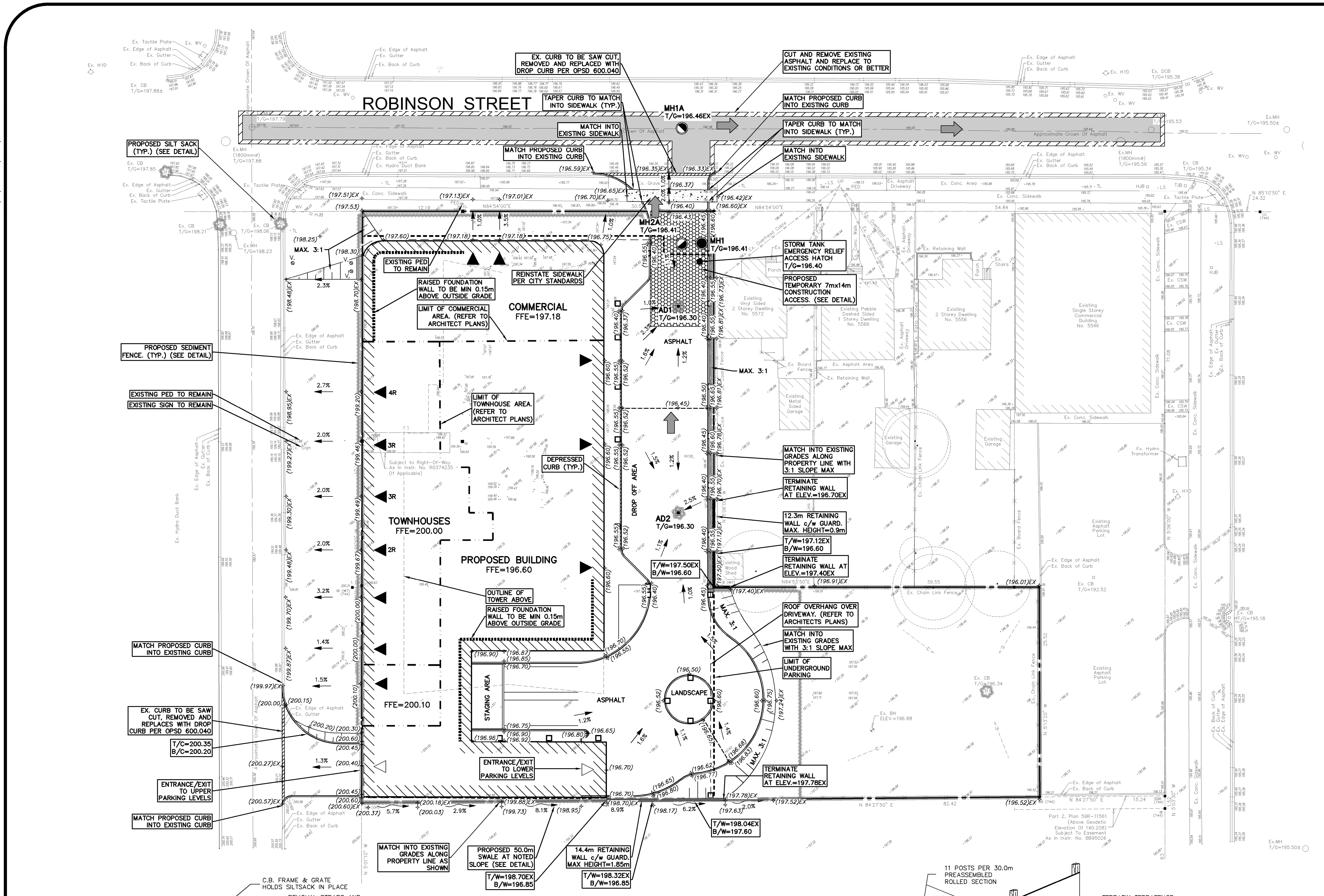
PROJECT
5592 ROBINSON STREET 77 STOREY BUILDING
5592 ROBINSON STREET NIAGARA FALLS, ON

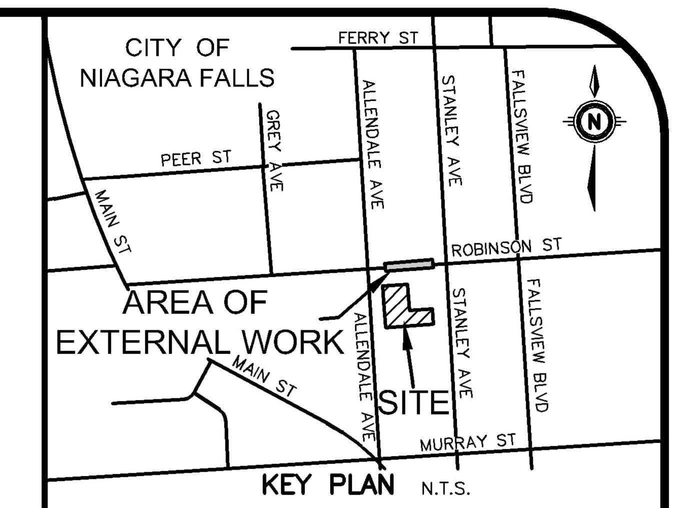
DRAWING
EXISTING CONDITIONS AND REMOVALS PLAN

Project Manager: R.CALOGERO	Project No.: 50064-100
Design By: RNC	Checked By: KRR
Drawn By: SDU	Checked By: RNC
Surveyed By: OTHERS	Drawing No.: C1.1
Date: Jan.11/22	
Scale: 1:250	Sheet 1 of 4

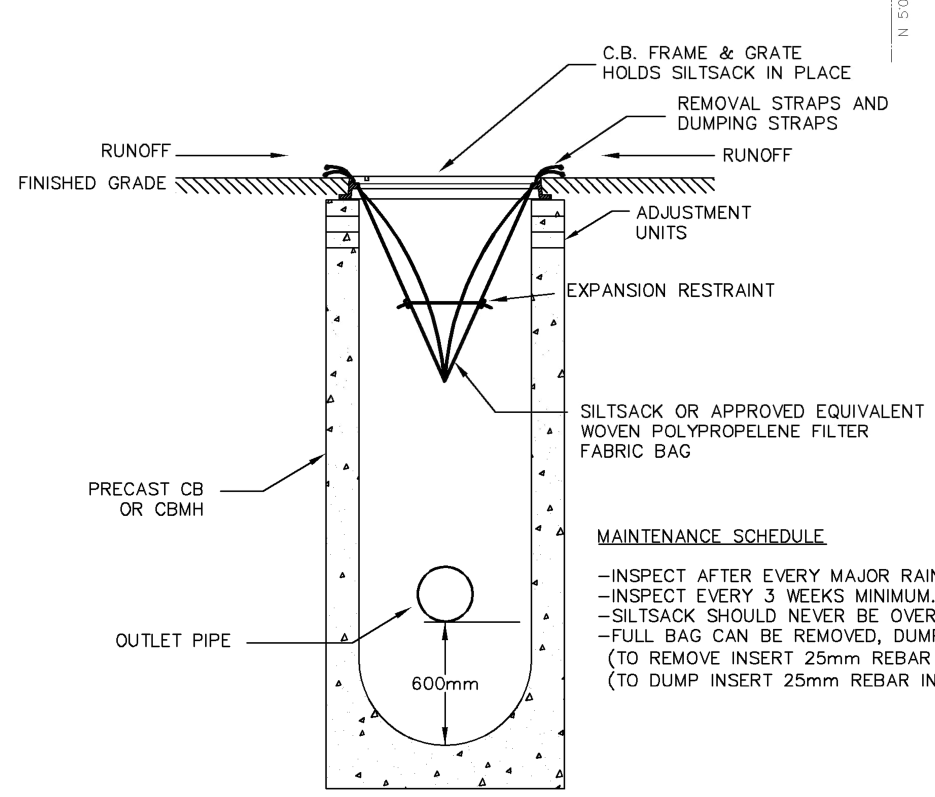
MTE FILE PATH: P:\P50064\100\50064-100-C1

February 2, 2023 - 4:05:42 PM - Plotted By: Lina Qolw





KEY PLAN N.T.S.

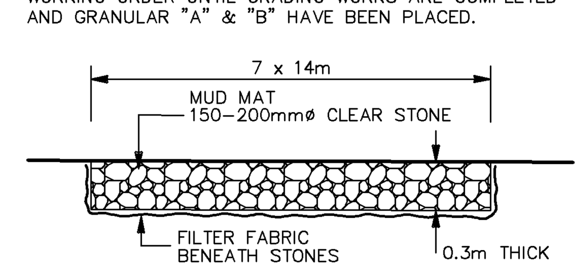


MAINTENANCE SCHEDULE

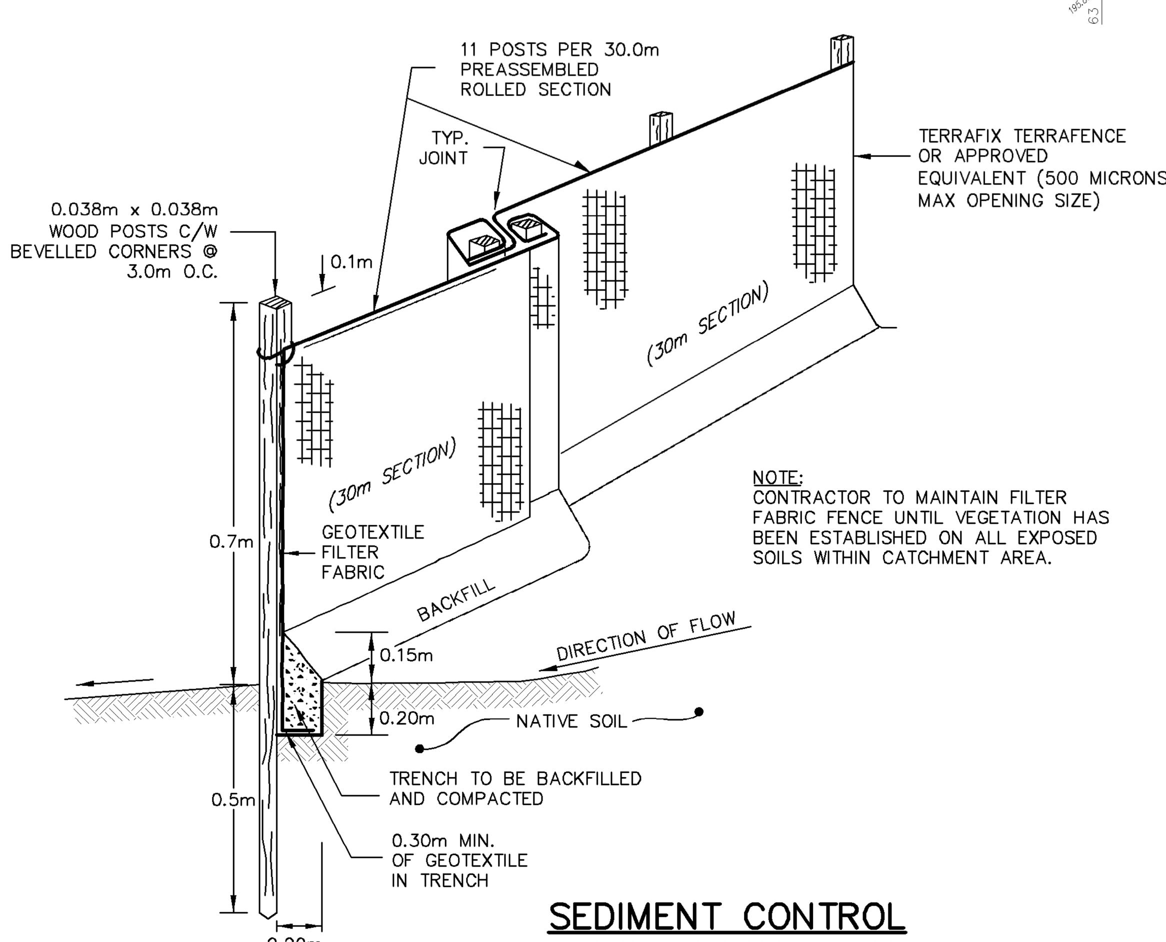
- INSPECT AFTER EVERY MAJOR RAIN EVENT.
- INSPECT EVERY 3 WEEKS MINIMUM.
- SILTSACK SHOULD NEVER BE OVER HALF FULL.
- FULL BAG CAN BE REMOVED, DUMPED, CLEANED AND REUSED (TO REMOVE INSERT 25mm REBAR INTO REMOVAL FLAP POCKETS) (TO DUMP INSERT 25mm REBAR INTO BOTH DUMPING STRAPS)

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

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.



CONSTRUCTION ACCESS DETAIL
N.T.S.



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

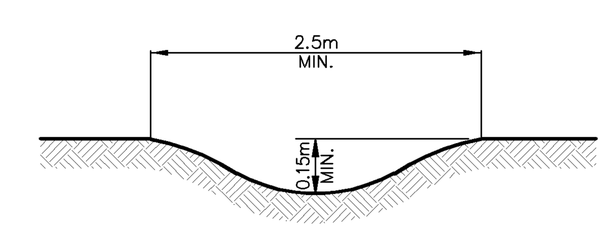
SEDIMENT CONTROL FILTER FABRIC FENCE
N.T.S.

LEGEND OF EXISTING FEATURES

- SITE BOUNDARY
- EASEMENT
- EXISTING SPOT ELEVATIONS
- EXISTING DIRECTION OF DRAINAGE
- EXISTING CURB
- EXISTING BUILDING
- EXISTING FENCE
- EXISTING BOLLARD
- EXISTING TRAFFIC SIGNAL/ LIGHT STANDARD/ UTILITY POLE
- EXISTING TELEPHONE PEDESTAL
- EXISTING HYDRO JUNCTION BOX
- EXISTING TREES
- EXISTING OVERHEAD CABLE
- EXISTING BOREHOLES

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
	PROPOSED BUILDING
	OVERHEAD DOOR
	MAN DOOR
(DROP CURB)	CONCRETE CURB
	RETAINING WALL
	OVERLAND FLOW ROUTE (MAJOR STORM)
	SILT SACK (SEE DETAIL)
	SAW CUT c/w ASPHALT LAP JOINT (SEE DETAIL ON C2.2)
	LIMIT OF TOWER ABOVE
	ROOF OVERHANG (REFER TO ARCHITECT PLANS)
	LIMIT OF UNDERGROUND PARKING
	RAISED FOUNDATION WALL
	ASPHALT RESTORATION
	CONCRETE RESTORATION
(TOP) 3:1 (BOTTOM)	EMBANKMENT (SLOPE AS NOTED)
	CONSTRUCTION ACCESS (SEE DETAIL)
	SEDIMENT CONTROL FENCE (SEE DETAIL)



TYPICAL DRAINAGE SWALE
N.T.S.

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SITE BENCHMARK ELEV. = NA m

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No.	REVISION	BY	YYYY-MM-DD
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2.	RE-ISSUED FOR ZBA & OPA	KRR	2023-02-03
1.	ISSUED FOR ZBA & OPA	KRR	2022-04-05

MTE
Engineers, Scientists, Surveyors
905-639-2552

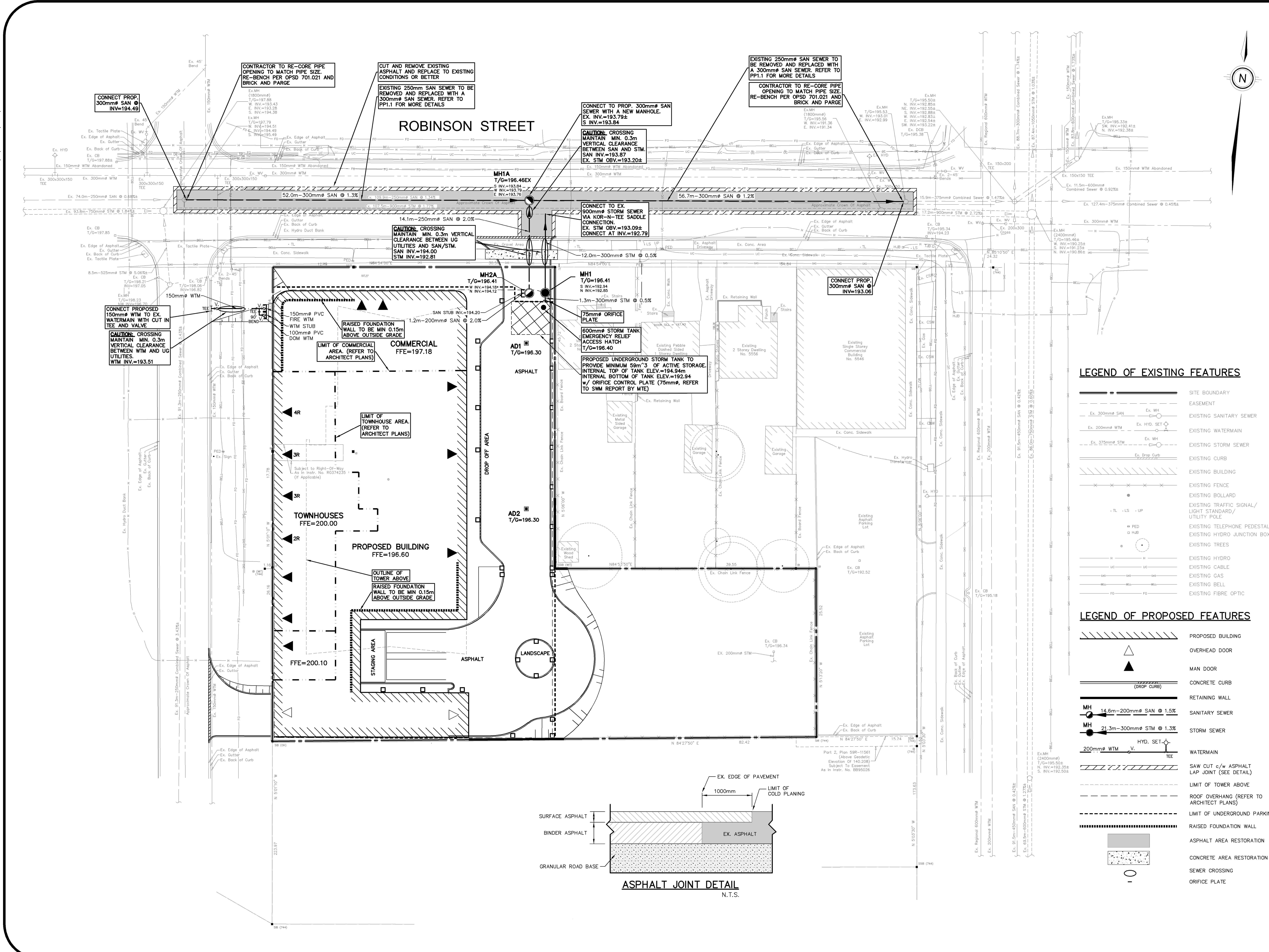
NOT FOR CONSTRUCTION

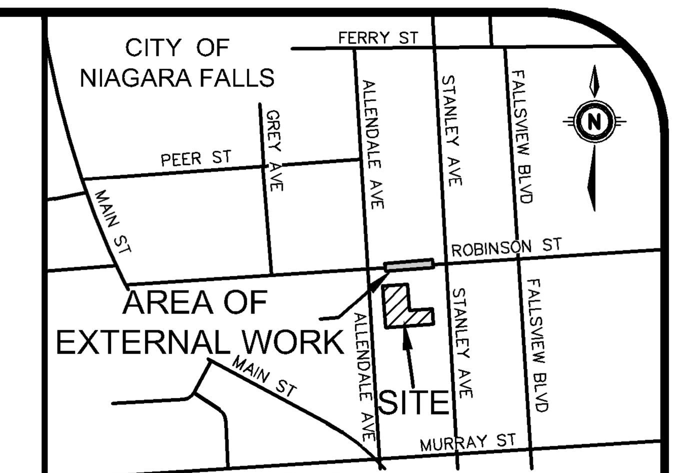
CLIENT
FUDZI INTERNATIONAL GROUP INC.
6158 ALLENDALE AVE NIAGARA FALLS, ON

PROJECT
5592 ROBINSON STREET
77 STOREY BUILDING
5592 ROBINSON STREET NIAGARA FALLS, ON

DRAWING
SITE GRADING AND EROSION & SEDIMENT CONTROL PLAN

Project Manager: R.CALOGERO	Project No.: 50064-100
Design By: RNC	Checked By: KRR
Drawn By: SDU/LXQ	Checked By: RNC
Surveyed By: OTHERS	Drawing No.:
Date: Jan.13/22	C2.1
Scale: 1:250	Sheet 2 of 4





KEY PLAN N.T.S.

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6158 ALLENDALE AVE NIAGARA FALLS, ON

PROJECT

5592 ROBINSON STREET 77 STOREY BUILDING

5592 ROBINSON STREET NIAGARA FALLS, ON

DRAWING

SITE SERVICING PLAN

Project Manager: R.CALOGERO	Project No.: 50064-100
Design By: RNC	Checked By: KRR
Drawn By: SDU/LXQ	Checked By: RNC
Surveyed By: OTHERS	Drawing No.: C2.2
Date: Jan.13/22	
Scale: 1:250	Sheet 3 of 4

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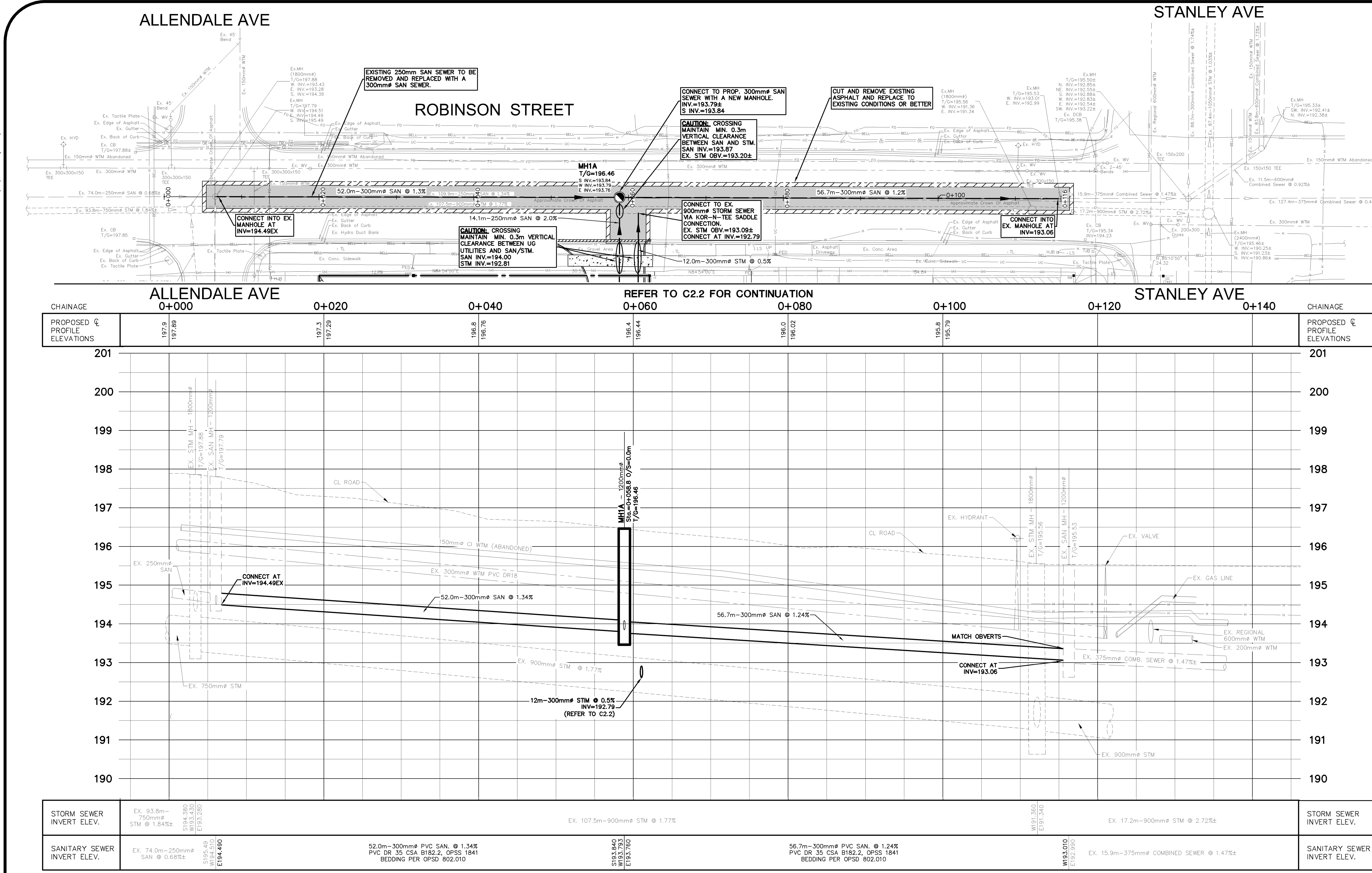
February 2, 2023 – 3:55:59 PM – Plotted By: Lina Qolw



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 AND REPORT FINDINGS TO MTE. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.

3. **SHOP DRAWINGS**
CONTRACTOR TO PROVIDE SHOP DRAWINGS TO THE ENGINEER FOR REVIEW AND APPROVAL FOR ALL CHAMBERS AND STRUCTURES PRIOR THE START OF CONSTRUCTION AND PRIOR TO ORDERING ANY STRUCTURES AND PARTS.

4. **EXISTING UTILITIES**
FOR CONNECTIONS TO EXISTING SERVICING ALONG BASELINE ROAD, PRIOR TO CONSTRUCTION THE CONTRACTOR IS TO OBTAIN UTILITY LOCATES AND CONFIRM THE DEPTH OF ALL EXISTING UTILITIES AND SERVICES AND REPORT FINDINGS TO THE ENGINEER. IF REQUIRED, DAYLIGHT EXISTING UTILITIES TO CONFIRM THE DEPTH.

SANITARY SEWERS NOTES:

1.1. PIPE BEDDING FOR RIGID PIPE TO BE CLASS "B" AS PER OPSD 802.030. PIPE BEDDING FOR FLEXIBLE PIPE TO BE AS PER OPSD 802.010. BEDDING MATERIAL AND COVER MATERIAL TO BE GRANULAR "A". TRENCH BACKFILL TO BE NATIVE MATERIAL REPLACED IN 300mm LIFTS AND COMPACTED TO 100% SPMDD

1.2. SANITARY SEWER PIPE SHALL BE POLYVINYL CHLORIDE (PVC) PIPE DR35 CSA B182.2 CONFORMING TO OPSS 1841 WITH INTEGRAL BELL AND SPIGOT UTILIZING FLEXIBLE ELASTOMERIC SEALS.

1.3. MANHOLES TO BE 1200mmø PRECAST WITH ALUMINIUM STEPS AT 300mm CENTRES AS PER OPSD 701.010 UNLESS OTHERWISE SPECIFIED.

1.4. MANHOLES TO BE BENCHED PER OPSD 701.021.

1.5. SANITARY MANHOLE LIDS TO BE PER OPSD 401.010 –TYPE 'A'.

1.6. MANHOLE FRAMES, CASTINGS AND LIDS TO BE QUALITY GREY IRON ASTM A48 CLASS 30B.

1.7. ADJUSTMENT UNITS FOR SANITARY STRUCTURES TO BE IN ACCORDANCE WITH OPSD 704.010 OR 704.011.

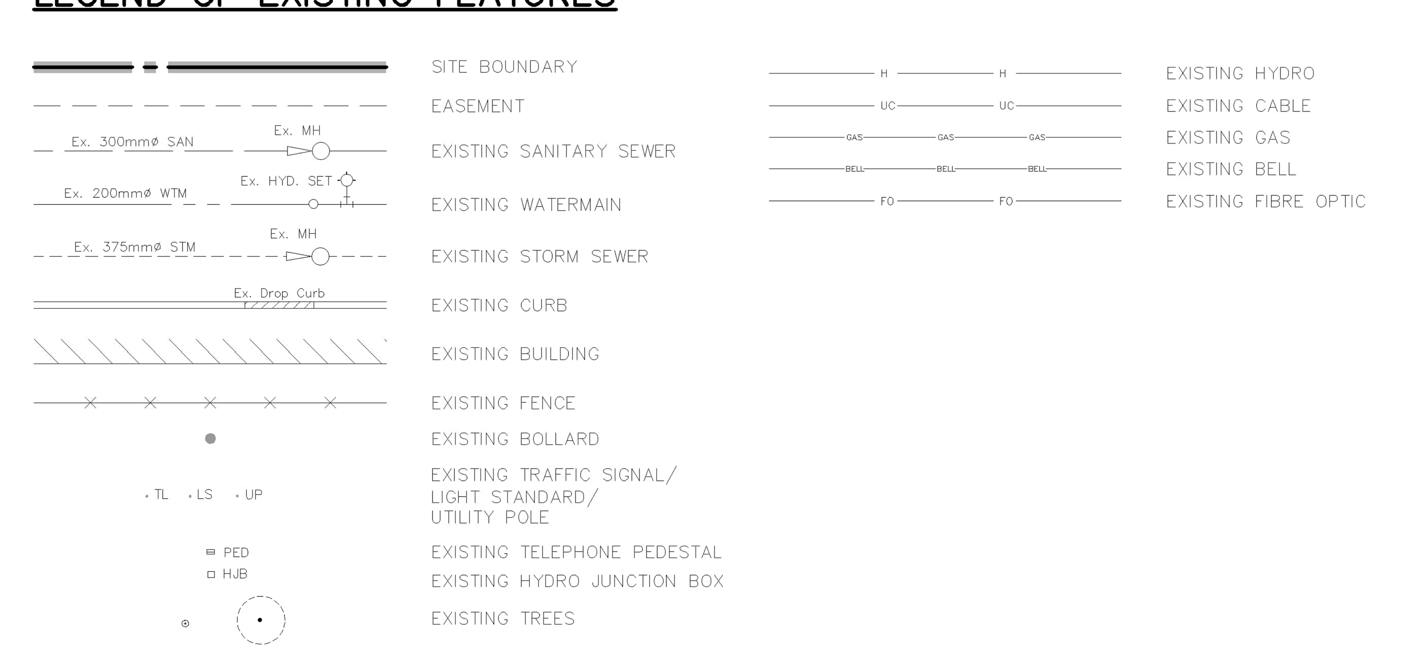
1.8. FACTORY FABRICATED WYES SHALL BE USED FOR ALL SERVICE CONNECTIONS.

1.9. SANITARY SEWERS AND SERVICES TO HAVE MINIMUM 1.4m COVER ON TOP OF PIPE.

1.10. CONTRACTOR RESPONSIBLE FOR TESTING OF SANITARY SEWERS IN ACCORDANCE WITH OPSS 410.

1.11. SANITARY LATERAL INSTALLATION WITHIN THE MUNICIPAL ROW SHALL BE DONE BY THE CITY OF NIAGARA FALLS PUBLIC WORKS DEPARTMENT OR THEIR DESIGNATE, AND IN ACCORDANCE WITH THE CITY OF NAIGARA FALLS MUNICIPAL STANDARDS. ALL COSTS ASSOCIATED WITH THE INSTALLATION OF THE SANITARY SERVICE SHALL BE IN ACCORDANCE WITH THE MOST CURRENT CITY OF NIAGARA FALLS USER FEE BY-LAW.

LEGEND OF EXISTING FEATURES



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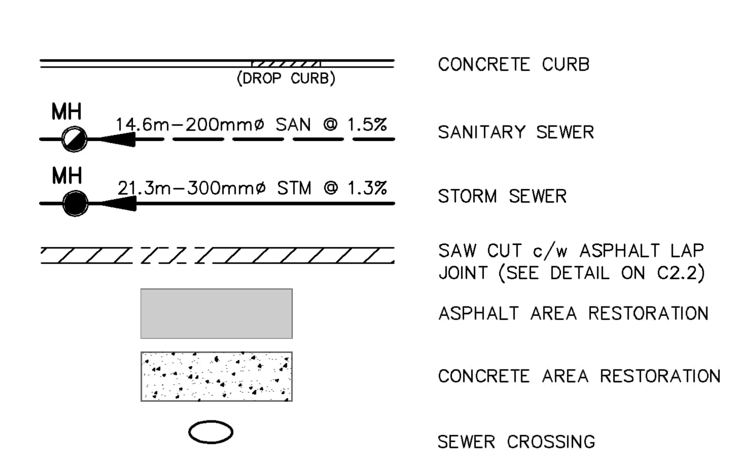

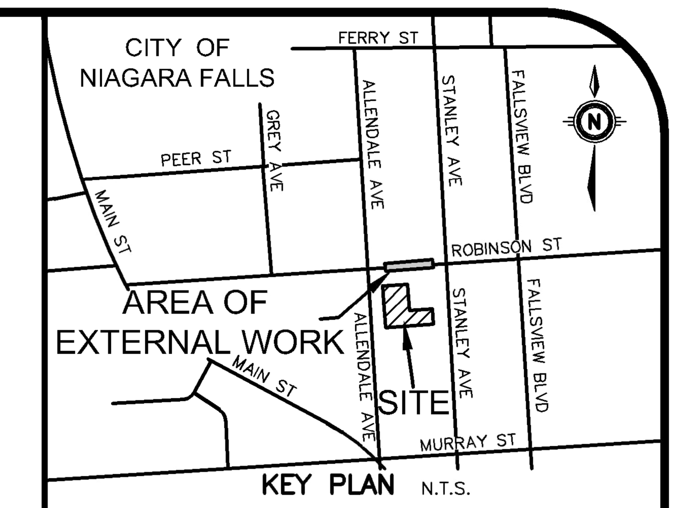

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DRAWING
EXTERNAL WORKS - SANITARY SEWERS ROBINSON STREET
STA 0+000 TO STA 0+116

Project Manager R.CALOGERO	Project No. 50064-100
Design By RNC	Checked By KRR
Drawn By LXQ	Checked By RNC
Surveyed By OTHERS	Drawing No. PP1.1
Date Nov.25/22	
Scale 1:250	Sheet 4 of 4