FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT DESIGN BRIEF

8-UNIT RESIDENTIAL DEVELOPMENT
3090 MONTROSE ROAD, NIAGARA FALLS

PREPARED BY:

URBAN & ENVIRONMENTAL MANAGEMENT INC.
PROFESSIONAL CONSULTING SERVICES

UEM Project No. 21-219

June 12, 2023

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1.0 INTRODUCTION

The proposal for the property is an 8-unit residential development consisting of 6 townhouse units (one 6-unit block) and a semi-detached dwelling (2-units) located on a 0.282 ha parcel of land. The proposed development is shown in Appendix A. The proposed development is located at 3090 Montrose Road on the east side of the road between Kalar Road and Thorold Stone Road and borders the Queen Elizabeth Way (QEW). There is currently a single-family residence on the property. The proposed development includes removing the existing single-family home to construct the 8 residential units. The existing property has a gravel driveway that adjoins Montrose Road at the west side of the property and runs along the south side of the property to the existing residence. An existing watermain and sanitary sewer are available on Montrose Road. The existing storm sewer along Montrose Road ends approximately 56 m south of the subject site. Therefore, the existing storm sewer is being proposed to be extended to the front of the site to accommodate a stormwater outlet for the proposed development. This Functional Servicing and Stormwater Management (SWM) Brief will evaluate the serviceability of the site with respect to sanitary, water and storm services as well as provide a preliminary SWM strategy to be implemented. This brief will also satisfy the zoning bylaw amendment (ZBA) requirements for the proposed residential development. The following standards and guidelines were reviewed in preparing this brief:

- The City of Niagara Falls Engineering Design Guidelines Manual
- Ontario Provincial Standards (OPS),
- Ministry of Environment, Conservation and Parks (MECP)
    - Niagara Region Stormwater Management Guidelines (2022)
    - Stormwater Management Planning and Design Manual (2003)
    - Design Guidelines for Sewage Works (2008)
    - Design Guidelines for Drinking-Water Systems (2008)
- Niagara Peninsula Conservation Authority (NPCA) Stormwater Management Guidelines (2010)
- Fire Underwriters Survey Guide (1999)

2.0 WATER DISTRIBUTION SYSTEM

The City of Niagara Falls has an existing 300mm PVC watermain (constructed in 1986) located along the east side of Montrose Road in the boulevard.

The proposed private water distribution system will consist of a 200mm diameter PVC DR18 pipe that will connect to the existing 300mm PVC watermain on Montrose Road and enter the development road on the north side. The 200mm diameter watermain will service the 8 residential units. A private fire hydrant will be located within the site to provide the 90m coverage distance to each residential unit's principal entrance. Each residential unit will have its own 20mm diameter type "k" soft copper water service with a 20mm curb stop located at the property line or approved equivalent location. All pipe material and associated appurtenances will meet the current American Water Works Association (AWWA) specifications and Ontario Provincial Standards (OPS).

The proposed water distribution system will be designed using municipal guidelines and the MECP Design Guidelines for Drinking-Water Systems (2008). The distribution system will be designed to provide maximum day demand plus fire flow. The peak hour flow and maximum day flow were calculated based on the number of dwelling units and population. The required fire flow for the proposed residential development was calculated based on the Fire Underwriters Survey: Water Supply for Public Fire

Protection. Units 4, 5 and 6 of the townhouse block were considered when determining the fire flow requirements. Various scenarios were analyzed to determine the greatest required fire flow for the site. It was determined that units 4, 5 and 6 had the greatest number of exterior fire exposures resulting from unit 4 to the north, the semi-detached dwelling to the west, and the existing single-family home on the adjacent property to the south. This scenario produced the greatest required fire flow and therefore was used to determine the required fire flow demands for the site. Fire flows considered that the exterior building envelopes for the townhouses will be constructed of brick or non-combustible material (ordinary construction). As noted, the total required flow for the proposed site will be the maximum day flow plus the fire flow. The total required flow for this site will be approximately 6094 L/min (see Appendix B for detailed calculations). Table 2-1 summarizes the required water demands. Therefore, based on the size of the 300mm diameter watermain along Montrose Road and UEM's experience on similar projects, UEM believes sufficient flow and pressure will be available to support the proposed residential development. If required, the watermain pressure and capacity can be further reviewed following approval of the zoning by-law (ZBA) application and prior to or during building permit stage (i.e. hydrant pressure testing).

Table 2-1: Total Water Demand

Land Use	Population	Average Daily Demand (450 L/c/day)	Peaking Factors		Peak Hour	Max. Day	Fire Flow	Total Required Fire Flow
			Max. Day	Peak Hour				
Residential	18 (6 units x 4 people/unit)	0.17 L/s, 10.2 L/min	9.4	14.2	2.36 L/s, 141.6 L/min	1.57 L/s, 94.2 L/min	6000 L/min	6094.2 L/min

3.0 SANITARY SEWAGE SYSTEM

The City of Niagara Falls has an existing 200mm diameter sanitary sewer that runs along the west side of Montrose Road in the boulevard. This sewer will be used to service the 8 residential units within the proposed development.

The proposed sanitary sewer service for the 8 residential units will consist of a 200mm diameter PVC DR35 pipe conforming to CSA B182.2 and CSA B182.1. The sanitary sewer will connect to the existing 200mm diameter sanitary sewer on Montrose Road. It is estimated that the development will generate an additional 0.57 L/s to the 200mm diameter Montrose Road sanitary sewer (see Appendix C). All sanitary service laterals will be 100mm in diameter DR28 pipe in accordance with the City of Niagara Falls Engineering Design Guidelines Manual. The City of Niagara Falls provided construction drawings for the surrounding areas of the subject site. The 200mm diameter sanitary sewer fronting the subject site has a pipe slope of 0.5% and a maximum pipe capacity of 23.19 L/s as per drawing CC-5221. Based on the proposed developments sanitary sewage generation, it is estimated that the proposed development will contribute approximately 2.46% to the overall capacity of the sanitary sewer.

4.0 STORMWATER DRAINAGE

The existing site consists of a single-family residence with no underground storm sewer system. The existing storm flows from the site are split into two areas. The western portion currently drains overland towards the roadside ditches on Montrose Road. The eastern portion currently drains overland towards the MTO QEW corridor (see Pre-Development Drainage Area Plan in Appendix D). There is an existing 375mm diameter storm sewer that terminates approximately 56m south of the subject site. Therefore, the existing 375mm diameter storm sewer will need to be extended approximately 56m north to the subject site to provide a storm outlet.

The storm sewer within the development will connect to the proposed future storm sewer extension along Montrose Road. The proposed storm sewer will consist of manholes, rear yard catchbasins (RYCB), and swales to collect stormwater from the proposed 8-unit residential development. The grading of the townhouse units will utilize split drainage. The fronts of the 6-unit townhouse block will drain onto the development roadway and stormwater will be collected by catchbasins. It is proposed to drain the rear yards of the 6 townhouse units overland towards the MTO QEW corridor as per the pre-development drainage condition. It is proposed to drain the fronts of the semi-detached (2-unit block) towards Montrose Road as per the pre-development drainage condition (see Post-Development Drainage Area Plan in Appendix D).

5.0 STORMWATER MANAGEMENT

Pre-development and post-development drainage area plans were created to determine whether the proposed development would increase the existing stormwater runoff from the site. The pre-development and post-development drainage area plans are included in Appendix D. The runoff and storage calculations provided in Appendix D, indicates that the proposed development will generate an increase in stormwater runoff towards Montrose Road for Area 1. The proposed development does not result in an increase in stormwater runoff for Areas 2 and 3. Therefore, stormwater management is only proposed for Area 1. The pre-development drainage area plan indicates an average runoff coefficient of 0.511 and an area of 0.117 ha for Area 1. The post-development drainage area plan indicates an average runoff coefficient of 0.788 and an area of 0.170 ha for Area 1. Due to the increase in the hard surface area between pre-development and post-development conditions for Area 1, the following provides a proposed approach to stormwater quantity and quality control.

Preliminary stormwater calculations were performed using the Modified Rational Method (MRM) as the subject site is less than 1 hectare in area. The Niagara Region Stormwater Management Guidelines approves the use of the MRM to size volumetric controls for sites up to 1 hectare in drainage area. As noted, the average runoff coefficient for the pre-development and post-development conditions has increased from 0.511 to 0.788 respectively for Area 1.

The preliminary MRM calculations indicate that approximately 25 m^3 of storage will be required to detain the post-development 5-year storm (minor drainage system) to the 5-year pre-development flow rate which will be subject to more detailed design of the outlet control structure (see Appendix D) following approval of the ZBA application and prior to or during the building permit stage. The required storage can be provided using oversized pipes and surface storage within the development roadway, if required. Flows will be restricted to the 5-year predevelopment rates using a flow control structure with an orifice plate. The size of the orifice plate will be determined during more detailed design following approval of the ZBA

application and prior to or during the building permit stage. Major storm event runoff will be directed towards Montrose Road via the development roadway.

To address quality control, an oil-grit separator (OGS) will be included in the SWM plan. The OGS will be sized for normal protection as per the Region's comments in the pre-consultation meeting minutes of September 15th, 2022, with a minimum of 70% total suspended solids (TSS) removal. OGS calculations and sizing will be included at the more detailed design stage following approval of the ZBA application and prior to or during the building permit stage.

6.0 CONCLUSIONS

In conclusion, the proposed 8-unit residential development is serviceable utilizing existing municipal sanitary, storm and regional watermain infrastructure on Montrose Road subject to the following:

1. Extending the existing 375mm diameter storm sewer on Montrose Road approximately 56m north to the front of the proposed development to provide a stormwater outlet.
2. Controlling stormwater on-site for 25 m^3 of storage through oversize pipes, surface storage and an outlet control structure (i.e. orifice plate).
3. Installing an Oil-Grit Separator (OGS) within the development roadway to meet the required stormwater quality to a normal protection level.

Respectfully Submitted,
Urban & Environmental Management Inc.

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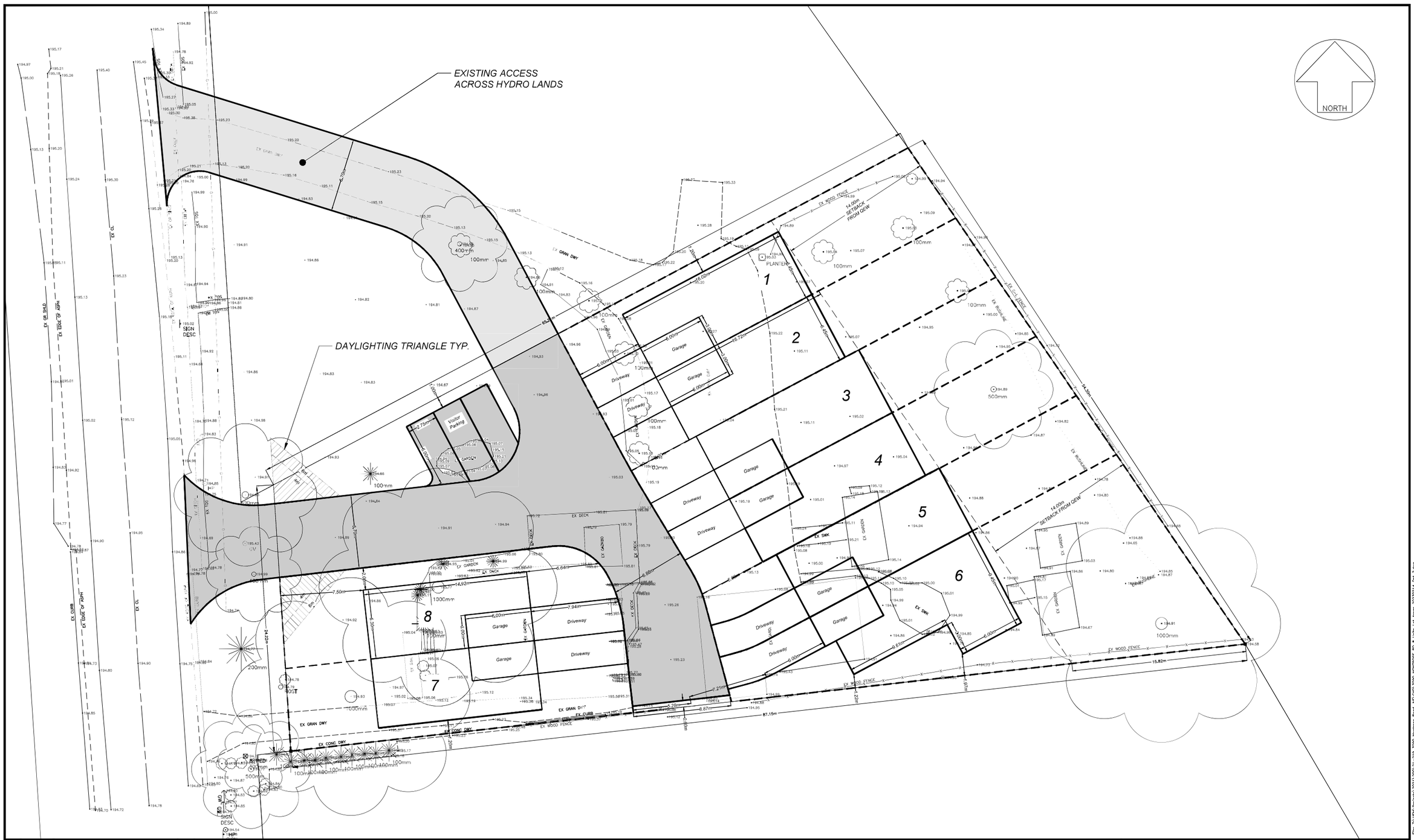
APPENDIX A

Conceptual Site Plan



PROJ. NO. 21-219

No.	DATE	REVISION	BY	O
1	JUNE 6/23	FOR ZONING BYLAW AMENDMENT	JS	JS

NOTES
1. The position of pole lines, conduits, watermains, sewers, and other underground and above ground utilities and structures is not necessarily shown on the contract drawings, and, where shown the accuracy of the position of such utilities and structures is not guaranteed. Before starting work, the contractor shall identify the exact location of all such utilities and structures and shall assume liability for damage to them.
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3090 MONTROSE ROAD
SITE PLAN

URBAN & ENVIRONMENTAL MANAGEMENT INC.
PROFESSIONAL CONSULTING SERVICES

UEM No. 21-219
SCALE HORZ 1 : 150
DWG. No. 01
MUN. REF No. 00-00

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APPENDIX B

WATER DEMAND CALCULATIONS

The fire flow demand for the proposed 8-unit residential development was calculated based on ordinary construction[1], using the equation in the *Fire Underwriters Survey Guide* and the stated assumptions as follows:

Townhome Units: 3-unit block

A two-hour rated firewall is assumed to be constructed between townhouse unit #3 and townhouse unit #4. The three-unit townhome block at the south end of the site (units #4-#6) was used for these calculations. It is assumed that the proposed townhomes will consist of a second storey.

3-Unit Block Ground Floor Area (GFA) = 337.66 m^2 (based on site plan dimensions)

1. $\mathrm{F} = 220\mathrm{C}\sqrt{\mathrm{A}}$

Where,
F = The required fire flow in litres per minute

C = Coefficient related to the type of construction
1.0 for ordinary construction (assuming the exterior building envelopes for the townhouses will be constructed of brick or non-combustible material)

A = The total area in square metres (based on a 2 storey 3-unit townhome block)

$\mathrm{A} = 675.32\ \mathrm{m}^2$

$F = 220\ x\ 1.0\sqrt{675.32}$
$\mathbf{F = 5717.12\ L/min}$
Rounded off to the nearest 1000 L/min,
$\mathbf{F = 6000\ L/min}$

2. Assuming limited combustible fire contents hazard – 15% reduction

$F = 6000\ \mathrm{L/min}\ \times 0.15 = -900\ \mathrm{L/min}$
$F = 6000\ \mathrm{L/min} - 900\ \mathrm{L/min} = \mathbf{5100\ L/min}$

3. Assuming no sprinkler system – 0% reduction

[1] Ordinary construction: Brick or other masonry walls, combustible floors and interior

4. A percentage should be added for structures exposed within 45m by the fire area under consideration:

Exposed Structures	**Separation**	**Charge**	**Adjustment**
North adjacent townhome	0 m	10%	10%
West townhome block	19.6 m	15%	15%
Total Adjustment			**25%**

Therefore, the total adjustment applied in **25%**

$5100\ \mathrm{L/min} \times 0.25 = \mathbf{1275\ L/min}$
$5100\ \mathrm{L/min} + 1275\ \mathrm{L/min} = \mathbf{6375\ L/min}$

Rounded off to the nearest 1000 L/min,
$\mathbf{F = 6000\ L/min}$

Water Demand Calculations - 3090 Montrose Road, Niagara Falls

The MOECC Design Guidelines for Drinking-Water Systems 2008 was used for the following calculations

Site Information

6 Townhouse Units and a semi-detached (2-units) = 8 units
Using 4 people/dwelling unit

P = 8 x 4 = 32/1000 = 0.032
q = 450 L/per/day
PHF = 14.2 (Table 3-3; interpolation)
MDF = 9.4 (Table 3-3; interpolation)

$$Q\,(d) = \frac{P \times q \times M}{86.4}$$

Q (d) = Peak domestic flow (including extraneous flows) in L/s
P = Design population, in thousands
q = Average daily per capita domestic flow in L/cap·d (exclusive of extraneous flow)
I = Unit of peak extraneous flow, in L/(ha·s)
A = Gross tributary area in hectares

$$Q\,(d) = \frac{P \times q \times PHF}{86.4}$$

$$Q\,(d) = \frac{0.032 \times 450 \times 14.2}{86.4}$$

$$Q\,(d) = 2.36\ L/s \quad (peak\ hour\ flow)$$

$$Q\,(d) = \frac{P \times q \times MDF}{86.4}$$

$$Q\,(d) = \frac{0.032 \times 450 \times 9.4}{86.4}$$

$$Q\,(d) = 1.57\ L/s \quad (maximum\ day\ flow)$$

Table 3-3: Peaking Factors for Drinking-Water Systems Serving Fewer than 500 People

DWELLING UNITS SERVICED	EQUIVALENT POPULATION	NIGHT MINIMUM HOUR FACTOR	MAXIMUM DAY FACTOR	PEAK HOUR FACTOR
10	30	0.1	9.5	14.3
50	150	0.1	4.9	7.4
100	300	0.2	3.6	5.4
150	450	0.3	3.0	4.5
167	500	0.4	2.9	4.3

APPENDIX C

SANITARY SEWAGE CALCULATIONS

Sewage Generation Calculations - 3090 Montrose Road, Niagara Falls

The MOECC Design Guidelines for Sewage Works 2008 and the City of Niagara Falls Engineering Design Guidelines Manual were used for the following calculations.

Site Information

Townhouse Units = 6 units
Semi-Detached Units = 2 units
Using 4 people/dwelling unit

P = 8 x 4 = 32/1000 = 0.032
q = 380 L/per/day
I = 0.28 L/ha·s
A = 0.224 ha
4 per/unit, 8 units, p = 32, q = 380 L/per/day
M = 3.59

$$Q\,(d) = \frac{P \times q \times M}{86.4} + IA$$

$$Q\,(d) = \frac{0.032 \times 380 \times 3.59}{86.4} + (0.28 \times 0.224)$$

$$Q\,(d) = 0.57\ L/s$$

$$Q\,(d) = \frac{P \times q \times M}{86.4} + IA$$

$$M = \frac{1+14}{4+P^{0.5}}$$

$$M = \frac{1+14}{4+0.032^{0.5}}$$

$$M = 3.59$$

P = Design population, in thousands
q = Average daily per capita domestic flow in L/cap·d (exclusive of extraneous flow)
I = Unit of peak extraneous flow, in L/(ha·s)
A = Gross tributary area in hectares
M = Harmon Peaking factor

APPENDIX D

STORMWATER CALCULATIONS

PROJ. NO. 21-219

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3090 MONTROSE ROAD PRE-DEVELOPMENT DRAINAGE AREA PLAN

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UEM No. 21–219
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MUN. REF No. 00-00

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CATCHMENT AREA

AREA (HECTARES)

WEIGHTED RUNOFF COEFFICIENT

NORTH

QUEEN ELIZABETH WAY (QEW)

MONTROSE ROAD

DRIVEWAY BY OTHERS

PRELIMINARY CONCEPTUAL STORM SEWER LAYOUT

PROPOSED FUTURE 56m STORM SEWER EXTENSION

AREA 1

0.788 | 0.169

AREA 2

0.396 | 0.101

AREA 3

0.250 | 0.012

PROJ. NO. 21-219

No.	DATE	REVISION	BY	O
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3090 MONTROSE ROAD POST-DEVELOPMENT DRAINAGE AREA PLAN

URBAN & ENVIRONMENTAL MANAGEMENT INC.
PROFESSIONAL CONSULTING SERVICES

UEM No.	21-219
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DWG. No.	01
MUN. REF No.	00-00

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STORMWATER RUNOFF CALCULATIONS

Urban & Environmental Mangement Inc.

IDF CURVES

RATIONAL METHOD

UEM PROJECT NO: 21-219

PROJECT: 6-Unit Townhouse and a semi-detached (2-units)= 8 units Development, 3090 Montrose Road, Niagara Falls

DESIGNED BY: JS

CHECKED BY: MM

$i = a / (t_c + b)^c$

Where: i = rainfall intensity (mm/hr); t_c = time of concentration (min)

Coefficients:	5-year	100-year
a =	719.5	1264.57
b =	6.34	7.72
c =	0.7687	0.7814

$Q = 2.78AiR$

Where: Q = Flow (L/s); A = Area (ha); R = Runoff Coefficient

Storage = $Q_{post} \times T_d - Q_{pre} (T_d + T_c) / 2$

Description	Area (ha)	R	A * R	TC (min)	i (mm/hr)	Q (L/S)
5-YEAR PRE-DEVELOPMENT PEAK FLOW						
AREA 1						
Building	0.025	0.95	0.024	10.000	84.02	5.5
Concrete	0.001	0.95	0.001	10.000	84.02	0.2
Gravel	0.026	0.8	0.021	10.000	84.02	4.9
Grass	0.066	0.25	0.017	10.000	84.02	3.9
Total	**0.118**		**0.062**			**14.5**
Weighted Runoff Coefficient	**0.525**					
AREA 2						
Building	0.017	0.95	0.016	10.000	84.02	3.8
Concrete	0.004	0.95	0.004	10.000	84.02	0.9
Gravel	0.028	0.8	0.022	10.000	84.02	5.2
Grass	0.116	0.25	0.029	10.000	84.02	6.8
Total	**0.165**		**0.071**			**16.7**
Weighted Runoff Coefficient	**0.432**					
100-YEAR PRE-DEVELOPMENT PEAK FLOW						
AREA 1						
Building	0.025	0.95	0.024	10.000	133.78	8.8
Concrete	0.001	0.95	0.001	10.000	133.78	0.3
Gravel	0.026	0.8	0.021	10.000	133.78	7.7
Grass	0.066	0.25	0.017	10.000	133.78	6.1
Total	**0.118**		**0.062**			**23.0**
Weighted Runoff Coefficient	**0.525**					
AREA 2						
Building	0.017	0.95	0.016	10.000	133.78	6.0
Concrete	0.004	0.95	0.004	10.000	133.78	1.4
Gravel	0.028	0.8	0.022	10.000	133.78	8.3
Grass	0.116	0.25	0.029	10.000	133.78	10.8
Total	**0.165**		**0.071**			**26.5**
Weighted Runoff Coefficient	**0.432**					
5-YEAR POST-DEVELOPMENT PEAK FLOW						
AREA 1						
Building	0.063	0.95	0.060	10.000	84.02	14.0
Asphalt/Concrete	0.067	0.95	0.064	10.000	84.02	14.9
Grass	0.039	0.25	0.010	10.000	84.02	2.3
Total	**0.169**		**0.133**			**31.1**
Weighted Runoff Coefficient	**0.788**					
AREA 2						
Building	0.021	0.95	0.020	10.000	84.02	4.7
Grass	0.080	0.25	0.020	10.000	84.02	4.7
Total	**0.101**		**0.040**			**9.3**
Weighted Runoff Coefficient	**0.396**					
AREA 3						
Grass	0.012	0.25	0.003	10.000	84.02	0.7
Total	**0.012**		**0.003**			**0.7**
Weighted Runoff Coefficient	**0.250**					
100-YEAR POST-DEVELOPMENT PEAK FLOW						
AREA 1						
Building	0.063	0.95	0.060	10.000	133.78	22.3
Asphalt/Concrete	0.067	0.95	0.064	10.000	133.78	23.7
Grass	0.039	0.25	0.010	10.000	133.78	3.6
Total	**0.169**		**0.133**			**49.6**
Weighted Runoff Coefficient	**0.788**					
AREA 2						
Building	0.021	0.95	0.020	10.000	133.78	7.4
Grass	0.080	0.25	0.020	10.000	133.78	7.4
Total	**0.101**		**0.040**			**14.9**
Weighted Runoff Coefficient	**0.396**					
AREA 3						
Grass	0.012	0.25	0.003	10.000	133.78	1.1
Total	**0.012**		**0.003**			**1.1**
Weighted Runoff Coefficient	**0.250**					

Area 1: Storage Volume Determination (5-Year Storm)

0.0145	10	84.02	600	0.039	15.0
	15	68.44	900	0.032	18.1
	20	58.21	1200	0.027	19.8
	25	50.93	1500	0.024	20.7
	30	45.45	1800	0.021	21.1
	35	41.16	2100	0.019	21.1
	40	37.71	2400	0.018	20.8
	45	34.85	2700	0.016	20.3
	50	32.45	3000	0.015	19.7
	55	30.39	3300	0.014	18.9
	60	28.62	3600	0.013	18.0
	65	27.06	3900	0.013	17.1
	70	25.69	4200	0.012	16.0
	75	24.47	4500	0.011	14.9
	80	23.37	4800	0.011	13.7
	85	22.38	5100	0.011	12.4
Total Required Storage Volume (m^3)					**21.1**