UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

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UCC File: 24090

PRELIMINARY FUNCTIONAL SERVICING REPORT

825 GARRISON ROAD TOWN OF FORT ERIE October 2025

INTRODUCTION

The purpose of this Preliminary Functional Servicing Report (FSR) is to address the municipal servicing requirements for the proposed residential apartment building located at 825 Garrison Road in the Town of Fort Erie. The site is currently zoned as R1 residential under the Town of Fort Erie Zoning Bylaw, which permits single detached residential dwelling types.

Under proposed conditions, the developable area is approximately 0.96 hectares and would permit a 6 storey apartment building with a total of 100 units. The subject lands will be developed to include associated asphalt parking lot, concrete curb, concrete sidewalk, catch basins, storm servicing, sanitary servicing, and water servicing.

The objectives of this report are as follows:

1. Identify domestic and fire protection water servicing 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 300mm diameter watermain on Garrison Road. A single 150mm diameter private water service connected to the existing Municipal watermain is proposed to supply both domestic water and fire protection for the development in accordance with the Ontario Building Code (OBC). The size and location of the proposed water service will be determined as part of the detailed engineering design.

Under current zoning, the property would accommodate 35 persons per hectare for a total population of 33 persons. The population density will increase to 228 persons per hectare for a total of 218 persons under the proposed zoning.

The estimated peak domestic water demands are summarized in Table 1, comparing the existing permissible 33 persons condition to the proposed 218 persons. An average residential water demand of 270 L/capita/day has been assumed. Domestic peaking factors have been interpolated

from Table 3-3 of the MECP Design Guidelines for Drinking Water Systems. All peak demand estimates will be confirmed during the detailed engineering design stage.

Table 1. Estimated Peak Water Demand		
Estimated Peak Domestic Water Demand	**Existing**	**Future**
Average Domestic Demand *270 L/cap/day*	**0.10 L/s**	**0.68 L/s**
Maximum Day Domestic Peaking Factor	9.5	4.3
Maximum Day Domestic Demand	**0.95 L/s**	**2.92 L/s**
Peak Hour Domestic Peaking Factor	14.3	6.5
Peak Hour Domestic Demand	**1.43 L/s**	**4.42 L/s**

There is an existing fire hydrant on the south side of Garrison Road directly fronting the site however, additional private hydrants can be provided within the development site to provide fire protection for the proposed dwellings. The spacing and location of any private fire hydrants if required will be provided in accordance with the Town of Fort Erie design standards and Ontario Building Code requirements as part of the detailed engineering design.

Therefore, there is expected to be adequate capacity to provide domestic water supply and fire protection within the subject lands and adjacent development lands.

SANITARY SERVICING

There is an existing 250mm diameter sanitary sewer flowing westerly on Garrison Road, in front of the subject site. Under the current zoning, peak sanitary flow from the subject lands at the 33 person population density is 0.70 L/s. The proposed development comprises will consist of 218 persons, with an estimated peak sanitary flow of 2.94 L/s.

The existing 250mm diameter municipal sanitary sewer on Garrison Road has a capacity of 29.10 L/s. Under the current zoning, the subject lands would occupy approximately 2.4% of this capacity. As proposed, the subject lands occupy approximately 10.1% of this capacity. Therefore, there is expected to be adequate capacity within the downstream sanitary system for the subject lands. All sanitary sewer calculations can be found in Appendix A for reference.

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STORMWATER MANAGEMENT

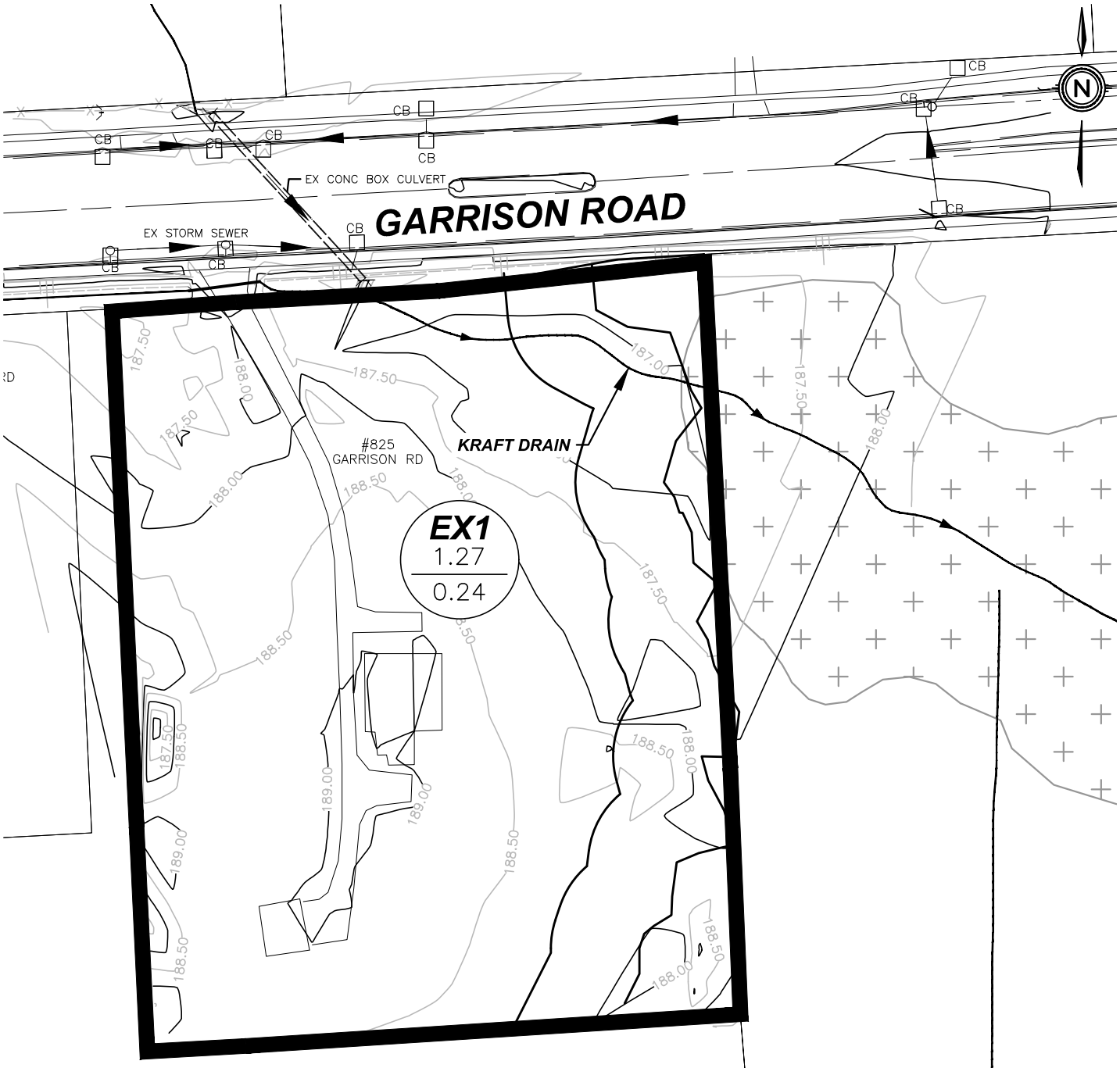
UCC has assessed the existing stormwater drainage patterns within the site and the existing storm drainage areas for the site are illustrated in Figure 1. Drainage Area EX1 consists of a entire site area of 1.44 hectares and overall runoff coefficient of 0.24 based on the existing land use. Existing flows from this area are conveyed as overland sheet flows to the Kraft Drain, which flows through the north-eastern corner of the subject lands in a southerly direction.

Figure 2 shows the future Storm Drainage Areas for the subject site. Drainage Area A1 represents the area where future stormwater flows will captured in the proposed internal storm sewer system and consists of an area of 0.88 hectares with an overall runoff coefficient of 0.76. Drainage Area A2 consists of an area of 0.57 hectares with an overall runoff coefficient of 0.20 and represents the area that will continue to convey existing stormwater flows uncontrolled to the Kraft Drain.

Weighted Runoff Coefficient calculations for existing and future conditions have been provided in Appendix C for Reference

Stormwater Quantity Assessment

To assess the required stormwater management quantity controls for the subject lands, Modified Rational Method (MRM) calculations have been prepared for the subject lands to identify existing and future peak stormwater flows discharging from the subject lands under the 5 and 100 year design storm events. The MRM calculations can be found in Appendix D and E for the 5 and 100 year design storm events respectively.



LEGEND

A0 / 0.00 / 0.00	DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / RUN-OFF COEFFICIENT
▬	DRAINAGE AREA BOUNDARY

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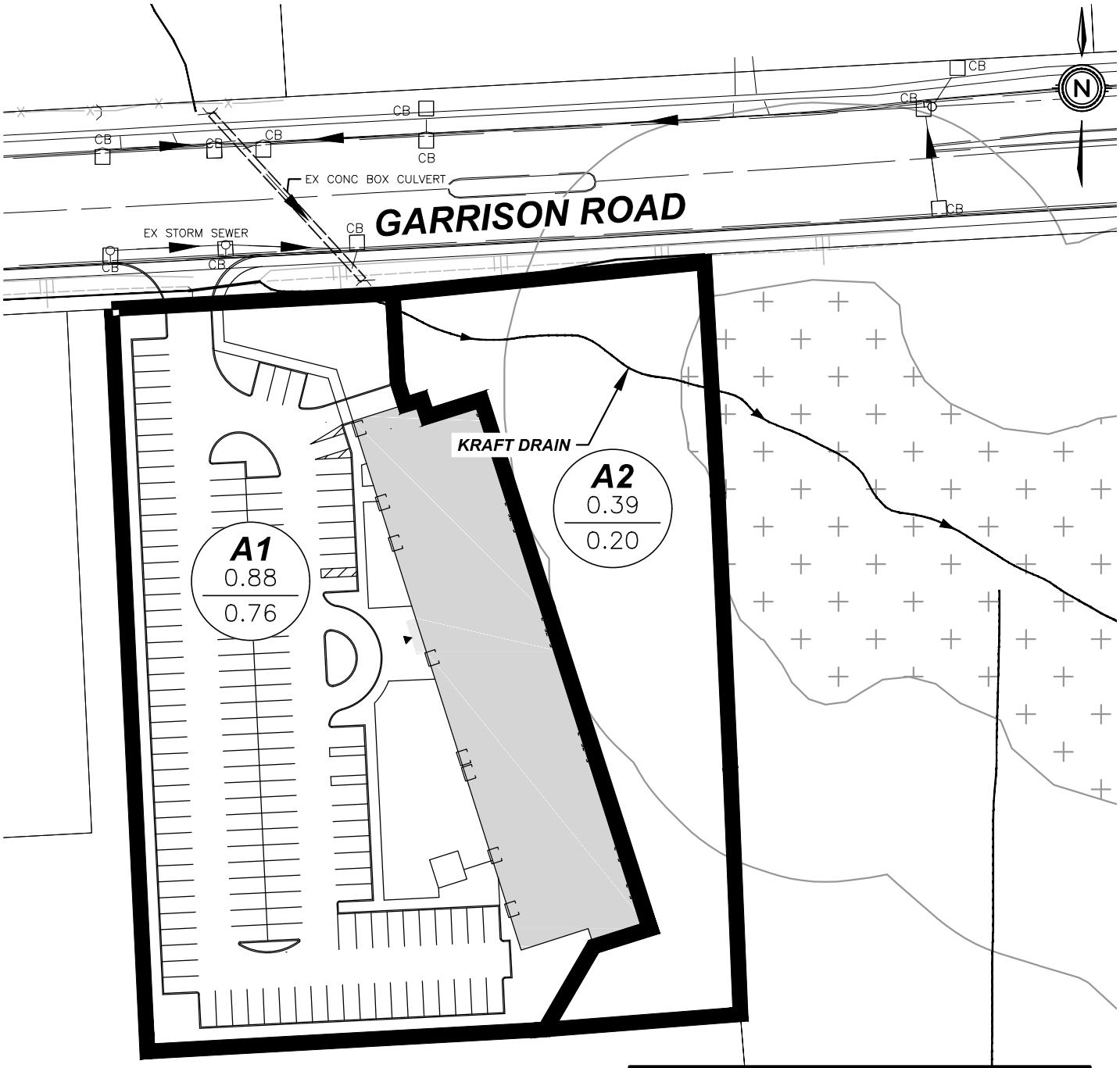
825 GARRISON ROAD
TOWN OF FORT ERIE
EX STORM DRAINAGE AREAS

DATE	2025-10-03
SCALE	1:1000 m
REF No.	24090
DWG No.	FIGURE 1



LEGEND

A0 / 0.00 / 0.00	DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / RUN-OFF COEFFICIENT
▬	DRAINAGE AREA BOUNDARY

UPPER CANADA CONSULTANTS
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825 GARRISON ROAD
TOWN OF FORT ERIE
FUT STORM DRAINAGE AREAS

DATE	2025-10-03
SCALE	1:1000 m
REF No.	24090
DWG No.	FIGURE 2

5 Year Design Storm

Under existing conditions, the existing peak 5 year flow from Drainage Area EX1 to the Kraft Drain is 72.5 L/s.

Under future conditions, it is proposed to convey future stormwater flows from Drainage Area A1 to the Kraft Drain via a new storm sewer outlet. The future peak 5 year flow from Drainage Area A1 is 159.2 L/s, which exceeds existing conditions and therefore stormwater management quantity controls will be required. Additionally, Drainage Area A2 has a peak 5 year flow of 18.6 L/s uncontrolled, therefore the allowable rate for the 5 year design storm event is 54.0 L/s (72.5 L/s – 18.6 L/s).

As shown in the 5 year MRM calculations provided in Appendix D, approximately 80.0 m^3 of on-site stormwater storage is required to reduce future peak stormwater flows to the allowable 54.0 L/s rate. It is proposed to provide this storage via oversized underground storm sewer storage. Preliminary calculations determine this volume can be provided by 180 m of 750mm diameter pipe.

To reduce the rate of flow discharging from the subject lands to the Kraft Drain, a control orifice will be installed immediately upstream of the site's outlet to Garrison Road. The exact size and location of the control orifice and storm sewer storage will be determined as part of the Detailed Engineering Design.

100 Year Design Storm

As shown in the 100 year MRM calculations provided in Appendix E**,** existing peak flows from Drainage Area EX1 discharge at 116.3 L/s to the Kraft Drain.

For the 100 year design storm event, it is proposed to maintain the same stormwater outlet as the 5 year event, where Drainage Area A1 will be controlled to the Kraft Drain, and Drainage Area A2 will discharge uncontrolled to the Kraft Drain. The future peak 100 year flow from Drainage Area A1 is 255.1 L/s, which exceeds existing conditions and therefore stormwater management quantity controls will be required. Additionally, Drainage Area A2 has a peak 100 year flow of 29.8 L/s uncontrolled, therefore the allowable rate for the 100 year design storm event is 86.5 L/s (116.3 L/s – 24.8 L/s).

As shown in the MRM calculations provided in Appendix E, approximately 134.7 m^3 of on-site stormwater storage is required to reduce future peak stormwater flows to the allowable 86.5 L/s rate. It is proposed to use additional storage within the 750mm diameter underground storm sewer storage up to approximately 82 m^3 and provide the remaining 53 m^3 as surface storage in the parking area. The surface storage will flow overland to the Kraft Drain. The configuration of the 100 year stormwater storage and outlet will be determined as part of the Detailed Engineering Design. Major overland flows will be directed to the Kraft Drain.

Stormwater Quality Assessment

Stormwater quality controls are required for the future stormwater flows discharging from Drainage Area A1. The Kraft Drain has been identified to contain Type 2 Fish Habitat, therefore in accordance with MECP Guidelines, future stormwater flows discharging to existing storm sewers are required to provide stormwater quality improvements to a minimum of Normal Levels (70% TSS Removal). However, as required by Town of Fort Erie staff, a minimum quality improvement of Enhanced (80% TSS removal) is required.

To improve stormwater quality levels for Drainage Area A1, a stormwater oil/grit separator (OGS) is proposed. The OGS will be located within a maintenance hole located at the site outlet to Garrison Road. The contributing drainage area from the proposed development and adjacent lands to the proposed oil/grit separator is 0.88 hectares with a weighted imperviousness of 80%. The Hydroworks modelling software has indicated that an HD8 will provide 84.9% TSS overall removal and capture 100% of the stormwater flows. Therefore, a Hydroworks HD8 is proposed for the site development. The modelling output file has been provided in Appendix F.

Future Drainage Area A2 will consist of solely clean stormwater flows generated from gassed areas. Therefore, stormwater quality controls are not considered necessary for this area.

MAINTENANCE OF STORMWATER MANAGEMENT FACILITY

HD8 Oil/Grit Separator

The function of the proposed stormwater quality protection facility, a stormwater oil/grit separator, will require maintenance on an annual basis. The following is a summary of the maintenance activities required.

Regular inspections of the stormwater Maintenance Hole (MH) oil/grit interceptor will indicate whether maintenance is required or not. They should be made after every significant storm during the first two years of operation to ensure that it is functioning properly. This will translate into an average of six inspections per year.

Points of regular inspections are as follows:

a) Is there sediment in the separator sump? The level of sediment can be measured from the surface without entry into the oil/grit separator via a dipstick tube equipped with a ball valve (Sludge Judge) or with a graduated pole with a flat plate attached to the bottom.

b) Is there oil in the separator sump? This can be checked from the surface by inserting a dipstick in the 150mm vent tube. The presence of oil is usually indicated by an oily sheen, frothing or unusual colouring. The separator should be cleaned in the event of a major spill contamination.

c) Is there debris or trash at the inlet weir and drop pipe? This can be observed from the surface without entry into the separator. Clogging at the inlet drop pipe will cause stormwater to bypass the sedimentation section and continue downstream without treatment.

d) Completion of the Inspection Report (a sample report is included in Appendix G for reference purposes). These reports will provide details about the operation and maintenance requirements for this type of stormwater quality device. After an evaluation period (usually 2 years) this information will be used to maximize efficiency and minimize the costs of operation and maintenance for the maintenance hole oil/grit separator.

Typically, stormwater MH oil/grit separators are cleaned out using vacuum pumping. No entry into the unit is required for maintenance. Cleaning should occur annually or whenever the accumulation reaches sediment storage specified by the manufacturer and after any major spills have occurred. Oil levels greater than 2.5 centimeters should be removed immediately by a licensed waste management firm.

Generally, the sediment removed from the separator will not be contaminated to the point that it would be classified as hazardous waste. However, the sediment should be tested to determine the disposal options. The Ministry of Environment, Conservation and Parks publishes sediment disposal guidelines which should be consulted for up-to-date information pertaining to the exact parameters and acceptable levels for the various disposal options. The preferred option is an off-site disposal, arranged by a licensed waste management firm.

The future owners of a Hydroworks facility are provided with an Owner's Manual upon installation, which explains the function, maintenance requirements and procedures for the facility with extensive use It is recommended to follow the manufacturers instructions to allow the oil/grit separator to perform as intended.

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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 300mm diameter municipal watermain is expected to have adequate capacity to provide both domestic and fire protection water supply for the subject lands.

2. The receiving 250mm diameter municipal sanitary sewer is expected to have adequate capacity to service the subject lands.

3. Stormwater management quantity controls for the 5 year storm event can be provided to existing conditions by internal storm sewer storage and a control orifice prior to outletting to the Kraft Drain.

4. Stormwater quantity controls for the 100 year storm event can be provided with a combination of internal storm sewer and parking lot surface storage.

5. Major overland flows will be directed to the Kraft Drain.

6. Stormwater quality controls can be provided to MECP Enhanced Levels with a Hydroworks HD8 oil/grit separator.

Based on the above and the accompanying calculations, there exists adequate municipal infrastructure 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.

Prepared By:

Taia Mussari, B.Eng.

Reviewed By:

Brendan Kapteyn, P.Eng.
October 20, 2025

Encl.

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APPENDICES

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APPENDIX A

Sanitary Sewer Calculations

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

DESIGN FLOWS

RESIDENTIAL:	255	LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INFILTRATION RATE:	0.286	LITRES/HECTARE (MECP EXTRANEOUS FLOW ALLOWANCE)
CURRENT POPULATION DENSITY	35.0	PERSONS HECTARE
POPULATION DENSITY:	228.0	PERSONS HECTARE

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 FORT ERIE
PROJECT : 825 GARRISON ROAD
PROJECT NO: 24090

S A N I T A R Y S E W E R D E S I G N S H E E T

LOCATION			AREA		POPULATION			ACCUMULATED PEAK FLOW				DESIGN FLOW					
Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	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)	Check Percent Full
												250mm Dia. Sanitary Sewer on Garrison Road					
CURRENT ZONING			0.96	0.96	1	33	33	4.35	0.43	0.27	0.70	**250**	**94.8**	**0.22**	**0.6**	**29.10**	**2.4%**
												250mm Dia. Sanitary Sewer on Garrison Road					
PROPOSED SITE			0.96	0.96	100	218	218	4.13	2.66	0.27	2.94	**250**	**94.8**	**0.22**	**0.6**	**29.10**	**10.1%**

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APPENDIX B

Weighted Percent Impervious Calculations

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	825 GARRISON ROAD, FORT ERIE
Project Number:	24090
Date:	OCT 2025
Person:	T. MUSSARI, B,ENG

EX - EXISTING CONDITIONS

	Footprint	*% Impervious*		*Effective Impervious Area*
EX1				
Existing Building, Parking Lot/Sidewalk	820.2 m^2	100%	ea	820.2 m^2
Landscape/Forested Lands	11905.8 m^2	0.1%	ea	11.9 m^2
CATCHMENT IMPERVIOUS AREAS				832 m^2
CATCHMENT AREA				12,726 m^2
		WEIGHTED CATCHMENT % IMPERVIOUS		**6.5 %**
		RUNOFF COEFFICIENT		**0.25**
TOTAL CATCHMENT IMPERVIOUS AREAS				832 m^2
TOTAL CATCHMENT AREA				12,726 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**6.5 %**
		RUNOFF COEFFICIENT		**0.25**

PROP - PROPOSED CONDITIONS

	Footprint	*% Impervious*		*Effective Impervious Area*
A1				
Proposed Buildings, Asphalt Road/Parking Areas	7022.2 m^2	100%	ea	7022.2 m^2
Landscape/Greenspace	1759.2 m^2	0.1%	ea	1.8 m^2
CATCHMENT IMPERVIOUS AREAS				7,024 m^2
CATCHMENT AREA				8,781 m^2
		WEIGHTED CATCHMENT % IMPERVIOUS		**80.0 %**
		RUNOFF COEFFICIENT		**0.76**
A2				
Proposed Buildings, Asphalt Road/Parking Areas	0.0 m^2	100%	ea	0.0 m^2
Landscape/Greenspace	3944.8 m^2	0.1%	ea	3.9 m^2
CATCHMENT IMPERVIOUS AREAS				4 m^2
CATCHMENT AREA				3,945 m^2
		WEIGHTED CATCHMENT % IMPERVIOUS		**0.1 %**
		RUNOFF COEFFICIENT		**0.20**
TOTAL CATCHMENT IMPERVIOUS AREAS				7,028 m^2
TOTAL CATCHMENT AREA				12,726 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS		**55.2 %**
		RUNOFF COEFFICIENT		**0.59**

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APPENDIX C

5 Year Design Storm Modified Rational Method (MRM) Calculations

STORM SEWER DESIGN SHEET

5 YEAR DESIGN STORM

PROJECT: 825 GARRISON ROAD, FORT ERIE

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 CONDITIONS												
EX1	SITE	OUTLET		1.27	1.27	10.00	0.00	0.240	0.305	0.305	85.669	72.5
FUTURE CONDITIONS												
A1 - Controlled	SITE	OUTLET		0.88	0.88	10.00	0.00	0.760	0.669	0.669	85.669	159.2
A2 - Uncontrolled	SITE	OUTLET		0.39	0.39	10.00	0.00	0.200	0.078	0.078	85.669	18.6
ALLOWABLE PEAK OUTFLOW												54.0
PROVIDED OUTFLOW (250mm PIPE)												**54.0**

DESIGN BY: **UPPER CANADA CONSULTANTS**
30 HANNOVER DRIVE, UNIT 3
ST. CATHARINES, ON L2W 1A3
DESIGN BY: **T. MUSSARI, B.ENG.**
DATE: **OCTOBER 2025**

RAINFALL PARAMETERS:

Time to Upper End = 10 min.

Town of Fort Erie - 5 Year IDF Curve

a = 747.93 mm/hr

b = 6.80 minutes

c = 0.77

Modified Rational Method (MRM) Required Storage Volume

5YEAR DESIGN STORM

Project: 825 GARRISON ROAD
Project No: 24090
Date: OCTOBER 2025
Design By: T. MUSSARI, B.ENG.

Description: STORMWATER MANAGEMENT PLAN

Storm Event: **Town of Fort Erie - 5 Year IDF Curve**

a = 747.93 mm/hr
b = 6.80 minutes
c = 0.77

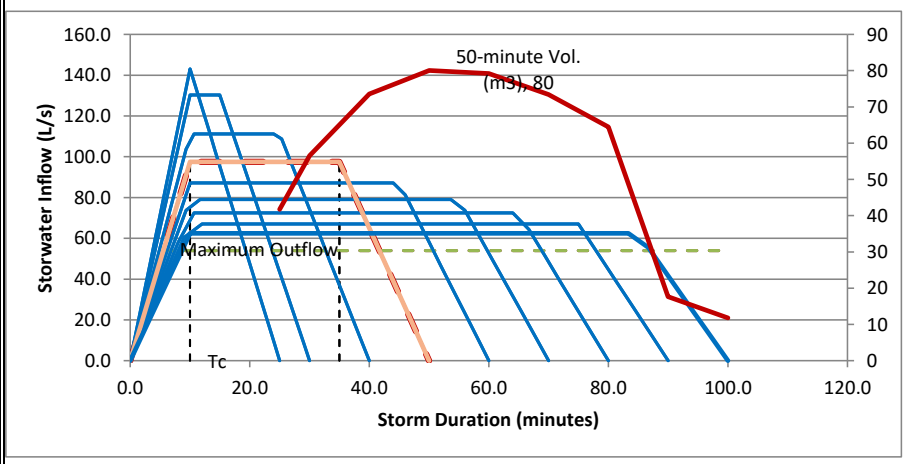
Critical Storm Duration: 50.00 minutes Tail Multiplier (x1-1.5
Tc From Design: 10.00 minutes
Storm Tail Time: 35.00 minutes

Accumulated Area x R (Ha): 0.669 <-- Area x Runoff Coefficient (Sewer Design Sheet)
Peak Rainfall Intensity: 52.48 mm/hr
Peak Inflow at Tc: 97.50 L/s
Maximum Release Rate: 53.97 <-- Outlet Full Flow Capacity (Design Sheet)
Time When Outlet Exceeded: 5.54

Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Interval Volume (m3)	Total Required Volume (m3)
0.0	0.00	0.00	53.97	-3.2	0.0
1.7	8.75	16.25	53.97	-3.8	0.0
3.3	17.49	32.50	53.97	-2.1	0.0
5.0	26.24	48.75	53.97	-0.5	0.0
6.7	34.99	65.00	53.97	1.1	1.1
8.3	43.73	81.25	53.97	2.7	3.8
10.0	52.48	97.50	53.97	4.4	8.2
11.7	52.48	97.50	53.97	4.4	12.5
13.3	52.48	97.50	53.97	4.4	16.9
15.0	52.48	97.50	53.97	4.4	21.2
16.7	52.48	97.50	53.97	4.4	25.6
18.3	52.48	97.50	53.97	4.4	29.9
20.0	52.48	97.50	53.97	4.4	34.3
21.7	52.48	97.50	53.97	4.4	38.7
23.3	52.48	97.50	53.97	4.4	43.0
25.0	52.48	97.50	53.97	4.4	47.4
26.7	52.48	97.50	53.97	4.4	51.7
28.3	52.48	97.50	53.97	4.4	56.1
30.0	52.48	97.50	53.97	4.4	60.4
31.7	52.48	97.50	53.97	4.4	64.8
33.3	52.48	97.50	53.97	4.4	69.1
35.0	52.48	97.50	53.97	4.4	73.5
36.7	46.65	86.66	53.97	3.3	76.7
38.3	40.82	75.83	53.97	2.2	78.9
40.0	34.99	65.00	53.97	1.1	80.0
41.7	29.16	54.16	53.97	0.0	***80.0***
43.3	23.32	43.33	53.97	-1.1	79.0
45.0	17.49	32.50	53.97	-2.1	76.8
46.7	11.66	21.67	53.97	-3.2	73.6
48.3	5.83	10.83	53.97	-4.3	69.3
50.0	0.00	0.00	53.97	-5.4	63.9

Variable Storm Duration Storage Requirements

Duration	*Max Storage*	*Duration*	*Max Storage*	*Duration*	*Max Storage*
25 Min	41.7 m3	50 Min	**80.0 m3**	80 Min	64.4 m3
30 Min	56.5 m3	60 Min	79.2 m3	90 Min	17.6 m3
40 Min	73.6 m3	70 Min	73.4 m3	100 Min	11.8 m3



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APPENDIX D

100 Year Design Storm Modified Rational Method (MRM) Calculations

STORM SEWER DESIGN SHEET

100 YEAR DESIGN STORM

PROJECT: 825 GARRISON ROAD, FORT ERIE

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 CONDITIONS												
EX1	SITE	OUTLET		1.27	1.27	10.00	0.00	0.240	0.305	0.305	137.317	116.3
FUTURE CONDITIONS												
A1 - Controlled	SITE	OUTLET		0.88	0.88	10.00	0.00	0.760	0.669	0.669	137.317	255.1
A2 - Uncontrolled	SITE	OUTLET		0.39	0.39	10.00	0.00	0.200	0.078	0.078	137.317	29.8
ALLOWABLE PEAK OUTFLOW												86.5
PROVIDED OUTFLOW (250mm PIPE)												**86.5**

DESIGN BY: **UPPER CANADA CONSULTANTS**
30 HANNOVER DRIVE, UNIT 3
ST. CATHARINES, ON L2W 1A3
DESIGN BY: **T. MUSSARI, B.ENG.**
DATE: **OCTOBER 2025**

RAINFALL PARAMETERS:
Time to Upper End = 10 min.
Town of Fort Erie - 100 Year IDF Curve

a = 1083.55 mm/hr
b = 6.62 minutes
c = 0.74

Modified Rational Method (MRM) Required Storage Volume

100 YEAR DESIGN STORM

Project: 825 GARRISON ROAD
Project No: 24090
Date: OCTOBER 2025
Design By: T. MUSSARI, B.ENG.

Description: STORMWATER MANAGEMENT PLAN

Storm Event: **Town of Fort Erie - 100 Year IDF Curve**

a = 1083.55 mm/hr
b = 6.62 minutes
c = 0.74

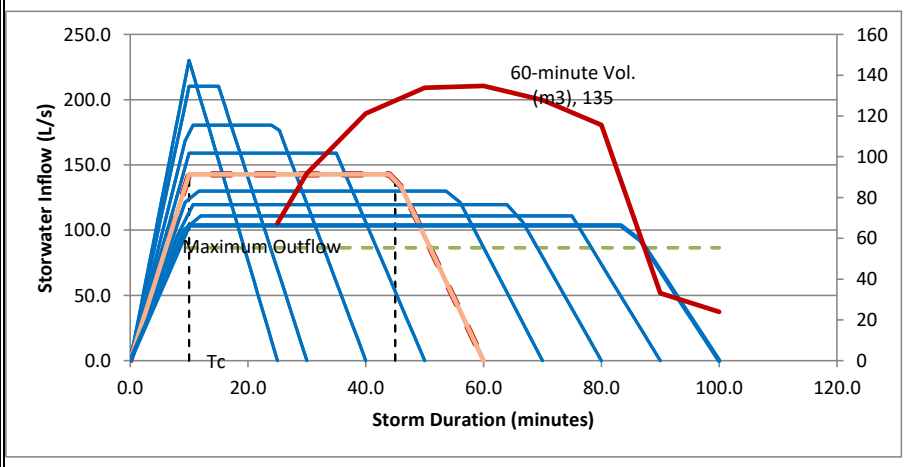
Critical Storm Duration: 60.00 minutes Tail Multiplier (x1-11.5
Tc From Design: 10.00 minutes
Storm Tail Time: 45.00 minutes

Accumulated Area x R (Ha): 0.669 <-- Area x Runoff Coefficient (Sewer Design Sheet)
Peak Rainfall Intensity: 76.83 mm/hr
Peak Inflow at Tc: 142.73 L/s
Maximum Release Rate: 86.51 <-- Outlet Full Flow Capacity (Design Sheet)
Time When Outlet Exceeded: 6.06

Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Interval Volume (m3)	Total Required Volume (m3)
0.0	0.00	0.00	86.51	-5.2	0.0
2.0	15.37	28.55	86.51	-7.0	0.0
4.0	30.73	57.09	86.51	-3.5	0.0
6.0	46.10	85.64	86.51	-0.1	0.0
8.0	61.46	114.19	86.51	3.3	3.3
10.0	76.83	142.73	86.51	6.7	10.1
12.0	76.83	142.73	86.51	6.7	16.8
14.0	76.83	142.73	86.51	6.7	23.6
16.0	76.83	142.73	86.51	6.7	30.3
18.0	76.83	142.73	86.51	6.7	37.1
20.0	76.83	142.73	86.51	6.7	43.8
22.0	76.83	142.73	86.51	6.7	50.5
24.0	76.83	142.73	86.51	6.7	57.3
26.0	76.83	142.73	86.51	6.7	64.0
28.0	76.83	142.73	86.51	6.7	70.8
30.0	76.83	142.73	86.51	6.7	77.5
32.0	76.83	142.73	86.51	6.7	84.3
34.0	76.83	142.73	86.51	6.7	91.0
36.0	76.83	142.73	86.51	6.7	97.8
38.0	76.83	142.73	86.51	6.7	104.5
40.0	76.83	142.73	86.51	6.7	111.3
42.0	76.83	142.73	86.51	6.7	118.0
44.0	76.83	142.73	86.51	6.7	124.8
46.0	71.71	133.22	86.51	5.6	130.4
48.0	61.46	114.19	86.51	3.3	133.7
50.0	51.22	95.16	86.51	1.0	***134.7***
52.0	40.98	76.12	86.51	-1.2	133.5
54.0	30.73	57.09	86.51	-3.5	130.0
56.0	20.49	38.06	86.51	-5.8	124.1
58.0	10.24	19.03	86.51	-8.1	116.0
60.0	0.00	0.00	86.51	-10.4	105.7

Variable Storm Duration Storage Requirements

Duration	*Max Storage*	*Duration*	*Max Storage*	*Duration*	*Max Storage*
25 Min	67.4 m3	50 Min	133.9 m3	80 Min	115.5 m3
30 Min	91.9 m3	60 Min	**134.7 m3**	90 Min	33.1 m3
40 Min	121.2 m3	70 Min	127.9 m3	100 Min	23.9 m3



UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDIX E

Hydroworks OGS Output Files

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

Hydroworks HD8 Output

```
*************************************************
*      Storm Water Management Sizing Model      *
*               Hydroworks, LLC                 *
*                Version 4.4                    *
*                                               *
*        Continuous Simulation Program          *
*             Based on SWMM 4.4H                *
*             Hydroworks, LLC                   *
*              Graham Bryant                    *
*               2003 - 2021                     *
*************************************************

                  Developed by

*************************************************
*              Hydroworks, LLC                  *
*            Metcalf & Eddy, Inc.               *
*           University of Florida               *
*       Water Resources Engineers, Inc.         *
*      (Now Camp Dresser & McKee, Inc.)         *
*              Modified SWMM 4.4                *
*************************************************

          Distributed and Maintained by

*************************************************
*                                               *
*                Hydroworks, LLC                *
*                 888-290-7900                  *
*              www.hydroworks.com               *
*                                               *
*************************************************

*************************************************
*     If any problems occur executing this      *
*     model, contact Mr. Graham Bryant at       *
*     Hydroworks, LLC by phone at 888-290-7900  *
*     or by e-mail: support@hydroworks.com      *
*************************************************

*************************************************
*     This model is based on EPA SWMM 4.4       *
*  "Nature is full of infinite causes which     *
*   have never occurred in experience" da Vinci *
*************************************************

*****************************************************
* Entry made to the Rain Block                      *
* Created by the University of Florida - 1988       *
* Updated by Oregon State University, March 2000    *
*****************************************************

825 GARRISON ROAD
TOWN OF FORT ERIE

HydroDome Simulation

 ########################################
 #  Precipitation Block Input Commands  #
 ########################################

Station Name.........................  St. Catherines A

Station Location.....................  Ontario

Station, ISTA........................    7287

Beginning date, IYBEG (Yr/Mo/Dy).....  1971/ 1/ 1

Ending date, IYEND (Yr/Mo/Dy).........  2005/12/31

Minimum interevent time, MIT..........     1

Number of ranked storms, NPTS.........    10

NWS format, IFORM (See text)..........     1

Print storm summary, ISUM (O-No 1-Yes)     0

Print all rainfall, IYEAR (O-No 1-Yes)     0

Save storm event data on NSCRAT(1)....     0
(IFILE =0 -Do not save, =1 -Save data)

IDECID 0 - Create interface file
       1 - Create file and analyze
       2 - Synoptic analysis..........     2

Plotting position parameter, A........  0.40

Storm event statistics, NOSTAT........  1100

KODEA (from optional group B0)........     2
 = 0, Do not include NCDC cumulative values.
 = 1, Average NCDC cumulative values.
```

```
     = 2, Use NCDC cumulative value as inst. rain.

    KODEPR (from optional group B0).......     0
     Print NCDC special codes in event summary:
     = 0, only on days with events.
     = 1, on all days with codes present.
     Codes: A = accumulated value, I = incomplete value,
            M = missing value,     O = other code present

*****************************************************
*  Precipitation output created using the Rain block   *
*  Number of precipitation stations...        1        *
*****************************************************

Location Station Number
-------- --------------
       1.     7287

STATION ID ON PRECIP. DATA INPUT FILE = 7287
REQUESTED STATION ID =     7287  CHECK TO BE SURE THEY MATCH.

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
Note, 15-min. data are being processed, but hourly
print-out, summaries, and statistics are based on
hourly totals only.  Data placed on interface file
are at correct 15-min. intervals.
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

#####################################################
# Entry made to the Runoff Block, last updated by #
# Oregon State University, and Camp, Dresser and  #
# McKee, Inc., March 2002.                        #
#####################################################
# "And wherever water goes, amoebae go along for  #
#  the ride"                    Tom Robbins       #
#####################################################

                  825 GARRISON ROAD

                  TOWN OF FORT ERIE

Snowmelt parameter - ISNOW.....................          0

Number of rain gages - NRGAG...................          1

Horton infiltration equation used - INFILM.....          2
Maximum infiltration volume is limited to RMAXINF input on  subcatchment lines.
Infiltration volume regenerates during  non rainfall periods.

Quality is simulated - KWALTY..................          1

IVAP is negative.  Evaporation will be set to zero
    during time steps with rainfall.

Read evaporation data on line(s) F1 (F2) - IVAP..          1

Hour of day at start of storm - NHR............          1

Minute of hour at start of storm - NMN.........          1

Time TZERO at start of storm (hours)...........      1.017

Use Metric units for I/O - METRIC..............          1
 ===> Ft-sec units used in all internal computations

Runoff input print control...                             0

Runoff graph plot control....                             1

Runoff output print control..                             0

Print headers every 50 lines - NOHEAD (0=yes, 1=no)       0

Print land use load percentages -LANDUPR (0=no, 1=yes)    0

Limit number of groundwater convergence messages to 10000 (if simulated)

Month, day, year of start of storm is:             1/ 1/1971

Wet time step length (seconds).......                  300.

Dry time step length (seconds).......                  900.

Wet/Dry time step length (seconds)...                  450.

Simulation length is......                     20051231.0 Yr/Mo/Dy

Percent of impervious area with zero detention depth    25.0

Horton infiltration model being used
Rate for regeneration of infiltration = REGEN * DECAY
DECAY is read in for each subcatchment
REGEN = ........................................   0.01000

*****************************************************
*   Processed Precipitation will be read from file     *
*****************************************************
```

```
  ############################
  #        Data Group F1     #
  # Evaporation Rate (mm/day) #
  ############################

 JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV.  DEC.
 ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----
 0.00  0.00  0.00  2.54  2.54  3.81  3.81  3.81  2.54  2.54  0.00  0.00

**********************************************************
*         C H A N N E L  A N D  P I P E  D A T A          *
**********************************************************

Input   NAMEG:      Drains                            Invert  L Side   R Side  Intial     Max  Mann-    Full
equen  Channel       to      Channel  Width  Length    Slope   Slope    Slope   Depth     Depth   ings    Flow
umber    ID #      NGTO:     Type     (m)    (m)      (m/m)   (m/m)    (m/m)    (m)       (m)    "N"    (cms)
-----  ----------------- -------- ------ -------   ------- -------- ------- ------- ------- -----  -----
  1        201         200   Dummy     0.0     0.0    0.0000   0.0000  0.0000     0.0     0.0  0.0000 0.00E+00

 ***************************************************
 *          S U B C A T C H M E N T  D A T A       *
 ***************************************************

*NOTE. SEE LATER TABLE FOR OPTIONAL SUBCATCHMENT PARAMETERS*
      SUBCATCH-  CHANNEL      WIDTH     AREA  PERCENT     SLOPE     RESISTANCE   FACTOR    DEPRES.  STORAGE(MM)  INFILTRATION    DECAY RATE GAGE  MAXIMUM
       MENT NO.  OR INLET       (M)     (HA)  IMPERV.     (M/M)      IMPERV.     PERV.     IMPERV.     PERV.     RATE(MM/HR)     (1/SEC)     NO.  VOLUME
                                                                                                              MAXIMUM MINIMUM                      (MM)
 ---  --------  --------  --------- --------  -----    -------     -------   --------  ------  ------  ----  -------  -------  ------ -------
  1       300       200     93.81      0.88  80.00     0.0200       0.015     0.250     0.510     5.080    63.50   10.16    0.00055     1  101.60000

TOTAL NUMBER OF SUBCATCHMENTS...              1
TOTAL TRIBUTARY AREA (HECTARES).           0.88
IMPERVIOUS AREA (HECTARES)......           0.70
PERVIOUS AREA (HECTARES)........           0.18
TOTAL WIDTH (METERS)............          93.81
PERCENT IMPERVIOUSNESS.........           80.00

**********************************************************
*      U P S T R E A M   S T O R A G E  D A T A          *
**********************************************************

     Storage        Flow
      (m3)         (m3/s)

         0.        0.000
       137.       85.600

**********************************************************
*      G R O U N D W A T E R   I N P U T   D A T A       *
**********************************************************

    SUB-      CHANNEL      ========== E L E V A T I O N S ========  =========== F L O W   C O N S T A N T S ===========
    CATCH          OR      GROUND  BOTTOM   STAGE      BC       TW        A1          B1        A2          B2        A3
    NUMBER      INLET        (M)     (M)      (M)      (M)      (M) (MM/HR-M^B1)          (MM/HR-M^B2)          (MM/HR-M^2)
    ------      -----      -------  ------  ------   ------   ------ -----------  ------- -----------  ------- -----------
         0        602         3.05    0.00    0.61     0.61   3.484E-04    2.600   0.000E+00    1.000    0.00E+00

**********************************************************
* G R O U N D W A T E R   I N P U T   D A T A (CONTINUED) *
**********************************************************

               S O I L   P R O P E R T I E S
                     SATURATED                                          PERCOLATION     E T  P A R A M E T E R S
       SUBCAT.           HYDRAULIC  WILTING  FIELD   INITIAL     MAX. DEEP   PARAMETERS         DEPTH  FRACTION OF ET
       NO.   POROSITY CONDUCTIVITY  POINT  CAPACITY MOISTURE  PERCOLATION   HCO     PCO        OF ET  TO UPPER ZONE
                        (mm/hr)                                   (mm/hr)                       (m)
      ----   ------     -------    ------  ------   ------     ----------  ------  ------      ------      ------
         0    .4000     127.000     .1500   .3000    .3000     5.080E-02   10.00    4.57       4.27       0.350

**********************************************************
*    Arrangement of Subcatchments and Channel/Pipes      *
**********************************************************
* See second subcatchment output table for connectivity *
* of subcatchment to subcatchment flows.                *
**********************************************************

   Channel
   or Pipe
       201     No Tributary Channel/Pipes
               No Tributary Subareas.....

    INLET
       200     Tributary Channel/Pipes...        201
               Tributary Subareas........        300

**********************************************************
* Hydrographs will be stored for the following   1 INLETS *
**********************************************************
          200
#####################################################
#             Quality Simulation                    #
#####################################################
#      General Quality Control Data Groups          #
#####################################################

 Description                          Variable       Value
```

Number of quality constituents.....	NQS.....	1	
Number of land uses.....	JLAND.....	1	
Standard catchbasin volume.....	CBVOL.....	1.22	cubic meters
Erosion is not simulated.....	IROS.....	0	
DRY DAYS PRIOR TO START OF STORM...	DRYDAY.....	3.00	DAYS
DRY DAYS REQUIRED TO RECHARGE CATCHBASIN CONCENTRATION TO INITIAL VALUES.....	DRYBSN.....	5.00	DAYS
DUST AND DIRT STREET SWEEPING EFFICIENCY.....	REFFDD.....	0.300	
DAY OF YEAR ON WHICH STREET SWEEPING BEGINS.....	KLNBGN.....	120	
DAY OF YEAR ON WHICH STREET SWEEPING ENDS.....	KLNEND.....	270	

```
###########################################
#     Land use data on data group J2      #
###########################################
```

AND USE LNAME)	BUILDUP EQUATION TYPE (METHOD)	FUNCTIONAL DEPENDENCE OF BUILDUP PARAMETER(JACGUT)	LIMITING BUILDUP QUANTITY (DDLIM)	BUILDUP POWER (DDPOW)	BUILDUP COEFF. (DDFACT)	CLEANING INTERVAL IN DAYS (CLFREQ)	AVAIL. FACTOR FRACTION (AVSWP)	DAYS SINCE LAST SWEEPING (DSLCL)
Urban De	EXPONENTIAL(1)	AREA(1)	2.802E+01	0.500	67.250	30.000	0.300	30.000

```
###############################################
#     Constituent data on data group J3       #
###############################################
```

	Total Su
Constituent units.....	mg/l
Type of units.....	0
KALC.....	2
Type of buildup calc.....	EXPONENTIAL(2)
KWASH.....	0
Type of washoff calc.....	POWER EXPONEN.(0)
KACGUT.....	1
Dependence of buildup....	AREA(1)
LINKUP.....	0
Linkage to snowmelt.....	NO SNOW LINKAGE
Buildup param 1 (QFACT1).	28.020
Buildup param 2 (QFACT2).	0.500
Buildup param 3 (QFACT3).	67.250
Buildup param 4 (QFACT4).	0.000
Buildup param 5 (QFACT5).	0.000
Washoff power (WASHPO)...	1.100
Washoff coef. (RCOEF)....	0.086
Init catchb conc (CBFACT)	100.000
Precip. conc. (CONCRN)...	0.000
Street sweep effic (REFF)	0.300
Remove fraction (REMOVE).	0.000
1st order QDECAY, 1/day..	0.000
Land use number.....	1

```
************************************************
* Constant Groundwater Quality Concentration(s) *
************************************************
```

Total Susp has a concentration of.. 0.0000 mg/l

```
***********************************************
* REMOVAL FRACTIONS FOR SELECTED CHANNEL/PIPES *
* FROM J7 LINES                               *
***********************************************
```

CHANNEL/ PIPE	CONSTITUENT Total Susp
201	0.000

```
*****************************************************
*     Subcatchment surface quality on data group L1 *
*****************************************************
```

No.	Land Usage	Land Use No.	Total Gutter Length Km	Number of Catch-Basins	Input Loading load/ha Total Su
1	300 Urban De	1	0.19	2.00	0.0E+00
Totals (Loads in kg or other)			0.19	2.00	0.0E+00

```
**********************
*    DATA GROUP M1    *
**********************
```

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TOTAL NUMBER OF PRINTED GUTTERS/INLETS...NPRNT.. 1
NUMBER OF TIME STEPS BETWEEN PRINTINGS..INTERV.. 0
STARTING AND STOPPING PRINTOUT DATES..... 0 0

****
* DATA GROUP M3 *
****

CHANNEL/INLET PRINT DATA GROUPS..... -200

****
* Rainfall from Nat. Weather Serv. file *
* in units of hundredths of an inch *
****

825 GARRISON ROAD
TOWN OF FORT ERIE

Rainfall Station St. Catherines A
State/Province Ontario

Rainfall Depth Summary (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1971.	31.	0.	0.	0.	0.	0.	126.	93.	52.	60.	29.	0.	391.
1972.	0.	0.	0.	47.	65.	100.	39.	115.	63.	90.	1.	0.	521.
1973.	0.	0.	0.	103.	77.	71.	53.	29.	63.	139.	0.	0.	534.
1974.	0.	0.	0.	67.	105.	62.	50.	31.	74.	37.	110.	0.	536.
1975.	0.	0.	0.	0.	0.	94.	78.	76.	73.	56.	59.	6.	442.
1976.	0.	0.	0.	119.	136.	87.	101.	60.	72.	73.	13.	1.	662.
1977.	0.	0.	0.	94.	29.	69.	57.	150.	230.	71.	0.	1.	701.
1978.	0.	0.	0.	72.	43.	72.	43.	86.	156.	95.	0.	0.	567.
1979.	0.	0.	0.	84.	92.	33.	91.	88.	84.	129.	71.	0.	673.
1980.	0.	0.	0.	81.	39.	122.	60.	32.	79.	96.	45.	0.	554.
1981.	0.	0.	0.	91.	71.	106.	122.	61.	123.	91.	84.	0.	749.
1982.	0.	0.	0.	28.	65.	97.	36.	66.	82.	25.	143.	0.	544.
1983.	0.	0.	0.	78.	100.	65.	55.	106.	75.	122.	92.	0.	694.
1984.	0.	0.	0.	31.	113.	136.	19.	51.	144.	24.	44.	0.	562.
1985.	0.	0.	67.	32.	52.	64.	40.	94.	42.	109.	0.	1.	501.
1986.	0.	0.	0.	93.	113.	60.	85.	83.	98.	80.	43.	65.	719.
1987.	0.	2.	11.	77.	42.	80.	122.	97.	99.	71.	94.	34.	730.
1988.	0.	0.	41.	71.	42.	21.	110.	82.	70.	68.	75.	5.	585.
1989.	0.	0.	13.	63.	137.	108.	36.	45.	89.	73.	84.	0.	647.
1990.	0.	2.	38.	99.	124.	44.	68.	95.	56.	112.	96.	0.	735.
1991.	0.	0.	86.	124.	67.	31.	85.	57.	79.	64.	61.	28.	682.
1992.	0.	0.	29.	127.	56.	92.	185.	116.	77.	47.	103.	38.	869.
1993.	3.	0.	7.	83.	56.	86.	32.	61.	71.	92.	80.	38.	610.
1994.	0.	0.	44.	88.	105.	124.	48.	77.	117.	15.	0.	15.	633.
1995.	112.	23.	16.	48.	37.	60.	123.	66.	8.	137.	94.	0.	724.
1998.	0.	0.	0.	0.	51.	54.	64.	29.	9.	0.	1.	0.	207.
1999.	0.	0.	0.	79.	59.	35.	61.	58.	116.	78.	0.	0.	487.
2000.	0.	0.	0.	123.	134.	216.	51.	0.	0.	0.	10.	0.	534.
2001.	0.	0.	0.	56.	88.	45.	25.	30.	81.	129.	0.	0.	454.
2002.	0.	0.	0.	73.	104.	64.	53.	49.	52.	65.	8.	0.	468.
2003.	0.	0.	0.	10.	163.	77.	81.	64.	67.	73.	2.	0.	537.
2004.	0.	0.	0.	131.	126.	99.	115.	40.	88.	17.	0.	0.	616.
2005.	0.	0.	0.	38.	42.	78.	53.	120.	112.	0.	0.	0.	443.

Total Rainfall Depth for Simulation Period 19310. (mm)

Rainfall Intensity Analysis (mm/hr)

(mm/hr)	(#)	(%)	(mm)	(%)
2.50	21481	74.6	6454.	33.4
5.00	3585	12.4	3088.	16.0
7.50	1973	6.8	2886.	14.9
10.00	575	2.0	1233.	6.4
12.50	389	1.4	1070.	5.5
15.00	194	0.7	660.	3.4
17.50	210	0.7	846.	4.4
20.00	66	0.2	306.	1.6
22.50	92	0.3	487.	2.5
25.00	39	0.1	232.	1.2
27.50	37	0.1	246.	1.3
30.00	34	0.1	245.	1.3
32.50	29	0.1	228.	1.2
35.00	5	0.0	42.	0.2
37.50	10	0.0	90.	0.5
40.00	10	0.0	97.	0.5
42.50	12	0.0	124.	0.6
45.00	9	0.0	99.	0.5
47.50	1	0.0	12.	0.1
50.00	3	0.0	37.	0.2
>50.00	49	0.2	829.	4.3

Total # of Intensities 28803

Daily Rainfall Depth Analysis (mm)

(mm)	(#)	(%)	(mm)	(%)
2.50	1077	38.9	1247.	6.5
5.00	507	18.3	1850.	9.6

7.50	326	11.8	2006.	10.4
10.00	226	8.2	1958.	10.1
12.50	150	5.4	1672.	8.7
15.00	111	4.0	1495.	7.7
17.50	100	3.6	1620.	8.4
20.00	67	2.4	1260.	6.5
22.50	45	1.6	958.	5.0
25.00	37	1.3	881.	4.6
27.50	23	0.8	609.	3.2
30.00	20	0.7	575.	3.0
32.50	20	0.7	631.	3.3
35.00	12	0.4	405.	2.1
37.50	8	0.3	290.	1.5
40.00	9	0.3	350.	1.8
42.50	4	0.1	165.	0.9
45.00	4	0.1	173.	0.9
47.50	2	0.1	91.	0.5
50.00	4	0.1	192.	1.0
>50.00	15	0.5	882.	4.6

Total # Days with Rain 2767

****
* End of time step DO-loop in Runoff *
****

Final Date (Mo/Day/Year) = 1/ 1/2006
Total number of time steps = 2056443
Final Julian Date = 2006001
Final time of day = 3. seconds.
Final time of day = 0.00 hours.
Final running time = 306816.0000 hours.
Final running time = 12784.0000 days.

****
* Extrapolation Summary for Watersheds *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of OVERLND Calls *
****

Subcatch	# Steps	# Calls	Subcatch	# Steps	# Calls	Subcatch	# Steps	# Calls
300	6237605	1593111						

****
* Extrapolation Summary for Channel/Pipes *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of GUTNR Calls *
****

Chan/Pipe	# Steps	# Calls	Chan/Pipe	# Steps	# Calls	Chan/Pipe	# Steps	# Calls
201	0	0						

****
* Continuity Check for Surface Water *
****

	cubic meters	Millimeters over Total Basin
Total Precipitation (Rain plus Snow)	169509.	19263.
Total Infiltration	33717.	3832.
Total Evaporation	14124.	1605.
Surface Runoff from Watersheds	122720.	13946.
Total Water remaining in Surface Storage	0.	0.
Infiltration over the Pervious Area...	33717.	19158.

Infiltration + Evaporation + Surface Runoff + Snow removal + Water remaining in Surface Storage + Water remaining in Snow Cover.....	170561.	19382.
Total Precipitation + Initial Storage.	169509.	19263.

The error in continuity is calculated as

****
* Precipitation + Initial Snow Cover *
* - Infiltration - *
*Evaporation - Snow removal - *
*Surface Runoff from Watersheds - *
*Water in Surface Storage - *
*Water remaining in Snow Cover *
----
* Precipitation + Initial Snow Cover *
****
Error..... -0.621 Percent

****
* Continuity Check for Channel/Pipes *
****

	cubic meters	Millimeters over Total Basin
Initial Channel/Pipe Storage.....	0.	0.
Final Channel/Pipe Storage.....	0.	0.
Surface Runoff from Watersheds.....	122720.	13946.
Baseflow.....	0.	
Groundwater Subsurface Inflow.....	0.	0.
Evaporation Loss from Channels.....	0.	0.
Channel/Pipe/Inlet Outflow.....	122720.	13946.
Initial Storage + Inflow.....	122720.	13946.

```
Final Storage + Outflow.....................              122720.     13946.
*******************************************
* Final Storage + Outflow + Evaporation  - *
* Watershed Runoff - Groundwater Inflow  - *
*     Initial Channel/Pipe Storage         *
*     ---------------------------------    *
*  Final Storage + Outflow  + Evaporation  *
*******************************************
Error.....................................      0.000 Percent

************************************************
*     Continuity Check for Subsurface Water    *
************************************************

                                                                Millimeters over
                                                cubic meters    Subsurface Basin

Total Infiltration                                        0.          0.
Total Upper Zone ET                                       0.          0.
Total Lower Zone ET                                       0.          0.
Total Groundwater flow                                    0.          0.
Total Deep percolation                                    0.          0.
Initial Subsurface Storage                             8046.        914.
Final Subsurface Storage                               8046.        914.
Upper Zone ET over Pervious Area                          0.          0.
Lower Zone ET over Pervious Area                          0.          0.

****************************************
* Infiltration + Initial Storage - Final *
* Storage - Upper and Lower Zone ET -    *
* Groundwater Flow - Deep Percolation    *
* -------------------------------------- *
*     Infiltration + Initial Storage     *
****************************************
Error .....................................     0.000 Percent
```

SUMMARY STATISTICS FOR SUBCATCHMENTS

SUBCATCHMENT NO.	GUTTER OR INLET NO.	AREA (HA)	PERCENT IMPER.	TOTAL SIMULATED RAINFALL (MM)	PERVIOUS AREA TOTAL RUNOFF DEPTH (MM)	PERVIOUS AREA TOTAL LOSSES (MM)	PERVIOUS AREA PEAK RUNOFF RATE (CMS)	IMPERVIOUS AREA RUNOFF DEPTH (MM)	IMPERVIOUS AREA PEAK RUNOFF RATE (CMS)	TOTAL SUBCATCHMENT AREA RUNOFF DEPTH (MM)	TOTAL SUBCATCHMENT AREA PEAK RUNOFF RATE (CMS)	TOTAL SUBCATCHMENT AREA PEAK UNIT RUNOFF (MM/HR)
300	200	0.88	80.019262.47	107.382********	0.06217402.131	0.383	13943.182	0.445	183.449			

*** NOTE *** IMPERVIOUS AREA STATISTICS AGGREGATE IMPERVIOUS AREAS WITH AND WITHOUT DEPRESSION STORAGE

SUMMARY STATISTICS FOR CHANNEL/PIPES

CHANNEL NUMBER	FULL FLOW (CMS)	FULL VELOCITY (M/S)	FULL DEPTH (M)	MAXIMUM COMPUTED INFLOW (CMS)	MAXIMUM COMPUTED OUTFLOW (CMS)	MAXIMUM COMPUTED DEPTH (M)	MAXIMUM COMPUTED VELOCITY (M/S)	TIME OF OCCURRENCE DAY	TIME OF OCCURRENCE HR.	LENGTH OF SURCHARGE (HOUR)	MAXIMUM SURCHARGE VOLUME (CU-M)	RATIO OF MAX. TO FULL FLOW	RATIO OF MAX. DEPTH TO FULL DEPTH
201				0.00				1/ 0/1900	0.00				
200				0.44				8/14/1972	14.25				

TOTAL NUMBER OF CHANNELS/PIPES = 2

*** NOTE *** THE MAXIMUM FLOWS AND DEPTHS ARE CALCULATED AT THE END OF THE TIME INTERVAL

```
##########################################################
#              Runoff Quality Summary Page               #
# If NDIM = 0 Units for:   loads    mass rates           #
#             METRIC = 1    lb        lb/sec             #
#             METRIC = 2    kg        kg/sec             #
# If NDIM = 1 Loads are in units of quantity             #
#             and mass rates are quantity/sec            #
# If NDIM = 2 loads are in units of concentration        #
#             times volume and mass rates have units     #
#             of concentration times volume/second       #
##########################################################

Total Su NDIM =  0
METRIC =  2
```

	Total Su
Inputs	
1. INITIAL SURFACE LOAD	19.
2. TOTAL SURFACE BUILDUP	16058.
3. INITIAL CATCHBASIN LOAD	0.
4. TOTAL CATCHBASIN LOAD	0.
5. TOTAL CATCHBASIN AND SURFACE BUILDUP (2+4)	16058.
Remaining Loads	
6. LOAD REMAINING ON SURFACE	7.
7. REMAINING IN CATCHBASINS	0.
8. REMAINING IN CHANNEL/PIPES	0.

Removals

```
--------
 9. STREET SWEEPING REMOVAL.....     1285.
10. NET SURFACE BUILDUP (2-9)...    14772.
11. SURFACE WASHOFF.............    14763.
12. CATCHBASIN WASHOFF..........        0.
13. TOTAL WASHOFF (11+12).......    14763.
14. LOAD FROM OTHER CONSTITUENTS        0.
15. PRECIPITATION LOAD..........        0.
15a.SUM SURFACE LOAD (13+14+15).    14763.
16. TOTAL GROUNDWATER LOAD......        0.
16a.TOTAL I/I LOAD..............        0.
17. NET SUBCATCHMENT LOAD
    (15a-15b-15c-15d+16+16a)....    14763.
>>Removal in channel/pipes (17a, 17b):
17a.REMOVE BY BMP FRACTION......        0.
17b.REMOVE BY 1st ORDER DECAY...        0.
18. TOTAL LOAD TO INLETS........    14763.
19. FLOW WT'D AVE.CONCENTRATION  mg/l
    (INLET LOAD/TOTAL FLOW).....      120.

Percentages
-----------
20. STREET SWEEPING (9/2).......        8.
21. SURFACE WASHOFF (11/2)......       92.
22. NET SURFACE WASHOFF(11/10)..      100.
23. WASHOFF/SUBCAT LOAD(11/17)..      100.
24. SURFACE WASHOFF/INLET LOAD
    (11/18).....................      100.
25. CATCHBASIN WASHOFF/
    SUBCATCHMENT LOAD (12/17)...        0.
26. CATCHBASIN WASHOFF/
    INLET LOAD (12/18)..........        0.
27. OTHER CONSTITUENT LOAD/
    SUBCATCHMENT LOAD (14/17)...        0.
28. INSOLUBLE FRACTION/
    INLET LOAD (14/18)..........        0.
29. PRECIPITATION/
    SUBCATCHMENT LOAD (15/17)...        0.
30. PRECIPITATION/
    INLET LOAD (15/18)..........        0.
31. GROUNDWATER LOAD/
    SUBCATCHMENT LOAD (16/17)...        0.
32. GROUNDWATER LOAD/
    INLET LOAD (16/18)..........        0.
32a.INFILTRATION/INFLOW LOAD/
    SUBCATCHMENT LOAD (16a/17)..        0.
32b.INFILTRATION/INFLOW LOAD/
    INLET LOAD (16a/18).........        0.
32c.CH/PIPE BMP FRACTION REMOVAL/
    SUBCATCHMENT LOAD (17a/17)..        0.
32d.CH/PIPE 1st ORDER DECAY REMOVAL/
    SUBCATCHMENT LOAD (17b/17)..        0.
33. INLET LOAD SUMMATION ERROR
    (18+8+6a+17a+17b-17)/17.....        0.

CAUTION. Due to method of quality routing (Users Manual, Appendix IX)
quality routing through channel/pipes is sensitive to the time step.
Large "Inlet Load Summation Errors" may result.
These can be reduced by adjusting the time step(s).
Note: surface accumulation during dry time steps at end of simulation is
not included in totals.  Buildup is only performed at beginning of
wet steps or for street cleaning.

*********************************************************
*            TSS Particle Size Distribution             *
*********************************************************
   Diameter    %     Specific    Settling Velocity   Critical Peclet
     (um)             Gravity        (m/s)                Number

       2.     5.0      2.65         0.000003            0.054484
       5.     5.0      2.65         0.000017            0.061150
       8.    10.0      2.65         0.000043            0.067744
      20.    15.0      2.65         0.000267            0.093400
      50.    10.0      2.65         0.001629            0.152500
      75.     5.0      2.65         0.003548            0.196250
     100.    10.0      2.65         0.006044            0.235000
     150.    15.0      2.65         0.012234            0.297500
     250.    15.0      2.65         0.026615            0.391296
     500.     5.0      2.65         0.060604            0.602917
    1000.     5.0      2.65         0.111334            0.928988

*****************************************************
*                                                   *
*              Summary of TSS Removal               *
*                                                   *
*****************************************************

TSS Removal based on Lab Performance Curve

 Model      Low Q Treated  High Q Treated     Runoff Treated        TSS Removed
   #           (cms)          (cms)               (%)                 (%)

 Unavailabl   0.090          0.090               98.7                59.8
 HD 4         0.090          0.090               98.7                67.5
 HD 5         0.090          0.090               98.7                73.2
 HD 6         0.090          0.090               98.7                78.1
 HD 7         0.090          0.090               98.7                81.8
```

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HD 8	0.090	0.090	98.7	84.9
HD 10	0.090	0.090	98.7	89.7
HD 12	0.090	0.090	98.7	92.9

****
* *
* Summary of Annual Flow Treatmnet & TSS Removal *
* *
****

HD 8

Year	Flow Vol (m3)	Flow Treated (m3)	TSS In (kg)	TSS Rem (kg)	TSS Out (kg)	TSS Byp (kg)	Flow Treated (%)	TSS Removal (%)
1971.	27983.	26595.	288.	239.	49.	2.	95.0	82.4
1972.	35975.	32910.	377.	324.	53.	15.	91.5	82.7
1973.	35932.	35929.	413.	350.	63.	0.	100.0	84.7
1974.	36648.	35900.	435.	387.	48.	6.	98.0	87.6
1975.	31078.	30416.	374.	315.	59.	4.	97.9	83.6
1976.	46306.	45112.	465.	402.	63.	10.	97.4	84.7
1977.	49610.	48303.	449.	366.	83.	9.	97.4	79.9
1978.	39631.	39631.	438.	363.	75.	0.	100.0	82.8
1979.	47373.	46416.	492.	422.	70.	6.	98.0	84.7
1980.	38151.	37997.	470.	398.	72.	1.	99.6	84.6
1981.	52707.	52532.	522.	456.	65.	1.	99.7	87.4
1982.	37125.	37087.	427.	374.	53.	0.	99.9	87.6
1983.	49015.	48380.	541.	464.	77.	7.	98.7	84.7
1984.	39425.	39425.	421.	355.	65.	0.	100.0	84.4
1985.	34378.	34378.	417.	359.	58.	0.	100.0	86.1
1986.	50149.	50030.	566.	492.	74.	1.	99.8	86.7
1987.	51843.	51145.	567.	487.	80.	3.	98.7	85.4
1988.	41398.	41101.	477.	416.	61.	0.	99.3	87.1
1989.	45700.	45219.	455.	400.	55.	2.	98.9	87.5
1990.	51836.	51583.	582.	511.	70.	3.	99.5	87.5
1991.	48540.	48145.	543.	470.	72.	3.	99.2	86.2
1992.	61725.	61637.	627.	529.	98.	1.	99.9	84.3
1993.	41956.	41956.	539.	476.	63.	0.	100.0	88.3
1994.	44911.	42950.	428.	361.	67.	12.	95.6	82.0
1995.	52230.	51357.	515.	433.	82.	9.	98.3	82.5
1998.	13505.	13505.	205.	174.	32.	0.	100.0	84.5
1999.	33088.	32999.	409.	347.	62.	1.	99.7	84.7
2000.	38169.	38169.	350.	282.	68.	0.	100.0	80.6
2001.	30160.	30160.	333.	295.	39.	0.	100.0	88.5
2002.	31484.	31484.	390.	338.	52.	0.	100.0	86.6
2003.	35817.	35706.	400.	337.	63.	1.	99.7	84.1
2004.	42911.	42911.	409.	345.	64.	0.	100.0	84.3
2005.	30961.	29637.	307.	247.	60.	5.	95.7	79.1
5.	95.7	89.1						

****
* *
* Summary of Toronto Rainfall Intensities *
* *
****

Rainfall Intensity (mm/h)	Flow (L/s)	Percentage %
1.50	2.9	31.0
2.25	4.4	9.9
3.00	5.9	7.6
3.75	7.3	5.0
4.75	9.3	6.2
5.75	11.2	5.0
8.00	15.6	7.9
10.00	19.6	4.4
15.50	30.3	7.8
23.25	45.5	15.3

****
* Summary of Quantity and Quality Results at *
* Location 200 INFlow in cms. *
* Values are instantaneous at indicated time step *
****

825 GARRISON ROAD
TOWN OF FORT ERIE

Date Mo/Da/Year	Time Hr:Min	Flow cum/s	Total Su mg/l
Flow wtd means.....		0.002	120.
Flow wtd std devs..		0.006	68.
Maximum value.....		0.442	594.
Minimum value.....		0.000	0.
Total loads.....		122514.	14733.
		Cub-Met	KILOGRAM

===> Runoff simulation ended normally.

===> SWMM 4.4 simulation ended normally.
Always check output file for possible warning messages.

****
* SWMM 4.4 Simulation Date and Time Summary *
****
* Starting Date... September 25, 2025 *
* Time... 15:11:36.982 *

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```
*   Ending Date... September  25, 2025               *
*           Time...          15:11:40. 99            *
*  Elapsed Time...               0.052 minutes.      *
*  Elapsed Time...               3.117 seconds.      *
*****************************************************
```

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APPENDIX F

Sample OGS Inspection Report

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SAMPLE INSPECTION REPORT

Owner:

Location: 825 Garrison Road, Fort Erie

Manhole Oil/Grit Separator: HD8

Type of Inspection ☐ Monthly ☐ Annually ☐ Special

Inlet/Outlet Information

	Inlet		Outlet	
Clear of Debris	☐ Yes	☐ No	☐ Yes	☐ No
Build Up of Sediment	☐ Yes	☐ No	☐ Yes	☐ No

Action Taken:

Sediment Tank Information

A. Manhole Sump Depth: ± m from cover rim (to be as-constructed verified)

B. Measurement from Rim to Sediment Level: m

C. Depth of Sediment: m (A - B)

Note: If the measured depth of sediment is greater than **200mm** then sediment removal is required.

Presence of Contaminants

Oil	☐ Yes	☐ No	Depth	m
Foam	☐ Yes	☐ No	Depth	m

Action Taken:

Name of Regulatory Agency Telephone No.:

Transaction No.:

Name of Licensed Waste Management Collector Telephone No.:

Transaction No.:

Owner Notification ☐ Yes ☐ No Other:

Time: Date:

Name of Inspector:

Signed: Date: