UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

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File: 22150

FUNCTIONAL SERVICING REPORT

1839 Four Mile Creek Road
Niagara-on-the-Lake
Revised June 2025

INTRODUCTION

Upper Canada Consultants has been retained to undertake and provide a Functional Servicing Report to address the servicing needs and requirements as part of a Re-zoning Application Submission for the proposed development. The property located at the above noted address has recently been a part of a completed severance, however the proposed development would result in the re-amalgamation of the property to its' original state. The site is located on the east side of Four Mile Creek Road, south of East and West Line and north of Line 1. The property has historically been the location of a single detached residential dwelling.

The proposed development site is approximately 0.31 hectares and shall consist of a 3-storey, 29-unit residential apartment building with an underground parking garage and will include associated asphalt above-ground parking lot, concrete curb, catch basins, storm sewers, sanitary sewers, and watermain.

The objectives of this study are as follows:

1. Identify domestic and fire protection water service needs for the site;
2. Identify sanitary servicing needs for the site; and,
3. Identify stormwater management needs for the site.

WATER SERVICING

There is an existing 250mm diameter municipal PVC watermain located on Four Mile Creek Road fronting the proposed development site. It is proposed to construct a 150mm diameter service to provide both domestic water supply and fire protection for the proposed apartment building.

An existing water service currently supplies the existing dwelling although passes through the adjacent northerly #1845 Four Mile Creek Road property. The existing service will be decommissioned within the road allowance, and completely removed to the property line on the #1839 Four Mile Creek Road lands.

An existing fire hydrant is located at the north-west corner of the property on fronting Four Mile Creek Road. Due to the size of the proposed building, it is expected that an internal sprinkler

system will be required. The current proposed configuration of the site will allow a Fire Department Connection to be constructed within 45m of the existing hydrant per Ontario Building Code requirements. The buildings' Sprinkler System Engineer will provide the minimum flow calculations and requirements necessary to provide adequate fire protection for the proposed buildings as part of future building permit submissions.

Per the sanitary calculations outlined further in this report, the proposed development will result in a total population of 58 persons at 2.0 persons/apartment. Per the 2021 Regional Water Master Servicing Plan Update, 240 L/cap/day is attributed as the average daily demand. Therefore, the average, maximum day, and peak hour domestic requirements will be 13,920L/cap/day, 38,280L/cap/day, and 57,490L/cap/day respectively.

SANITARY SERVICING

There is an existing 600mm diameter AC municipal sanitary sewer on Four Mile Creek Road fronting the proposed development site. A 200mm diameter sanitary service will be connected to the existing sanitary sewer to provide a sanitary outlet for the development. The existing municipal sanitary sewer conveys flows northerly, ultimately discharging to the Regional 600mm diameter trunk sanitary sewer at the intersection of East and West Line.

An analysis of the downstream sanitary system and associated peak sanitary flows from the proposed site has been conducted and included in Appendix A. The calculations utilize a population of 2.0 persons/apartment unit as well as residential flow rates of 255L/cap/day and infiltration rates of 0.286L/s/ha in accordance with the 2021 Niagara Regional Master Servicing Plan Update. The calculations have concluded that the proposed development will result in a population of 58 persons discharging a peak sanitary outflow of 0.82 L/s to the downstream sanitary sewer system – an increase of 0.69L/s from existing conditions. The total peak flow will occupy a maximum of 0.5% of the capacity of the existing downstream municipal sanitary sewer system. It is expected that this will be an acceptable addition to the current capacity of the existing municipal sanitary sewer system.

STORMWATER MANAGEMENT PLAN

As part of the site development for the proposed residential development, the following is a summary of the Stormwater Management Plan.

The criteria provided by the Town of Niagara-on-the-Lake and Region of Niagara for this development includes the requirement to control future development stormwater flows to allowable levels from this site for up to and including the 5-year design storm event. It is also required to improve stormwater quality levels to MECP Normal Protection (70% TSS removal) levels prior to discharge to the existing storm sewer system.

To limit future stormwater flows to allowable levels, typically a control is placed on the outlet from the site that may include an orifice with associated internal site stormwater storage. To improve stormwater quality, typically an CB Shield, Oil/Grit Separator or other ETV Verified device provides the required TSS (Total Suspended Solids) removal for this type of development.

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Existing Conditions

There is an existing municipal 735x1145 HE III Elliptical storm sewer fronting the proposed development on Four Mile Creek Road conveying flows northerly to its ultimate outlet at the Wagner Drain at East & West Line. Per topographical information outlined on the Preliminary Site Grading Plan, the entirety of the site (as well as additional exterior lands) is sloped towards Four Mile Creek Road, conveying stormwater flows overland towards the road allowance and its' associated storm sewer system. The majority of stormwater flows enter a ditch inlet catch basin at the south-west corner of the property, ultimately discharging to the Four Mile Creek Road storm sewer.

Figure 1 in Appendix B outlines the Existing Overall Storm Drainage Area Plan for this development. Per the Weighted Impervious Calculation Sheet in Appendix C, the total site area (and external area) of approximately 0.38 hectares conveys flows to the Four Mile Creek Road stormwater system at an average Runoff Coefficient of 0.31 represented by Drainage Area EX on Figure 1.

However, per Drainage Area Plans produced by Kerry T. Howe Engineering for the municipal storm sewer, only a portion of the site (0.07ha, south-west corner) was included in the drainage areas for the storm sewer system at a Runoff Coefficient of 0.20 represented by Drainage Area B6a on Figure 1. The rest of the development site was noted as conveying flows overland directly to the Wagner Drain at a Runoff Coefficient of 0.20 represented by Drainage Area B7a on Figure 1.

Proposed Conditions

It is proposed to collect all stormwater flows from the development site within an internal stormwater management system, prior to discharging to the existing storm sewer on Four Mile Creek Road. Figure 2 (Appendix B) outlines the Future Overall Storm Drainage Area Plan for the proposed development.

Drainage Area A10 represents the lands that will discharge stormwater flows into the on-site storm sewer system ultimately to the Four Mile Creek Road storm sewer. A Weighted Impervious Calculation Sheet has determined Drainage Areas A10 to have a weighted Runoff Coefficient of 0.60 under the current site design.

Quantity Analysis

Using the Modified Rational Method, the existing and future peak stormwater flow rates have been determined for the proposed development during the 5-, and 100-year design storm events using the Town of Niagara-on-the-Lake IDF curves. All Modified Rational Method calculations have been included in Appendix C.

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Table 1. Peak Stormwater Flows (L/s)						
Design Storm	Existing Peak Flows				Allowable Peak Flow to Sewer	*Future Peak Flows 'A10'
	KTH Design 'B6a'	KTH Design 'B7a'	Total KTH Design	Existing Conditions 'EX'		
5 Year	3.5	15.5	19.0	29.4	*17.5*	55.0
100 Year	5.6	24.8	30.5	47.2	*20.1*	88.3
*Note: outlines future flows without quantity controls						

Per the Kerry T. Howe Storm Sewer Design for Four Mile Creek Road, the portion of the site labelled as Drainage Area 'B6a' in Figure 1 was allocated to the storm sewer, equating to approximately 3.5L/s during the 5-year design storm event. The remaining site area (Drainage Area B7a) conveyed flows directly to the Wagner Drain at 15.5 L/s, for a total of 19.0L/s from the site. As stated previously, under actual existing conditions the entirety of the property directs flows overland to Four Mile Creek Road at rates greater than previously designed in the Kerry T. Howe storm sewer design.

During analysis of the existing storm sewer system, it was determined that a number of errors were found within the Four Mile Creek Road storm sewer calculation sheet. The sheet was replicated and corrected (Appendix C) to determine the available capacity within the downstream storm sewer system. It was concluded that the existing 735x1145mm HE III ellipse storm sewer fronting the site has the lowest available capacity of approximately 14.0L/s (588.1-574.1L/s) during the 5-year storm event – in addition to the 3.5L/s attributed for Drainage Area B6. This concludes the storm sewer system has an available capacity of **17.5L/s** for the proposed development. Therefore, as it is known that sewers have an additional available capacity of 15% during surcharged conditions, the allowable outflow from the site to the Four Mile Creek Road storm sewer will be **20.1L/s** during the 100-year design storm event.

Therefore, the proposed development will restrict stormwater flows to the available capacity of the downstream storm sewer system prior to discharge to the existing Four Mile Creek Road storm sewer system: 17.5L/s during the 5-year storm event. And 20.1 L/s during the 100-year storm event. This will effectively control stormwater flows to less than both existing levels and the allowable outflow to the downstream Wagner Creek per the Kerry T. Howe design. It should be noted, that if further overland flows are to outlet to the Four Mile Creek Road road allowance during the 100-year design storm event as per future detailed design, they will be required to be restricted to a combined total of 30.5L/s with the storm sewer flows, as per the Kerry T. Howe design.

Per the Modified Rational Method Calculations in Appendix C, the proposed quantity controls will require a minimum on-site storage capacity of approximately 28.0m^3 and 65.2m^3 for the 5- and 100-year design storm events respectively. The required storage volume may be provided by a combination of underground pipe storage, surface parking lot storage and rooftop storage.

During extreme storm events, overland flows from the proposed development site will be directed to the Four Mile Creek Road road allowance as occurs under existing conditions.

Quality Analysis

To improve stormwater quality levels from this development site, it is expected a CB Shield, Oil/Grit Separator or other ETV verified device will provide the necessary quality controls to the minimum 70% TSS removal. Stormwater quality enhancement measures will be completed as part of future detailed design.

CONCLUSIONS AND RECOMMENDATIONS

Therefore, based on the above comments and design calculations provided for this site, the following summarizes the servicing for this site.

1. The existing 250mm diameter watermain will have sufficient capacity to provide both domestic and fire protection water supply.

2. The existing 600mm diameter municipal sanitary sewer on Four Mile Creek Road will have adequate capacity for the proposed residential development.

3. Stormwater quantity controls will be provided to allowable conditions up to and including the 100-year design storm event.

4. The site extreme stormwater overland route from the parking lot will be to Four Mile Creek Road.

5. Stormwater quality protection will be provided to 70% TSS Removal (Normal Protection) levels prior to discharge from the site.

Based on the above and the accompanying calculations, there exists adequate municipal servicing for this development. We trust the above comments and enclosed calculations are satisfactory for approval. If you have any questions or require additional information, please do not hesitate to contact our office.

Yours very truly,

Kurt Tiessen, P.Eng.
Revised June 13, 2025
Encl.

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APPENDICES

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APPENDIX A

Sanitary Sewer Calculations

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3-30 HANNOVER DRIVE
ST.CATHARINES, ONTARIO
L2W 1A3

DESIGN FLOWS

RESIDENTIAL: 255 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INFILTRATION RATE: 0.286 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L / s / ha)
POPULATION DENSITY: 2.0 PERSONS / UNIT

SEWER DESIGN

PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION
PIPE SIZES: 1.016 IMPERIAL EQUIVALENT FACTOR
PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE
PROJECT : 1839 FOUR MILE CREEK ROAD APARTMENTS
PROJECT NO: 22150

SANITARY SEWER DESIGN SHEET

Peaking Factor= $M = 1 + \frac{14}{4 + P^{0.5}}$ Where P = design population in thousands

LOCATION			AREA		POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
Location and Description	**From M.H**	**To M.H.**	**Increment (hectares)**	**Accumulated (hectares)**	**Number of Units**	**Population Density (persons/unit)**	**Population Increment**	**Total Population Served**	**Peaking Factor**	**Flow (L/s)**	**Infiltration Flow L/s**	**Total Peak Flow (L/s)**	**Pipe Diameter (mm)**	**Pipe Length (m)**	**Pipe Slope (%)**	**Full Flow Velocity (m/s)**	**Full Flow Capacity (L/s)**	**Percent Full**
EXISTING CONDITIONS																		
SITE	SITE	SEWER	0.31	0.31	1	3.0	3	3	4.45	0.04	0.09	0.13						
FUTURE CONDITIONS																		
SITE	SITE	SEWER	0.31	0.31	29	2.0	58	58	4.30	0.74	0.09	0.82	200	10.0	0.60	0.82	26.50	3.1%
FOUR MILE CREEK ROAD	EX MH 37	EX MH 36		0.31				58	4.30	0.74	0.09	0.82	600		0.13	0.79	230.96	0.4%
FOUR MILE CREEK ROAD	EX MH 36	EX MH 35		0.31				58	4.30	0.74	0.09	0.82	600		0.07	0.58	169.48	0.5%
FOUR MILE CREEK ROAD	EX MH 35	EX MH 34		0.31				58	4.30	0.74	0.09	0.82	600		0.19	0.96	279.21	0.3%
FOUR MILE CREEK ROAD	EX MH 34	EX MH 162		0.31				58	4.30	0.74	0.09	0.82	600		0.15	0.85	248.09	0.3%

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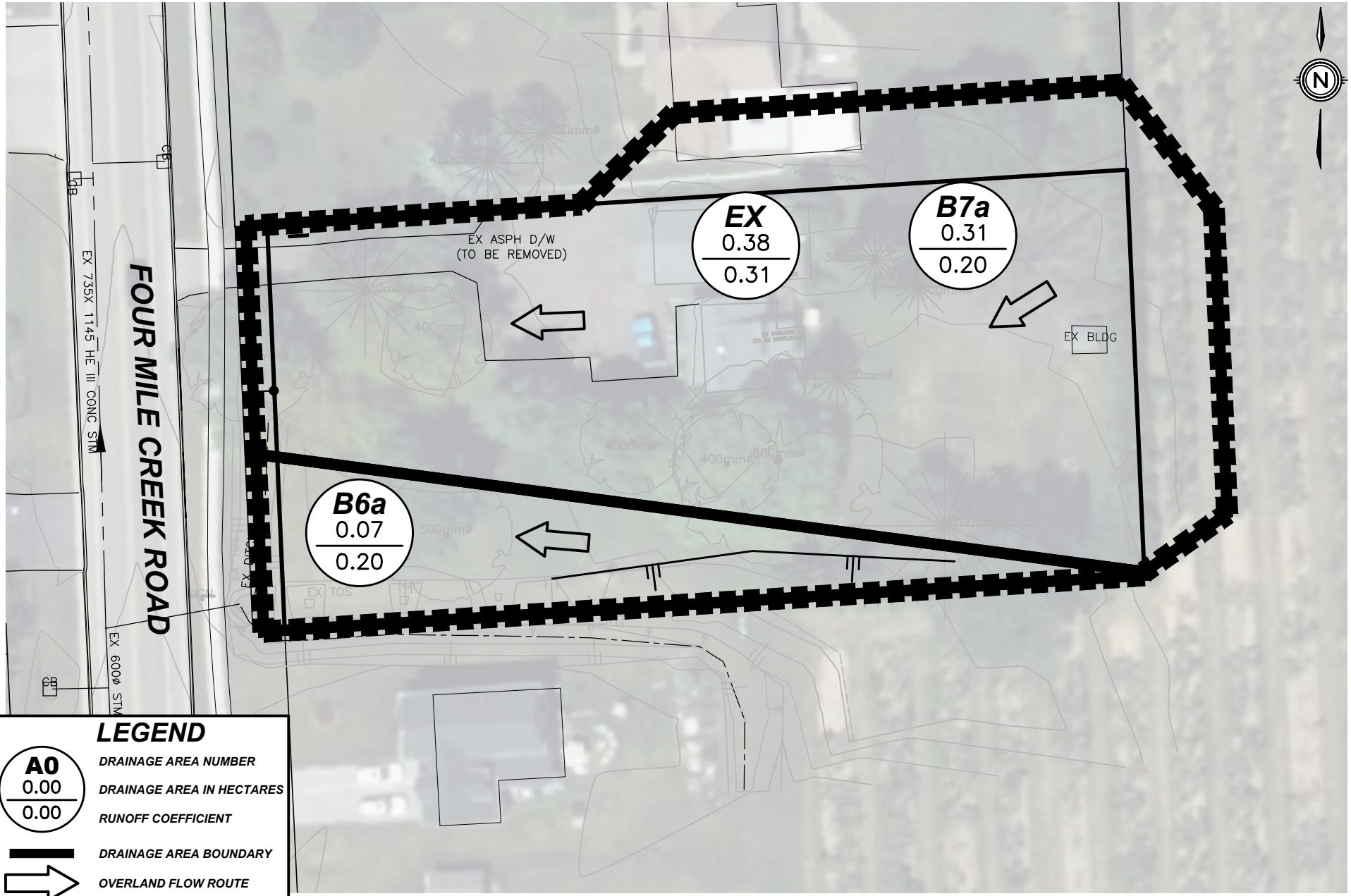
APPENDIX B

Figure 1 – Existing Overall Storm Drainage Area Plan
Figure 2 – Proposed Overall Storm Drainage Area Plan



LEGEND

- **A0** / 0.00 / 0.00 — DRAINAGE AREA NUMBER; DRAINAGE AREA IN HECTARES; RUNOFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

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BICE CREEK APARTMENTS

TOWN OF NIAGARA-ON-THE-LAKE

EXISTING OVERALL STORM DRAINAGE AREA PLAN

DATE	2025–01–29
SCALE	1:200 m
REF No.	22150
DWG No.	FIGURE 1

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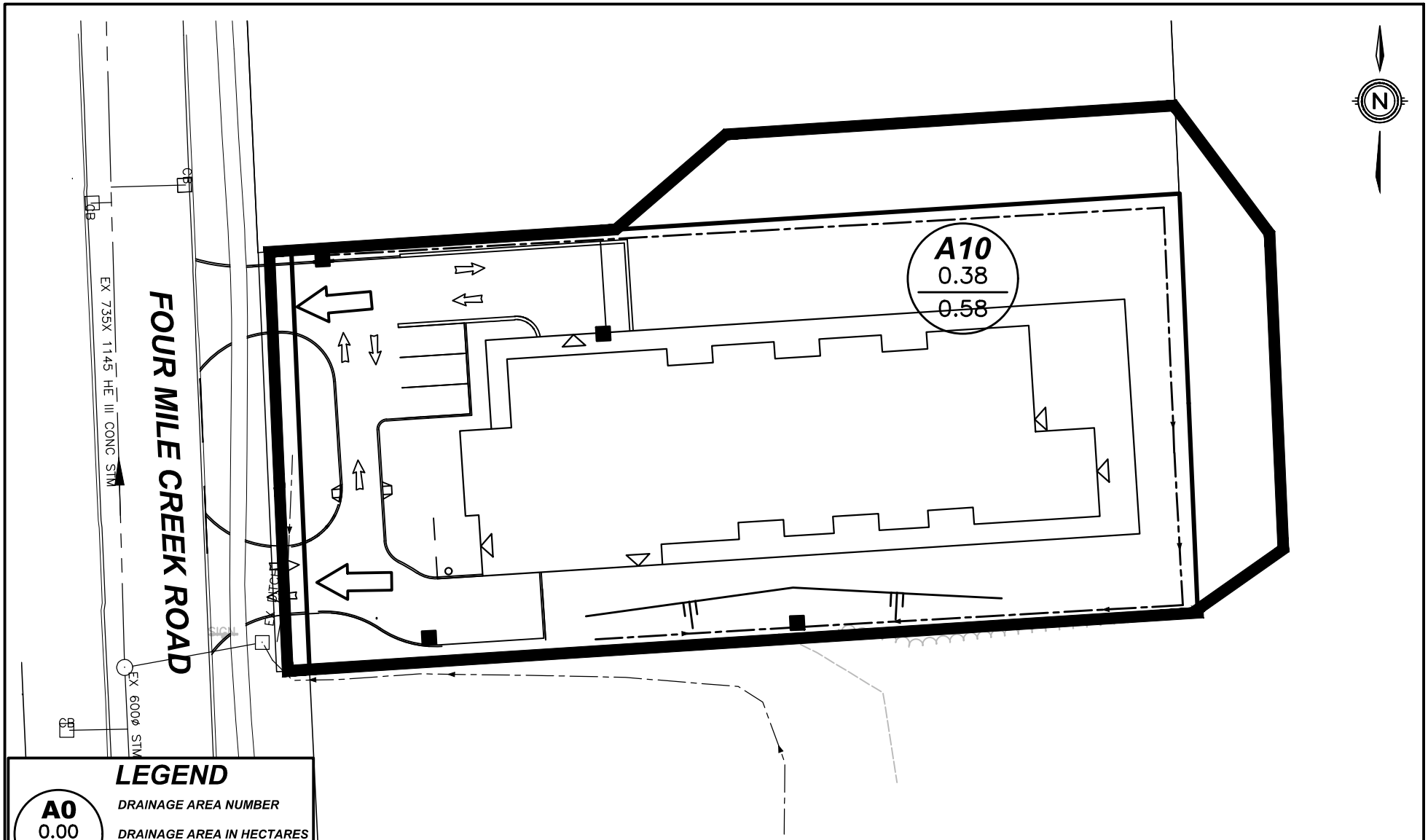

LEGEND

- **A0** / 0.00 / 0.00 — DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / RUNOFF COEFFICIENT
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

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BICE CREEK APARTMENTS

TOWN OF NIAGARA-ON-THE-LAKE

FUTURE OVERALL STORM DRAINAGE AREA PLAN

DATE	2025–06–13
SCALE	1:200 m
REF No.	22150
DWG No.	FIGURE 2

DRAWING FILE: F:\22150\Engineering\22150–BASE–4.dwg PLOTTED: Jun 13, 2025 – 8:10am PLOTTED BY: kurt

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APPENDIX C

Four Mile Creek Road – Storm Sewer Calculation Sheet
Weighted Impervious Calculations
Modified Rational Method Calculation Sheet – Peak Flows
Modified Rational Method Calculation Sheet – Required Volumes

UPPER CANADA CONSULTANTS
3-30 HANNOVER DRIVE
ST. CATHARINES, ON L2W 1A3

STORM SEWER DESIGN

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE — A = 664.00 mm/hr — 5 YEAR DESIGN IDF
PROJECT: BICE CREEK APARTMENT — B = 4.70 minutes — PIPE ROUGHNESS = 0.013
UCC PROJECT NO.: 22150 — C = 0.744 — PIPE CONVERSION FACTOR = 1.016

DESCRIPTION			STORMWATER ANALYSIS										STORM SEWER DESIGN					
LOCATION	FROM MH	TO MH	AREA (ha)	ACCUMLTD AREA (ha)	RUNOFF COEFFICNT	A*R	ACCUMLTD A*R	T of C (min.)	PIPE TIME (min.)	T of C (sum)	INTENSITY (mm/hr)	FLOW (L/s)	LENGTH (m)	DIAMETER (mm)	SLOPE (%)	CAPACITY (L/s)	VELOCITY (m/s)	PERCENT FULL
A3 - Four Mile Creek Road	1	2	0.84	0.84	0.45	0.378												
A4 - Four Mile Creek Road			0.21	1.05	0.45	0.095	0.473	10.00	1.68	11.68	89.9	118.0	100.0	450	0.30	162.98	1.0	72.4%
B1 - Field W of FMC Rd.	2	3	0.65	0.65	0.20	0.130												
A5 - Four Mile Creek Road			0.19	1.89	0.45	0.086	0.688	11.68	2.19	13.87	82.9	158.5	118.0	525	0.20	200.72	0.9	79.0%
B2 - Field W of FMC Rd.	3	4	1.30	1.30	0.20	0.260												
A6 - Four Mile Creek Road			0.27	3.46	0.45	0.122	1.070	13.87	1.70	15.57	75.5	224.4	100.0	600	0.20	286.58	1.0	78.3%
B6 - Field E of FMC Rd.	DICB	4	7.20	7.20	0.20	1.440	1.440	15.00	0.10	15.10	72.3	289.2	11.5	450	1.10	312.07	1.9	92.7%
B3 - Field W of FMC Rd.	4	5	1.04	1.04	0.20	0.208												
A7 - Four Mile Creek Road			0.45	12.15	0.45	0.203	2.920	15.57	2.83	18.40	70.8	**574.1**	151.0	735 x 1145	0.10	**588.13**	0.9	97.6%
A8 - Four Mile Creek Road	5	6	0.40	12.55	0.45	0.180	3.100	18.40	1.96	20.35	64.2	553.0	128.0	735 x 1145	0.15	720.31	1.1	76.8%
B5 - Field W of FMC Rd.	DICB	6	2.30	2.30	0.20	0.460												
B4 - E/W Line South Ditch			1.20	28.20	0.25	0.300	0.760	15.00	0.28	15.28	72.3	152.6	18.0	450	0.35	176.03	1.1	86.7%
OUTLET	6	7					3.860	20.35	0.42	20.77	60.5	648.2	28.0	900	0.15	731.74	1.1	88.6%

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	Bice Creek Apartments
Project Number:	22150
Date:	June 2025
Person:	K.Tiessen

EX - EXISTING CONDITIONS

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
Asphalt Driveway	350.6 m^2	0.90	315.5 m^2
Existing Buildings	251.2 m^2	0.90	226.1 m^2
Landscape/Forested Lands	3224.0 m^2	0.20	644.8 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,186 m^2
TOTAL CATCHMENT AREA			3,826 m^2
		EFFECTIVE RUNOFF COEFFICIENT	**0.31**

A10 - PROPOSED CONDITIONS

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
Proposed Buildings	1272.0 m^2	0.90	1144.8 m^2
Parking Lot, Sidewalk, Playground	714.7 m^2	0.90	643.2 m^2
Existing Building	77.8 m^2	0.90	70.0 m^2
Landscape/Greenspace	1756.1 m^2	0.20	351.2 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			2,209 m^2
TOTAL CATCHMENT AREA			3,821 m^2
		EFFECTIVE RUNOFF COEFFICIENT	**0.58**

STORM SEWER DESIGN SHEET

PROJECT: BICE CREEK APARTMENTS, NIAGARA-ON-THE-LAKE

LOCATION						TIME OF FLOW		STORMWATER ANALYSIS				
DESCRIPTION	**FROM M.H.**	**TO M.H.**	**PIPE LENGTH (m)**	**INCREMENT AREA (hectares)**	**TOTAL AREA (hectares)**	**TO UPPER END (min)**	**IN SECTION (min)**	**RUNOFF COEFF**	**SECTION A X R**	**ACCUMLD A x R**	**RAINFALL INTENSITY (mm/hr)**	**PEAK FLOW (L/s)**
EXISTING SEWER DESIGN CONDITIONS												
B6a - TO FMCR SEWER	SITE	SEWER		0.07	0.07	10.00	0.00	0.200	0.014	0.014	89.884	3.5
B7a - DIRECT TO WAGNER DRAIN	SITE	DRAIN		0.31	0.31	10.00	0.00	0.200	0.062	0.062	89.884	15.5
												19.0
				Available Capacity in Four Mile Creek Storm Sewer (Per Sewer Calculations) during 5 Year Event								**17.5**
EXISTING CONDITIONS												
EX	SITE	SEWER		0.38	0.38	10.00	0.00	0.310	0.118	0.118	89.884	29.4
FUTURE CONDITIONS												
A10 - Uncontrolled	SITE	SEWER		0.38	0.38	10.00	0.00	0.580	0.220	0.220	89.884	55.0
ALLOWABLE PEAK OUTFLOW (To Sewer)												17.5
PROVIDED OUTFLOW												**17.5**

DESIGN BY: **UPPER CANADA CONSULTANTS**
30 HANNOVER DRIVE, UNIT 3
ST. CATHARINES, ON L2W 1A3
DESIGN BY: **J.SCHOOLEY, P.ENG.**
DATE: **JUNE 2025**

RAINFALL PARAMETERS:
Time to Upper End = 10 min.
Town of Niagara-on-the-Lake - 5 Year IDF C

a = 664.00 mm/hr
b = 4.70 minutes
c = 0.74

Modified Rational Method (MRM) Required Storage Volume

Project:	BICE CREEK APARTMENTS
Project No:	22150
Date:	JUNE 2025
Design By:	K.Tiessen, P.Eng.
Description:	STORMWATER MANAGEMENT PLAN

Storm Event: **Town of Niagara-on-the-Lake - 5 Year IDF Curve**

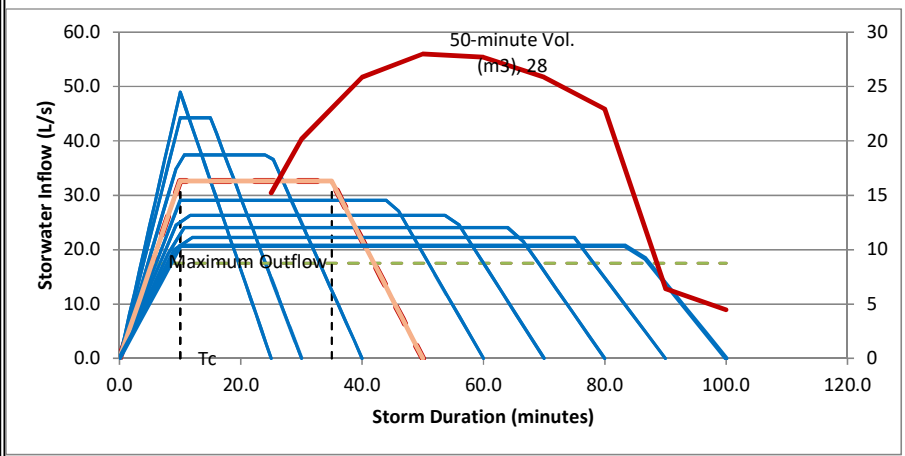
a =	664.00	mm/hr
b =	4.70	minutes
c =	0.74	

Critical Storm Duration:	50.00	minutes	Tail Multiplier (x1-11.5
Tc From Design:	10.00	minutes	
Storm Tail Time:	35.00	minutes	
Accumulated Area x R (Ha):	0.220		<-- Area x Runoff Coefficient (Sewer Design Sheet)
Peak Rainfall Intensity:	53.26	mm/hr	
Peak Inflow at Tc:	32.61	L/s	
Maximum Release Rate:	17.50		<-- Outlet Full Flow Capacity (Design Sheet)
Time When Outlet Exceeded:	5.37		

Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Interval Volume (m3)	Total Required Volume (m3)
0.0	0.00	0.00	17.50	-1.1	0.0
1.7	8.88	5.43	17.50	-1.2	0.0
3.3	17.75	10.87	17.50	-0.7	0.0
5.0	26.63	16.30	17.50	-0.1	0.0
6.7	35.51	21.74	17.50	0.4	0.4
8.3	44.39	27.17	17.50	1.0	1.4
10.0	53.26	32.61	17.50	1.5	2.9
11.7	53.26	32.61	17.50	1.5	4.4
13.3	53.26	32.61	17.50	1.5	5.9
15.0	53.26	32.61	17.50	1.5	7.4
16.7	53.26	32.61	17.50	1.5	8.9
18.3	53.26	32.61	17.50	1.5	10.5
20.0	53.26	32.61	17.50	1.5	12.0
21.7	53.26	32.61	17.50	1.5	13.5
23.3	53.26	32.61	17.50	1.5	15.0
25.0	53.26	32.61	17.50	1.5	16.5
26.7	53.26	32.61	17.50	1.5	18.0
28.3	53.26	32.61	17.50	1.5	19.5
30.0	53.26	32.61	17.50	1.5	21.0
31.7	53.26	32.61	17.50	1.5	22.5
33.3	53.26	32.61	17.50	1.5	24.1
35.0	53.26	32.61	17.50	1.5	25.6
36.7	47.35	28.99	17.50	1.1	26.7
38.3	41.43	25.36	17.50	0.8	27.5
40.0	35.51	21.74	17.50	0.4	27.9
41.7	29.59	18.12	17.50	0.1	***28.0***
43.3	23.67	14.49	17.50	-0.3	27.7
45.0	17.75	10.87	17.50	-0.7	27.0
46.7	11.84	7.25	17.50	-1.0	26.0
48.3	5.92	3.62	17.50	-1.4	24.6
50.0	0.00	0.00	17.50	-1.8	22.9

Variable Storm Duration Storage Requirements

Duration	*Max Storage*	*Duration*	*Max Storage*	*Duration*	*Max Storage*
25 Min	15.2 m3	50 Min	**28.0 m3**	80 Min	22.9 m3
30 Min	20.2 m3	60 Min	27.7 m3	90 Min	6.4 m3
40 Min	25.9 m3	70 Min	25.9 m3	100 Min	4.5 m3



STORM SEWER DESIGN SHEET

PROJECT: BICE CREEK APARTMENTS, NIAGARA-ON-THE-LAKE

LOCATION						TIME OF FLOW		STORMWATER ANALYSIS				
DESCRIPTION	**FROM M.H.**	**TO M.H.**	**PIPE LENGTH (m)**	**INCREMENT AREA (hectares)**	**TOTAL AREA (hectares)**	**TO UPPER END (min)**	**IN SECTION (min)**	**RUNOFF COEFF**	**SECTION A X R**	**ACCUMLD A x R**	**RAINFALL INTENSITY (mm/hr)**	**PEAK FLOW (L/s)**
EXISTING SEWER DESIGN CONDITIONS												
B6a - TO FMCR SEWER	SITE	SEWER		0.07	0.07	10.00	0.00	0.200	0.014	0.014	144.260	5.6
B7a - DIRECT TO WAGNER DRAIN	SITE	DRAIN		0.31	0.31	10.00	0.00	0.200	0.062	0.062	144.260	24.8
												30.5
				Available Capacity in Four Mile Creek Storm Sewer (Per Sewer Calculations) during 5 Yr Event + 15%								**20.1**
EXISTING CONDITIONS												
EX	SITE	SEWER		0.38	0.38	10.00	0.00	0.310	0.118	0.118	144.260	47.2
FUTURE CONDITIONS												
A10 - Uncontrolled	SITE	SEWER		0.38	0.38	10.00	0.00	0.580	0.220	0.220	144.260	88.3
ALLOWABLE PEAK OUTFLOW (To Sewer)												20.1
PROVIDED OUTFLOW												**20.1**

DESIGN BY: **UPPER CANADA CONSULTANTS**
30 HANNOVER DRIVE, UNIT 3
ST. CATHARINES, ON L2W 1A3
DESIGN BY: **J.SCHOOLEY, P.ENG.**
DATE: **JUNE 2025**

RAINFALL PARAMETERS:
Time to Upper End = 10 min.
Town of Niagara-on-the-Lake - 100 Year IDI

a = 980.00 mm/hr
b = 3.70 minutes
c = 0.73

Modified Rational Method (MRM) Required Storage Volume

Project:	BICE CREEK APARTMENTS
Project No:	22150
Date:	JUNE 2025
Design By:	K.Tiessen, P.Eng.
Description:	STORMWATER MANAGEMENT PLAN

Storm Event: **Town of Niagara-on-the-Lake - 100 Year IDF Curve**

a =	980.00	mm/hr
b =	3.70	minutes
c =	0.73	

Critical Storm Duration:	70.00 minutes	Tail Multiplier (x1-11.5
Tc From Design:	10.00 minutes	
Storm Tail Time:	55.00 minutes	
Accumulated Area x R (Ha):	0.220	<-- Area x Runoff Coefficient (Sewer Design Sheet)
Peak Rainfall Intensity:	67.46 mm/hr	
Peak Inflow at Tc:	41.30 L/s	
Maximum Release Rate:	20.13	<-- Outlet Full Flow Capacity (Design Sheet)
Time When Outlet Exceeded:	4.87	

Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Interval Volume (m3)	Total Required Volume (m3)
0.0	0.00	0.00	20.13	-1.2	0.0
2.3	15.74	9.64	20.13	-1.5	0.0
4.7	31.48	19.27	20.13	-0.1	0.0
7.0	47.22	28.91	20.13	1.2	1.2
9.3	62.96	38.54	20.13	2.6	3.8
11.7	67.46	41.30	20.13	3.0	6.8
14.0	67.46	41.30	20.13	3.0	9.7
16.3	67.46	41.30	20.13	3.0	12.7
18.7	67.46	41.30	20.13	3.0	15.7
21.0	67.46	41.30	20.13	3.0	18.6
23.3	67.46	41.30	20.13	3.0	21.6
25.7	67.46	41.30	20.13	3.0	24.6
28.0	67.46	41.30	20.13	3.0	27.5
30.3	67.46	41.30	20.13	3.0	30.5
32.7	67.46	41.30	20.13	3.0	33.5
35.0	67.46	41.30	20.13	3.0	36.4
37.3	67.46	41.30	20.13	3.0	39.4
39.7	67.46	41.30	20.13	3.0	42.3
42.0	67.46	41.30	20.13	3.0	45.3
44.3	67.46	41.30	20.13	3.0	48.3
46.7	67.46	41.30	20.13	3.0	51.2
49.0	67.46	41.30	20.13	3.0	54.2
51.3	67.46	41.30	20.13	3.0	57.2
53.7	67.46	41.30	20.13	3.0	60.1
56.0	62.96	38.54	20.13	2.6	62.7
58.3	52.47	32.12	20.13	1.7	64.4
60.7	41.97	25.70	20.13	0.8	***65.2***
63.0	31.48	19.27	20.13	-0.1	65.0
65.3	20.99	12.85	20.13	-1.0	64.0
67.7	10.49	6.42	20.13	-1.9	62.1
70.0	0.00	0.00	20.13	-2.8	59.3

Variable Storm Duration Storage Requirements

Duration	*Max Storage*	*Duration*	*Max Storage*	*Duration*	*Max Storage*
25 Min	32.3 m3	50 Min	61.4 m3	80 Min	64.2 m3
30 Min	42.0 m3	60 Min	64.5 m3	90 Min	20.8 m3
40 Min	54.4 m3	70 Min	**65.2 m3**	100 Min	17.8 m3