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FUNCTIONAL SERVICING REPORT

Block 84 Condo – Modero Estates
Town of Niagara-on-the-Lake
January 2026

INTRODUCTION

Upper Canada Consultants has been retained to undertake and provide a Functional Servicing Report to address the servicing needs and requirements for the proposed townhouse condominium development known as Block 84 located within the Draft Plan approved residential subdivision known as Modero Estates.

The project site is located in the Town of Niagara-on-the-Lake as part of Lot 181 and is situated north of York Road (Regional Road 81), west of Concession 7 and south of Butlersburg Circle. The subject property has historically been agricultural land.

Block 84 is approximately 3.37 hectares and will ultimately be divided into two separate condominiums with the west side of Stuart Place acting as the dividing line between the two parcels. The easterly Phase 1 Condominium will consist of 72 townhouse units with two (2) roadway entrances onto Butlersburg Circle, one (1) roadway entrance onto Concession 7 Road and a pathway entrance to Butlersburg Circle. The westerly Phase 2 Condominium will consist of 56 townhouse units with a single roadway access to Butlersburg Circle for a total of 128 units. Both condominiums will contain a blanket access easement as well as a number of servicing easements. The site shall include associated asphalt road, 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 Regional 400mm diameter PVC watermain located on York Road as well as an existing municipal 300mm diameter PVC watermain on Concession 7. As part of the Modero Estates Subdivision, a 300mm diameter PVC watermain will be extended along Butlersburg Circle fronting Block 84, and ultimately looped within the subdivision with two connections to the existing Concession 7 watermain.

As the condominium will ultimately be split into two parcels, two connections have been designed to the 300mm diameter Butlersburg Circle watermain as follows:

- 200mm diameter connection at Cooper Place
- 300mm diameter connection at Benner Place

Each connection will be constructed with a 200mm diameter Water Meter and associated Water Meter Chamber located in close proximity to the property line. In order to provide adequate hydrant flow rates under fire flow conditions (140kPa), the watermain upstream of the Water Meter on Benner Place and Bennett Place has been increased to 300mm diameter pipe.

Four (4) private hydrants will be constructed within the condominium block with a further four (4) municipal hydrants located on Butlersburg Circle and Concession 7 Road to provide adequate fire protection for the development. All units within the Block 84 Condo will be located within 90m of a hydrant to the principle entrance.

Utilizing a population density of 2.4 persons per unit per in accordance with the Niagara Regional Official Plan, Block 84 Condo (128 units) will have a total population of 308 persons. The 2021 Regional Water Master Servicing Plan Update notes an average daily demand of 240 L/cap/day resulting in a total average demand of approximately 73,920 L/day. This correlates to maximum day and peak hourly demand rates of 203,280L/day and 305,290L/day, respectively.

As part of the completion of the Functional Servicing Report for the Modero Estates Subdivision, an analysis was completed to ensure sufficient fire water supply would be provided to all units within the development. Per Table 8 of the 2020 'Water Supply for Public Fire Protection', townhouse developments require minimum fire flow rate of 8,000LPM (133L/s). The modelling concluded that two hydrants at the north end of the subdivision would result in theoretical flows less that 133L/s servicing single family dwellings. All other hydrants within the subdivision and Condo Block 84 would provide flow greater than 133 L/s and have acceptable static pressures.

Therefore, it is expected that the proposed watermain servicing strategy will provide sufficient domestic and fire water supply for the proposed development. All calculations can be found as part of the Modero Estates Functional Servicing Report in Appendix B.

SANITARY SERVICING

There is an existing 375mm diameter sanitary sewer on York Road (Regional Road 81) fronting the adjacent Lifepointe Church property at #736 York Road. As part of the Modero Estates Subdivision, a 300mm diameter sanitary sewer will be constructed north through and easement within the Lifepointe Church property, and continue through a subsequent easement through the Block 84 Condo in order to provide service for both the Bock 84 Condo and upstream Modero Subdivision development.

Three (3) mainline connections will be made to the 300mm diameter sanitary sewer to service the proposed Block 84 Condo development. All units within the condo will be serviced via gravity sewer. Units 51-64 will discharge sanitary flows directly to the 300mm diameter municipal sanitary sewer passing through the Block 84, however as the full lateral will be private, no cleanout will be required for these services as for all other condo services.

As part of the design of the Modero Estates Subdivision, an Overall Sanitary Analysis has been conducted on the capacities within the York Road (Regional Road 81) municipal trunk sanitary sewer and downstream system to Taylor Road and included within the Modero Estates Functional Servicing Report in Appendix B. The analysis includes the complete Block 84 Condo with its' calculations. Using data provided within the 'Glendale Industrial Area Servicing Study Update' provided by the Town of Niagara-on-the-Lake, peak sanitary flows rates were calculated using details utilized in the initial sewer design. An updated Overall Sanitary Analysis has been included in Appendix A for the proposed updated condominium conditions.

The sanitary analysis has determined that new development as part of the proposed Modero Estates subdivision and associated condos will discharge a peak flow of 13.42L/s to the downstream municipal system. The analysis concludes that the post-development conditions of the previously designed 32.2-hectare drainage area will contribute approximately 33.03L/s to the downstream sanitary sewer system – less than the 52.1L/s originally designed for the area per the Glendale Servicing Study. Therefore, it is expected that the downstream municipal sanitary sewer system will have sufficient capacity for the proposed development. The updated calculation values are included in Appendix A, however additional sanitary information can be found in Appendix B of the Modero Estates Functional Servicing Report included in Appendix B.

STORMWATER MANAGEMENT PLAN

As part of the site development, the following is a summary of the stormwater management plan for the proposed residential development.

The criteria provided by the Town of Niagara-on-the-Lake and Region of Niagara for this development includes the requirement to control peak stormwater flows to existing levels up to and including the 100-year design storm event. It is also required to improve stormwater quality levels to MECP Normal Protection levels (70% TSS removal) prior to discharge from the development in accordance with the Town of Niagara-on-the-Lake Consolidated Linear Infrastructure Environmental Compliance Approval from the MECP.

The Block 84 Condo was included within the Stormwater Management (SWM) Plan for the Modero Estates Subdivision. Stormwater flows discharge from the Block 84 Condo to the downstream Modero Estates Subdivision storm sewers on Butlersburg Circle at two locations; the westerly roadway entrance, and at the path between units 138 & 139. The internal private Block 84 Condo stormwater sewers as well as the downstream Modero Estates storm sewer systems have both been designed to accommodate flows up to and including the 5 year design storm event using the Town of Niagara-on-the-Lake IDF curves.

As part of the storm sewer sizing calculations, all drainage areas as part of the Condo Block 84 were completed utilizing a Runoff Coefficient of 0.75. A Weighted Impervious Calculation was conducted for the condo and included within Appendix A of the Modero Estates Stormwater Management (SWM) Report in Appendix B concluding the condo has an effective Runoff Coefficient of 0.73. Therefore, all storm sewer within Condo Block 84 and downstream within the Modero Estates Subdivision are expected to have adequate capacity for the condo up to and including the 5 year design storm event.

During storms greater than the 5 year design storm event, stormwater flows unable to enter the on-site storm sewer system will be directed overland to Butlersburg Circle fronting the condo and ultimately be directed to the Modero Estates SWM Facility as outlined in the Modero Estates SWM Plan.

The Modero Estates SWM Facility will provide the necessary quality controls to Normal Protection Levels and quantity controls up to and including the 100 year design storm event prior to discharge to the downstream Six Mile Creek Tributary. Therefore, no adverse effects will occur to adjacent properties or downstream stormwater infrastructure as a result of the proposed Stormwater Management Plan. All additional details regarding the SWM strategy can be found in the Modero Estates FSR/SWM Report included in Appendix B.

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 York Road watermain and future 200mm diameter Butlersburg Circle watermain will have sufficient capacity to provide both domestic and fire protection water supply.

2. The 300mm diameter sanitary sewer passing through Block 84 and downstream municipal sanitary infrastructure will have adequate capacity for the proposed residential development.

3. Stormwater quality controls are being provided to Normal Protection (70% TSS removal) levels by the Modero Estates Stormwater Management Wet Pond Facility before discharging to the Six Mile Creek tributary.

4. Stormwater quantity controls are being provided by the Modero Estates Stormwater Management Wet Pond Facility up o the 100 year design storm event prior discharging to the Six Mile Creek tributary.

5. The site stormwater overland route from the road system is to the proposed Modero Estates Stormwater Management Facility.

Based on the above and the accompanying General Servicing Plan, and Drainage Area Plans, 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,

LICENSED PROFESSIONAL ENGINEER
K. N. TIESSEN
100581347
PROVINCE OF ONTARIO

Kurt Tiessen, P.Eng.
January 6, 2026
Encl.

UPPER CANADA CONSULTANTS
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APPENDICES

UPPER CANADA CONSULTANTS
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APPENDIX A

Updated Overall Sanitary Sewer Calculation Sheet

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

DESIGN FLOWS

RESIDENTIAL: 255 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INSTITUTIONAL/CHURCH: 315 LITRES/PARKING SPACE (ASSUMING 3 PERSONS PER PARKING SPACE)
INDUSTRIAL: 0.45 L / s / GROSS HECTARE (MECP DESIGN CRITERIA)
INFILTRATION RATE: 0.286 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L / s / ha)
POPULATION DENSITY: 2.4 PERSONS / UNIT

INDUSTRIAL PEAKING FACTOR 2.00 (MINIMUM PER MECP DESIGN CRITERIA)

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 : MODERO ESTATES
PROJECT NO: 2130

SANITARY SEWER DESIGN SHEET

Res. 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
A1 - BUTLERSBURG CIR	PIT MH	F	1.07	1.07	15	2.4	36	36	4.34	0.46	0.31	0.77						
A2 - LASALLE LANE	E	F	0.64	0.64	13	2.4	31	31	4.35	0.40	0.18	0.58	200	100.0	0.60	0.82	26.50	2.2%
A3 - BUTLERSBURG CIR	F	G	0.16	1.87	2	2.4	5	72	4.28	0.91	0.53	1.44	250	27.2	0.25	0.61	31.02	4.7%
A4 - BUTLERSBURG CIR	G	K	0.24	2.11	7	2.4	17	89	4.26	1.12	0.60	1.72	250	50.9	0.25	0.61	31.02	5.5%
A5 - MEADOWS MANOR	H	I	0.25	0.25	6	2.4	14	14	4.40	0.19	0.07	0.26	200	25.2	1.00	1.06	34.22	0.8%
A6 - MEADOWS MANOR	I	J	0.60	0.85	17	2.4	41	55	4.31	0.70	0.24	0.94	200	84.3	0.40	0.67	21.64	4.4%
MEADOWS MANOR	J	K		0.85				55	4.31	0.70	0.24	0.94	200	8.0	0.40	0.67	21.64	4.4%
A7 - BUTLERSBURG CIR	K	O	0.34	3.30	10	2.4	24	168	4.17	2.07	0.94	3.01	250	77.7	0.25	0.61	31.02	9.7%
A8 - GREENHILL GATE	L	M	0.25	0.25	8	2.4	19	19	4.38	0.25	0.07	0.32	200	28.3	1.00	1.06	34.22	0.9%
A9 - GREENHILL GATE	M	N	0.36	0.61	11	2.4	26	46	4.32	0.58	0.17	0.76	200	43.0	0.40	0.67	21.64	3.5%
GREENHILL GATE	N	O		0.61				46	4.32	0.58	0.17	0.76	200	12.5	0.40	0.67	21.64	3.5%
A10 - BUTLERSBURG CIR	O	P	0.39	4.30	9	2.4	22	235	4.12	2.86	1.23	4.09	250	59.9	0.25	0.61	31.02	13.2%
A11 - BUTLERSBURG CIR	P	Q	0.23	4.53	5	2.4	12	247	4.11	3.00	1.30	4.30	250	37.8	0.25	0.61	31.02	13.9%
A12 - BLOCK 82	STUB	Q	0.91	0.91	26	2.4	62	62	4.29	0.79	0.26	1.05	200	7.5	0.40	0.67	21.64	4.9%
A13 - BUTLERSBURG CIR	Q	R	0.06	5.50				310	4.07	3.72	1.57	5.29	250	39.5	0.25	0.61	31.02	17.1%
A14 - BUTLERSBURG CIR	R	V	0.12	5.62				310	4.07	3.72	1.61	5.33	250	79.5	0.25	0.61	31.02	17.2%
A15 - BLOCK 83 EAST	STUB	S	0.49	0.49	13	2.4	31	31	4.35	0.40	0.14	0.54	200	10.5	0.40	0.67	21.64	2.5%
A16 - BUTLERSBURG CIR	S	U	0.10	0.59	1	2.4	2	34	4.35	0.43	0.17	0.60	200	33.5	0.40	0.67	21.64	2.8%
A17 - BLOCK 83 WEST	STUB	U	0.34	0.34	15	2.4	36	36	4.34	0.46	0.10	0.56	200	10.5	1.00	1.06	34.22	1.6%
A18 - BUTLERSBURG CIR	U	V	0.17	1.10	4	2.4	10	79	4.27	1.00	0.31	1.31	200	36.3	0.40	0.67	21.64	6.1%
BUTLERSBURG CIR	V	JJ		6.72				389	4.03	4.62	1.92	6.54	250	10.1	0.25	0.61	31.02	21.1%
A19 - BUTLERSBURG CIR	PIT MH	Z	1.01	1.01	14	2.4	34	34	4.35	0.43	0.29	0.72						
A20 - BUTLERSBURG CIR	E	Y	0.43	0.43	9	2.4	22	22	4.38	0.28	0.12	0.40	200	60.5	0.60	0.82	26.50	1.5%
	Y	Z		0.43				22	4.38	0.28	0.12	0.40	200	8.0	0.40	0.67	21.64	1.9%
A21 - BUTLERSBURG CIR	Z	AA	0.16	1.60	2	2.4	5	60	4.30	0.76	0.46	1.22	250	36.3	0.25	0.61	31.02	3.9%
A22 - BUTLERSBURG CIR	AA	BB	0.22	1.82	5	2.4	12	72	4.28	0.91	0.52	1.43	250	44.2	0.25	0.61	31.02	4.6%
A23 - BUTLERSBURG CIR	BB	CC	0.18	2.00	4	2.4	10	82	4.27	1.03	0.57	1.60	250	39.4	0.25	0.61	31.02	5.2%
A24 - BUTLERSBURG CIR	CC	DD	0.14	2.14	3	2.4	7	89	4.26	1.12	0.61	1.73	250	36.0	0.25	0.61	31.02	5.6%
A25 - BUTLERSBURG CIR	DD	EE	0.14	2.28	4	2.4	10	98	4.25	1.23	0.65	1.89	250	28.4	0.25	0.61	31.02	6.1%
A26 - BUTLERSBURG CIR	EE	FF	0.30	2.58	8	2.4	19	118	4.22	1.47	0.74	2.20	250	39.7	0.25	0.61	31.02	7.1%
A27 - BUTLERSBURG CIR	FF	GG	0.31	2.89	9	2.4	22	139	4.20	1.73	0.83	2.55	250	67.1	0.25	0.61	31.02	8.2%
A28 - BUTLERSBURG CIR	GG	HH	0.02	2.91				139	4.20	1.73	0.83	2.56	250	10.3	0.25	0.61	31.02	8.2%
A29 - BUTLERSBURG CIR	HH	II	0.29	3.20	6	2.4	14	154	4.19	1.90	0.92	2.81	250	64.5	0.25	0.61	31.02	9.1%
A30 - BUTLERSBURG CIR	II	JJ	0.15	3.35	3	2.4	7	161	4.18	1.98	0.96	2.94	250	39.4	0.25	0.61	31.02	9.5%
A31 - ACCESS	JJ	KK	0.04	10.11				550	3.95	6.41	2.89	9.30	300	64.5	0.20	0.62	45.12	20.6%
A32 - BENNER PLACE	84-A	84-C	0.23	0.23	7	2.4	17	17	4.39	0.22	0.07	0.28	200	45.6	0.60	0.82	26.50	1.1%
A33 - BENNER PLACE	84-B	84-C	0.09	0.09	3	2.4	7	7	4.43	0.09	0.03	0.12	200	17.0	0.60	0.82	26.50	0.5%
A34 - BENNETT PLACE	84-C	84-D	0.40	0.72	18	2.4	43	67	4.29	0.85	0.21	1.06	200	77.3	0.40	0.67	21.64	4.9%
A35 - BENNETT PLACE	84-D	84-G	0.13	0.85	4	2.4	10	77	4.27	0.97	0.24	1.21	200	25.8	0.40	0.67	21.64	5.6%
A36 - POWELL PLACE	84-E	84-F	0.42	0.42	18	2.4	43	43	4.33	0.55	0.12	0.67	200	66.1	1.00	1.06	34.22	2.0%
A37 - POWELL PLACE	84-F	84-G	0.04	0.46	1	2.4	2	46	4.32	0.58	0.13	0.71	200	11.9	0.40	0.67	21.64	3.3%
BENNETT PLACE	84-G	84-H		1.31				122	4.22	1.52	0.37	1.90	200	8.5	0.40	0.67	21.64	8.8%
A38 - BENNETT PLACE	84-H	KK	0.16	1.47	5	2.4	12	134	4.21	1.67	0.42	2.09	200	39.7	0.40	0.67	21.64	9.7%
A39 - COOPER PLACE	84-I	84-K	0.27	0.27	13	2.4	31	31	4.35	0.40	0.08	0.48	200	52.2	1.00	1.06	34.22	1.4%
A40 - COOPER PLACE	84-J	84-K	0.38	0.38	16	2.4	38	38	4.34	0.49	0.11	0.60	200	61.9	1.00	1.06	34.22	1.8%
A41 - BENNETT PLACE	84-K	84-N	0.04	0.69				70	4.28	0.88	0.20	1.08	200	31.9	0.40	0.67	21.64	5.0%
A42 - PAWLING PLACE	84-L	84-N	0.12	0.12	6	2.4	14	14	4.40	0.19	0.03	0.22	200	51.2	1.00	1.06	34.22	0.6%
A43 - PAWLING PLACE	84-M	84-N	0.32	0.32	15	2.4	36	36	4.34	0.46	0.09	0.55	200	59.1	1.00	1.06	34.22	1.6%
A44 - BENNETT PLACE	84-N	KK	0.23	1.36	8	2.4	19	139	4.20	1.73	0.39	2.12	200	68.5	0.40	0.67	21.64	9.8%
A45 - STUART PLACE	KK	LL	0.42	13.36	6	2.4	14	838	3.85	9.51	3.82	13.33	300	69.0	0.20	0.62	45.12	29.6%
A46 - PALMER PLACE	LL	MM	0.11	13.47				838	3.85	9.51	3.85	13.37	300	12.4	0.20	0.62	45.12	29.6%
A46 - CHURCH PROPERTY	MM	NN	0.08	13.55				838	3.85	9.51	3.88	13.39	300	12.4	0.20	0.62	45.12	29.7%
A47 - YORK ROAD	NN	OO	0.12	13.67				838	3.85	9.51	3.91	13.42	300	12.4	0.20	0.62	45.12	29.8%
YORK ROAD OUTLET	OO	EX MH		13.67				838	3.85	9.51	3.91	**13.42**	300	12.4	0.20	0.62	45.12	29.8%
A50 - DEL PRIORE	SERVICE	OO	1.21	1.21	-				2.00	1.09	0.35	1.44						
A51 - LIFEPOINTE CHURCH				0.36	75	3.0			2.00	1.64	0.10	1.74						
Remaining Light Industrial - south side of York Road			13.85	13.85		0.45 L/s/ha			2.00	12.47	3.96	16.43						
York Road - Con 7 to 490m East of Townline Road				29.09						24.71	8.32	**33.03**	375	388.0	0.22	0.75	85.79	38.5%
York Road - 490m East of Townline to Townline Road			37.80	66.89		0.45 L/s/ha			2.00	58.73	19.13	77.86	375	492.0	0.42	1.04	118.54	65.7%
Townline Road - York Road to 140m North			11.00	77.89		0.45 L/s/ha			2.00	68.63	22.28	90.90	450	146.0	0.44	1.20	197.30	46.1%
Townline Road - 140m North of York to 350m South of Q			13.40	91.29		0.45 L/s/ha			2.00	80.69	26.11	106.80	525	352.0	0.39	1.25	280.19	38.1%
Townline Road - 350m South of Queenston to Queenston			26.70	117.99		0.45 L/s/ha			2.00	104.72	33.75	138.46	525	343.0	0.17	0.83	184.99	74.9%
Queenston Road - Townline Road to Taylor Road			8.50	126.49		0.45 L/s/ha			2.00	112.37	36.18	148.54	525	850.0	0.17	0.83	184.99	80.3%
			126.13															

Note: Lands as part of 'Remaining Light Industrial' Area include south side properties from #785-#683 York Road as well as the northerly #680 York Road

** All pipe lengths and slopes, as well as all drainage areas and flow rates downstream of the focus drainage area taken from the 'Glendale Industrial Area Servicing Study Update' (June 25, 1992)

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDIX B

Modero Estates Functional Servicing Report/Stormwater Management Report

UPPER CANADA CONSULTANTS
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UCC File: 2130

FUNCTIONAL SERVICING REPORT

Modero
Town of Niagara-on-the-Lake
Revised September 2025

INTRODUCTION

Upper Canada Consultants has been retained to undertake and provide a Functional Servicing Report to address the servicing needs and requirements for the proposed Draft Plan approved residential development known as Modero.

The project site is located in the Town of Niagara-on-the-Lake as part of lots 180 & 181. The subject property is situated north of York Road (Regional Road 81), west of Concession 7 and south of Queenston Road. The site is bound by Six Mile Creek to the west and a tributary of Six Mile Creek at the north-east portion of the property. The site has historically been agricultural land.

The development site is approximately 15.42 hectares and shall consist of 2 condominium blocks and a mixed use block (206 units), 128 townhouses and 55 single family homes for a total unit count of 389 units. The site shall include associated asphalt road, 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 Regional 400mm diameter PVC watermain located on York Road as well as an existing municipal 300mm diameter PVC watermain located on Concession 7 fronting much of the development. The 300mm diameter Concession 7 watermain reduces to a 150mm diameter watermain approximately 20m south of the site boundary on Concession 7.

A 300mm diameter watermain connection will be made at the Butlersburg Circle entrance while a 200mm diameter watermain connection will be made at the Chandler Chase entrance to the existing municipal Concession 7 watermain at both development entrances and extended into the development site to provide both domestic water supply and fire protection. The connections will provide an internal loop within the development.

The 300mm diameter watermain on Butlersburg Circle will be extended westerly to the west Block 84 condominium entrance to provide suitable fire flows for the condo block. 150mm diameter watermains will be constructed on Greenhill Gate, Meadows Manor and the north limit of Butlersburg Circle from the intersections of Lasalle Lane. The remaining watermains will be 200mm diameter on Lasalle Lane, Chandler Chase and the remainder of Butlersburg Circle.

Twelve (12) municipal fire hydrants will be constructed within the proposed subdivision. An existing hydrant on York Road will be moved into the subdivision limits on Chandler Chase, and a second hydrant on York road will be adjusted out of the location of the Block 84 condo entrance. Additional private hydrants will be constructed within the condominium blocks, to be designed as part of future Site Plan Applications for those properties.

A Fire Underwriters Survey review has been completed as required by the Town of Niagara-on-the-Lake for the development. Using the 'Water Supply for Public Fire Protection' (2020, FUS), it is noted that suggested flow values in Tables 7 & 8 of the document are acknowledged at 66.7L/s for single family dwellings and 133.3L/s for townhouse units under the proposed development conditions. It should be noted that all buildings are expected to have at least 3.0m of separation and no single-family dwellings will be constructed larger than 450m^2.

An analysis has been conducted by Upper Canada Consultants to determine the effectiveness of the future watermain system within the proposed subdivision using the EPANET software. The analysis utilizes the hydrant flow testing conducted by Niagara Regional Fire Protection on the three (3) existing hydrant on Concession 7 fronting the site. As of completing this submission, the design for the Block 84 condominium development is well underway and has been included in the watermain analysis. The Block 82 & Block 83 developments have been represented within the system as well, however just at their subdivision connection points.

The Hydrant Flow Test Data results as well as associated Fire Flow Calculation Sheets for each hydrant are included in Appendix A. Additionally, imagery of the conducted EPANET model as well as an EPANET Model Calculation Sheet have been included in Appendix A as well.

The existing Concession 7 watermain was replicated in the EPANET model utilizing the hydrant flow test data. UCC was able to calibrate the model to within an acceptable 5% of verified hydrant flow test data and calculated theoretical fire flow rates. Imagery of the existing model conditions are included in Appendix A.

Following confirmation of existing conditions, the proposed watermain was added to the model as outlet in the future conditions imagery in Appendix A. The modelling concluded that two hydrants (#9 & #10) fronting lots 12 & 19 will experience theoretical flows less than 133.3L/s under fire flow conditions. However, these hydrants are only in proximity to service single family dwellings and will therefore be acceptable for their location. All other hydrants will provide theoretical fire flows at rates greater than the required 133.3L/s. Additionally, all hydrants have been calculated to have static pressures greater than 64psi – greater than the minimum preferred 50psi.

Therefore, as all proposed hydrants will be able to provide acceptable theoretical flow rates at 20psi (fire flow conditions), it is expected that the outlined servicing strategy will be acceptable for the proposed development.

SANITARY SERVICING

The upstream limit of the existing 375mm diameter sanitary sewer, located on York Road (Regional Road 18), fronts the Lifepointe Church property at #736 York Road. It is proposed to connect to the existing sanitary sewer system with a 300mm diameter sanitary sewer extended within the site. The sanitary sewer on York Road will be extended up to the east and continue through the Lifepointe Bible Church property within an 11.0m easement.

A majority of the proposed development will be serviced through gravity sewers with the sanitary mainline located beneath the basement elevation. However, due to the locations of the sanitary and stormwater outlets, grade restrictions have resulted in the necessity of Grinder Pumps as well as a Low Pressure Forcemain System (E/One) on site. Approximately 106 units will require basements pumps to the sanitary service. A further 28 dwellings located at the north portion of the development will be serviced with an E/One sanitary sewer system including Grinder Pumps to a sanitary forcemain conveying flows to the proposed gravity sanitary sewer system. These design considerations will ensure sufficient grade and cover is provided on all sanitary systems within the proposed development to meet minimum standards set forth in the MECP Design Criteria (2023).

An Overall Sanitary Analysis has been conducted on the capacities within the York Road (Regional Road 81) municipal trunk sanitary sewer and downstream system to Taylor Road. The UCC sanitary analysis utilizes downstream sewer information outlined within the 'Glendale Industrial Area Servicing Study Update' provided by the Town of Niagara-on-the-Lake. Both the UCC Sanitary Sewer Analysis as well as the original sanitary sewer calculation sheet and drainage area conditions as part of the Glendale Servicing Study update have been included in Appendix B.

The Servicing Study provides an analysis on the trunk sanitary sewer conveying peak sanitary flows to Taylor Road from an overall drainage area of 130.6 hectares. The proposed development site was included within a 33.2-hectare drainage area for the initial design of the trunk sewer under a 'Light Industrial' zoning classification producing a peak sanitary flow rate of 35 m^3/ha/day. The peak sanitary outflow for this drainage area (Figure 4, Appendix A) has been re-calculated to include updated conditions for the contributing developments within the same drainage area to this section of sanitary sewer.

The sanitary analysis has determined that new development as part of the proposed Modero subdivision and associated condos will discharge a peak flow of **14.01L/s** to the downstream municipal system. The analysis concludes that the post-development conditions of the previously designed 32.2-hectare drainage area will contribute approximately 35.1L/s to the downstream sanitary sewer system - less than the 52.1L/s originally designed for the area per the Glendale Servicing Study. Therefore, it is expected that the downstream municipal sanitary sewer system will have sufficient capacity for the proposed development. All sanitary calculations can be found in Appendix B.

STORMWATER MANAGEMENT PLAN

As part of the site development, the following is a summary of the stormwater management plan for the proposed residential development.

The criteria provided by the Town of Niagara-on-the-Lake and Region of Niagara for this development includes the requirement to control peak stormwater flows to existing levels up to and including the 100-year design storm event. Additionally, although the receiving watercourse requires only Normal (70% TSS Removal) Protection, the Town of Niagara-on-the-Lake has required the development provided quality controls to Enhanced (80% TSS removal) Protection prior to discharge from the development, above and beyond the requirements of their CLI Environmental Compliance Approval.

To limit future stormwater flows to allowable levels, and improve stormwater quality to the required TSS removal levels, a stormwater management wetpond facility will provide the necessary controls for the subdivision development. Roadway overland flows will be directed to the stormwater management facility at the north end of the site. Further quantity controls will be provided for the Concession 7 Road reconstruction prior to discharge to the Six Mile Creek to ensure quantity controls are provided for all storm events.

The proposed Stormwater Management Facility within the site will provide the necessary quality enhancements for stormwater flows within the development prior to discharge to Six Mile Creek. A Hydroworks HD5 Oil/Grit Separator will provide the necessary quality controls for stormwater flows discharging from the Concession 7 Road storm sewer outlet. A Stormwater Management Plan for this development has been created and can be found in Appendix C.

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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 will have sufficient capacity to provide both domestic and fire protection water supply;

2. The existing 375mm diameter municipal trunk sanitary sewer on York Road (Regional Road 81) and downstream infrastructure will have adequate capacity for the proposed residential development;

3. Stormwater quality controls are being provided to Enhanced Protection (80% TSS removal) levels by a stormwater wetpond facility and oil/grit separator prior to outletting to the Six Mile Creek tributary;

4. Stormwater quantity controls are being provided be a stormwater management wetpond facility up to the 100-year design storm event before outletting to the Six Mile Creek tributary; and,

5. The site stormwater overland route from the road system is to the proposed stormwater management facility before outletting to the Six Mile Creek tributary.

Based on the above and the accompanying General Servicing Plan, and Drainage Area Plans, 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,

LICENSED PROFESSIONAL ENGINEER
K. N. TIESSEN
100581347
PROVINCE OF ONTARIO

Kurt Tiessen, P.Eng.
Revised September 24, 2025

Encl.

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APPENDICES

UPPER CANADA CONSULTANTS
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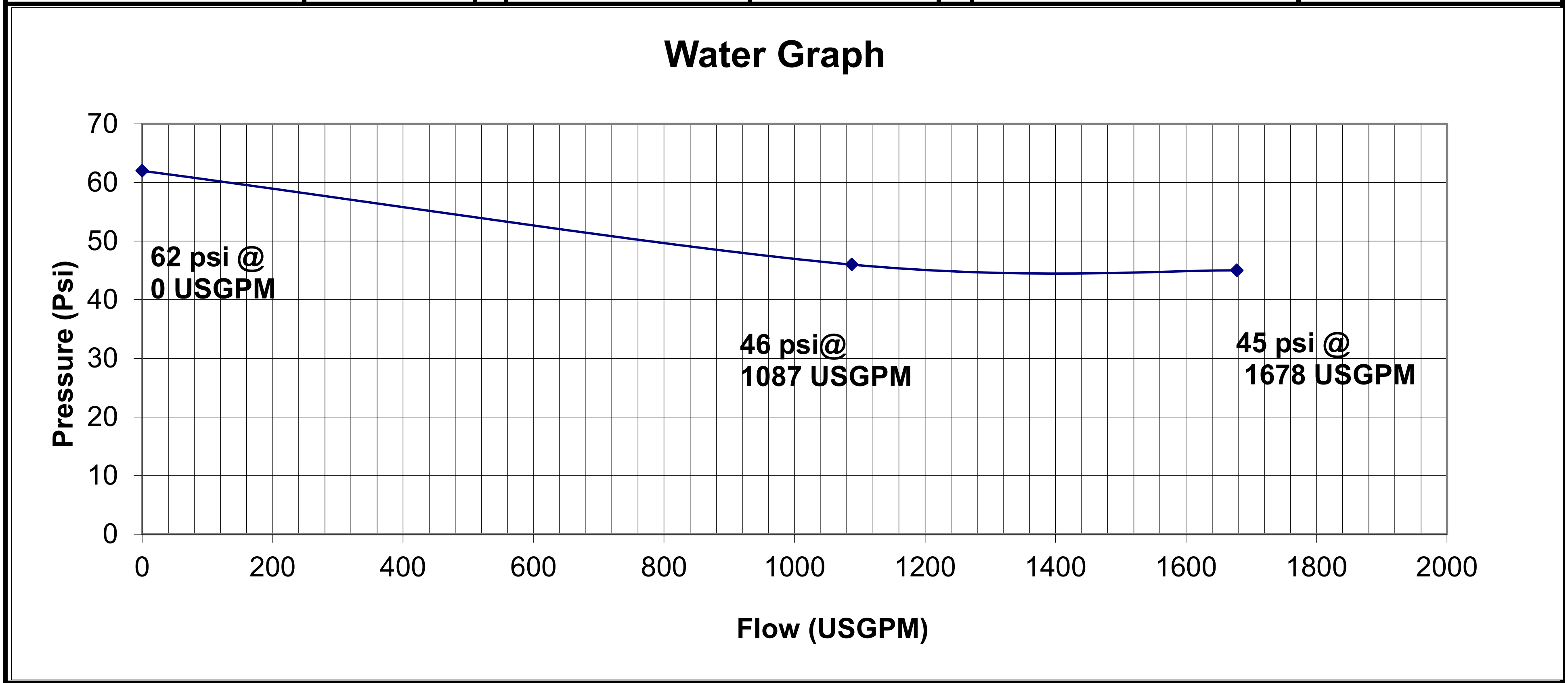
APPENDIX A

Hydrant Flow Test Results – Niagara Regional Fire Protection
Hydrant Fire Flow Calculations
EPANET Calculation Sheet
EPANET Imagery

NIAGARA REGIONAL FIRE PROTECTION INC.

Flow Test Location: Con. 7 125M North of York

Static Pressure (Psi)		**Pitot Reading 1**	42	**# of Outlets Flowed 1**	1
	62	**Outlet Size 1**	2.5	**# of Outlets Flowed 2**	2
Residual Pressure 1 (Psi)		**Pitot Reading 2**	25	**# of Outlets Flowed 3**	2
	46	**Outlet Size 2**	2.5	**Graph Data:**	
Residual Pressure 2 (Psi)		**Pitot Reading 3**	25	**Pressure Values (y-axis)**	**Flow Values (x-axis)**
	45	**Outlet Size 3**	2.5	62	0
Residual Pressure 3 (Psi)		**Flow 1 Calculated**		46	1087
	45		1087.4	45	1678
		Flow 2 Calculated		45	1678
			1677.9	**Date & Time of Test :**	**July 29/2024**
Coefficient value		**Flow 3 Calculated**			**11:00AM**
	0.9		1677.9	**Performed by:**	Derek & Ryan



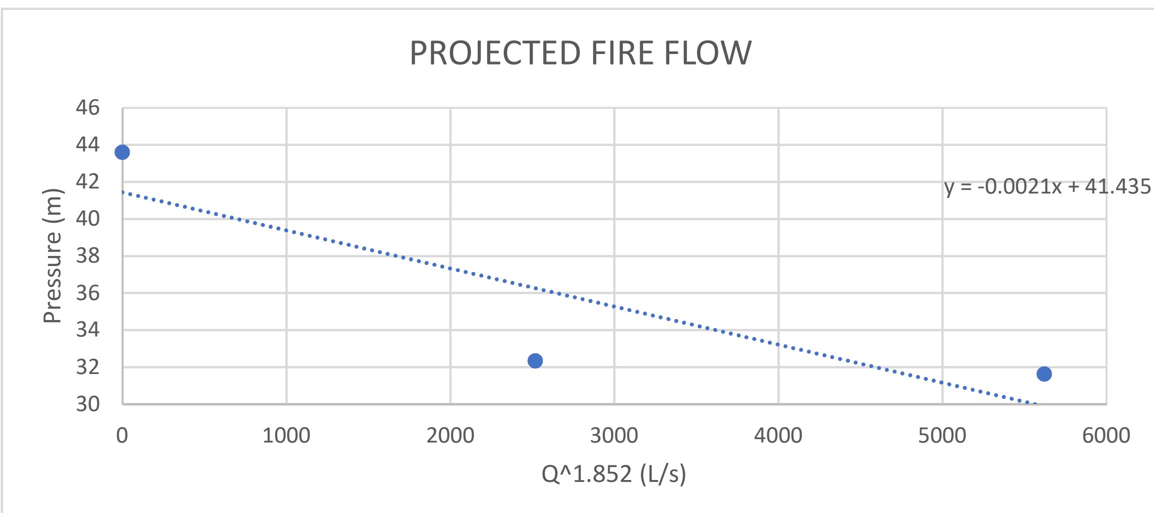
FIRE FLOW CALCULATION SHEET

Project: Modero Estates
Project Number: 2130
Date: July 29, 2024
Prepared By: Kurt Tiessen, EIT
Reviewed By: Jason Schooley, P.Eng.

Flow Test Provided by: Niagara Regional Fire Protection
Data of Test: July 29, 2024
Hydrant Location: Concession 7, 125m north of York Road

FLOW TEST RESULTS

TEST	PRESSURE (psi)	FLOW RATE (USGPM)	FLOW RATE (L/s)	$Q^{1.852}$	PRESSURE (m)
STATIC	62	0	0	0	43.60
RESIDUAL 1	46	1087.4	68.60	2517.21	32.35
RESIDUAL 2	45	1677.9	105.86	5620.74	31.64



FIRE FLOW FORMULA (y = ax + b)

a = -0.0021
b = 41.435

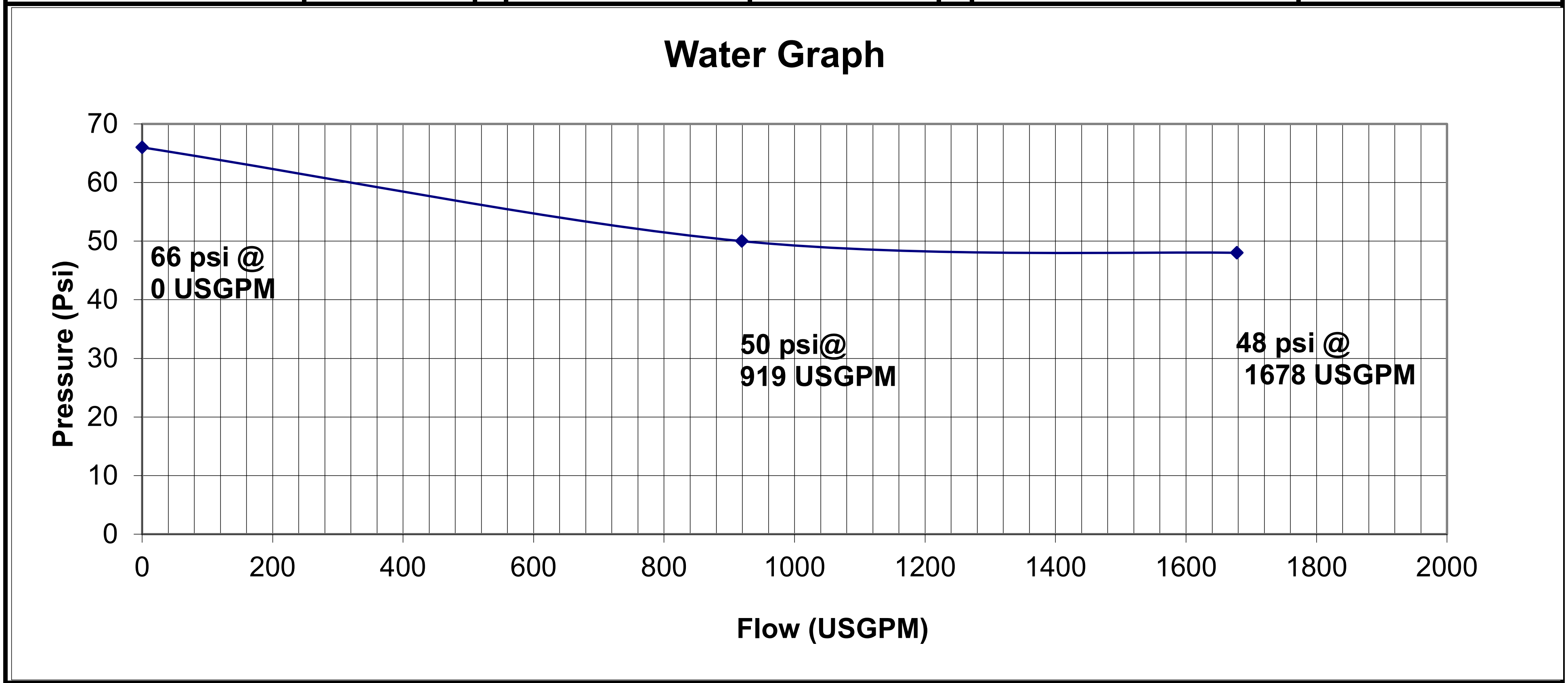
FIRE FLOW AT A SPECIFIED PRESSURE

Pressure = 20 psi
Pressure = 14.064 m
$Q^{1.852}$ = 13033.81
Flow, Q = 166.71 L/s
Flow, Q = 2642.41 USGPM

NIAGARA REGIONAL FIRE PROTECTION INC.

Flow Test Location: Con. 7 240M North of York

Static Pressure (Psi)		**Pitot Reading 1**	30	**# of Outlets Flowed 1**	1
	66	**Outlet Size 1**	2.5	**# of Outlets Flowed 2**	2
Residual Pressure 1 (Psi)		**Pitot Reading 2**	25	**# of Outlets Flowed 3**	2
	50	**Outlet Size 2**	2.5	**Graph Data:**	
Residual Pressure 2 (Psi)		**Pitot Reading 3**	25	**Pressure Values (y-axis)**	**Flow Values (x-axis)**
	48	**Outlet Size 3**	2.5	66	0
Residual Pressure 3 (Psi)		**Flow 1 Calculated**		50	919
	48		919.0	48	1678
		Flow 2 Calculated		48	1678
			1677.9	**Date & Time of Test :**	**July 29/2024**
Coefficient value		**Flow 3 Calculated**			**11:30AM**
	0.9		1677.9	**Performed by:**	Derek & Ryan



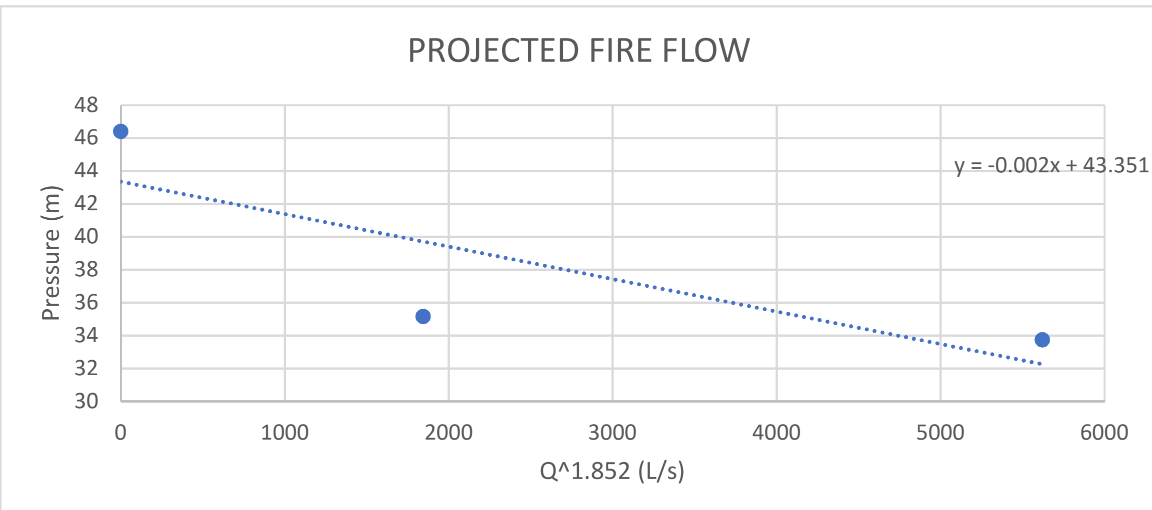
FIRE FLOW CALCULATION SHEET

Project: Modero Estates
Project Number: 2130
Date: July 29, 2024
Prepared By: Kurt Tiessen, EIT
Reviewed By: Jason Schooley, P.Eng.

Flow Test Provided by: Niagara Regional Fire Protection
Data of Test: July 29, 2024
Hydrant Location: Concession 7, 240m north of York Road

FLOW TEST RESULTS

TEST	PRESSURE (psi)	FLOW RATE (USGPM)	FLOW RATE (L/s)	$Q^{1.852}$	PRESSURE (m)
STATIC	66	0	0	0	46.41
RESIDUAL 1	50	919	57.98	1843.26	35.16
RESIDUAL 2	48	1677.9	105.86	5620.74	33.75



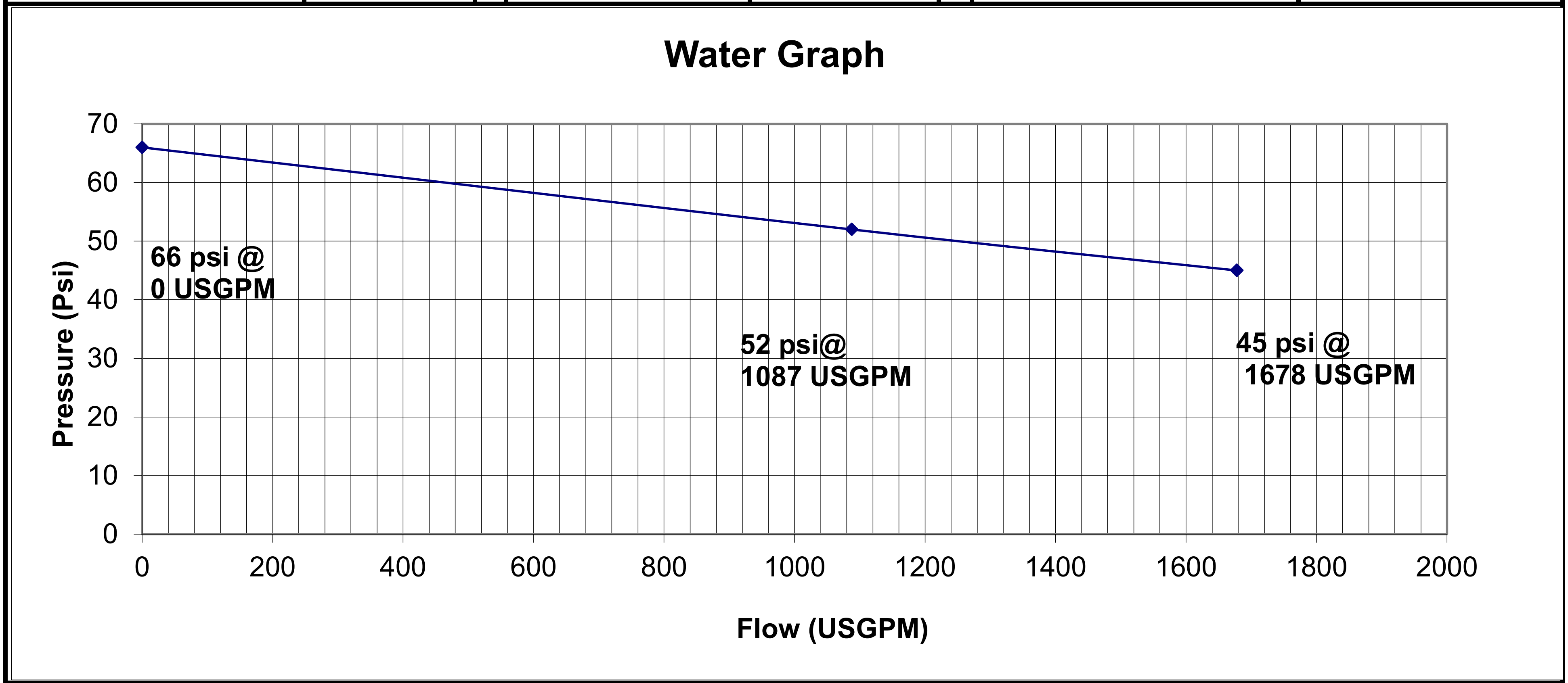
FIRE FLOW FORMULA (y = ax + b)

a = -0.002
b = 43.351

FIRE FLOW AT A SPECIFIED PRESSURE

Pressure = 20 psi
Pressure = 14.064 m
$Q^{1.852}$ = 14643.50
Flow, Q = 177.53 L/s
Flow, Q = 2813.89 USGPM

NIAGARA REGIONAL FIRE PROTECTION INC.					
Flow Test Location: Con. 7 350M North of York					
Static Pressure (Psi)		**Pitot Reading 1**	42	**# of Outlets Flowed 1**	1
	66	**Outlet Size 1**	2.5	**# of Outlets Flowed 2**	2
Residual Pressure 1 (Psi)		**Pitot Reading 2**	25	**# of Outlets Flowed 3**	2
	52	**Outlet Size 2**	2.5	**Graph Data:**	
Residual Pressure 2 (Psi)		**Pitot Reading 3**	25	**Pressure Values (y-axis)**	**Flow Values (x-axis)**
	45	**Outlet Size 3**	2.5	66	0
Residual Pressure 3 (Psi)		**Flow 1 Calculated**		52	1087
	45		1087.4	45	1678
		Flow 2 Calculated		45	1678
			1677.9	**Date & Time of Test :**	**July 29/2024**
Coefficient value		**Flow 3 Calculated**			**12:00AM**
	0.9		1677.9	**Performed by:**	Derek & Ryan



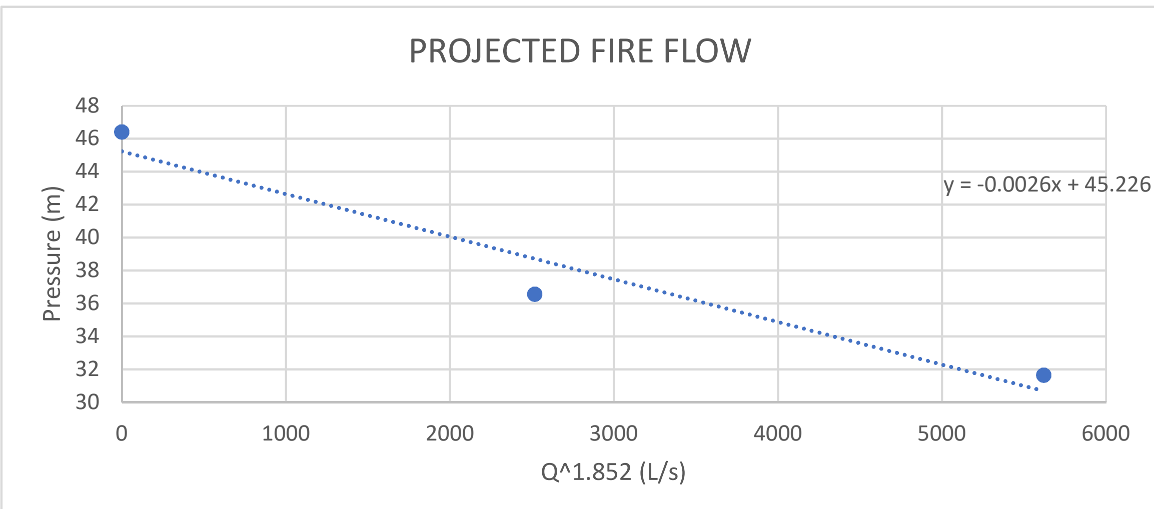
FIRE FLOW CALCULATION SHEET

Project: Modero Estates
Project Number: 2130
Date: July 29, 2024
Prepared By: Kurt Tiessen, EIT
Reviewed By: Jason Schooley, P.Eng.

Flow Test Provided by: Niagara Regional Fire Protection
Data of Test: July 29, 2024
Hydrant Location: Concession 7, 350m north of York Road

FLOW TEST RESULTS

TEST	PRESSURE (psi)	FLOW RATE (USGPM)	FLOW RATE (L/s)	$Q^{1.852}$	PRESSURE (m)
STATIC	66	0	0	0	46.41
RESIDUAL 1	52	1087.4	68.60	2517.21	36.57
RESIDUAL 2	45	1677.9	105.86	5620.74	31.64



FIRE FLOW FORMULA (y = ax + b)

a = -0.0026
b = 45.226

FIRE FLOW AT A SPECIFIED PRESSURE

Pressure = 20 psi
Pressure = 14.064 m
$Q^{1.852}$ = 11985.38
Flow, Q = 159.33 L/s
Flow, Q = 2525.43 USGPM

MODERO ESTATES EPANET MODELLING

FLOW UNITS = L/S

********NOTE: ONLY FILL OUT ITALICIZED CELLS***

			Hydrant Flow Test – Hydrant Data		EPANET – Existing Modelled		EPANET – Future Modelled			Hydrant Flow Test		Hydrant Flow Test		EPANET		Fire Flow Calc Sheet – Hydrant Data		EPANET – Existing Modelled		EPANET – Future Modelled	
	Key Street	**Hydrant Address**	**Static (PSI)**	**Static (m of H20)**	***Static (m of H20)***	**% Difference**	***Modelled Static Pressures (m of H2O)***	**Modelled Static Pressures (PSI)**	**% Difference**	**Actual Flow (GPM)**	**Actual Flow (LPS)**	**Residual PSI**	**Residual (m of H20)**	**Modelled Residual**	**% Difference**	**Theoretical Flow (GPM @ 20psi)**	**Theoretical Flow (LPS @ 20psi)**	**Modelled Theoretical Flow (LPS @ 14.06m)**	**% Difference**	**Fire Flow (LPS @ 14.06m)**	**Fire Flow GPM**
YORK	Con 7	Hydrant @ 125m North of York Rd	62	43.6	*45.0*	3.2%		0.0	-100.0%	1677.9	105.9	45	31.6	33.2	-4.8%	2642.41	166.7	*174.8*	4.9%		*0*
	Con 7	Hydrant @ 240m North of York Rd	66	46.4	*44.9*	-3.3%		0.0	-100.0%	1677.9	105.9	48	33.8	32.6	3.4%	2813.9	177.5	*169.0*	-4.8%		*0*
QUEENSTON	Con 7	Hydrant @ 350m North of York Rd	66	46.4	*45.6*	-1.7%		0.0	-100.0%	1677.9	105.9	45	31.6	33.0	-4.2%	2525.43	159.3	*167.3*	5.0%		*0*

BASE LOAD CALCULATIONS

Node	**Street**	**# of units**	**Population**	**Average Flow (L/s)**	**Max Day Flow (L/s)**	USED **Peak Day Flow (L/s)**	**Modelled Static Pressures (PSI)**	**Modelled Hydrant Flow @ 20 PSI (L/s)**
1	Butlersburg - Mixed Use Block 23	29	58	0.17	0.31	0.46	64.2	161
2	Butlersburg - Towns	11	22	0.06	0.12	0.18	65.6	166
3	Block 82	26	52	0.15	0.28	0.41	66.4	156
4	Butlersburg - Towns	10	20	0.06	0.11	0.16	66.6	157
5	Butlersburg - Towns	19	38	0.11	0.20	0.30	67.0	152
6	Meadows Manor	20	40	0.12	0.21	0.32	66.6	136
7	Butlersburg - Mixed	15	30	0.09	0.16	0.24	67.6	147
8	Lasalle Lane - Singles	18	36	0.11	0.19	0.29	66.7	141
9	Butlersburg - Singles	10	20	0.06	0.11	0.16	69.3	130
10	Butlersburg - Singles	16	32	0.09	0.17	0.26	69.3	**128**
11	Butlersburg - Mixed	15	30	0.09	0.16	0.24	66.4	144
12	Butlersburg - Towns	35	70	0.21	0.37	0.56	66.9	154
13	Butlersburg - Towns	21	42	0.12	0.22	0.33	66.4	164
14	Block 84	22	44	0.13	0.23	0.35	64.6	134
15	Block 84	16	32	0.09	0.17	0.26	65.6	134
16	Block 84	23	46	0.14	0.24	0.37	65.2	145
17	Block 84	32	64	0.19	0.34	0.51	66.8	159

Demand	**Value**	**Peaking Factor**
Average	255	1
Max Day	459	1.8
Peak	688.5	2.7

Conversions

PSI	**m of H2O**
1	0.7030889
20	14.061778
40	28.123556

Note:

- 255L/cap/day utilized per 2021 Niagara Regional Wastewater MSPU.
- Greater than 240 L/cap/day utilized in 2021 Niagara Regional Water MSPU.
- Peaking Factors from MOE Design Guidelines for Drinking Water Systems (2008)
- Peaking factors correspond to those utilized throughout Niagara Region

FUS Requirements

- Single Family Dwellings will require Fire Flow of 66.7L/s
- Townhouses will require Fire Flow of 133.3L/s

Conclusions:

- Lowest hydrant flow rate will be at Hydrant 10 located fronting Lot 12 at the north end
- All hydrants will provide acceptable flow rates for dwellings in their domain

FIGURE 1 – EPANET IMAGERY – EXISTING MODEL DIAMETERS

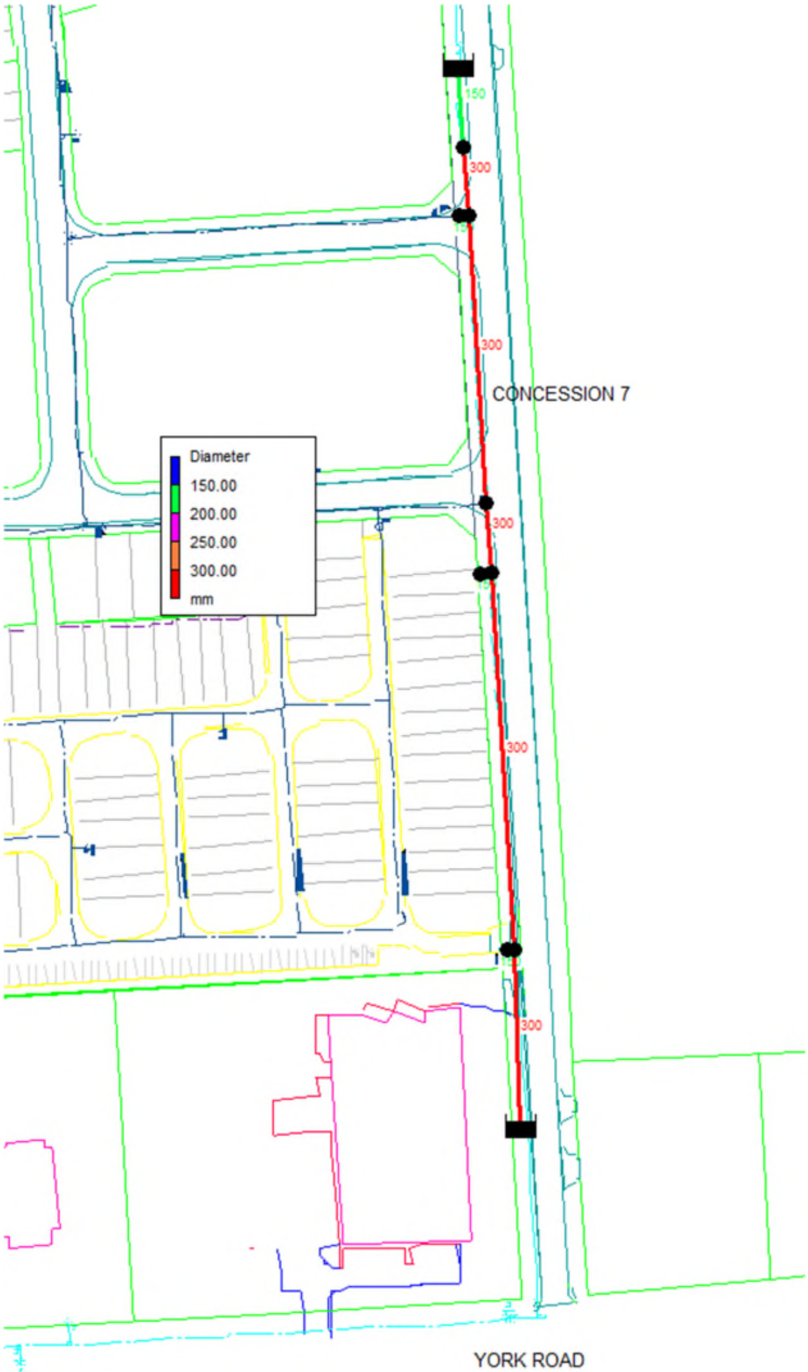


FIGURE 2 – EPANET IMAGERY – EXISTING STATIC PRESSURES

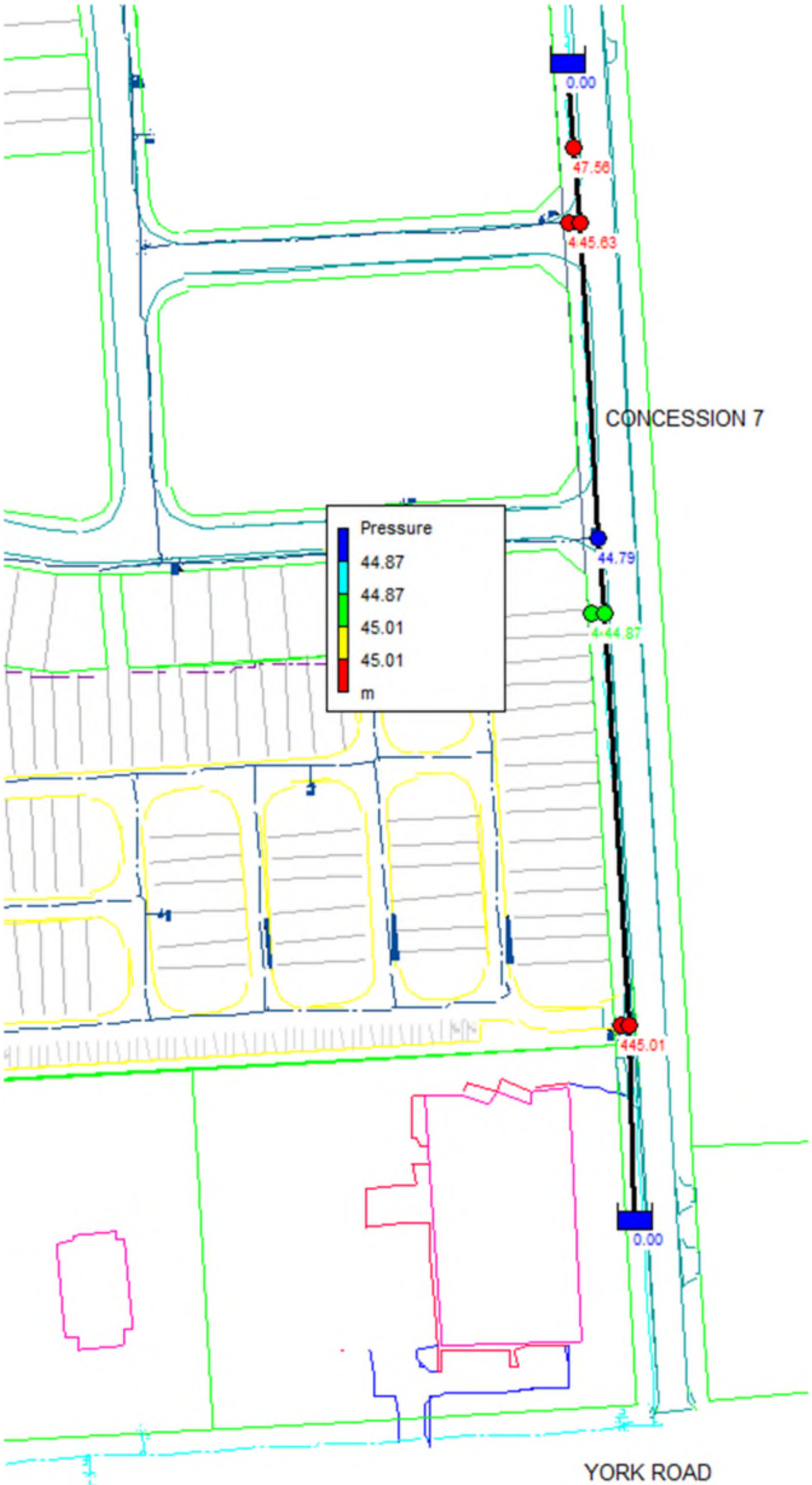


FIGURE 3 – EPANET IMAGERY – FUTURE DIAMETERS

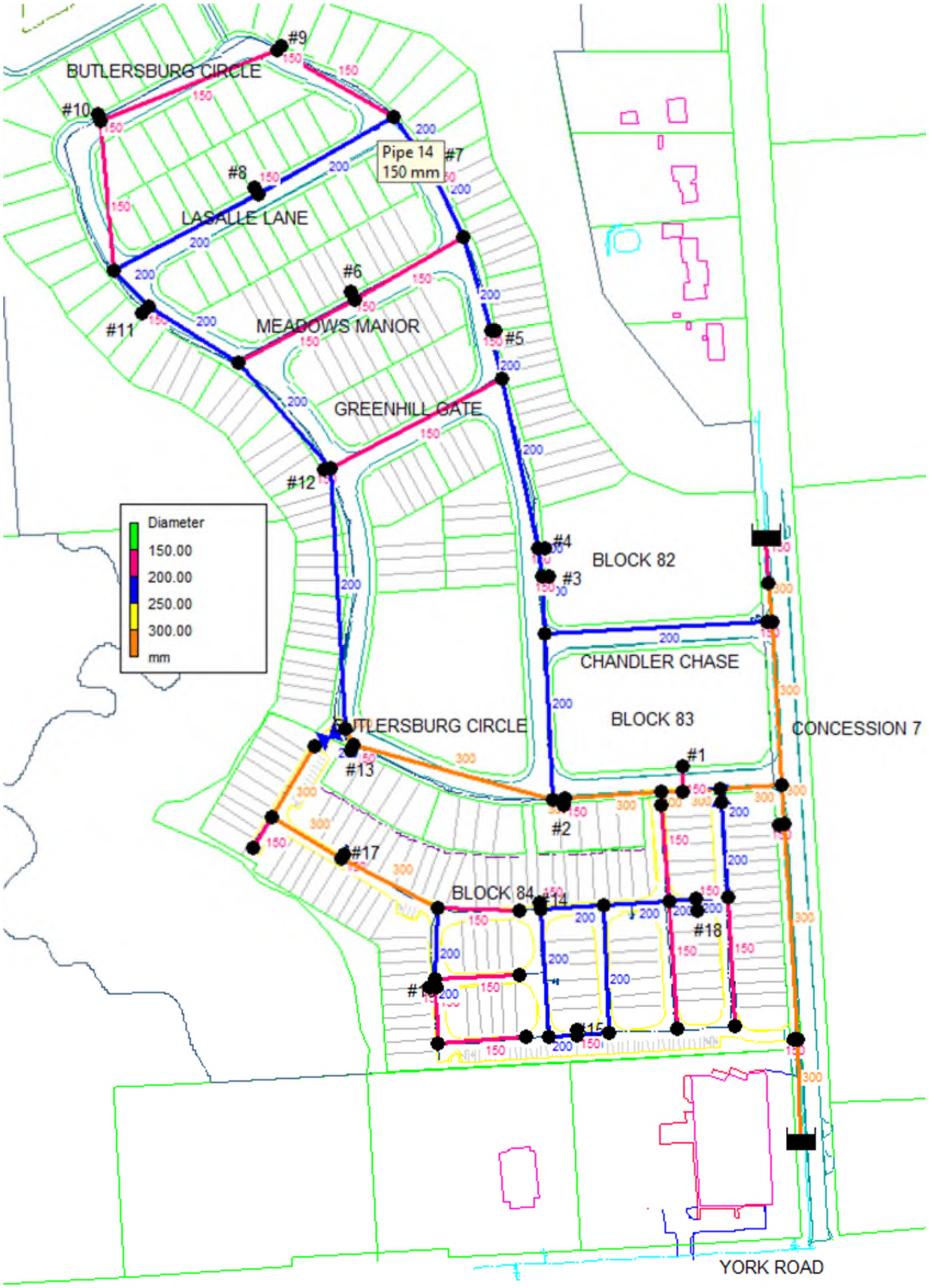
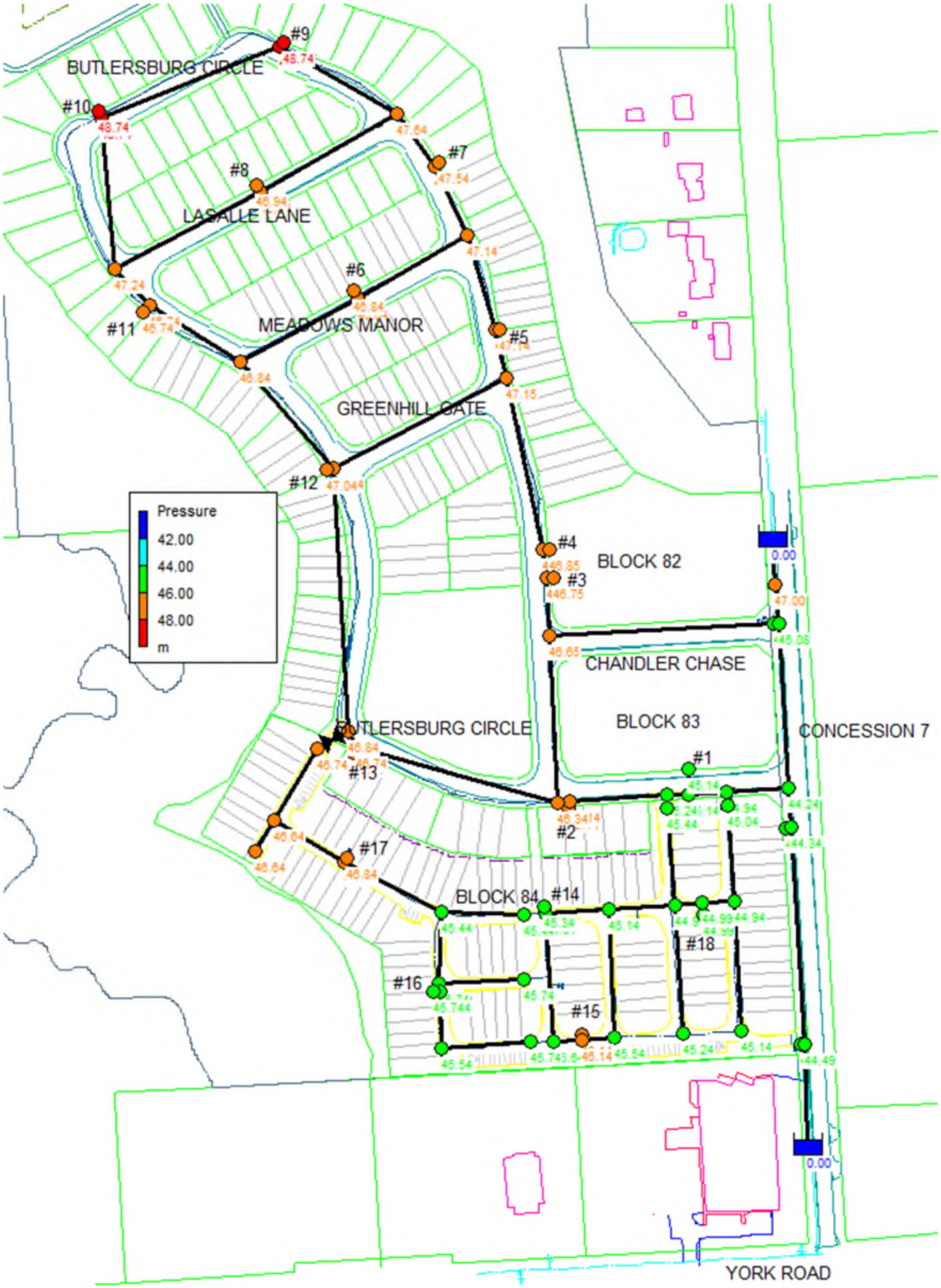


FIGURE 4 – EPANET IMAGERY – FUTURE STATIC PRESSURES



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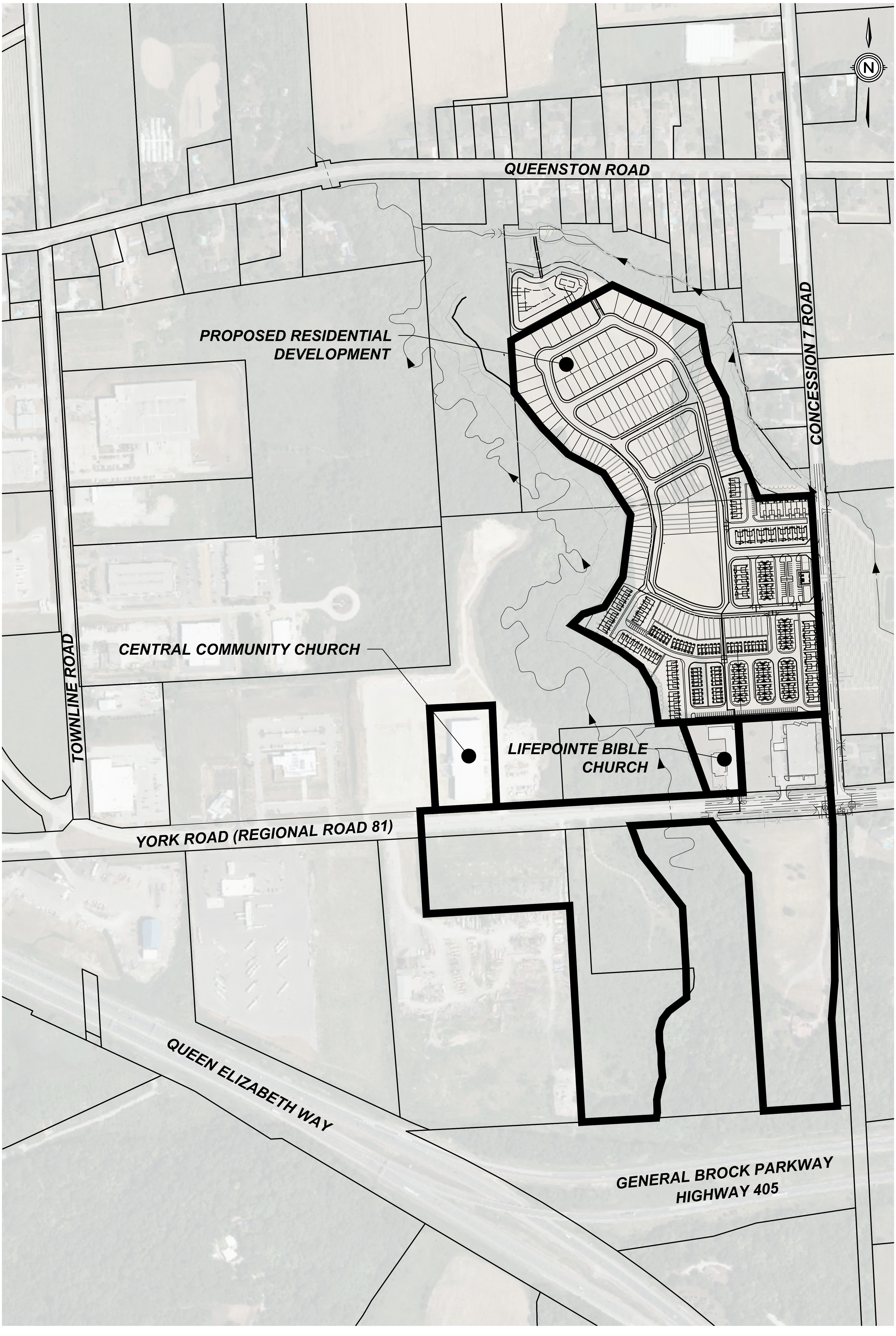
APPENDIX B

Figure 4 – Overall Sanitary Drainage Area Plan
Overall Sanitary Sewer Calculations
Glendale Industrial Area Servicing Study – Sanitary Sewer Calcs & Drainage Area Plan



UPPER CANADA CONSULTANTS
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CONCESSION 7

TOWN OF NIAGARA-ON-THE-LAKE

OVERALL SANITARY DRAINAGE AREA PLAN

DATE	2021-06-16
SCALE	1:5000 m
REF No.	2130
DWG No.	FIGURE 4

DRAWING FILE: F:\2130\Engineering\2130 BASE.dwg PLOTTED: Jun 16, 2021 - 2:24pm PLOTTED BY: kurt

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

DESIGN FLOWS

RESIDENTIAL: 255 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INSTITUTIONAL/CHURCH: 315 LITRES/PARKING SPACE (ASSUMING 3 PERSONS PER PARKING SPACE)
INDUSTRIAL: 0.45 L / s / GROSS HECTARE (MECP DESIGN CRITERIA)
INFILTRATION RATE: 0.286 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L / s / ha)
POPULATION DENSITY: 2.4 PERSONS / UNIT

INDUSTRIAL PEAKING FACTOR 2.00 (MINIMUM PER MECP DESIGN CRITERIA)

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 : MODERO ESTATES
PROJECT NO: 2130

SANITARY SEWER DESIGN SHEET

Res. 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
A1 - BUTLERSBURG CIR	PIT MH	F	1.06	1.06	15	2.4	36	36	4.34	0.46	0.30	0.76						
A2 - LASALLE LANE	E	F	0.64	0.64	13	2.4	31	31	4.35	0.40	0.18	0.58	200	100.0	0.60	0.82	26.50	2.2%
A3 - BUTLERSBURG CIR	F	G	0.16	1.86	2	2.4	5	72	4.28	0.91	0.53	1.44	250	27.2	0.25	0.61	31.02	4.6%
A4 - BUTLERSBURG CIR	G	K	0.24	2.10	7	2.4	17	89	4.26	1.12	0.60	1.72	250	50.9	0.25	0.61	31.02	5.5%
A5 - MEADOWS MANOR	H	I	0.22	0.22	5	2.4	12	12	4.41	0.16	0.06	0.22	200	25.2	1.00	1.06	34.22	0.6%
A6 - MEADOWS MANOR	I	J	0.63	0.85	18	2.4	43	55	4.31	0.70	0.24	0.94	200	84.3	0.40	0.67	21.64	4.4%
MEADOWS MANOR	J	K		0.85				55	4.31	0.70	0.24	0.94	200	8.0	0.40	0.67	21.64	4.4%
A7 - BUTLERSBURG CIR	K	O	0.34	3.29	10	2.4	24	168	4.17	2.07	0.94	3.01	250	77.7	0.25	0.61	31.02	9.7%
A8 - GREENHILL GATE	L	M	0.25	0.25	8	2.4	19	19	4.38	0.25	0.07	0.32	200	23.9	1.00	1.06	34.22	0.9%
A9 - GREENHILL GATE	M	N	0.36	0.61	11	2.4	26	46	4.32	0.58	0.17	0.76	200	43.0	0.40	0.67	21.64	3.5%
GREENHILL GATE	N	O		0.61				46	4.32	0.58	0.17	0.76	200	12.5	0.40	0.67	21.64	3.5%
A10 - BUTLERSBURG CIR	O	P	0.39	4.29	9	2.4	22	235	4.12	2.86	1.23	4.09	250	59.9	0.25	0.61	31.02	13.2%
A11 - BUTLERSBURG CIR	P	Q	0.23	4.52	5	2.4	12	247	4.11	3.00	1.29	4.29	250	37.8	0.25	0.61	31.02	13.8%
A12 - BLOCK 82	STUB	Q	0.91	0.91	26	2.4	62	62	4.29	0.79	0.26	1.05	200	7.5	0.40	0.67	21.64	4.9%
A13 - BUTLERSBURG CIR	Q	R	0.06	5.49				310	4.07	3.72	1.57	5.29	250	39.5	0.25	0.61	31.02	17.1%
A14 - BUTLERSBURG CIR	R	V	0.12	5.61				310	4.07	3.72	1.60	5.33	250	79.5	0.25	0.61	31.02	17.2%
A15 - BLOCK 83 EAST	STUB	S	0.49	0.49	13	2.4	31	31	4.35	0.40	0.14	0.54	200	10.5	0.40	0.67	21.64	2.5%
A16 - BUTLERSBURG CIR	S	U	0.10	0.59	1	2.4	2	34	4.35	0.43	0.17	0.60	200	33.5	0.40	0.67	21.64	2.8%
A17 - BLOCK 83 WEST	STUB	U	0.34	0.34	15	2.4	36	36	4.34	0.46	0.10	0.56	200	10.5	1.00	1.06	34.22	1.6%
A18 - BUTLERSBURG CIR	U	V	0.17	1.10	4	2.4	10	79	4.27	1.00	0.31	1.31	200	36.3	0.40	0.67	21.64	6.1%
BUTLERSBURG CIR	V	JJ		6.71				389	4.03	4.62	1.92	6.54	250	10.1	0.25	0.61	31.02	21.1%
A19 - BUTLERSBURG CIR	PIT MH	Z	1.01	1.01	14	2.4	34	34	4.35	0.43	0.29	0.72						
A20 - BUTLERSBURG CIR	E	Y	0.43	0.43	9	2.4	22	22	4.38	0.28	0.12	0.40	200	60.5	0.60	0.82	26.50	1.5%
	Y	Z		0.43				22	4.38	0.28	0.12	0.40	200	8.0	0.40	0.67	21.64	1.9%
A21 - BUTLERSBURG CIR	Z	AA	0.16	1.60	2	2.4	5	60	4.30	0.76	0.46	1.22	250	36.3	0.25	0.61	31.02	3.9%
A22 - BUTLERSBURG CIR	AA	BB	0.22	1.82	5	2.4	12	72	4.28	0.91	0.52	1.43	250	44.2	0.25	0.61	31.02	4.6%
A23 - BUTLERSBURG CIR	BB	CC	0.18	2.00	4	2.4	10	82	4.27	1.03	0.57	1.60	250	39.4	0.25	0.61	31.02	5.2%
A24 - BUTLERSBURG CIR	CC	DD	0.14	2.14	3	2.4	7	89	4.26	1.12	0.61	1.73	250	36.0	0.25	0.61	31.02	5.6%
A25 - BUTLERSBURG CIR	DD	EE	0.14	2.28	4	2.4	10	98	4.25	1.23	0.65	1.89	250	28.4	0.25	0.61	31.02	6.1%
A26 - BUTLERSBURG CIR	EE	FF	0.30	2.58	8	2.4	19	118	4.22	1.47	0.74	2.20	250	39.7	0.25	0.61	31.02	7.1%
A27 - BUTLERSBURG CIR	FF	GG	0.31	2.89	9	2.4	22	139	4.20	1.73	0.83	2.55	250	67.1	0.25	0.61	31.02	8.2%
A28 - BUTLERSBURG CIR	GG	HH	0.02	2.91				139	4.20	1.73	0.83	2.56	250	11.5	0.25	0.61	31.02	8.2%
A29 - BUTLERSBURG CIR	HH	II	0.30	3.21	6	2.4	14	154	4.19	1.90	0.92	2.82	250	71.0	0.25	0.61	31.02	9.1%
A30 - BUTLERSBURG CIR	II	JJ	0.15	3.36	3	2.4	7	161	4.18	1.98	0.96	2.95	250	31.5	0.25	0.61	31.02	9.5%
A31 - ACCESS	JJ	KK	0.04	10.11				550	3.95	6.41	2.89	9.30	300	64.5	0.20	0.62	45.12	20.6%
A32 - LANEWAY 84A	84-A	84-C	0.23	0.23	7	2.4	17	17	4.39	0.22	0.07	0.28	200	44.5	0.60	0.82	26.50	1.1%
A33 - LANEWAY 84A	84-B	84-C	0.09	0.09	3	2.4	7	7	4.43	0.09	0.03	0.12	200	17.0	0.60	0.82	26.50	0.5%
A34 - LANEWAY 84G	84-C	84-D	0.40	0.72	18	2.4	43	67	4.29	0.85	0.21	1.06	200	77.3	0.40	0.67	21.64	4.9%
A35 - LANEWAY 84G	84-D	84-E	0.13	0.85	4	2.4	10	77	4.27	0.97	0.24	1.21	200	34.3	0.40	0.67	21.64	5.6%
A36 - LANEWAY 84G	84-E	KK	0.21	1.06	11	2.4	26	103	4.24	1.29	0.30	1.59	200	43.7	0.40	0.67	21.64	7.4%
A37 - LANEWAY 84F	84-F	84-H	0.27	0.27	13	2.4	31	31	4.35	0.40	0.08	0.48	200	51.0	1.00	1.06	34.22	1.4%
A38 - LANEWAY 84F	84-G	84-H	0.38	0.38	16	2.4	38	38	4.34	0.49	0.11	0.60	200	61.9	1.00	1.06	34.22	1.8%
A39 - LANEWAY 84G	84-H	84-K	0.01	0.66				70	4.28	0.88	0.19	1.07	200	31.9	0.40	0.67	21.64	4.9%
A40 - LANEWAY 84E	84-I	84-K	0.13	0.13	6	2.4	14	14	4.40	0.19	0.04	0.22	200	50.4	1.00	1.06	34.22	0.7%
A41 - LANEWAY 84E	84-J	84-K	0.30	0.30	14	2.4	34	34	4.35	0.43	0.09	0.52	200	55.7	1.00	1.06	34.22	1.5%
A42 - LANEWAY 84G	84-K	84-M	0.10	1.19	4	2.4	10	127	4.21	1.58	0.34	1.92	200	35.1	0.40	0.67	21.64	8.9%
A43 - LANEWAY 84D	84-L	84-M	0.24	0.24	11	2.4	26	26	4.36	0.34	0.07	0.41	200	55.5	1.00	1.06	34.22	1.2%
A44 - LANEWAY 84G	84-M	KK	0.10	1.53	4	2.4	10	163	4.18	2.01	0.44	2.45	200	33.5	2.50	1.67	54.10	4.5%
A45 - LANEWAY 84C	KK	LL	0.12	12.82	6	2.4	14	830	3.85	9.44	3.67	13.10	300	69.0	0.20	0.62	45.12	29.0%
A46 - LANEWAY 84B	84-N	84-P	0.12	0.12	5	2.4	12	12	4.41	0.16	0.03	0.19	200	28.6	1.00	1.06	34.22	0.6%
A47 - LANEWAY 84H	84-O	84-P	0.17	0.17	12	2.4	29	29	4.36	0.37	0.05	0.42	200	44.0	1.00	1.06	34.22	1.2%
A48 - LANEWAY 84B	84-P	84-Q	0.11	0.40	5	2.4	12	53	4.31	0.67	0.11	0.79	200	34.3	0.40	0.67	21.64	3.6%
A49 - LANEWAY 84I	84-Q	LL	0.19	0.59	7	2.4	17	70	4.28	0.88	0.17	1.05	200	54.7	1.50	1.29	41.91	2.5%
A50 - LANEWAY 84I	LL	MM	0.03	13.44				900	3.83	10.17	3.84	**14.01**	300	12.5	0.20	0.62	45.12	31.1%
LIFEPOINTE CHURCH					75	3.0			2.00	1.64								
A51 - CHURCH	MM	NN	0.46	13.90				900	3.83	11.81	3.98	15.79	300	90.0	0.20	0.62	45.12	35.0%
A52 - CHURCH	NN	OO	0.03	13.93				900	3.83	11.81	3.98	15.80	300	38.4	0.20	0.62	45.12	35.0%
A53 - DEL PRIORE	SERVICE	OO	1.22	1.22	-				2.00	1.10	0.35	1.45						
YORK ROAD OUTLET	OO	EX MH		15.15				900	3.83	12.91	4.33	17.24	300	14.0	0.20	0.62	45.12	38.2%
Remaining Light Industrial - south side of York Road			13.85	13.85		0.45 L/s/ha			2.00	12.47	3.96	16.43						
										25.37	8.64	**35.12**	375	388.0	0.22	0.75	85.79	40.9%
York Road - 490m East of Townline to Townline Road			37.80	66.80		0.45 L/s/ha			2.00	59.39	19.10	78.50	375	492.0	0.42	1.04	118.54	66.2%
Townline Road - York Road to 140m North			11.00	77.80		0.45 L/s/ha			2.00	69.29	22.25	91.55	450	146.0	0.44	1.20	197.30	46.4%
Townline Road - 140m North of York to 350m South of Q			13.40	91.20		0.45 L/s/ha			2.00	81.35	26.08	107.44	525	352.0	0.39	1.25	280.19	38.3%
Townline Road - 350m South of Queenston to Queenston			26.70	117.90		0.45 L/s/ha			2.00	105.38	33.72	139.10	525	343.0	0.17	0.83	184.99	75.2%
Queenston Road - Townline Road to Taylor Road			8.50	126.40		0.45 L/s/ha			2.00	113.03	36.15	149.18	525	850.0	0.17	0.83	184.99	80.6%
			126.40															

Note: Lands as part of 'Remaining Light Industrial' Area include south side properties from #785-#683 York Road as well as the northerly #680 York Road
** All pipe lengths and slopes, as well as all drainage areas and flow rates downstream of the focus drainage area taken from the 'Glendale Industrial Area Servicing Study Update' (June 25, 1992)

GLENDALE INDUSTRIAL AREA SERVICING STUDY UPDATE

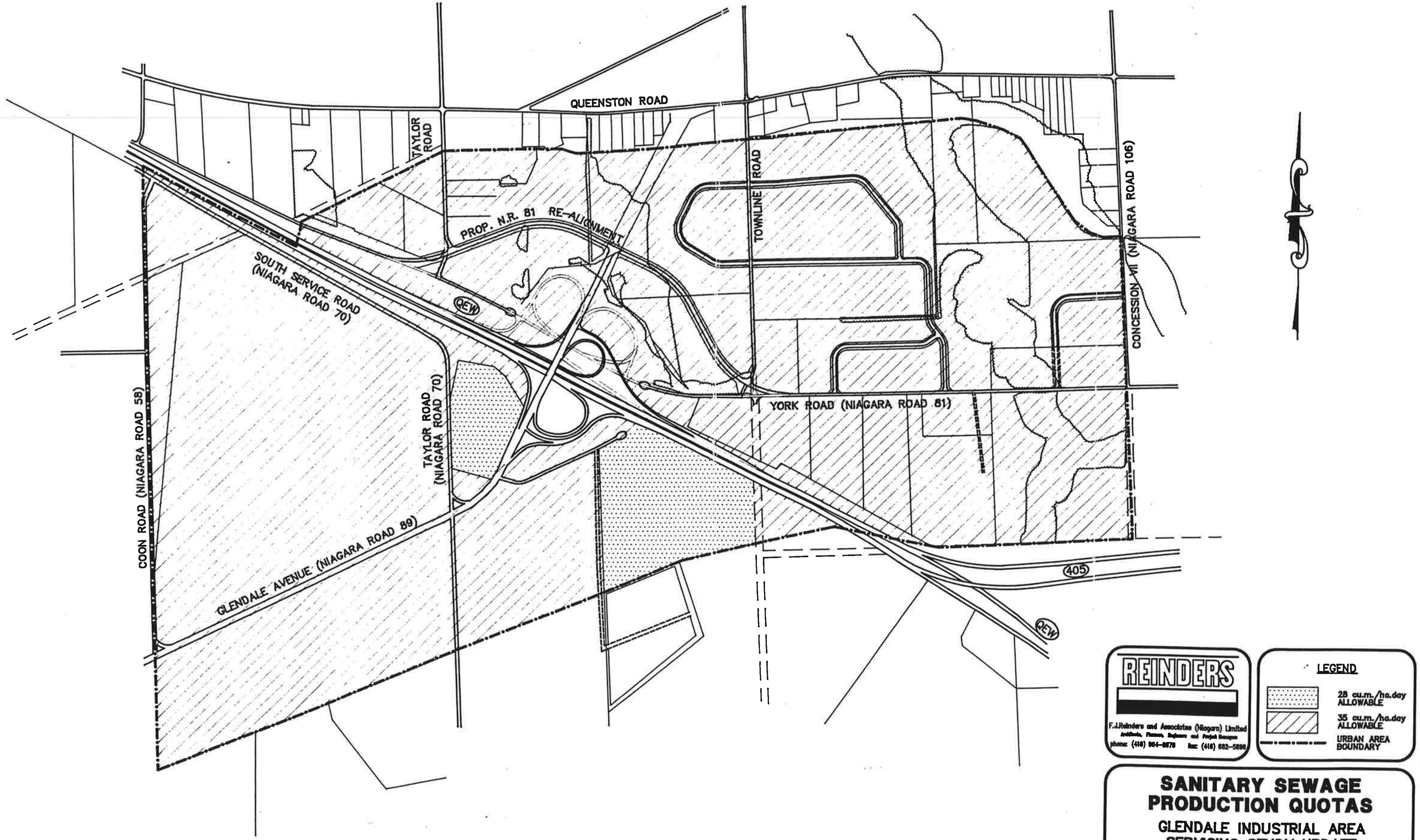
CAPACITY CHECK - EXISTING AND PROPOSED SANITARY SEWERS

Design Flow, Q(d) = Peak Domestic Flow, Q(p) + Peak Infiltration, Q(i) + External Point Load, Q(x)
Q(p) = AqM, where A = Contributing Area (ha)
q = Average Domestic Flow (l/ha-s)
0.4051 l/ha-s (3,100 IGPD) for light, service and prestige industrial
0.6366 l/ha-s (4,900 IGPD) for heavy industrial
0.3241 l/ha-s (2,500 IGPD) for commercial and institutional
M = Peaking Factor (use Appendix B from MOE Design Guidelines)

Q(i) = Ai, where A = Contributing Area (ha)
i = unit of peak infiltration
use 0.21 l/ha-s

Pipe Capacity = $(R^{0.67}) A (S^{0.5})/n$
where Manning's n = 0.011 for PE & PVC
= 0.013 for concrete

STREET	LOCATION FROM	TO	PROBABLE LAND USE	AREA (ha)	q (l/ha-s)	M	Q(p) (l/s)	Q(i) (l/s)	Q(x) (l/s)	Q(d) (l/s)	LENGTH (m)	SIZE (mm)	TYPE	AVERAGE GRADE (%)	CAPACITY (l/s)	CAPACITY USED (%)
York Road	110m west of Concession VII	490m east of Townline Road	Light Ind.	33.2	0.4051	3.35	45.1	7.0		52.1	388	375	PVC (DR35)	0.22	97.2	54
York Road	490m east of Townline Road	Townline Road	Light Ind.	71.0	0.4051	2.85	82.0	14.9		96.9	492	375	PVC (DR35)	0.42	134.3	72
Townline Road	York Road	140m north of York Road	Light Ind.	82.0	0.4051	2.80	93.0	17.2		110.2	146	450	PVC (ribbed)	0.44	223.5	49
Townline Road	140m north of York Road	350m south of Queenston Road	Light Ind.	95.4	0.4051	2.70	104.3	20.0		124.3	352	525	PVC (ribbed)	0.39	317.4	39
Townline Road	350m south of Queenston Road	Queenston Road	Light Ind.	122.1	0.4051	2.55	126.1	25.6		151.7	343	525	PVC (ribbed)	0.17	209.6	72
Queenston Road	Townline Road	Taylor Road	Light Ind.	130.6	0.4051	2.55	134.9	27.4		162.3	850	525	PVC (ribbed)	0.17	209.6	77
Taylor Road	Walker's Bros. Landfill	404m south of Glendale Ave.	Allowable discharge from Walker Bros. Landfill						5.3 (0.1MIGD)	5.3		150	PVC (DR35)	1.24 (Not as-built)	20.0	under head
Taylor Road	404m south of Glendale Ave.	390m south of Glendale Ave.	Allowable discharge from Walker Bros. Landfill						5.3	5.3	14	200	PVC (DR35)	1.24 (Not as-built)	43.2	under head
Taylor Road	390m south of Glendale Ave.	15m south of Glendale Ave.	Comm./Inst. Light Ind.	16.5 6.9	0.4051 0.4051	3.55	33.7	4.9	5.3	43.9	376	375	PVC (DR35)	0.72 (Not as-built)	175.8	25
Glendale Ave.	Coon Road	450m west of Taylor Road	Light Ind.	30.2	0.4051	3.35	41.0	6.3		47.3	450	300	FUTURE	0.30	62.6	76
Glendale Ave.	450m west of Taylor Road	Taylor Road	Light Ind.	44.6	0.4051	3.15	56.9	9.4		66.3		375	FUTURE	0.25	103.6	64



REINDERS

F.J.Reinders and Associates (Niagara) Limited

phone: (416) 984-8870 fax: (416) 682-5896

SANITARY SEWAGE PRODUCTION QUOTAS

GLENDALE INDUSTRIAL AREA SERVICING STUDY UPDATE NIAGARA-ON-THE-LAKE, ONTARIO

SCHEDULE D

SCALE 1:10000

JUNE 25, 1992

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDIX B

Modero – Stormwater Management Plan

STORMWATER MANAGEMENT PLAN

MODERO SUBDIVISION

TOWN OF NIAGARA-ON-THE-LAKE

Prepared for:

Marz Homes (NOTL) inc.

Prepared by:

Upper Canada Consultants
3-30 Hannover Drive
St. Catharines, Ontario
L2W 1A3

Revised August 8, 2025

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REFERENCES

1. Stormwater Management Planning and Design Manual
   Ontario Ministry of Environment (March 2003)

STORMWATER MANAGEMENT PLAN

MODERO

TOWN OF NIAGARA-ON-THE-LAKE

1.0 INTRODUCTION

1.1 Study Area

The proposed residential development is located in the Town of Niagara-on-the-Lake as part of Lots 180 & 181. As shown on the enclosed Site Location Plan (Figure 1), the subject property is situated west of Concession 7 Road, north of York Road (Regional Road 81) and south of Queenston Road.

The 23.01-hectare property is bound by Six Mile Creek to the west, as well as a tributary of Six Mile Creek at the north-east portion of the property. Provincially Significant Wetland, and further forested lands as part of Six Mile Creek, makes up approximately 7.59 hectares of the proposed site. Lifepointe Church and Del Priore Kitchens occupy properties at the southern limits of the site fronting York Road (Regional Road 81) and proposed development property has approximately 300m of frontage on Concession 7 Road.

This Stormwater Management Plan will discuss the servicing strategy for two separate stormwater systems: the Modero Subdivision (wet pond facility), as well as the Concession 7 Road Reconstruction (storm sewers). Lands to the south of the Modero Subdivision (i.e. Lifepointe Bible Church & Del Priore Custom Kitchens) will drain through existing stormwater systems (ditch & storm sewers) to the Six Mile Creek to the west. The York Road (Regional Road 81) stormwater system will remain unaffected by the proposed works.

1.2 Objectives

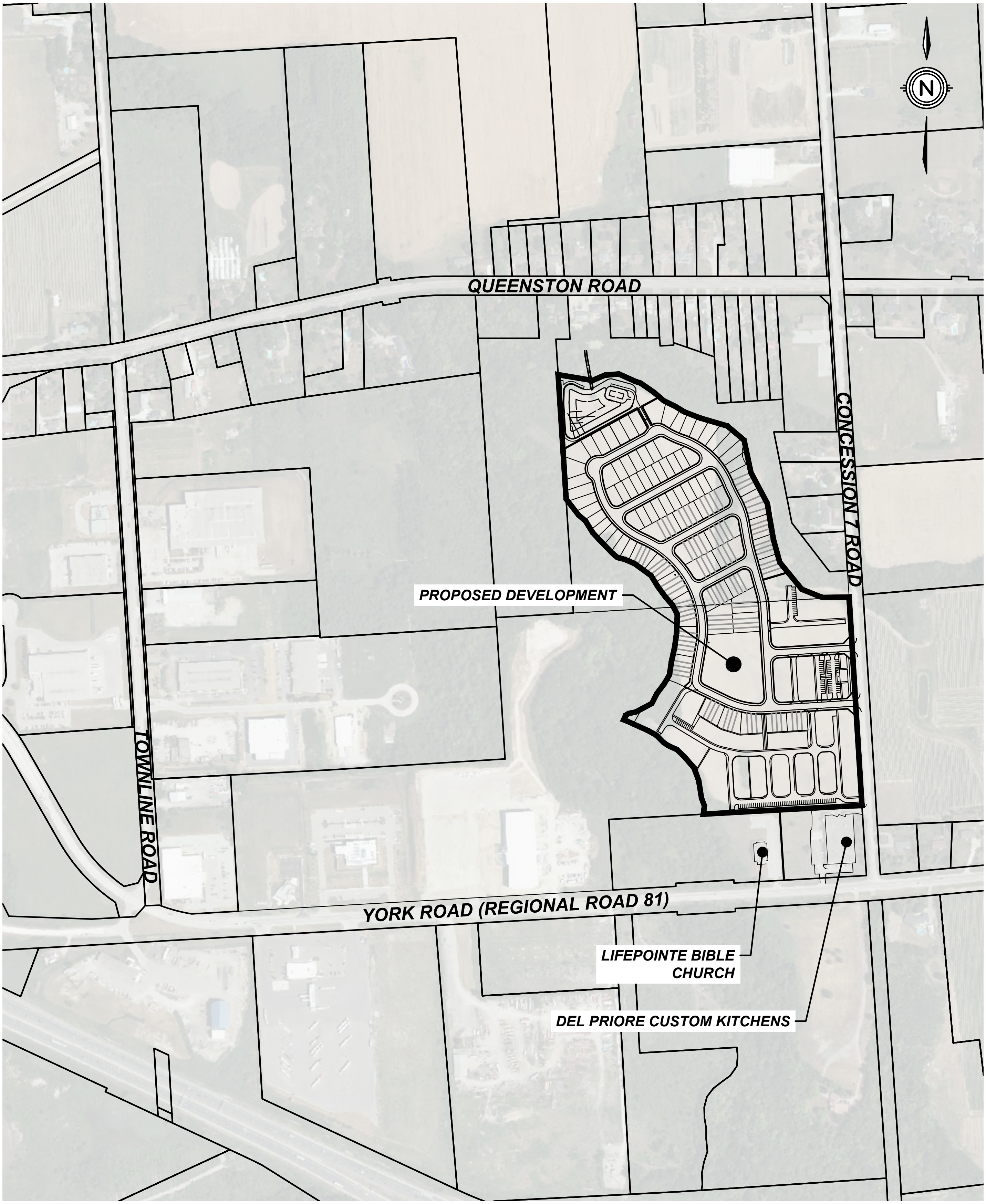
The objectives of this study are as follows:

1. Establish specific criteria for the management of stormwater from this site.

2. Determine the impact of development on the stormwater peak flows & volumes from this site.

3. Investigate alternatives for controlling the quantity and quality of stormwater from this site.

4. Recommend a comprehensive plan for the management of stormwater during and after construction.



UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

CONCESSION 7 DEVELOPMENT

TOWN OF NIAGARA-ON-THE-LAKE

SITE LOCATION PLAN

DATE	2021–06–17
SCALE	1:7500 m
REF No.	2130
DWG No.	FIGURE 1

DRAWING FILE: F:\2130\Engineering\2130 BASE.dwg PLOTTED: Jun 17, 2021 – 2:11pm PLOTTED BY: kurt

1.3 Existing & Proposed Conditions

a) Existing Conditions

The site has historically been used for agricultural purposes but is presently open space. The 23.01-hectare property includes 7.59 hectares of undevelopable lands along the west and north-east portion of the property comprised of Provincially Significant Wetland and forested lands as part of Six Mile Creek.

Peak stormwater flows from the site are conveyed to either the Main Branch west of the development or a tributary of Six Mile Creek at the north-east portion of the development under current conditions. A drainage area of approximately 655 hectares upstream of the York Road culvert (west of Lifepoint Bible Church) conveys stormwater flows from Niagara-on-the-Lake and Niagara Falls to the Main Branch of Six Mile Creek, west of the development. A drainage area of approximately 43.5 hectares conveys stormwater flows to the Concession 7 culvert (south of #330 Concession 7 Rd) and to the tributary of Six Mile Creek and the north-east portion of the development. Stormwater flows being conveyed through Six Mile Creek ultimately outlet to Lake Ontario to the North.

b) Proposed Conditions

The proposed development site is approximately 15.42 hectares and shall consist of 3 condominium blocks (206 units), 128 townhouses and 55 single family homes for a total count of 389 units. The site shall be provided with full municipal services including sanitary sewers, storm sewers and watermain with asphalt pavement, concrete curbs and gutters. The proposed stormwater management plan discusses the proposed development under fully developed conditions.

2.0 STORMWATER MANAGEMENT CRITERIA

New developments are required to provide stormwater management in accordance with provincial and municipal policies including:

- Stormwater Quality Guidelines for New Development (MECP/MNRF, May 1991)
- Stormwater Management Planning and Design Manual (MECP, March 2003)

Based on the comments and outstanding policies from various agencies (Town of Niagara-on-the-Lake, Regional Municipality of Niagara, Niagara Peninsula Conservation Authority (NPCA), and the Ministry of the Environment, Conservation and Parks (MECP), and others) the following site-specific considerations were identified:

- The receiving watercourse, Six Mile Creek has been identified by the Ministry of Natural Resources watercourse evaluation as a **Type 2** (*Important*) fish habitat. Based on this fish habitat, the corresponding required minimum MECP level of protection for stormwater management quality practices for this development site is *Normal*. However, per Town of Niagara-on-the-Lake guidelines, it will be required to provide quality enhancements to *Enhanced* (80% TSS removal) Protection levels.
- The site outlets to Six Mile Creek which contains lands that would be negatively impacted by increased flooding levels, and, therefore, stormwater quantity control is considered necessary to maintain the downstream peak water elevations.

Based on the above policies and site-specific considerations, the following stormwater management criteria have been established for this site.

- Stormwater **quality** controls are to be provided for the internal stormwater system of the development as well as the Concession 7 road reconstruction according to MECP guidelines. Quality enhancements will be provided to a minimum of *Enhanced Protection* (80% TSS removal) standard prior to discharge to Six Mile Creek Tributary.
- Stormwater **quantity** controls are to be provided for the outlet to limit the proposed development peak flows from the 2-, 5-, and 100-year storm events to existing peak flow levels.

3.0 STORMWATER ANALYSIS

A stormwater analysis has been conducted by Upper Canada Consultants as part of the design of this development using the MIDUSS computer modelling program. A new stormwater analysis was conducted to represent the existing and future conditions to Six Mile Creek.

This program was selected because it is applicable to an urban drainage area like the study area, it is relatively easy to use and modify for the proposed drainage conditions and control facilities, and it readily allows for the use of design storm hyetographs for the various return periods being investigated.

Copies of the current model output files are enclosed in Appendix B.

3.1 Design Storms

Design storm hyetographs were developed using a Chicago distribution based on the Town of Niagara-on-the-Lake Intensity-Duration-Frequency curves. Hyetographs for the 25mm, 5 and 100 year events were developed using a 4-hour Chicago distribution. The 100-year storm event has also been modelled for a 24-hour storm event to ensure sufficient capacities are provided as requested by the Region. Table 1 summarizes the rainfall data.

Table 1. Rainfall Data

Design Storm (Return Period)	Chicago Distribution Parameters		
	a	b	c
25mm	512.0	6.00	0.800
2 Year	567.0	5.20	0.746
5 Year	664.0	4.70	0.744
100 Year	980.0	3.70	0.732

$$\text{Intensity } (mm/hr) = \frac{a}{(t_d + b)^c}$$

3.2 Existing Conditions

Existing conditions were modelled to establish peak stormwater flows and volumes prior to any development within this site. The existing drainage areas for this subwatershed (shown on Figure 2 & 2a) were determined from field investigation, recent topographic surveys. The stormwater drainage for the proposed development has been split into three outlets, as well as a combined flow outlet for the purpose of stormwater modelling. As seen on Figure 2, the majority of the existing site conveys stormwater flows to the Six Mile Creek Tributary at the north-eastern portion of the site which has been split into two stormwater outlets (Stormwater Outlet B and C) to more accurately depict upstream and downstream conditions within the tributary. Stormwater Outlet 'D' represents the combined flowrate from outlets 'B' and 'C' within the Six Mile Creek tributary. Figure 2a outlines the delineated upstream drainage area discharging to Outlet B at the Six Mile Creek Tributary.

Input parameters for the model for existing conditions are shown in Table 2, with stormwater flows and volumes outlined in Table 3. The SCS Curve Number chosen for this development represents the current vacant open space conditions for a B/C Soil Group.

3.3 Proposed Conditions

The future drainage areas for the proposed development, shown in Figure 3, were delineated and modelled to establish the stormwater peak flows and volumes once development has been completed at the proposed site. Input parameters for the computer model with the proposed development conditions are shown in Table 2.

Table 2. Hydrologic Parameters

Area No.	Area (ha)	Length (m)	Slope (%)	SCS CN	Percent Impervious
Existing Conditions					
EX1	3.41	60	1.5	77	1.0%
EX2	1.86	60	2.0	77	3.2%
EX3	1.36	50	1.0	77	9.7%
EX4	8.14	400	1.0	77	1.0%
EX5	2.62	60	1.0	77	1.0%
EXT -E	54.09	900	1.0	77	3.0%
	71.48	**Total Area**			
Future Conditions					
A1	1.28	50	1.0	77	26.2
A2	2.35	140	1.0	77	28.8
A3	0.85	40	1.0	77	23.6
A4	13.08	600	1.0	77	70.0
EXT-F	54.00	900	1.0	77	3.0%
	71.56	**Total Area**			

Shown in Figures 2 and 3, peak stormwater flows and volumes have been calculated for three stormwater outlets under proposed and existing conditions. Stormwater Outlet 'A' represents stormwater flows being conveyed to the Main Branch of Six Mile Creek on the west limit of the site. Stormwater Outlets 'B' and 'C' both represent stormwater flows being directed to points along the Six Mile Creek tributary on the north-east portion of the site. Stormwater Outlet 'D' represents the combined peak stormwater flows from Outlets 'B' and 'C' within the Six Mile Creek tributary.

All stormwater flows conveyed to Stormwater Outlet 'A' under existing and proposed conditions are under sheet flow conditions from both Drainage Areas EX1 and A1. To model peak stormwater flows within the so named 'Six Mile Creek Tributary' on the north-east side of the site, the complete upstream drainage area has been delineated and noted as Drainage Area EXT (Figure 2a). For stormwater modelling of this development, Stormwater Outlet 'B' consists of the accumulation of peak stormwater flows from the upstream Drainage Area EXT in addition to Drainage Areas EX2, EX3 and EX4 under existing conditions and Drainage Areas A2 and A3 under proposed conditions.

Stormwater Outlet 'C' consists solely of Drainage Area EX5 under existing sheet flow conditions as well as outflows from the future SWM Facility as part of Drainage Area A4. This outlet has been denoted specifically to assist in specifying the location and quantity of flows discharging from both the future stormwater management facility and Drainage Area EX5. However, the calculations completed as part of this Stormwater Management Report have been conducted to ensure that peak stormwater flows at outlets A, B & D are maintained or are below existing conditions during the modelled storm events.

Under Existing Conditions (Figure 2), Drainage Areas EX1, EX4 & EX5 have all been attributed an imperviousness of 1.0% aligning with the open space conditions of these areas. A Weighted Impervious Calculation Sheet has been completed and included in Appendix A, detailing calculations to determine the respective imperviousness levels of Drainage Areas EX2 & EX3. For the purpose of this report, Drainage Area EXT has been attributed an imperviousness of 3.0% aligning with general impervious level of the overly agricultural lands in this space.

Under Future Conditions (Figure 3), weighted impervious calculations were completed for Drainage Areas A1, A2 & A3 with Drainage Area EXT remaining at an estimated imperviousness of 3.0%. A general weighted Runoff Calculation was conducted to Drainage Area A4 determining an average Runoff Coefficient of 0.68 (67.9% impervious). This SWM Plan has conservatively attributed an imperviousness of 70% for Drainage Area A4. Due to the urbanization of Concession 7, Drainage Area EXT is minorly reduced from 54.09 to 54.00 hectares under future conditions, however it will be discussed as Drainage Area EXT under both existing and future conditions within this report.

The stormwater conditions have been modelled for the various articulated outlets as part of this Stormwater Management Plan with the results shown in Table 3 on the next page. The table is meant to outline the difference in peak flows and volumes at the various outlets under existing conditions as well as future conditions without the inclusion of peak flow quantity controls. Modelling has been conducted for the 2-, 5- and 100-year events for a 4-hour Chicago storm event as well as a 100-year, 24-hour Chicago storm event as requested by the Region of Niagara.

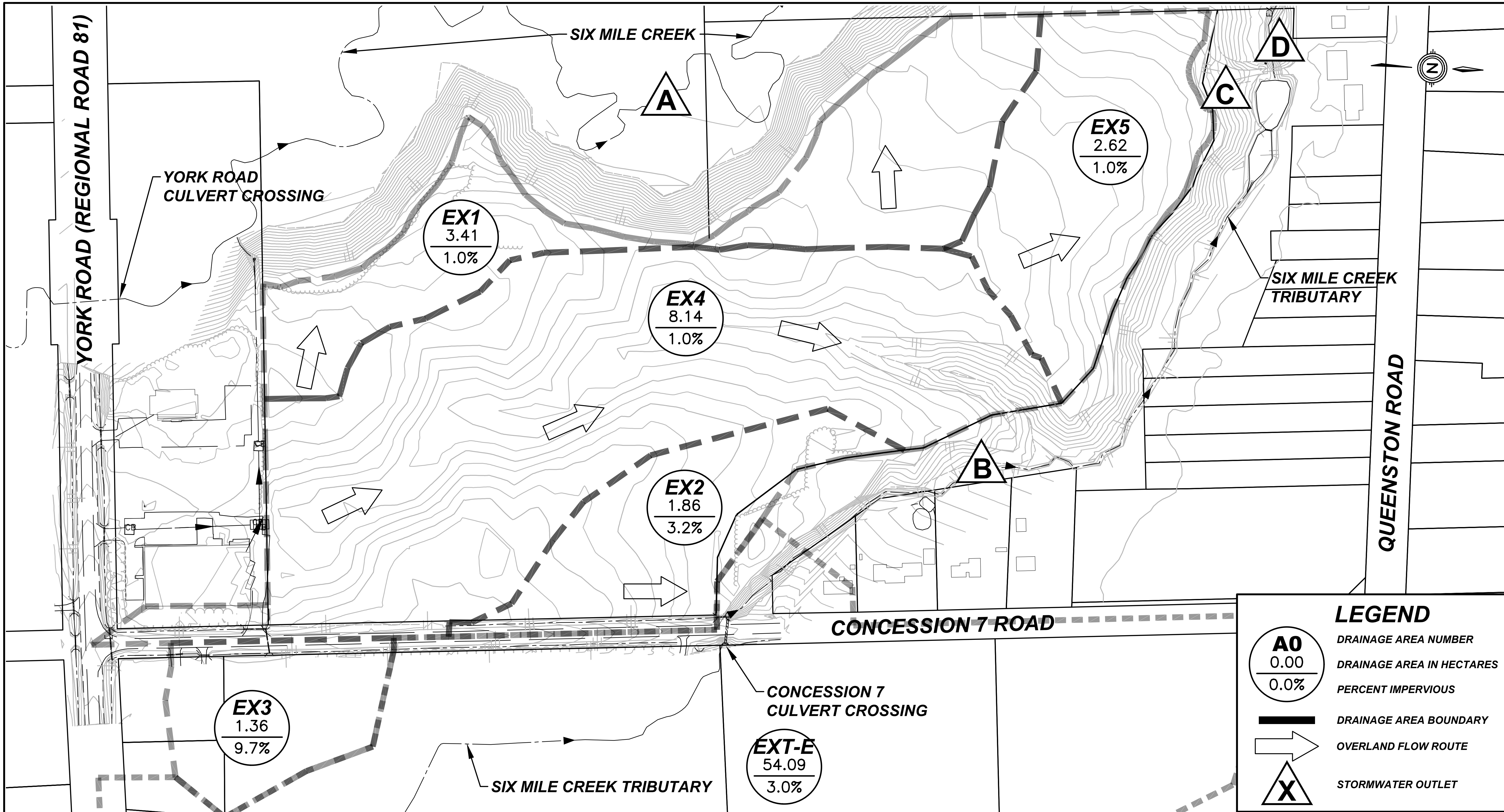
Table 3. Peak Flow and Volume for Future Development Conditions

Outlet	Peak Flow (L/s)			Volume (m^3)		
	Existing	Future*	Change	Existing	Future*	Change
2 Year Design Storm Event (4-hr Storm)						
A	47	47	0%	295	186	-109
B	246	258	+5%	5959	5253	-706
C	*33*	*981*	*+2,872%*	*227*	*3274*	*+3,047*
D	261	1,239	+375%	6182	8526	+2,344
5 Year Design Storm Event (4-hr Storm)						
A	75	64	-15%	418	242	-176
B	402	346	-14%	8364	7318	-1,046
C	*54*	*1,273*	*+2,257%*	*321*	*4,057*	*+3,736*
D	419	1,619	+286%	8682	11,371	+2,689
100 Year Design Storm Event (4-hr Storm)						
A	244	120	-51%	975	480	-495
B	1,281	1,052	-19%	19,188	16,586	-2,602
C	*177*	*2,497*	*+1,311%*	*748*	*6,999*	*+6,251*
D	1,326	3,265	+146%	19,933	23,584	+3,651
100 Year Design Storm Event (24-hr Storm)						
A	395	171	-57%	2141	948	-1,193
B	2,055	1,682	-18%	41,765	35,844	-5,921
C	*298*	*2566*	*+761%*	*1648*	*12,381*	*+10,733*
D	2,125	3,595	+69%	43,408	48,226	+4,858
*Note: Future Flows in this table area calculated without peak flow quantity controls						

As seen above in Table 3, stormwater flows directed to Outlet A will remain the same or decrease during all storm events. Therefore, stormwater quantity controls will not be required for this outlet.

Stormwater flows conveyed to Outlet B will increase slightly during the 2-year design storm event, though will be reduced during all other storm events. Therefore, stormwater quantity controls will be required to ensure no significant increase in flows occur at Outlet B during the 2-year event.

Outlet C has been included to outline the differential in peak flows due to the development, but does not represent flows within the adjacent Six Mile Creek watercourse. A significant increase is quantified at Outlet D under future conditions. Therefore, stormwater quantity controls will also be required for this outlet.



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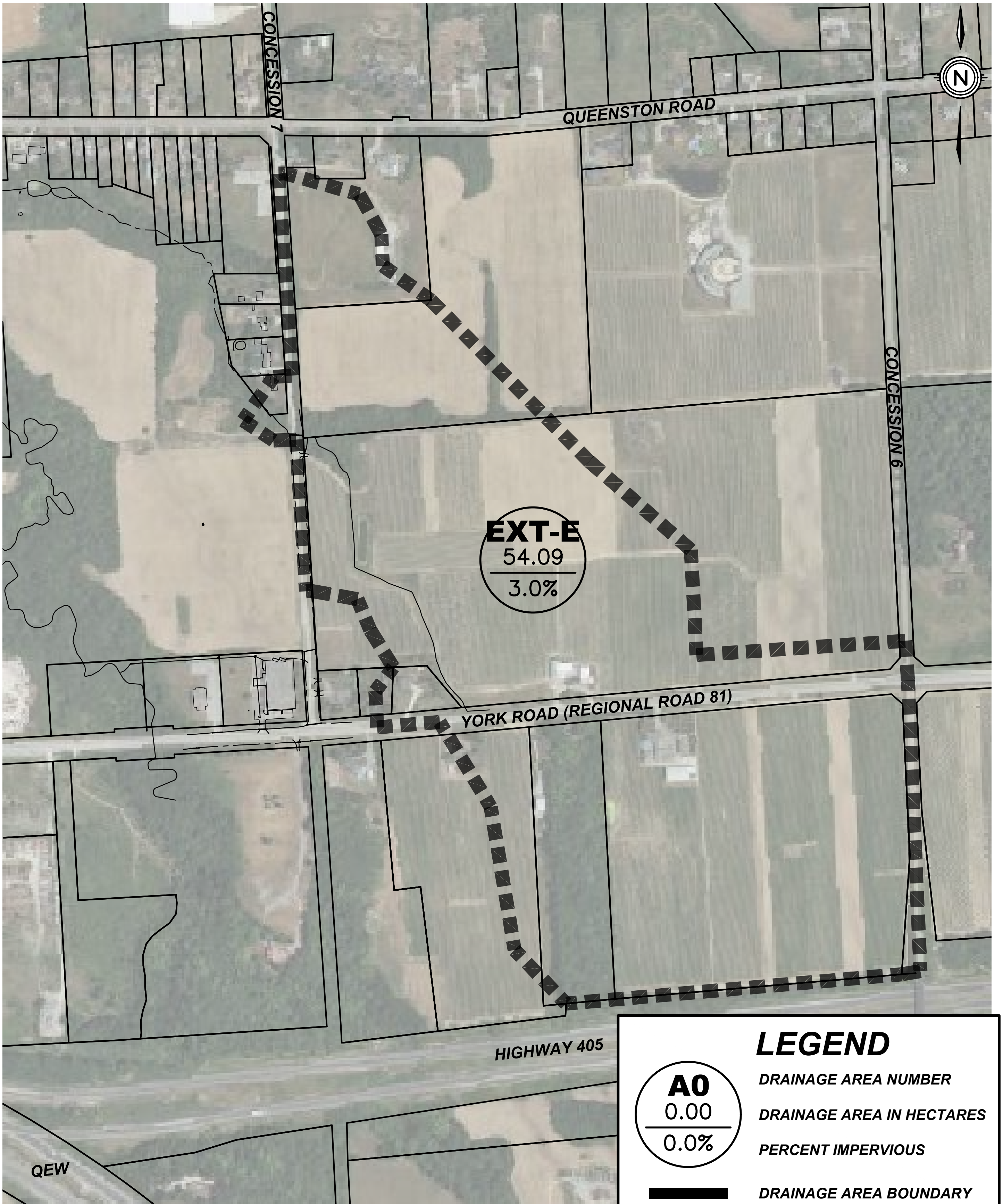
TOWN OF NIAGARA-ON-THE-LAKE

EXISTING STORM DRAINAGE AREA PLAN

DATE	2024–08–13
SCALE	1:2500 m
REF No.	2130
DWG No.	FIGURE 2

DRAWING FILE: F:\2130\Engineering\2130 BASE.dwg PLOTTED: Aug 13, 2024 – 3:57pm PLOTTED BY: kurt



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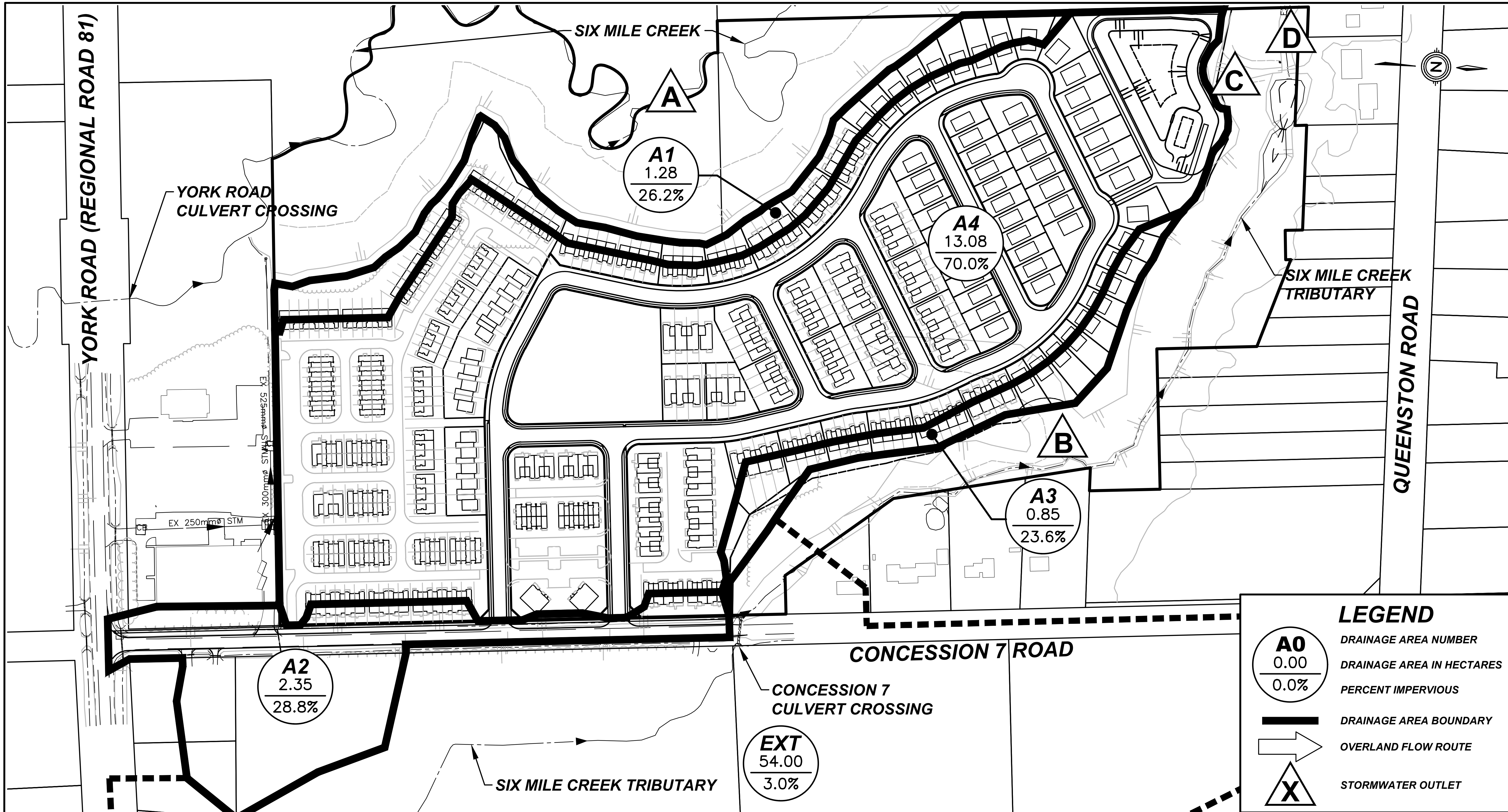
MODERO ESTATES SUBDIVISION

TOWN OF NIAGARA-ON-THE-LAKE
EXISTING UPSTREAM DRAINAGE AREA PLAN

DATE	2025–03–13
SCALE	1:7,500 m
REF No.	2130
DWG No.	FIGURE 2a

DRAWING FILE: F:\2130\Engineering\2130 BASE.dwg PLOTTED: Mar 13, 2025 – 3:25pm PLOTTED BY: kurt



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CONCESSION 7 - HUMMEL

TOWN OF NIAGARA-ON-THE-LAKE

PROPOSED OVERALL STORM DRAINAGE AREA PLAN

DATE	2024-08-13
SCALE	1:2500 m
REF No.	2130
DWG No.	FIGURE 3

DRAWING FILE: F:\2130\Engineering\2130 BASE.dwg PLOTTED: Aug 13, 2024 – 4:01pm PLOTTED BY: kurt

4.0 STORMWATER MANAGEMENT ALTERNATIVES

4.1 Screening of Stormwater Management Alternatives

A variety of stormwater management alternatives are available to control the quality of stormwater, most of which are described in the Stormwater Management Planning and Design Manual (MECP, March 2003). Alternatives for the proposed and ultimate developments were considered in the following broad categories: lot level, vegetative, infiltration, and end-of-pipe controls. General comments on each category are provided below. Individual alternatives for the proposed development are listed in Table 4 with comments on their effectiveness and applicability to the proposed outlet.

a) <u>Lot Level Controls</u>

Lot level controls are not generally suitable as the primary control facility for quality control. They are generally used to enhance stormwater quality in conjunction with other types of control facilities.

b) <u>Vegetative Alternatives</u>

Vegetative stormwater management practices are not generally suitable as the primary control facility for quality control. They are generally used to enhance stormwater quality in conjunction with other types of control facilities.

c) <u>Infiltration Alternatives</u>

Where soils are suitable, infiltration techniques can be very effective in providing quantity and quality control. However, the very small amount of surface area on this site dedicated to permeable surfaces such as greenspace and landscaping make this an impractical option. Therefore, infiltration techniques will not be considered for this development.

d) <u>End-of-Pipe Alternatives</u>

Surface storage techniques can be very effective in providing quality and quantity control. Dry facilities are effective practices for stormwater erosion and flood control for large drainage areas.

Wet facilities are effective practices for stormwater erosion, quality and quantity control for large drainage areas.

Table 4. Evaluation of Stormwater Management Practices

Modero	Criteria for Implementation of Stormwater Management Practices (SWMP)					Technical Effectiveness (10 high)	Recommend Implementation Yes / No	Comments
	Topography	Soils	Bedrock	Groundwater	Area			
Site Conditions	*Variable 1 to 3%*	*Silty Sand ±13.3mm/hr*	*At Considerable Depth*	*At Considerable Depth*	*± 13.1ha*			
Lot Level Controls								
Lot Grading	<5%	nlc	nlc	nlc	nlc	2	Yes	Quality/quantity benefits
Roof Leaders to Surface	nlc	nlc	nlc	nlc	nlc	2	Yes	Quality/quantity benefits
Roof Ldrs.to Soakaway Pits	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 0.5 ha	6	No	Unsuitable site conditions
Sump Pump Fdtn. Drains	nlc	nlc	nlc	nlc	nlc	2	Yes	Suitable site conditions
Vegetative								
Grassed Swales	< 5 %	nlc	nlc	nlc	nlc	7	Yes	Quality/quantity benefits
Filter Strips(Veg. Buffer)	< 10 %	nlc	nlc	>.5m Below Bottom	< 2 ha	5	No	Unsuitable site conditions
Infiltration								
Infiltration Basins	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 5 ha	2	No	Unsuitable site conditions
Infiltration Trench	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 2 ha	4	No	Unsuitable site conditions
Rear Yard Infiltration	< 2.0 %	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 0.5 ha	7	No	Unsuitable site conditions
Perforated Pipes	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	nlc	4	No	Unsuitable site conditions
Pervious Catch basins	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	nlc	3	No	Unsuitable site conditions
Sand Filters	nlc	nlc	nlc	>.5m Below Bottom	< 5 ha	5	No	High maintenance/poor aesthetics
Surface Storage								
Dry Ponds	nlc	nlc	nlc	nlc	> 5 ha	7	No	No quality control
Wet Ponds	nlc	nlc	nlc	nlc	> 5 ha	9	Yes	Very effective quality control
Wetlands	nlc	nlc	nlc	nlc	> 5 ha	10	No	Very effective quality control
Other								
Oil/Grit Separator	nlc	nlc	nlc	nlc	<2 ha	3	Yes	Effective for Concession 7

Reference: Stormwater Management Practices Planning and Design Manual - 1994
nlc - No Limiting Criteria

4.2 Selection of Stormwater Management Alternatives

Stormwater management alternatives were screened based on technical effectiveness, physical suitability for this site, and their ability to meet the stormwater management criteria established for proposed and future development areas. The following stormwater management alternatives are recommended for implementation on the proposed development:

- **Lot grading** to be kept as flat as practical in order to slow down stormwater and encourage infiltration.
- **Roof leaders to be discharged to the ground surface** in order to slow down stormwater and encourage infiltration.
- **Grassed swales** to be used to collect rear lot drainage. Grassed swales tend to filter sediments and slow down the rate of stormwater.
- A **wet pond facility** to be constructed to provide stormwater quality enhancement for frequent storms.

5.0 STORMWATER MANAGEMENT PLAN

A MIDUSS model was created to assess existing, future and ultimate development peak flows and stormwater volumes generated by the proposed subdivision. The stormwater management facility was sized according to MECP Guidelines (MECP, March 2003) as follows:

5.1 Modero Stormwater Management Wet Pond Facility

5.1.1 Stormwater Quality Control

The stormwater drainage outlet for the proposed development is Six Mile Creek, which has been identified by the Ministry of Natural Resources watercourse evaluation as a **Type 2** fish habitat. Based on this fish habitat, the corresponding MECP level of protection for stormwater management quality practices prior to discharging to this watercourse shall be *Normal*. However, due to Town of Niagara-on-the-Lake guidelines, the proposed SWM facility will be required to provide *Enhanced* quality controls prior to discharge to Six Mile Creek. Based on Table 3.2 of SWMP & Design Manual, the water quality storage requirement is approximately 225m^3/ha for *Enhanced* protection for developments with 70% impervious areas. The drainage area requiring stormwater quality improvement draining to the proposed facility is 13.08 hectares. The required and provided storage volumes for this facility are shown in Table 5.

Table 5. Stormwater Quality Volume Calculations	
Total Water Quality Volume = 13.08 ha x 225 m^3/ha = 2,943 m^3 *(5,303m^3 provided)*	Reference: Table 3.2, SWMP & Design Manual (MECP 2003)
Permanent Pool Volume = 13.08 ha x 185 m^3/ha = 2,420 m^3 *(2,690m^3 provided)*	**Extended Detention Volume** = 13.08 ha x 40 m^3/ha = 523 m^3 *(2,613m^3 provided)*

5.1.2 Stormwater Quantity Control

As shown in the previous Table 3, stormwater management quantity controls are required to reduce the peak flows from the development area to existing conditions for up to and including the 100-year design storm event. The stormwater peak flows from the proposed development shall be reduced to the existing levels by providing stormwater quantity storage. It is proposed to construct a control structure outlet to reduce the peak stormwater flows discharging from the proposed facility.

5.1.3 Stormwater Management Facility Configuration

As seen within the accompanying General Servicing Plan for the Modero development, the layout of the stormwater management facility is providing a single sewer outlet to the existing watercourse, Six Mile Creek Tributary. Rear yards for the proposed dwellings backing on to the significant wetlands as part of Six Mile Creek and its' tributary will drain towards the wetlands.

It is proposed to construct a two-stage outlet for the proposed Stormwater Management (SWM) Facility. The first stage of control consists of a reverse slope pipe acting as a 127mm (5") diameter orifice to provide the required quality controls. The second stage of control consists of a ditch inlet catch basin and outlet pipe which provides an outlet for flows exceeding the extended detention volume. An emergency spillway will provide an outlet for flows exceeding the capacity of the ditch inlet catch basin and outlet pipe.

The proposed effective bottom elevation of the facility is 112.50m, and the permanent pool water level is 114.00m for a water depth of 1.5 metres. The configuration of the facility provides 2,690 m^3 of permanent pool volume, which is more than the required 2,420m^3. The proposed top of pond is at an elevation of 115.50m which provides a total active volume of 6,484m^3. The complete Stage-Storage-Discharge Calculation Table can be found in Appendix A.

The proposed facility has a single storm sewer inlet, therefore, the sediment forebay was designed to minimize the transport of heavy sediment from the storm sewer outlet throughout the facility and localize maintenance activities. Calculations for the forebay sizing follow MECP guidelines and are shown in Table 6.

Table 6. Stormwater Management Facility Forebay Sizing

a) Forebay Settling Length (MOECC SWMP&D, Equation 4.5)

$$Settling\ Length = \sqrt{\frac{r * Q_p}{V_s}}$$

r =	2.2	:1	(Length:Width Ratio)
Q_p =	0.018	m^3/s	(25mm Storm Pond Discharge)
V_s =	0.0003	m/s	(Settling Velocity)

Settling Length = **11.46 m**

b) Dispersion Length (MOECC SWMP&D, Equation 4.6)

$$Dispersion\ Length = \frac{8 * Q}{D * V_f}$$

Q =	1.273	m^3/s	(5 Yr Stm Sew Design Inflow)
D =	1.50	m	(Depth of Forebay)
V_f =	0.5	m/s	(Desired Velocity)

Dispersion Length = **13.58 m**

c) Minimum Forebay Deep Zone Bottom Width (MOECC SWMP&D, Equation 4.7)

$$Width = \frac{Dispersion\ Length}{8}$$

Minimum Forebay Length from Equations 3.3 and 3.4

13.58 m (minimum required length)

Width = **1.70 m** (minimum required width)

d) Average Velocity of Flow

$$Average\ Velocity = \frac{Q}{A}$$

Q =	0.580	m^3/s	(Quality Design Inflow)
A =	22.50	m^2	(Cross Sectional Area)
D =	1.50	m	(Depth of Forebay)
W =	10.50	m	(Proposed Bottom Width)
S =	3	:1	(Side slopes - minimum)

Average Velocity = **0.03 m/s**

Is this Acceptable? **Yes** (Maximum velocity of flow = 0.15 m/s)

e) Cleanout Frequency

Is this Acceptable? **Yes**

L =	23.0	m	(Proposed Bottom Length)
ASL =	2.8	m^3/ha	(Annual Sediment Loading)
A =	13.08	ha	(Drainage Area)
FRC =	80	%	(Facility Removal Efficiency)
FV =	649.1	m^3	(Forebay Volume)

Cleanout Frequency = **14.2 years**

Is this Acceptable? **Yes** (10 year minimum cleanout frequency)

Based on the configuration of the proposed facility, it was determined that a 127mm (5”) diameter quality orifice shall provide 52.4 hours of detention (24-hour minimum required duration of detention). The rim elevation for the proposed ditch inlet catch basin is 114.70m and will provide an extended detention volume of 2,613m^3, which is more than the required 523m^3.

The outflow pipe from the stormwater management facility is to be 450mm in diameter and will convey the stormwater flows from the ditch inlet to the proposed headwall structure discharging to the Six Mile Creek tributary north of the development. A stage-storage-discharge relationship was determined for the facility and is included in Appendix A for reference purposes.

Overland flows from the development area shall be directed to the proposed stormwater management facility.

Table 7 summarizes the peak inflows and outflows (Outlet C) for the SWM Facility along with corresponding pond elevations and volumes. Based on the MIDUSS model, Table 7 shows the maximum wet pond elevation of 115.17m, and an active storage volume of 4,785 m^3 for the 4-hour 100-year design storm event. approximately 0.33m of free board will be provided by the stormwater management facility during this event.

Table 7. Stormwater Management Wet Pond Facility Characteristics

Design Storm (Return Period)	Peak Flows (L/s)		Maximum Elevation	Maximum Volume (m^3)
	Inflow	Outflow		
25mm	580	18	114.45	1,678
2 Year	981	38	114.73	2,749
5 Year	1,273	72	114.84	3,226
100 Year	2,497	226	115.17	4,785
100 Year (24 hr)	2,566	454	115.33	5,568

Therefore, the proposed Stormwater Management Facility has sufficient capacity for stormwater flows from the proposed development. As discussed previously, the SWM Facility does not restrict flows to levels based on Drainage Area EX5, though provides quantity controls to ensure peak flows at outlets B & D remain below existing levels. Table 9 further in this report outlines the combined impacts of this facility as well as the subsequently outlined Concession 7 controls on the overall peak stormwater flows within Six Mile Creek.

5.2 Concession 7 Stormwater Management Facility

As part of the urbanization of Concession 7 in front of the proposed development site, a storm sewer will be constructed on Concession 7 discharging to the Six Mile Creek. The storm sewer will discharge at the location of existing culvert outlet for the Concession 7 roadside ditch, and immediately adjacent to the 1200mm diameter culvert crossing Concession 7 for the upstream lands.

During the stormwater modelling for this development and as concluded in Table 3, it was determined that peak flows within Outlet B (as part of the downstream Six Mile Creek watercourse from the Concession 7 outlet to the existing ponds) will experience greater than existing peak flow levels during the 2-year design storm event. Therefore, quantity controls are to be provided within the proposed Concession 7 storm sewer. Additionally, as required by the MECP for the urbanization of roads, quality controls will also be required.

5.2.1 Stormwater Quantity Control

For the Concession 7 storm sewer, an orifice and underground pipe storage will provide the necessary quantity controls. As outlined in Figure 3, the storm sewer will provide an outlet for stormwater flows from Drainage Area A2 – an area of 2.35 hectares at an imperviousness of 28.8%.

A 150mm (6") diameter orifice will be utilized to restrict peak stormwater flows discharging from the storm sewer. The orifice will be incorporated into the design of the Hydroworks HydroDome HD5 Oil/Grit Separator to be constructed as part of STM MH 55. A Stage-Storage-Discharge Calculation Sheet has been included in Appendix A.

The storm sewers will be constructed to provide adequate capacity for the stormwater flows during the 5-year design storm event. As well, the drainage areas within the STMDA Plan (2130-STMDA) for the Concession 7 storm sewers have been extended further into the adjacent easterly property to remain conservative in the sizing. However, Drainage Area A2 on Figure 3, is an accurate representation of the drainage area for the Concession 7 storm sewer system. The single length of 825mm diameter storm sewer immediately upstream of the control (MH 55) has been upsized to provide sufficient stormwater storage to accommodate the additional volume during the necessary storm events.

Table 8 below outlines the future peak flows and volumes to be experienced by the Stormwater Management System during the various storm events.

Table 8. Concession 7 Stormwater Management Facility Characteristics

Design Storm (Return Period)	Peak Flows (L/s)		Maximum Elevation	Maximum Volume (m^3)
	Inflow	Outflow		
2 Year	93	59	119.76	30
5 Year	114	68	120.30	42

As noted above, during the 5-year event, stormwater levels will remain below the lowest catch basin rim elevation of 120.60 located immediately upstream of the control manhole. It is expected that during major storm events, stormwater flows unable to pass through the control orifice will surcharge out of the adjacent catch basins on Concession 7 and flow to the Six Mile Creek. Due to the slope of Concession 7, all extreme overland flows will be directed northerly to the Six Mile Creek crossing. As well, the depth of the storm sewers will ensure no significant surcharging occurs at the upstream end of the storm sewer system. A stage-storage relationship is in Appendix A.

Table 9 in the next section provides a summary of total peak flows in Six Mile Creek.

5.2.2 Stormwater Quality Control

To improve stormwater quality levels from this development site, an oil/grit separator (OGS) is typically proposed. For MECP Enhanced Protection, oil/grit separators are required to provide a minimum average of 80% TSS removal. The contributing drainage area to the proposed OGS is 2.35 hectares at conservatively utilized impervious coverage of 30%. The modelling for a Hydroworks Unit has indicated that an HD5 oil/grit separator unit will provide 82.8% TSS overall removal and capture 99.2% of the stormwater flows. Therefore, the Hydroworks HD5 is proposed for this outlet. All calculations regarding the quality assessment and sample inspection report can be found in Appendix C.

5.3 Six Mile Creek Peak Flow Summary

The following table provides a summary of peak stormwater flows within Six Mile Creek at the denoted outlets under existing and future conditions. As noted previously in Table 3, stormwater flows conveyed overland to Outlet A will be reduced from existing conditions and have therefore been excluded from this table. Additionally, peak outflows at Outlet C were denoted in Table 7 and do not represent total flows within the Six Mile Creek and have also been omitted from Table 9.

Table 9. Impacts of Wet Pond Facility on Peak Flows

Outlet	Peak Flow (L/s)		
	Existing	**Future with SWM**	**Change***
2 Year Design Storm Event			
B	246	245	-0.4%
D	261	258	-1.1%
5 Year Design Storm Event			
B	402	328	-18.4%
D	419	395	-5.7%
100 Year Design Storm Event – 4 Hour			
B	1,281	1,065	-16.9%
D	1,326	1,277	-3.7%
100 Year Design Storm Event – 24 Hour			
B	2,055	1,687	-17.9%
D	2,125	2,122	-0.1%

Note: *indicates the percent change between existing conditions and future conditions with stormwater management controls in place.

Per Table 9 above, peak stormwater flow rates at both sections within the Six Mile Creek will remain the same or reduce from existing flows rates under post-development conditions during the various storm events. Therefore, the proposed stormwater management plan will be acceptable for this development.

6.0 SEDIMENT AND EROSION CONTROL

Sediment and erosion controls are required during all construction phases of this development to limit the transport of sediment into the Six Mile Creek Tributary.

The following additional erosion and sediment controls will also be implemented during construction:

- Install silt control fencing along the limits of construction of the development to collect sediment in overland flows before discharging to downstream systems. The silt control fence installed along east end of site will be installed along the wetland buffer to act as the limit of construction.

- Re-vegetate disturbed areas as soon as possible after grading works have been completed.

- Lot grading and siltation controls plans will be provided with sediment and erosion control measures to the appropriate agencies for approval during the final design stage.

7.0 STORMWATER MANAGEMENT FACILITY MAINTENANCE

7.1 Wetpond Facility

Maintenance is a necessary and important aspect of urban stormwater quality and quantity measures such as constructed wetlands. Many pollutants (ie. nutrients, metals, bacteria, etc.) bind to sediment and therefore removal of sediment on a scheduled basis is required.

The wet pond for this development is subject to frequent wetting and deposition of sediments as a result of frequent low intensity storm events. The purpose of the wet pond is to improve post development sediment and contaminant loadings by detaining the 'first flush' flow for a 24 hour period. For the initial operation period of the stormwater management facility, the required frequency of maintenance is not definitively known and many of the maintenance tasks will be performed on an 'as required' basis. For example, during the home construction phase of the development there will be a greater potential for increased maintenance frequency, which depends on the effectiveness of sediment and erosion control techniques employed.

Inspections of the wet pond will indicate whether or not maintenance is required. Inspections should be made after every significant storm during the first two years of operation or until all development is completed to ensure the wet pond is functioning properly. This may translate into an average of six inspections per year. Once all building activity is finalized, inspections shall be performed annually. The following points should be addressed during inspections of the facility.

a) Standing water above the inlet storm sewer invert a day or more after a storm may indicate a blockage in the reverse slope pipe or orifice. The blockage may be caused by trash or sediment and a visual inspection would be required to determine the cause.

b) The vegetation around the wet pond should be inspected to ensure its function and aesthetics. Visual inspections will indicate whether replacement of plantings are required. A decline in vegetation habitat may indicate that other aspects of the constructed wet pond are operating improperly, such as the detention times may be inadequate or excessive.

c) The accumulation of sediment and debris at the wet pond inlet sediment forebay or around the high water line of the wet pond should be inspected. This will indicate the need for sediment removal or debris clean up.

d) The wet pond has been created by excavating a detention area. The integrity of the embankments should be periodically checked to ensure that it remains watertight and the side slopes have not sloughed.

Grass cutting is a maintenance activity that is done solely for aesthetic purposes. It is recommended that grass cutting be eliminated. It should be noted that municipal by-laws may require regular grass maintenance for weed control.

Trash removal is an integral part of maintenance and an annual cleanup, usually in the spring, is a minimum requirement. After this, trash removal is performed as required basis on observation of trash build-up during inspections.

To ensure long term effectiveness, the sediment that accumulates in the forebay area should be removed periodically to ensure that sediment in not deposited throughout the facility. For sediment removal operations, typical grading/excavating equipment should be used to remove sediment from the inlet forebay and detention areas. Care should be taken to ensure that limited damage occurs to existing vegetation and habitat.

Generally, the sediment which is removed from the detention pond 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.

7.2 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 C 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. A Sample Oil/Grit Separator Inspection Report has been included in Appendix C.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this study, the following conclusions are offered:

- Infiltration techniques are not suitable for this site as the primary control facility due to the low soil infiltration rates and the large drainage area for this development.

- The proposed Stormwater Management Wetpond Facility will provide stormwater quality controls to *Enhanced* Protection levels and quantity controls for the approximately 13.08-hectare catchment area within the Modero development.

- Further quantity controls will be provided by a combination of 150mm diameter orifice and storm sewer storage within the proposed Concession 7 storm sewer. A Hydroworks HD5 Oil/Grit Separator will provide quality controls to *Enhanced* Protection levels.

- Various lot level vegetative stormwater management practices can be implemented to enhance stormwater quality.

- This report was prepared in accordance with the provincial guidelines contained in "Stormwater Management Planning and Design Manual, March 2003".

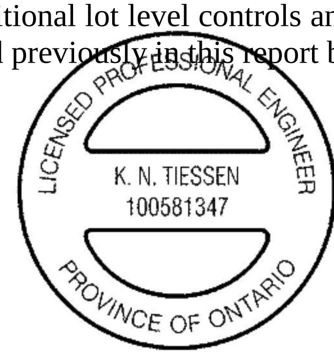
The above conclusions lead to the following recommendations:

- That the stormwater management criteria established in this report be accepted.

- That the Stormwater Management Facilities outlined in this report be constructed to provide stormwater quality protection to MECP *Enhanced* Protection levels and quantity controls to allowable levels.

- That additional lot level controls and vegetative stormwater management practices as described previously in this report be implemented.

Prepared By:



Kurt Tiessen
Revised August 8, 2025

APPENDICES

APPENDIX A

Weighted Impervious Calculation Sheet
Stormwater Management Facility – Wet Pond Calculations
Stormwater Management Facility – Concession 7 Storm Sewer Calculations

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	MODERO ESTATES
Project Number:	2130
Date:	AUGUST 2024
Person:	K.Tiessen

EX2 - TO TRIBUTARY

	Footprint	*Imperviousness*	*Effective Impervious Area*
Roadway	600.0 m^2	100%	600.0 m^2
Green Space/Agricultural Lands	17988.7 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			600 m^2
TOTAL CATCHMENT AREA			18,589 m^2
		EFFECTIVE PERCENT IMPERVIOUS	**3.2%**

EX3 - TO TRIBUTARY

	Footprint	*Imperviousness*	*Effective Impervious Area*
Roadway/Driveway	890.0 m^2	100%	890.0 m^2
Roof Top	445.0 m^2	100%	445.0 m^2
Green Space/Agricultural Lands	12232.6 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			1,335 m^2
TOTAL CATCHMENT AREA			13,568 m^2
		EFFECTIVE PERCENT IMPERVIOUS	**9.8%**

A1 - PROPOSED CONDITIONS

	Footprint	*Imperviousness*	*Effective Impervious Area*
Roof Top	3365.0 m^2	100%	3365.0 m^2
Landscape/Greenspace	9482.7 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			3,365 m^2
TOTAL CATCHMENT AREA			12,848 m^2
		EFFECTIVE PERCENT IMPERVIOUS	**26.2%**

A2 - PROPOSED CONDITIONS FOR CONCESSION 7

	Footprint	*Imperviousness*	*Effective Impervious Area*
Sidewalk	570.0 m^2	100%	570.0 m^2
Asphalt Roadway/Driveway Aprons	4485.0 m^2	100%	4485.0 m^2
Buildings	1708.5 m^2	100%	1708.5 m^2
Landscape/Greenspace	16722.5 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			6,764 m^2
TOTAL CATCHMENT AREA			23,486 m^2
		EFFECTIVE PERCENT IMPERVIOUS	**28.8%**

A3 - PROPOSED CONDITIONS

	Footprint	*Imperviousness*	*Effective Impervious Area*
Roof Top	2012.0 m^2	100%	2012.0 m^2
Landscape/Greenspace	6497.6 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			2,012 m^2
TOTAL CATCHMENT AREA			8,510 m^2
		EFFECTIVE PERCENT IMPERVIOUS	**23.6%**

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	MODERO ESTATES
Project Number:	2130
Date:	MARCH 2025
Person:	K.Tiessen

Block 82 Condo

	Footprint	*Imperviousness*	*Effective Impervious Area*
Impervious - Buildings, Sidewalk, Roadway, etc.	5005.9 m^2	100%	5005.9 m^2
Pervious - Landscape, etc.	3158.7 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			5,006 m^2
TOTAL CATCHMENT AREA			8,165 m^2
		EFFECTIVE IMPERVIOUSNESS	**61.3%**
		EFFECTIVE RUNOFF COEFFICIENT	**0.63**

Block 83 Condo

	Footprint	*Imperviousness*	*Effective Impervious Area*
Impervious - Buildings, Sidewalk, Roadway, etc.	5305.6 m^2	100%	5305.6 m^2
Pervious - Landscape, etc.	2080.7 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			5,306 m^2
TOTAL CATCHMENT AREA			7,386 m^2
		EFFECTIVE IMPERVIOUSNESS	**71.8%**
		EFFECTIVE RUNOFF COEFFICIENT	**0.70**

Block 84 Condo

	Footprint	*Imperviousness*	*Effective Impervious Area*
Impervious - Buildings, Sidewalk, Roadway, etc.	22895.7 m^2	100%	22895.7 m^2
Pervious - Landscape, etc.	7481.8 m^2	0%	0.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			22,896 m^2
TOTAL CATCHMENT AREA			30,378 m^2
		EFFECTIVE IMPERVIOUSNESS	**75.4%**
		EFFECTIVE RUNOFF COEFFICIENT	**0.73**

A4 - MODERO ESTATES

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
Park	7698.0 m^2	0.25	1924.5 m^2
Singles	24916.0 m^2	0.65	16195.4 m^2
Townhouses/Condos	90905.6 m^2	0.70	63633.9 m^2
Pond	7290.4 m^2	0.90	6561.4 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			88,315 m^2
TOTAL CATCHMENT AREA			130,810 m^2
		EFFECTIVE RUNOFF COEFFICIENT	**0.68**
		EFFECTIVE IMPERVIOUSNESS	**67.9%**

Upper Canada Consultants
30 HANNOVER DRIVE, UNIT 3
St. Catharines, Ontario L2W 1A3
PROJECT NAME: **MODERO ESTATES**
PROJECT NO.: **2130**

DATE: AUGUST 2024

STORMWATER MANAGEMENT FACILITY WETPOND

Quality Requirements
Drainage Area (ha) = 13.08
Enhanced (m^3/ha) = 225 (@ 70% Imp)
Perm Pool (m^3/ha) = 185
Perm Pool Vol (m^3) = 2,420
Active Vol (m^3) 523

Quality Orifice
Diameter (m) = 0.127
Cd = 0.63
Invert (m) = 114.00

Ditch Inlet Weir
Length (m) = 0.60
Width (m) = 0.60
Grate Slope (X:1) = 4
Inlet Elevation (m) = 114.70
Cd = 1.84

Outflow Pipe Orifice
Diameter (m) = 0.450
Cd = 0.63
Invert (m) = 114.00
Overt (m) = 114.45

Overflow Spillway
Minor Length (m) = 0.75
Slopes (X:1) = 1.00
Minor Invert (m) = 115.15
Major Length (m) = 1.45
Major Invert (m) = 155.50

Perm. Pool Elev. = 114.00 m

Elevation	Increment Depth (m)	Active Depth (m)	Surface Area (m^2)	Average Surface Area (m^2)	Increment Volume (m^3)	Permanent Volume (m^3)	Active Volume (m^3)	Quality Orifice (m^3/s)	Ditch Inlet (m^3/s)	Max Pipe Orifice (m^3/s)	Overflow Spillway (m^3/s)	Total Outflow (m^3/s)	Average Discharge (m^3/s)	Time (hrs)
112.50		-1.50	**1,079**			0								
	0.50			1,292	646									
113.00		-1.00	1,504			646								
	1.00			2,044	2,044									
114.00		0.00	**2,584**			**2,690**								
	0.00													
114.00		0.00	3,209				0.0	0.000	0.000	0.00	0.000	0.00		0.0
	0.70			3,733	2,613								0.014	
114.70		0.70	4,257				2613.1	0.028	0.000	0.28	0.000	0.028		**52.4**
	0.30			4,472	1,342								0.076	
115.00		1.00	4,687				3954.7	0.034	0.091	0.371	0.000	0.125		66.8
	0.15			4,797	720								0.164	
115.15		1.15	4,908				4674.4	0.036	0.167	0.409	0.000	0.203		74.7
	0.10			4,982	498								0.255	
115.25		1.25	5,056				5172.6	0.038	0.225	0.433	0.044	0.308		80.3
	0.25			5,246	1,311								0.550	
115.50		1.50	5,435				6484.0	0.042	0.395	0.486	0.356	0.793		83.6

Notes

1. Quality Orifice flow is the orifice controlling for the 24 hour detention period and uses an orifice formula.
2. Pipe Orifice flow is calcuated using an orifice formula on the pipe from the ditch inlet to the outlet and uses the total head on the orifice.
3. Overflow Weir flow is calculated using a trapezondial weir to convey outflow for less frequent storms through the embankment with an emergency spillway.
4. Total Outflow is calculated by adding the Overflow Spillway with the lowest of Quality Orifice plus Ditch Inlet or Max Pipe Orifice.

Underground Superpipe Stage Storage Discharge Calculations

Project Name: Concession 7 Road
Project No.: 2130
Date: OCTOBER 2024

		MH 54 TO MH 55			CB to Sewer			TOTAL STORAGE VOLUME	Orifice	Slot Weir	Total Outflow
Controlling Rim Elev:	**120.60**	Pipe	MH 55	MH 54	Pipe	CB					
Invert:		119.21	118.06	119.73	119.40	119.40			Dia (m) = 0.150		
Pipe Diameter:		0.838			0.200		**ROADWAY**		Cd = 0.60	Width (m) = 8.500	
Structure/Pipe Length:		69.9	1500	1500	7.20	;00x600mr	**VOLUME**		Invert (m) = 118.06	Invert (m) = 120.60	
											DISCHARGE
Elevation (m)		(m^3)	(m^3)	(m^3)	(m^3)	(m^3)		Total (m^3)	Orifice (m^3/s)	Slot Weir (m^3/s)	(L/s)
120.70		**38.55**	**4.67**	**1.71**	**0.23**	**0.94**	**8.70**	**54.8**	**0.075**	**0.495**	**569.4**
120.65		**38.55**	**4.58**	**1.63**	**0.23**	**0.90**	**4.35**	**50.2**	**0.074**	**0.175**	**249.0**
120.60		**38.55**	**4.49**	**1.54**	**0.23**	**0.86**		**45.7**	**0.073**	**0.000**	**73.4**
120.50		38.55	4.31	1.36	0.23	0.79		45.2	0.072	-	71.9
120.40		38.55	4.14	1.18	0.23	0.72		44.8	0.070	-	70.3
120.30		38.55	3.96	1.01	0.23	0.65		44.4	0.069	-	68.7
120.20		38.55	3.78	0.83	0.23	0.58		44.0	0.067	-	67.1
120.10		38.55	3.60	0.65	0.23	0.50		43.5	0.065	-	65.4
120.00		37.67	3.43	0.48	0.23	0.43		42.2	0.064	-	63.7
119.90		**33.96**	**3.25**	**0.30**	**0.23**	**0.36**		**38.1**	**0.062**	-	**62.0**
119.80		29.01	3.07	0.12	0.23	0.29		32.7	0.060	-	60.2
119.70		23.42	2.90	-	0.23	0.22		26.8	0.058	-	58.3
119.60		17.58	2.72	-	0.23	0.14		20.7	0.056	-	56.4
119.50		**11.84**	**2.54**	**-**	**0.11**	**0.07**		**14.6**	**0.054**	-	**54.4**
119.40		6.56	2.37	-	-	-		8.9	0.052	-	52.3
119.30		2.23	2.19	-	-	-		4.4	0.050	-	50.2
119.20		-	2.01	-	-	-		2.0	0.048	-	47.9
119.10		-	1.84	-	-	-		1.8	0.046	-	45.5
119.00		**-**	**1.66**	**-**	**-**	**-**		**1.7**	**0.043**	-	**43.1**
118.90		-	1.48	-	-	-		1.5	0.040	-	40.4
118.80		-	1.31	-	-	-		1.3	0.038	-	37.6
118.70		-	1.13	-	-	-		1.1	0.035	-	34.5
118.60		-	0.95	-	-	-		1.0	0.031	-	31.2
118.50		-	0.78	-	-	-		0.8	0.027	-	27.4
118.40		-	0.60	-	-	-		0.6	0.023	-	23.0
118.30		-	0.42	-	-	-		0.4	0.018	-	17.6
118.20		-	0.25	-	-	-		0.2	0.009	-	9.4
118.10		**-**	**0.07**	**-**	**-**	**-**		**0.1**	**-**	-	**-**

APPENDIX B

MIDUSS Output Files

Existing Conditions

```
         Output File (4.7) EX.OUT      opened 2024-10-09  11:57
         Units used are defined by G =    9.810
            144   288    10.000        are MAXDT MAXHYD & DTMIN values
         Licensee: UPPER CANADA CONSULTANTS
   35    COMMENT
        4     line(s) of comment
         CONCESSION 7 - HUMMEL
         STORMWATER MANAGEMENT PLAN
         EXISTING CONDITIONS TO SIX MILE CREEK
         MAY 2021
   35    COMMENT
        2     line(s) of comment
         DRAINAGE AREA UPSTREAM OF EAST CONC 7 CULVERT EQUIVALENT
         TO APPROX 43.5 HECTARES USING NPCA SUBWATERSHED MAPPING
   35    COMMENT
        2     line(s) of comment
         DRAINAGE AREA UPSTREAM OF YORK RD CULVERT EQUIVALENT TO
         APPROX 655 HECTARES USING NPCA SUBWATERSHED MAPPING
   35    COMMENT
        3     line(s) of comment
         ***************************************
         ** 2 YEAR DESIGN STORM EVENT **********
         ***************************************
    2    STORM
             1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       567.000      Coefficient  a
         5.200      Constant  b    (min)
          .746      Exponent  c
          .450      Fraction to peak  r
       240.000      Duration ó 1440 min
                 37.413 mm     Total depth
    3    IMPERVIOUS
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .015      Manning "n"
        98.000      SCS Curve No or C
          .100      Ia/S Coefficient
          .518      Initial Abstraction
   14    START
        1     1=Zero; 2=Define
   35    COMMENT
        1     line(s) of comment
         ***** DRAINAGE AREA EX1 - TO WEST, OUTLET A ***********
    4    CATCHMENT
         1.000      ID No.ó 99999
         3.410      Area in hectares
        60.000      Length (PERV) metres
         1.500      Gradient (%)
         1.000      Per cent Impervious
        60.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .047       .000       .000       .000 c.m/s
                .225       .851       .231     C perv/imperv/total
   27    HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .2948689E+03 c.m
   14    START
        1     1=Zero; 2=Define
   35    COMMENT
        1     line(s) of comment
         ********** DRAINAGE AREA EXT-E **********************
    4    CATCHMENT
         2.000      ID No.ó 99999
        54.090      Area in hectares
       900.000      Length (PERV) metres
         1.000      Gradient (%)
         3.000      Per cent Impervious
       900.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .192       .000       .000       .000 c.m/s
                .225       .863       .244     C perv/imperv/total
   15    ADD RUNOFF
                .192       .192       .000       .000 c.m/s
    9    ROUTE
          .000      Conduit Length
          .000      No Conduit defined
          .000      Zero lag
          .000      Beta weighting factor
          .000      Routing timestep
             0      No. of sub-reaches
                .192       .192       .192       .000 c.m/s
   17    COMBINE
        1     Junction Node No.
                .192       .192       .192       .192 c.m/s
   14    START
        1     1=Zero; 2=Define
   35    COMMENT
        1     line(s) of comment
         ** DRAINAGE AREA EX2 TO EAST *********************
    4    CATCHMENT
         2.000      ID No.ó 99999
         1.860      Area in hectares
        60.000      Length (PERV) metres
         2.000      Gradient (%)
         3.200      Per cent Impervious
        60.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .027       .000       .192       .192 c.m/s
                .224       .853       .244     C perv/imperv/total
   15    ADD RUNOFF
                .027       .027       .192       .192 c.m/s
    9    ROUTE
          .000      Conduit Length
          .000      No Conduit defined
          .000      Zero lag
          .000      Beta weighting factor
          .000      Routing timestep
             0      No. of sub-reaches
                .027       .027       .027       .192 c.m/s
   17    COMBINE
        1     Junction Node No.
                .027       .027       .027       .201 c.m/s
   14    START
        1     1=Zero; 2=Define
   35    COMMENT
        1     line(s) of comment
         ** EXTERNAL DRAINAGE AREA EX3 TO EX4 *****************
    4    CATCHMENT
         3.000      ID No.ó 99999
         1.360      Area in hectares
        50.000      Length (PERV) metres
         1.000      Gradient (%)
         9.800      Per cent Impervious
        50.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .022       .000       .027       .201 c.m/s
                .225       .851       .286     C perv/imperv/total
   15    ADD RUNOFF
                .022       .022       .027       .201 c.m/s
   35    COMMENT
        1     line(s) of comment
         ** EXTERNAL DRAINAGE AREA EX4 TO EAST - OUTLET B ********
    4    CATCHMENT
         4.000      ID No.ó 99999
         8.140      Area in hectares
       400.000      Length (PERV) metres
         1.000      Gradient (%)
         1.000      Per cent Impervious
       400.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .043       .022       .027       .201 c.m/s
                .225       .861       .231     C perv/imperv/total
   15    ADD RUNOFF
                .043       .052       .027       .201 c.m/s
    9    ROUTE
          .000      Conduit Length
          .000      No Conduit defined
          .000      Zero lag
          .000      Beta weighting factor
          .000      Routing timestep
             0      No. of sub-reaches
                .043       .052       .052       .201 c.m/s
   35    COMMENT
        1     line(s) of comment
         COMBINED VALUE BELOW IS EXISTING OUTFLOW TO OUTLET B
   17    COMBINE
        1     Junction Node No.
                .043       .052       .052       .245 c.m/s
   27    HYDROGRAPH DISPLAY
        7     is # of Hyeto/Hydrograph chosen
         Volume  =  .5959073E+04 c.m
   14    START
        1     1=Zero; 2=Define
   35    COMMENT
        1     line(s) of comment
         ** DRAINAGE AREA EX5 TO EAST - OUTLET C ********************
    4    CATCHMENT
         5.000      ID No.ó 99999
         2.620      Area in hectares
        60.000      Length (PERV) metres
         1.000      Gradient (%)
         1.000      Per cent Impervious
        60.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .033       .000       .052       .245 c.m/s
                .225       .853       .231     C perv/imperv/total
   27    HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .2265578E+03 c.m
   15    ADD RUNOFF
                .033       .033       .052       .245 c.m/s
    9    ROUTE
          .000      Conduit Length
          .000      No Conduit defined
          .000      Zero lag
          .000      Beta weighting factor
          .000      Routing timestep
             0      No. of sub-reaches
                .033       .033       .033       .245 c.m/s
   17    COMBINE
        1     Junction Node No.
                .033       .033       .033       .261 c.m/s
   35    COMMENT
        1     line(s) of comment
         CONFLUENCE VALUE BELOW IS TOTAL EX OUTFLOW TO EAST CREEK - D
   18    CONFLUENCE
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      1     Junction Node No.
           .033       .261       .033       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .6182399E+04 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      3     line(s) of comment
       ****************************************
       ** 5 YEAR DESIGN STORM EVENT ***********
       ****************************************
  2    STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    664.000     Coefficient  a
      4.700     Constant  b    (min)
       .744     Exponent  c
       .450     Fraction to peak  r
    240.000     Duration ó 1440 min
             44.365 mm     Total depth
  3    IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .015     Manning "n"
     98.000     SCS Curve No or C
       .100     Ia/S Coefficient
       .518     Initial Abstraction
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ***** DRAINAGE AREA EX1 - TO WEST, OUTLET A ***********
  4    CATCHMENT
      1.000     ID No.ó 99999
      3.410     Area in hectares
     60.000     Length (PERV) metres
      1.500     Gradient (%)
      1.000     Per cent Impervious
     60.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .075       .000       .033       .000 c.m/s
           .271       .872       .277     C perv/imperv/total
 27    HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .4184780E+03 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ********** DRAINAGE AREA EXT-E **********************
  4    CATCHMENT
      2.000     ID No.ó 99999
     54.090     Area in hectares
    900.000     Length (PERV) metres
      1.000     Gradient (%)
      3.000     Per cent Impervious
    900.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .316       .000       .033       .000 c.m/s
           .271       .883       .289     C perv/imperv/total
 15    ADD RUNOFF
           .316       .316       .033       .000 c.m/s
  9    ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
           0     No. of sub-reaches
           .316       .316       .316       .000 c.m/s
 17    COMBINE
      1     Junction Node No.
           .316       .316       .316       .316 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** DRAINAGE AREA EX2 TO EAST *********************
  4    CATCHMENT
      2.000     ID No.ó 99999
      1.860     Area in hectares
     60.000     Length (PERV) metres
      2.000     Gradient (%)
      3.200     Per cent Impervious
     60.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .047       .000       .316       .316 c.m/s
           .270       .871       .289     C perv/imperv/total
 15    ADD RUNOFF
           .047       .047       .316       .316 c.m/s
  9    ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
           0     No. of sub-reaches
           .047       .047       .047       .316 c.m/s
 17    COMBINE
      1     Junction Node No.
```

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           .047       .047       .047       .327 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** EXTERNAL DRAINAGE AREA EX3 TO EX4 *****************
  4    CATCHMENT
      3.000     ID No.ó 99999
      1.360     Area in hectares
     50.000     Length (PERV) metres
      1.000     Gradient (%)
      9.800     Per cent Impervious
     50.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .032       .000       .047       .327 c.m/s
           .271       .872       .329     C perv/imperv/total
 15    ADD RUNOFF
           .032       .032       .047       .327 c.m/s
 35    COMMENT
      1     line(s) of comment
       ** EXTERNAL DRAINAGE AREA EX4 TO EAST - OUTLET B ********
  4    CATCHMENT
      4.000     ID No.ó 99999
      8.140     Area in hectares
    400.000     Length (PERV) metres
      1.000     Gradient (%)
      1.000     Per cent Impervious
    400.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .071       .032       .047       .327 c.m/s
           .271       .873       .277     C perv/imperv/total
 15    ADD RUNOFF
           .071       .084       .047       .327 c.m/s
  9    ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
           0     No. of sub-reaches
           .071       .084       .084       .327 c.m/s
 35    COMMENT
      1     line(s) of comment
       COMBINED VALUE BELOW IS EXISTING OUTFLOW TO OUTLET B
 17    COMBINE
      1     Junction Node No.
           .071       .084       .084       .402 c.m/s
 27    HYDROGRAPH DISPLAY
      7     is # of Hyeto/Hydrograph chosen
       Volume  =  .8364115E+04 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** DRAINAGE AREA EX5 TO EAST - OUTLET C *******************
  4    CATCHMENT
      5.000     ID No.ó 99999
      2.620     Area in hectares
     60.000     Length (PERV) metres
      1.000     Gradient (%)
      1.000     Per cent Impervious
     60.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .054       .000       .084       .402 c.m/s
           .270       .870       .276     C perv/imperv/total
 27    HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .3211979E+03 c.m
 15    ADD RUNOFF
           .054       .054       .084       .402 c.m/s
  9    ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
           0     No. of sub-reaches
           .054       .054       .054       .402 c.m/s
 17    COMBINE
      1     Junction Node No.
           .054       .054       .054       .419 c.m/s
 35    COMMENT
      1     line(s) of comment
       CONFLUENCE VALUE BELOW IS TOTAL EX OUTFLOW TO EAST CREEK - D
 18    CONFLUENCE
      1     Junction Node No.
           .054       .419       .054       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .8682002E+04 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      3     line(s) of comment
       ********************************************
       ** 100 YEAR DESIGN STORM EVENT *************
       ********************************************
  2    STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
```

```
     980.000     Coefficient  a
       3.700     Constant  b    (min)
        .732     Exponent  c
        .450     Fraction to peak  r
     240.000     Duration ó 1440 min
              70.157 mm    Total depth
  3    IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .015     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
        .518     Initial Abstraction
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ***** DRAINAGE AREA EX1 - TO WEST, OUTLET A ***********
  4    CATCHMENT
       1.000     ID No.ó 99999
       3.410     Area in hectares
      60.000     Length (PERV) metres
       1.500     Gradient (%)
       1.000     Per cent Impervious
      60.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .244       .000       .054       .000 c.m/s
             .402       .909       .408     C perv/imperv/total
 27    HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .9750022E+03 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ********** DRAINAGE AREA EXT-E **********************
  4    CATCHMENT
       2.000     ID No.ó 99999
      54.090     Area in hectares
     900.000     Length (PERV) metres
       1.000     Gradient (%)
       3.000     Per cent Impervious
     900.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            1.024       .000       .054       .000 c.m/s
             .403       .920       .419     C perv/imperv/total
 15    ADD RUNOFF
            1.024      1.024       .054       .000 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
            1.024      1.024      1.024       .000 c.m/s
 17    COMBINE
      1     Junction Node No.
            1.024      1.024      1.024      1.024 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** DRAINAGE AREA EX2 TO EAST *********************
  4    CATCHMENT
       2.000     ID No.ó 99999
       1.860     Area in hectares
      60.000     Length (PERV) metres
       2.000     Gradient (%)
       3.200     Per cent Impervious
      60.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .136       .000      1.024      1.024 c.m/s
             .402       .907       .418     C perv/imperv/total
 15    ADD RUNOFF
             .136       .136      1.024      1.024 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
             .136       .136       .136      1.024 c.m/s
 17    COMBINE
      1     Junction Node No.
             .136       .136       .136      1.053 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** EXTERNAL DRAINAGE AREA EX3 TO EX4 *****************
  4    CATCHMENT
       3.000     ID No.ó 99999
       1.360     Area in hectares
      50.000     Length (PERV) metres
       1.000     Gradient (%)
       9.800     Per cent Impervious
      50.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .098       .000       .136      1.053 c.m/s
             .402       .909       .452     C perv/imperv/total
 15    ADD RUNOFF
             .098       .098       .136      1.053 c.m/s
 35    COMMENT
      1     line(s) of comment
       ** EXTERNAL DRAINAGE AREA EX4 TO EAST - OUTLET B ********
  4    CATCHMENT
       4.000     ID No.ó 99999
       8.140     Area in hectares
     400.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
     400.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .230       .098       .136      1.053 c.m/s
             .403       .919       .408     C perv/imperv/total
 15    ADD RUNOFF
             .230       .266       .136      1.053 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
             .230       .266       .266      1.053 c.m/s
 35    COMMENT
      1     line(s) of comment
       COMBINED VALUE BELOW IS EXISTING OUTFLOW TO OUTLET B
 17    COMBINE
      1     Junction Node No.
             .230       .266       .266      1.281 c.m/s
 27    HYDROGRAPH DISPLAY
      7     is # of Hyeto/Hydrograph chosen
       Volume  =  .1918774E+05 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** DRAINAGE AREA EX5 TO EAST - OUTLET C ********************
  4    CATCHMENT
       5.000     ID No.ó 99999
       2.620     Area in hectares
      60.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
      60.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
           1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .177       .000       .266      1.281 c.m/s
             .402       .911       .407     C perv/imperv/total
 27    HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .7484020E+03 c.m
 15    ADD RUNOFF
             .177       .177       .266      1.281 c.m/s
  9    ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
           0     No. of sub-reaches
             .177       .177       .177      1.281 c.m/s
 17    COMBINE
      1     Junction Node No.
             .177       .177       .177      1.326 c.m/s
 35    COMMENT
      1     line(s) of comment
       CONFLUENCE VALUE BELOW IS TOTAL EX OUTFLOW TO EAST CREEK - D
 18    CONFLUENCE
      1     Junction Node No.
             .177      1.326       .177       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1993319E+05 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      3     line(s) of comment
       *************************************************
       ** 100 YEAR DESIGN STORM EVENT  - 24 HOUR ********
       *************************************************
  2    STORM
           1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     980.000     Coefficient  a
       3.700     Constant  b    (min)
        .732     Exponent  c
        .450     Fraction to peak  r
    1440.000     Duration ó 1440 min
             114.472 mm    Total depth
  3    IMPERVIOUS
           1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .015     Manning "n"
      98.000     SCS Curve No or C
        .100     Ia/S Coefficient
        .518     Initial Abstraction
 14    START
      1     1=Zero; 2=Define
```

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 35     COMMENT
      1     line(s) of comment
       ***** DRAINAGE AREA EX1 - TO WEST, OUTLET A ***********
  4     CATCHMENT
       1.000     ID No.ó 99999
       3.410     Area in hectares
      60.000     Length (PERV) metres
       1.500     Gradient (%)
       1.000     Per cent Impervious
      60.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .395       .000       .177       .000 c.m/s
           .545       .939       .549     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .2140826E+04 c.m
 14     START
      1     1=Zero; 2=Define
 35     COMMENT
      1     line(s) of comment
       ********** DRAINAGE AREA EXT-E **********************
  4     CATCHMENT
       2.000     ID No.ó 99999
      54.090     Area in hectares
     900.000     Length (PERV) metres
       1.000     Gradient (%)
       3.000     Per cent Impervious
     900.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
          1.651       .000       .177       .000 c.m/s
           .546       .950       .558     C perv/imperv/total
 15     ADD RUNOFF
          1.651      1.651       .177       .000 c.m/s
  9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
          0      No. of sub-reaches
          1.651      1.651      1.651       .000 c.m/s
 17     COMBINE
      1     Junction Node No.
          1.651      1.651      1.651      1.651 c.m/s
 14     START
      1     1=Zero; 2=Define
 35     COMMENT
      1     line(s) of comment
       ** DRAINAGE AREA EX2 TO EAST **********************
  4     CATCHMENT
       2.000     ID No.ó 99999
       1.860     Area in hectares
      60.000     Length (PERV) metres
       2.000     Gradient (%)
       3.200     Per cent Impervious
      60.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .237       .000      1.651      1.651 c.m/s
           .544       .937       .557     C perv/imperv/total
 15     ADD RUNOFF
           .237       .237      1.651      1.651 c.m/s
  9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
          0      No. of sub-reaches
           .237       .237       .237      1.651 c.m/s
 17     COMBINE
      1     Junction Node No.
           .237       .237       .237      1.687 c.m/s
 14     START
      1     1=Zero; 2=Define
 35     COMMENT
      1     line(s) of comment
       ** EXTERNAL DRAINAGE AREA EX3 TO EX4 *****************
  4     CATCHMENT
       3.000     ID No.ó 99999
       1.360     Area in hectares
      50.000     Length (PERV) metres
       1.000     Gradient (%)
       9.800     Per cent Impervious
      50.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .165       .000       .237      1.687 c.m/s
           .545       .939       .584     C perv/imperv/total
 15     ADD RUNOFF
           .165       .165       .237      1.687 c.m/s
 35     COMMENT
      1     line(s) of comment
       ** EXTERNAL DRAINAGE AREA EX4 TO EAST - OUTLET B ********
  4     CATCHMENT
       4.000     ID No.ó 99999
       8.140     Area in hectares
     400.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
     400.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .386       .165       .237      1.687 c.m/s
           .546       .949       .550     C perv/imperv/total
 15     ADD RUNOFF
           .386       .437       .237      1.687 c.m/s
  9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
          0      No. of sub-reaches
           .386       .437       .437      1.687 c.m/s
 35     COMMENT
      1     line(s) of comment
       COMBINED VALUE BELOW IS EXISTING OUTFLOW TO OUTLET B
 17     COMBINE
      1     Junction Node No.
           .386       .437       .437      2.055 c.m/s
 27     HYDROGRAPH DISPLAY
      7     is # of Hyeto/Hydrograph chosen
       Volume  =  .4176507E+05 c.m
 14     START
      1     1=Zero; 2=Define
 35     COMMENT
      1     line(s) of comment
       ** DRAINAGE AREA EX5 TO EAST - OUTLET C ********************
  4     CATCHMENT
       5.000     ID No.ó 99999
       2.620     Area in hectares
      60.000     Length (PERV) metres
       1.000     Gradient (%)
       1.000     Per cent Impervious
      60.000     Length (IMPERV)
        .000     %Imp. with Zero Dpth
          1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
        .250     Manning "n"
      77.000     SCS Curve No or C
        .100     Ia/S Coefficient
       7.587     Initial Abstraction
          1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           .298       .000       .437      2.055 c.m/s
           .546       .941       .550     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .1648355E+04 c.m
 15     ADD RUNOFF
           .298       .298       .437      2.055 c.m/s
  9     ROUTE
        .000     Conduit Length
        .000     No Conduit defined
        .000     Zero lag
        .000     Beta weighting factor
        .000     Routing timestep
          0      No. of sub-reaches
           .298       .298       .298      2.055 c.m/s
 17     COMBINE
      1     Junction Node No.
           .298       .298       .298      2.125 c.m/s
 35     COMMENT
      1     line(s) of comment
       CONFLUENCE VALUE BELOW IS TOTAL EX OUTFLOW TO EAST CREEK - D
 18     CONFLUENCE
      1     Junction Node No.
           .298      2.125       .298       .000 c.m/s
 27     HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .4340879E+05 c.m
 20     MANUAL
```

Future Conditions – NO SWM

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          Output File (4.7) NOSWM.OUT    opened 2024-10-09  11:48
          Units used are defined by G =    9.810
             144   288    10.000        are MAXDT MAXHYD & DTMIN values
          Licensee: UPPER CANADA CONSULTANTS
  35      COMMENT
         4     line(s) of comment
          CONCESSION 7 - HUMMEL
          STORMWATER MANAGEMENT PLAN
          FUTURE CONDITIONS TO SIX MILE CREEK
          MAY 2021
  14      START
         1     1=Zero; 2=Define
  35      COMMENT
         3     line(s) of comment
          ***************************************************
          ** 2 YEAR DESIGN STORM EVENT *********************
          ***************************************************
   2      STORM
              1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
        567.000     Coefficient  a
          5.200     Constant  b    (min)
           .746     Exponent  c
           .450     Fraction to peak  r
        240.000     Duration ó 1440 min
                  37.413 mm     Total depth
   3      IMPERVIOUS
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .015     Manning "n"
         98.000     SCS Curve No or C
           .100     Ia/S Coefficient
           .518     Initial Abstraction
  35      COMMENT
         1     line(s) of comment
          ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ***************
   4      CATCHMENT
          1.000     ID No.ó 99999
          1.280     Area in hectares
         50.000     Length (PERV) metres
          1.000     Gradient (%)
         26.000     Per cent Impervious
         50.000     Length (IMPERV)
           .000     %Imp. with Zero Dpth
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250     Manning "n"
         77.000     SCS Curve No or C
           .100     Ia/S Coefficient
          7.587     Initial Abstraction
              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .047       .000       .000       .000 c.m/s
                .225       .851       .388     C perv/imperv/total
  27      HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .1856209E+03 c.m
  14      START
         1     1=Zero; 2=Define
  35      COMMENT
         1     line(s) of comment
          ********** DRAINAGE AREA EXT-F *********************
   4      CATCHMENT
          2.000     ID No.ó 99999
         52.370     Area in hectares
        900.000     Length (PERV) metres
          1.000     Gradient (%)
          3.000     Per cent Impervious
        900.000     Length (IMPERV)
           .000     %Imp. with Zero Dpth
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250     Manning "n"
         77.000     SCS Curve No or C
           .100     Ia/S Coefficient
          7.587     Initial Abstraction
              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .186       .000       .000       .000 c.m/s
                .225       .863       .244     C perv/imperv/total
  15      ADD RUNOFF
                .186       .186       .000       .000 c.m/s
   9      ROUTE
           .000     Conduit Length
           .000     No Conduit defined
           .000     Zero lag
           .000     Beta weighting factor
           .000     Routing timestep
              0     No. of sub-reaches
                .186       .186       .186       .000 c.m/s
  17      COMBINE
         1     Junction Node No.
                .186       .186       .186       .186 c.m/s
  14      START
         1     1=Zero; 2=Define
  35      COMMENT
         1     line(s) of comment
          ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
   4      CATCHMENT
          2.000     ID No.ó 99999
          2.348     Area in hectares
        140.000     Length (PERV) metres
          1.000     Gradient (%)
         28.800     Per cent Impervious
        140.000     Length (IMPERV)
           .000     %Imp. with Zero Dpth
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250     Manning "n"
         77.000     SCS Curve No or C
           .100     Ia/S Coefficient
          7.587     Initial Abstraction
              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .093       .000       .186       .186 c.m/s
                .225       .847       .404     C perv/imperv/total
  15      ADD RUNOFF
                .093       .093       .186       .186 c.m/s
   9      ROUTE
           .000     Conduit Length
           .000     No Conduit defined
           .000     Zero lag
           .000     Beta weighting factor
           .000     Routing timestep
              0     No. of sub-reaches
                .093       .093       .093       .186 c.m/s
  17      COMBINE
         1     Junction Node No.
                .093       .093       .093       .232 c.m/s
  14      START
         1     1=Zero; 2=Define
  35      COMMENT
         1     line(s) of comment
          ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
   4      CATCHMENT
          3.000     ID No.ó 99999
           .850     Area in hectares
         40.000     Length (PERV) metres
          1.000     Gradient (%)
         23.600     Per cent Impervious
         40.000     Length (IMPERV)
           .000     %Imp. with Zero Dpth
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250     Manning "n"
         77.000     SCS Curve No or C
           .100     Ia/S Coefficient
          7.587     Initial Abstraction
              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .032       .000       .093       .232 c.m/s
                .225       .853       .373     C perv/imperv/total
  15      ADD RUNOFF
                .032       .032       .093       .232 c.m/s
   9      ROUTE
           .000     Conduit Length
           .000     No Conduit defined
           .000     Zero lag
           .000     Beta weighting factor
           .000     Routing timestep
              0     No. of sub-reaches
                .032       .032       .032       .232 c.m/s
  35      COMMENT
         1     line(s) of comment
          *****************    OUTLET B    ******************
  17      COMBINE
         1     Junction Node No.
                .032       .032       .032       .258 c.m/s
  27      HYDROGRAPH DISPLAY
         7     is # of Hyeto/Hydrograph chosen
          Volume  =  .5253400E+04 c.m
  14      START
         1     1=Zero; 2=Define
  35      COMMENT
         2     line(s) of comment
          ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
          *************       OUTLET C    **************
   4      CATCHMENT
          4.000     ID No.ó 99999
         13.080     Area in hectares
        600.000     Length (PERV) metres
          1.000     Gradient (%)
         70.000     Per cent Impervious
        600.000     Length (IMPERV)
           .000     %Imp. with Zero Dpth
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250     Manning "n"
         77.000     SCS Curve No or C
           .100     Ia/S Coefficient
          7.587     Initial Abstraction
              1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .981       .000       .032       .258 c.m/s
                .225       .859       .669     C perv/imperv/total
  27      HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .3273709E+04 c.m
  15      ADD RUNOFF
                .981       .981       .032       .258 c.m/s
  27      HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .3273709E+04 c.m
   9      ROUTE
           .000     Conduit Length
           .000     No Conduit defined
           .000     Zero lag
           .000     Beta weighting factor
           .000     Routing timestep
              0     No. of sub-reaches
                .981       .981       .981       .258 c.m/s
  17      COMBINE
         1     Junction Node No.
                .981       .981       .981      1.239 c.m/s
  35      COMMENT
         1     line(s) of comment
          *************    OUTLET D    **********************
  18      CONFLUENCE
         1     Junction Node No.
                .981      1.239       .981       .000 c.m/s
  27      HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .8526002E+04 c.m
  14      START
         1     1=Zero; 2=Define
  35      COMMENT
         3     line(s) of comment
          ***************************************************
          ** 5YR DESIGN STORM EVENT ***************************
          ***************************************************
   2      STORM
              1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
        664.000     Coefficient  a
          4.700     Constant  b    (min)
           .744     Exponent  c
           .450     Fraction to peak  r
        240.000     Duration ó 1440 min
                  44.365 mm     Total depth
   3      IMPERVIOUS
              1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .015     Manning "n"
         98.000     SCS Curve No or C
           .100     Ia/S Coefficient
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        .518     Initial Abstraction
 35     COMMENT
        1     line(s) of comment
        ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
  4     CATCHMENT
        1.000     ID No.ó 99999
        1.280     Area in hectares
       50.000     Length (PERV) metres
        1.000     Gradient (%)
       26.000     Per cent Impervious
       50.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
          1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .064       .000       .981       .000 c.m/s
            .271       .872       .427     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
        Volume  =  .2423836E+03 c.m
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        1     line(s) of comment
        ********** DRAINAGE AREA EXT-F **********************
  4     CATCHMENT
        2.000     ID No.ó 99999
       52.370     Area in hectares
      900.000     Length (PERV) metres
        1.000     Gradient (%)
        3.000     Per cent Impervious
      900.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
          1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .306       .000       .981       .000 c.m/s
            .271       .883       .289     C perv/imperv/total
 15     ADD RUNOFF
            .306       .306       .981       .000 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
          0       No. of sub-reaches
            .306       .306       .306       .000 c.m/s
 17     COMBINE
        1     Junction Node No.
            .306       .306       .306       .306 c.m/s
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        1     line(s) of comment
        ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
  4     CATCHMENT
        2.000     ID No.ó 99999
        2.348     Area in hectares
      140.000     Length (PERV) metres
        1.000     Gradient (%)
       28.800     Per cent Impervious
      140.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
          1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .114       .000       .306       .306 c.m/s
            .271       .860       .440     C perv/imperv/total
 15     ADD RUNOFF
            .114       .114       .306       .306 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
          0       No. of sub-reaches
            .114       .114       .114       .306 c.m/s
 17     COMBINE
        1     Junction Node No.
            .114       .114       .114       .323 c.m/s
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        1     line(s) of comment
        ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
  4     CATCHMENT
        3.000     ID No.ó 99999
         .850     Area in hectares
       40.000     Length (PERV) metres
        1.000     Gradient (%)
       23.600     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
          1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .040       .000       .114       .323 c.m/s
            .270       .871       .412     C perv/imperv/total
 15     ADD RUNOFF
            .040       .040       .114       .323 c.m/s
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
          0       No. of sub-reaches
            .040       .040       .040       .323 c.m/s
 35     COMMENT
        1     line(s) of comment
        *****************    OUTLET B    ******************
 17     COMBINE
        1     Junction Node No.
            .040       .040       .040       .346 c.m/s
 27     HYDROGRAPH DISPLAY
        7     is # of Hyeto/Hydrograph chosen
        Volume  =  .7318154E+04 c.m
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        2     line(s) of comment
        ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
        *************       OUTLET C    **************
  4     CATCHMENT
        4.000     ID No.ó 99999
       13.080     Area in hectares
      600.000     Length (PERV) metres
        1.000     Gradient (%)
       70.000     Per cent Impervious
      600.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
          1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
           1.273       .000       .040       .346 c.m/s
            .271       .883       .699     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
        Volume  =  .4056540E+04 c.m
 15     ADD RUNOFF
           1.273      1.273       .040       .346 c.m/s
 27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
        Volume  =  .4056540E+04 c.m
  9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
          0       No. of sub-reaches
           1.273      1.273      1.273       .346 c.m/s
 17     COMBINE
        1     Junction Node No.
           1.273      1.273      1.273      1.619 c.m/s
 35     COMMENT
        1     line(s) of comment
        *************    OUTLET D    **********************
 18     CONFLUENCE
        1     Junction Node No.
           1.273      1.619      1.273       .000 c.m/s
 27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1137180E+05 c.m
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        3     line(s) of comment
        *********************************
        ** 100 YEAR DESIGN STORM EVENT **
        *********************************
  2     STORM
          1       1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      980.000     Coefficient  a
        3.700     Constant  b    (min)
         .732     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó 1440 min
              70.157 mm     Total depth
  3     IMPERVIOUS
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
 35     COMMENT
        1     line(s) of comment
        ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
  4     CATCHMENT
        1.000     ID No.ó 99999
        1.280     Area in hectares
       50.000     Length (PERV) metres
        1.000     Gradient (%)
       26.000     Per cent Impervious
       50.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
          1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
          1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .120       .000      1.273       .000 c.m/s
            .402       .909       .534     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
        Volume  =  .4795691E+03 c.m
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        1     line(s) of comment
        ********** DRAINAGE AREA EXT-F **********************
  4     CATCHMENT
        2.000     ID No.ó 99999
       52.370     Area in hectares
      900.000     Length (PERV) metres
        1.000     Gradient (%)
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        3.000     Per cent Impervious
      900.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .992       .000      1.273       .000 c.m/s
             .403       .920       .419     C perv/imperv/total
 15    ADD RUNOFF
             .992       .992      1.273       .000 c.m/s
  9    ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
             .992       .992       .992       .000 c.m/s
 17    COMBINE
      1     Junction Node No.
             .992       .992       .992       .992 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
  4    CATCHMENT
        2.000     ID No.ó 99999
        2.348     Area in hectares
      140.000     Length (PERV) metres
        1.000     Gradient (%)
       28.800     Per cent Impervious
      140.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .199       .000       .992       .992 c.m/s
             .402       .911       .549     C perv/imperv/total
 15    ADD RUNOFF
             .199       .199       .992       .992 c.m/s
  9    ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
             .199       .199       .199       .992 c.m/s
 17    COMBINE
      1     Junction Node No.
             .199       .199       .199      1.038 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
  4    CATCHMENT
        3.000     ID No.ó 99999
         .850     Area in hectares
       40.000     Length (PERV) metres
        1.000     Gradient (%)
       23.600     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .079       .000       .199      1.038 c.m/s
             .402       .905       .521     C perv/imperv/total
 15    ADD RUNOFF
             .079       .079       .199      1.038 c.m/s
  9    ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
             .079       .079       .079      1.038 c.m/s
 35    COMMENT
      1     line(s) of comment
       *****************    OUTLET B    ******************
 17    COMBINE
      1     Junction Node No.
             .079       .079       .079      1.052 c.m/s
 27    HYDROGRAPH DISPLAY
      7     is # of Hyeto/Hydrograph chosen
       Volume  =  .1658609E+05 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      2     line(s) of comment
       ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
       *************       OUTLET C    **************
  4    CATCHMENT
        4.000     ID No.ó 99999
       13.080     Area in hectares
      600.000     Length (PERV) metres
        1.000     Gradient (%)
       70.000     Per cent Impervious
      600.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
```

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            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             2.497       .000       .079      1.052 c.m/s
              .403       .917       .763     C perv/imperv/total
 27    HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .6998922E+04 c.m
 15    ADD RUNOFF
             2.497      2.497       .079      1.052 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .6998922E+04 c.m
  9    ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
             2.497      2.497      2.497      1.052 c.m/s
 17    COMBINE
      1     Junction Node No.
             2.497      2.497      2.497      3.265 c.m/s
 35    COMMENT
      1     line(s) of comment
       *************    OUTLET D    **********************
 18    CONFLUENCE
      1     Junction Node No.
             2.497      3.265      2.497       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .2358479E+05 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      3     line(s) of comment
       **************************************************
       ** 100 YEAR DESIGN STORM EVENT  - 24 HOUR ********
       **************************************************
  2    STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      980.000     Coefficient  a
        3.700     Constant  b    (min)
         .732     Exponent  c
         .450     Fraction to peak  r
     1440.000     Duration ó 1440 min
               114.472 mm     Total depth
  3    IMPERVIOUS
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .015     Manning "n"
       98.000     SCS Curve No or C
         .100     Ia/S Coefficient
         .518     Initial Abstraction
 35    COMMENT
      1     line(s) of comment
       ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
  4    CATCHMENT
        1.000     ID No.ó 99999
        1.280     Area in hectares
       50.000     Length (PERV) metres
        1.000     Gradient (%)
       26.000     Per cent Impervious
       50.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .171       .000      2.497       .000 c.m/s
              .545       .939       .647     C perv/imperv/total
 27    HYDROGRAPH DISPLAY
      4     is # of Hyeto/Hydrograph chosen
       Volume  =  .9483962E+03 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ********** DRAINAGE AREA EXT-F *********************
  4    CATCHMENT
        2.000     ID No.ó 99999
       52.370     Area in hectares
      900.000     Length (PERV) metres
        1.000     Gradient (%)
        3.000     Per cent Impervious
      900.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             1.599       .000      2.497       .000 c.m/s
              .546       .950       .558     C perv/imperv/total
 15    ADD RUNOFF
             1.599      1.599      2.497       .000 c.m/s
  9    ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
             1.599      1.599      1.599       .000 c.m/s
 17    COMBINE
      1     Junction Node No.
             1.599      1.599      1.599      1.599 c.m/s
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      1     line(s) of comment
       ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
  4    CATCHMENT
        2.000     ID No.ó 99999
        2.348     Area in hectares
      140.000     Length (PERV) metres
```

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        1.000     Gradient (%)
       28.800     Per cent Impervious
      140.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .241       .000      1.599      1.599 c.m/s
               .546       .943       .660     C perv/imperv/total
   15     ADD RUNOFF
               .241       .241      1.599      1.599 c.m/s
    9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .241       .241       .241      1.599 c.m/s
   17     COMBINE
       1     Junction Node No.
               .241       .241       .241      1.665 c.m/s
   14     START
       1     1=Zero; 2=Define
   35     COMMENT
       1     line(s) of comment
        ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
    4     CATCHMENT
        3.000     ID No.ó 99999
         .850     Area in hectares
       40.000     Length (PERV) metres
        1.000     Gradient (%)
       23.600     Per cent Impervious
       40.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               .120       .000       .241      1.665 c.m/s
               .545       .936       .637     C perv/imperv/total
   15     ADD RUNOFF
               .120       .120       .241      1.665 c.m/s
    9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
               .120       .120       .120      1.665 c.m/s
   35     COMMENT
       1     line(s) of comment
        *****************    OUTLET B    ******************
   17     COMBINE
       1     Junction Node No.
               .120       .120       .120      1.682 c.m/s
   27     HYDROGRAPH DISPLAY
       7     is # of Hyeto/Hydrograph chosen
        Volume  =  .3584419E+05 c.m
   14     START
       1     1=Zero; 2=Define
   35     COMMENT
       2     line(s) of comment
        ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
        *************       OUTLET C   **************
    4     CATCHMENT
        4.000     ID No.ó 99999
       13.080     Area in hectares
      600.000     Length (PERV) metres
        1.000     Gradient (%)
       70.000     Per cent Impervious
      600.000     Length (IMPERV)
         .000     %Imp. with Zero Dpth
            1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
         .250     Manning "n"
       77.000     SCS Curve No or C
         .100     Ia/S Coefficient
        7.587     Initial Abstraction
            1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              2.566       .000       .120      1.682 c.m/s
               .546       .947       .827     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .1238127E+05 c.m
   15     ADD RUNOFF
              2.566      2.566       .120      1.682 c.m/s
   27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1238127E+05 c.m
    9     ROUTE
         .000     Conduit Length
         .000     No Conduit defined
         .000     Zero lag
         .000     Beta weighting factor
         .000     Routing timestep
            0     No. of sub-reaches
              2.566      2.566      2.566      1.682 c.m/s
   17     COMBINE
       1     Junction Node No.
              2.566      2.566      2.566      3.595 c.m/s
   35     COMMENT
       1     line(s) of comment
        *************    OUTLET D    **********************
   18     CONFLUENCE
       1     Junction Node No.
              2.566      3.595      2.566       .000 c.m/s
   27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .4822620E+05 c.m
   20     MANUAL
```

Future Conditions – WITH SWM

```
         Output File (4.7) SWM.OUT      opened 2024-10-23  17:45
         Units used are defined by G =    9.810
            144   288    10.000        are MAXDT MAXHYD & DTMIN values
         Licensee: UPPER CANADA CONSULTANTS
 35      COMMENT
        4     line(s) of comment
         CONCESSION 7 - HUMMEL
         STORMWATER MANAGEMENT PLAN
         FUTURE CONDITIONS TO SIX MILE CREEK
         MAY 2021
 35      COMMENT
        3     line(s) of comment
         ***********************************
         ** 25MM STORM EVENT ***************
         ***********************************
  2      STORM
             1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       512.000      Coefficient  a
         6.000      Constant  b    (min)
          .800      Exponent  c
          .450      Fraction to peak  r
       240.000      Duration ó 1440 min
                  25.035 mm     Total depth
  3      IMPERVIOUS
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .015      Manning "n"
        98.000      SCS Curve No or C
          .100      Ia/S Coefficient
          .518      Initial Abstraction
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        2     line(s) of comment
         ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
         *************       OUTLET C    **************
  4      CATCHMENT
         4.000      ID No.ó 99999
        13.080      Area in hectares
       600.000      Length (PERV) metres
         1.000      Gradient (%)
        70.000      Per cent Impervious
       600.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .580       .000       .000       .000 c.m/s
                .130       .807       .604     C perv/imperv/total
 27      HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1972449E+04 c.m
 15      ADD RUNOFF
                .580       .580       .000       .000 c.m/s
 27      HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .1972449E+04 c.m
 10      POND
        6 Depth - Discharge - Volume sets
         114.000        .000          .0
         114.700       .0280      2613.1
         115.000        .125      3954.7
         115.150        .203      4674.4
         115.250        .308      5172.6
         115.500        .793      6484.0
         Peak Outflow    =      .018 c.m/s
         Maximum Depth   =   114.450 metres
         Maximum Storage =     1678. c.m
                .580       .580       .018       .000 c.m/s
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        3     line(s) of comment
         **************************************************
         ** 2 YEAR DESIGN STORM EVENT *********************
         **************************************************
  2      STORM
             1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       567.000      Coefficient  a
         5.200      Constant  b    (min)
          .746      Exponent  c
          .450      Fraction to peak  r
       240.000      Duration ó 1440 min
                  37.413 mm     Total depth
  3      IMPERVIOUS
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .015      Manning "n"
        98.000      SCS Curve No or C
          .100      Ia/S Coefficient
          .518      Initial Abstraction
 35      COMMENT
        1     line(s) of comment
         ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
  4      CATCHMENT
         1.000      ID No.ó 99999
         1.280      Area in hectares
        50.000      Length (PERV) metres
         1.000      Gradient (%)
        26.200      Per cent Impervious
        50.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .050       .000       .018       .000 c.m/s
                .225       .851       .389     C perv/imperv/total
 27      HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1862528E+03 c.m
```

```
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        1     line(s) of comment
         ********* DRAINAGE AREA EXT-F *********************
  4      CATCHMENT
         2.000      ID No.ó 99999
        52.370      Area in hectares
       900.000      Length (PERV) metres
         1.000      Gradient (%)
         3.000      Per cent Impervious
       900.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .186       .000       .018       .000 c.m/s
                .225       .863       .244     C perv/imperv/total
 15      ADD RUNOFF
                .186       .186       .018       .000 c.m/s
  9      ROUTE
          .000      Conduit Length
          .000      No Conduit defined
          .000      Zero lag
          .000      Beta weighting factor
          .000      Routing timestep
             0      No. of sub-reaches
                .186       .186       .186       .000 c.m/s
 17      COMBINE
        1     Junction Node No.
                .186       .186       .186       .186 c.m/s
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        1     line(s) of comment
         ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
  4      CATCHMENT
         2.000      ID No.ó 99999
         2.348      Area in hectares
       140.000      Length (PERV) metres
         1.000      Gradient (%)
        28.800      Per cent Impervious
       140.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .093       .000       .186       .186 c.m/s
                .225       .847       .404     C perv/imperv/total
 15      ADD RUNOFF
                .093       .093       .186       .186 c.m/s
 10      POND
        7 Depth - Discharge - Volume sets
         118.100        .000          .0
         119.000       .0430         1.7
         119.500       .0540        14.6
         119.900       .0620        38.1
         120.600       .0730        45.7
         120.650        .249        50.2
         120.700        .569        54.8
         Peak Outflow    =      .059 c.m/s
         Maximum Depth   =   119.760 metres
         Maximum Storage =       30. c.m
                .093       .093       .059       .186 c.m/s
 17      COMBINE
        1     Junction Node No.
                .093       .093       .059       .228 c.m/s
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        1     line(s) of comment
         ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
  4      CATCHMENT
         3.000      ID No.ó 99999
          .850      Area in hectares
        40.000      Length (PERV) metres
         1.000      Gradient (%)
        23.600      Per cent Impervious
        40.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .032       .000       .059       .228 c.m/s
                .225       .853       .373     C perv/imperv/total
 15      ADD RUNOFF
                .032       .032       .059       .228 c.m/s
  9      ROUTE
          .000      Conduit Length
          .000      No Conduit defined
          .000      Zero lag
          .000      Beta weighting factor
          .000      Routing timestep
             0      No. of sub-reaches
                .032       .032       .032       .228 c.m/s
 35      COMMENT
        1     line(s) of comment
         *****************     OUTLET B    ******************
 17      COMBINE
        1     Junction Node No.
                .032       .032       .032       .245 c.m/s
 27      HYDROGRAPH DISPLAY
        7     is # of Hyeto/Hydrograph chosen
         Volume  =  .5250400E+04 c.m
 14      START
        1     1=Zero; 2=Define
 35      COMMENT
        2     line(s) of comment
```

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         ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
         *************       OUTLET C   *************
   4     CATCHMENT
         4.000     ID No.ó 99999
        13.080     Area in hectares
       600.000     Length (PERV) metres
         1.000     Gradient (%)
        70.000     Per cent Impervious
       600.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .981       .000       .032       .245 c.m/s
                .225       .859       .669     C perv/imperv/total
  15     ADD RUNOFF
                .981       .981       .032       .245 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .3273709E+04 c.m
  10     POND
        6 Depth - Discharge - Volume sets
         114.000        .000         .0
         114.700       .0280      2613.1
         115.000        .125      3954.7
         115.150        .203      4674.4
         115.250        .308      5172.6
         115.500        .793      6484.0
         Peak Outflow    =      .038 c.m/s
         Maximum Depth   =   114.730 metres
         Maximum Storage =     2749. c.m
                .981       .981       .038       .245 c.m/s
  17     COMBINE
        1     Junction Node No.
                .981       .981       .038       .258 c.m/s
  35     COMMENT
        1     line(s) of comment
         *************    OUTLET D    **********************
  18     CONFLUENCE
        1     Junction Node No.
                .981       .258       .038       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .6941400E+04 c.m
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        3     line(s) of comment
         *******************************************************
         ** 5YR DESIGN STORM EVENT ****************************
         *******************************************************
   2     STORM
             1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       664.000     Coefficient  a
         4.700     Constant  b    (min)
          .744     Exponent  c
          .450     Fraction to peak  r
       240.000     Duration ó 1440 min
                  44.365 mm     Total depth
   3     IMPERVIOUS
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .015     Manning "n"
        98.000     SCS Curve No or C
          .100     Ia/S Coefficient
          .518     Initial Abstraction
  35     COMMENT
        1     line(s) of comment
         ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
   4     CATCHMENT
         1.000     ID No.ó 99999
         1.280     Area in hectares
        50.000     Length (PERV) metres
         1.000     Gradient (%)
        26.200     Per cent Impervious
        50.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .064       .000       .038       .000 c.m/s
                .271       .872       .428     C perv/imperv/total
  27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .2430660E+03 c.m
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        1     line(s) of comment
         ********** DRAINAGE AREA EXT-F *********************
   4     CATCHMENT
         2.000     ID No.ó 99999
        52.370     Area in hectares
       900.000     Length (PERV) metres
         1.000     Gradient (%)
         3.000     Per cent Impervious
       900.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .306       .000       .038       .000 c.m/s
                .271       .883       .289     C perv/imperv/total
  15     ADD RUNOFF
                .306       .306       .038       .000 c.m/s
   9     ROUTE
          .000     Conduit Length
          .000     No Conduit defined
          .000     Zero lag
          .000     Beta weighting factor
          .000     Routing timestep
             0     No. of sub-reaches
                .306       .306       .306       .000 c.m/s
  17     COMBINE
        1     Junction Node No.
                .306       .306       .306       .306 c.m/s
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        1     line(s) of comment
         ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
   4     CATCHMENT
         2.000     ID No.ó 99999
         2.348     Area in hectares
       140.000     Length (PERV) metres
         1.000     Gradient (%)
        28.800     Per cent Impervious
       140.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .114       .000       .306       .306 c.m/s
                .271       .860       .440     C perv/imperv/total
  15     ADD RUNOFF
                .114       .114       .306       .306 c.m/s
  10     POND
        7 Depth - Discharge - Volume sets
         118.100        .000         .0
         119.000       .0430        1.7
         119.500       .0540       14.6
         119.900       .0620       38.1
         120.600       .0730       45.7
         120.650        .249       50.2
         120.700        .569       54.8
         Peak Outflow    =      .068 c.m/s
         Maximum Depth   =   120.301 metres
         Maximum Storage =       42. c.m
                .114       .114       .068       .306 c.m/s
  17     COMBINE
        1     Junction Node No.
                .114       .114       .068       .323 c.m/s
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        1     line(s) of comment
         ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
   4     CATCHMENT
         3.000     ID No.ó 99999
          .850     Area in hectares
        40.000     Length (PERV) metres
         1.000     Gradient (%)
        23.600     Per cent Impervious
        40.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .040       .000       .068       .323 c.m/s
                .270       .871       .412     C perv/imperv/total
  15     ADD RUNOFF
                .040       .040       .068       .323 c.m/s
   9     ROUTE
          .000     Conduit Length
          .000     No Conduit defined
          .000     Zero lag
          .000     Beta weighting factor
          .000     Routing timestep
             0     No. of sub-reaches
                .040       .040       .040       .323 c.m/s
  35     COMMENT
        1     line(s) of comment
         ****************    OUTLET B    *****************
  17     COMBINE
        1     Junction Node No.
                .040       .040       .040       .328 c.m/s
  27     HYDROGRAPH DISPLAY
        7     is # of Hyeto/Hydrograph chosen
         Volume  =  .7312155E+04 c.m
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        2     line(s) of comment
         ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
         *************       OUTLET C   *************
   4     CATCHMENT
         4.000     ID No.ó 99999
        13.080     Area in hectares
       600.000     Length (PERV) metres
         1.000     Gradient (%)
        70.000     Per cent Impervious
       600.000     Length (IMPERV)
          .000     %Imp. with Zero Dpth
             1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250     Manning "n"
        77.000     SCS Curve No or C
          .100     Ia/S Coefficient
         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               1.273       .000       .040       .328 c.m/s
                .271       .883       .699     C perv/imperv/total
  15     ADD RUNOFF
               1.273      1.273       .040       .328 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .4056540E+04 c.m
  10     POND
        6 Depth - Discharge - Volume sets
         114.000        .000         .0
         114.700       .0280      2613.1
```

```
          115.000        .125      3954.7
          115.150        .203      4674.4
          115.250        .308      5172.6
          115.500        .793      6484.0
          Peak Outflow    =      .072 c.m/s
          Maximum Depth   =   114.837 metres
          Maximum Storage =      3226. c.m
             1.273      1.273       .072       .328 c.m/s
  17    COMBINE
         1     Junction Node No.
             1.273      1.273       .072       .395 c.m/s
  35    COMMENT
         1     line(s) of comment
          *************    OUTLET D    **********************
  18    CONFLUENCE
         1     Junction Node No.
             1.273       .395       .072       .000 c.m/s
  27    HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .9656398E+04 c.m
  14    START
         1     1=Zero; 2=Define
  35    COMMENT
         3     line(s) of comment
          *********************************
          ** 100 YEAR DESIGN STORM EVENT **
          *********************************
   2    STORM
             1       1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
        980.000      Coefficient  a
          3.700      Constant  b    (min)
           .732      Exponent  c
           .450      Fraction to peak  r
        240.000      Duration ó 1440 min
                   70.157 mm     Total depth
   3    IMPERVIOUS
             1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .015      Manning "n"
         98.000      SCS Curve No or C
           .100      Ia/S Coefficient
           .518      Initial Abstraction
  35    COMMENT
         1     line(s) of comment
          ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
   4    CATCHMENT
          1.000      ID No.ó 99999
          1.280      Area in hectares
         50.000      Length (PERV) metres
          1.000      Gradient (%)
         26.200      Per cent Impervious
         50.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
             1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
             1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .121       .000       .072       .000 c.m/s
                .402       .909       .535     C perv/imperv/total
  27    HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .4804795E+03 c.m
  14    START
         1     1=Zero; 2=Define
  35    COMMENT
         1     line(s) of comment
          ********** DRAINAGE AREA EXT-F **********************
   4    CATCHMENT
          2.000      ID No.ó 99999
         52.370      Area in hectares
        900.000      Length (PERV) metres
          1.000      Gradient (%)
          3.000      Per cent Impervious
        900.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
             1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
             1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .992       .000       .072       .000 c.m/s
                .403       .920       .419     C perv/imperv/total
  15    ADD RUNOFF
                .992       .992       .072       .000 c.m/s
   9    ROUTE
           .000      Conduit Length
           .000      No Conduit defined
           .000      Zero lag
           .000      Beta weighting factor
           .000      Routing timestep
             0       No. of sub-reaches
                .992       .992       .992       .000 c.m/s
  17    COMBINE
         1     Junction Node No.
                .992       .992       .992       .992 c.m/s
  14    START
         1     1=Zero; 2=Define
  35    COMMENT
         1     line(s) of comment
          ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
   4    CATCHMENT
          2.000      ID No.ó 99999
          2.348      Area in hectares
        140.000      Length (PERV) metres
          1.000      Gradient (%)
         28.800      Per cent Impervious
        140.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
             1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
             1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .199       .000       .992       .992 c.m/s
```

```
                .402       .911       .549     C perv/imperv/total
  15    ADD RUNOFF
                .199       .199       .992       .992 c.m/s
  10    POND
         7 Depth - Discharge - Volume sets
          118.100        .000          .0
          119.000       .0430         1.7
          119.500       .0540        14.6
          119.900       .0620        38.1
          120.600       .0730        45.7
          120.650        .249        50.2
          120.700        .569        54.8
          Peak Outflow    =      .198 c.m/s
          Maximum Depth   =   120.636 metres
          Maximum Storage =        49. c.m
                .199       .199       .198       .992 c.m/s
  17    COMBINE
         1     Junction Node No.
                .199       .199       .198      1.051 c.m/s
  14    START
         1     1=Zero; 2=Define
  35    COMMENT
         1     line(s) of comment
          ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
   4    CATCHMENT
          3.000      ID No.ó 99999
           .850      Area in hectares
         40.000      Length (PERV) metres
          1.000      Gradient (%)
         23.600      Per cent Impervious
         40.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
             1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
             1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .079       .000       .198      1.051 c.m/s
                .402       .905       .521     C perv/imperv/total
  15    ADD RUNOFF
                .079       .079       .198      1.051 c.m/s
   9    ROUTE
           .000      Conduit Length
           .000      No Conduit defined
           .000      Zero lag
           .000      Beta weighting factor
           .000      Routing timestep
             0       No. of sub-reaches
                .079       .079       .079      1.051 c.m/s
  35    COMMENT
         1     line(s) of comment
          *****************    OUTLET B    ******************
  17    COMBINE
         1     Junction Node No.
                .079       .079       .079      1.065 c.m/s
  27    HYDROGRAPH DISPLAY
         7     is # of Hyeto/Hydrograph chosen
          Volume  =  .1655609E+05 c.m
  14    START
         1     1=Zero; 2=Define
  35    COMMENT
         2     line(s) of comment
          ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
          *************       OUTLET C    **************
   4    CATCHMENT
          4.000      ID No.ó 99999
         13.080      Area in hectares
        600.000      Length (PERV) metres
          1.000      Gradient (%)
         70.000      Per cent Impervious
        600.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
             1       Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
             1       Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               2.497       .000       .079      1.065 c.m/s
                .403       .917       .763     C perv/imperv/total
  15    ADD RUNOFF
               2.497      2.497       .079      1.065 c.m/s
  27    HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .6998922E+04 c.m
  10    POND
         6 Depth - Discharge - Volume sets
          114.000        .000          .0
          114.700       .0280      2613.1
          115.000        .125      3954.7
          115.150        .203      4674.4
          115.250        .308      5172.6
          115.500        .793      6484.0
          Peak Outflow    =      .226 c.m/s
          Maximum Depth   =   115.172 metres
          Maximum Storage =      4785. c.m
               2.497      2.497       .226      1.065 c.m/s
  17    COMBINE
         1     Junction Node No.
               2.497      2.497       .226      1.277 c.m/s
  35    COMMENT
         1     line(s) of comment
          *************    OUTLET D    **********************
  18    CONFLUENCE
         1     Junction Node No.
               2.497      1.277       .226       .000 c.m/s
  27    HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .2166300E+05 c.m
  14    START
         1     1=Zero; 2=Define
  35    COMMENT
         3     line(s) of comment
          *************************************************
          ** 100 YEAR DESIGN STORM EVENT  - 24 HOUR ********
          *************************************************
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```
 2     STORM
          1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    980.000     Coefficient  a
      3.700     Constant  b    (min)
       .732     Exponent  c
       .450     Fraction to peak  r
   1440.000     Duration ó 1440 min
            114.472 mm     Total depth
 3     IMPERVIOUS
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .015     Manning "n"
     98.000     SCS Curve No or C
       .100     Ia/S Coefficient
       .518     Initial Abstraction
35     COMMENT
     1     line(s) of comment
       ** A1 - UNCONTROLLED DRAINAGE AREA TO WEST ****************
 4     CATCHMENT
      1.000     ID No.ó 99999
      1.280     Area in hectares
     50.000     Length (PERV) metres
      1.000     Gradient (%)
     26.200     Per cent Impervious
     50.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .171       .000       .226       .000 c.m/s
             .545       .939       .648     C perv/imperv/total
27     HYDROGRAPH DISPLAY
     4     is # of Hyeto/Hydrograph chosen
       Volume  =  .9495515E+03 c.m
14     START
     1     1=Zero; 2=Define
35     COMMENT
     1     line(s) of comment
       ********** DRAINAGE AREA EXT-F **********************
 4     CATCHMENT
      2.000     ID No.ó 99999
     52.370     Area in hectares
    900.000     Length (PERV) metres
      1.000     Gradient (%)
      3.000     Per cent Impervious
    900.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            1.599       .000       .226       .000 c.m/s
             .546       .950       .558     C perv/imperv/total
15     ADD RUNOFF
            1.599      1.599       .226       .000 c.m/s
 9     ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
          0     No. of sub-reaches
            1.599      1.599      1.599       .000 c.m/s
17     COMBINE
     1     Junction Node No.
            1.599      1.599      1.599      1.599 c.m/s
14     START
     1     1=Zero; 2=Define
35     COMMENT
     1     line(s) of comment
       ** A2 - CON 7 DRAINAGE AREA TO CREEK     **************
 4     CATCHMENT
      2.000     ID No.ó 99999
      2.348     Area in hectares
    140.000     Length (PERV) metres
      1.000     Gradient (%)
     28.800     Per cent Impervious
    140.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
             .241       .000      1.599      1.599 c.m/s
             .546       .943       .660     C perv/imperv/total
15     ADD RUNOFF
             .241       .241      1.599      1.599 c.m/s
10     POND
     7 Depth - Discharge - Volume sets
       118.100        .000          .0
       119.000       .0430         1.7
       119.500       .0540        14.6
       119.900       .0620        38.1
       120.600       .0730        45.7
       120.650        .249        50.2
       120.700        .569        54.8
       Peak Outflow    =      .239 c.m/s
       Maximum Depth   =   120.647 metres
       Maximum Storage =       50. c.m
              .241       .241       .239      1.599 c.m/s
17     COMBINE
     1     Junction Node No.
              .241       .241       .239      1.670 c.m/s
14     START
     1     1=Zero; 2=Define
35     COMMENT
     1     line(s) of comment
       ** A3 - UNCONTROLLED DRAINAGE AREA TO EAST *************
 4     CATCHMENT
      3.000     ID No.ó 99999
       .850     Area in hectares
     40.000     Length (PERV) metres
      1.000     Gradient (%)
     23.600     Per cent Impervious
     40.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
              .120       .000       .239      1.670 c.m/s
              .545       .936       .637     C perv/imperv/total
15     ADD RUNOFF
              .120       .120       .239      1.670 c.m/s
 9     ROUTE
       .000     Conduit Length
       .000     No Conduit defined
       .000     Zero lag
       .000     Beta weighting factor
       .000     Routing timestep
          0     No. of sub-reaches
              .120       .120       .120      1.670 c.m/s
35     COMMENT
     1     line(s) of comment
       *****************    OUTLET B    ******************
17     COMBINE
     1     Junction Node No.
              .120       .120       .120      1.687 c.m/s
27     HYDROGRAPH DISPLAY
     7     is # of Hyeto/Hydrograph chosen
       Volume  =  .3586220E+05 c.m
14     START
     1     1=Zero; 2=Define
35     COMMENT
     2     line(s) of comment
       ** A4 - CONTROLLED DRAINAGE AREA TO POND   **
       *************       OUTLET C    **************
 4     CATCHMENT
      4.000     ID No.ó 99999
     13.080     Area in hectares
    600.000     Length (PERV) metres
      1.000     Gradient (%)
     70.000     Per cent Impervious
    600.000     Length (IMPERV)
       .000     %Imp. with Zero Dpth
          1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
       .250     Manning "n"
     77.000     SCS Curve No or C
       .100     Ia/S Coefficient
      7.587     Initial Abstraction
          1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            2.566       .000       .120      1.687 c.m/s
              .546       .947       .827     C perv/imperv/total
15     ADD RUNOFF
            2.566      2.566       .120      1.687 c.m/s
27     HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1238127E+05 c.m
10     POND
     6 Depth - Discharge - Volume sets
       114.000        .000          .0
       114.700       .0280      2613.1
       115.000        .125      3954.7
       115.150        .203      4674.4
       115.250        .308      5172.6
       115.500        .793      6484.0
       Peak Outflow    =      .454 c.m/s
       Maximum Depth   =   115.325 metres
       Maximum Storage =     5568. c.m
            2.566      2.566       .454      1.687 c.m/s
17     COMBINE
     1     Junction Node No.
            2.566      2.566       .454      2.122 c.m/s
35     COMMENT
     1     line(s) of comment
       *************    OUTLET D    ***********************
18     CONFLUENCE
     1     Junction Node No.
            2.566      2.122       .454       .000 c.m/s
27     HYDROGRAPH DISPLAY
     5     is # of Hyeto/Hydrograph chosen
       Volume  =  .4653001E+05 c.m
20     MANUAL
```

APPENDIX C

Hydroworks Output Files
Sample Inspection Report

```
         *************************************************
         *      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  *
         ***************************************************
         Concession 7 Storm Sewer
         Niagara-on-the-Lake
         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    #
###################################################
```

```
                   Concession 7 Storm Sewer
                  Niagara-on-the-Lake
Snowmelt parameter - ISNOW......................          0
Number of rain gages - NRGAG....................          1
orton 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    108.40     2.35  30.00    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).          2.35
IMPERVIOUS AREA (HECTARES)......          0.70
PERVIOUS AREA (HECTARES)........          1.64
TOTAL WIDTH (METERS)............        108.40
PERCENT IMPERVIOUSNESS..........         30.00

********************************************************
*      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
          2.        0.042
          5.        0.054
         29.        0.061
         46.        0.072
         51.        0.074
********************************************************
*      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    0.00    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      #
###########################################
                                                              LIMITING                       CLEANING  AVAIL.    DAYS SINCE
                                                              BUILDUP    BUILDUP  BUILDUP    INTERVAL  FACTOR       LAST
AND USE   BUILDUP EQUATION TYPE   FUNCTIONAL DEPENDENCE OF    QUANTITY   POWER    COEFF.     IN DAYS   FRACTION   SWEEPING
LNAME)          (METHOD)          BUILDUP PARAMETER(JACGUT)   (DDLIM)    (DDPOW)  (DDFACT)   (CLFREQ)  (AVSWP)     (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/   CONSTITUENT
     PIPE Total Susp
----------  --------
       201     0.000


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

                                  Total   Number   Input
                         Land    Gutter     of    Loading
                 Land     Use    Length   Catch-  load/ha
            No.  Usage    No.      Km     Basins   Total Su
        ------ --------  ----   -------- --------  -------
   1       300 Urban De  1         0.22     2.00  0.0E+00
   Totals (Loads in kg or other)   0.22     2.00  0.0E+00
```

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

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

===> WARNING !! STORAGE UNIT IS FLOODING. EXCESS VOLUME CONVEYED AS DISCHARGE
===> WARNING !! STORAGE UNIT IS FLOODING. EXCESS VOLUME CONVEYED AS DISCHARGE
===> WARNING !! STORAGE UNIT IS FLOODING. EXCESS VOLUME CONVEYED AS DISCHARGE

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

Concession 7 Storm Sewer
Niagara-on-the-Lake

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 =                   2056423
Final Julian Date  =                           2006001
Final time of day  =                                2. seconds.
Final running time =                             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   6218045   1584419

##################################################
*     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   *
##############################################
                                                                   Millimeters over
                                                     cubic meters  Total Basin
Total Precipitation (Rain plus Snow)                      452666.    19263.
Total Infiltration                                        316184.    13455.
Total Evaporation                                          14005.      596.
Surface Runoff from Watersheds                            123627.     5261.
Total Water remaining in Surface Storage                       0.        0.
Infiltration over the Pervious Area...                    316184.    19221.
                      --------
Infiltration + Evaporation +
Surface Runoff + Snow removal +
Water remaining in Surface Storage +
Water remaining in Snow Cover.........                    453816.    19312.
Total Precipitation + Initial Storage.                    452666.    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.................................       -0.254 Percent

##############################################
*       Continuity Check for Channel/Pipes   *
##############################################
                                                                   Millimeters over
                                                     cubic meters  Total Basin
Initial Channel/Pipe Storage................                   0.        0.
Final Channel/Pipe Storage..................                   0.        0.
Surface Runoff from Watersheds..............              123627.     5261.
Baseflow....................................                   0.
Groundwater Subsurface Inflow...............                   0.        0.
Evaporation Loss from Channels..............                   0.        0.
Channel/Pipe/Inlet Outflow..................              123627.     5261.
Initial Storage + Inflow....................              123627.     5261.
Final Storage + Outflow.....................              123627.     5261.
############################################
* 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                              21488.       914.
Final Subsurface Storage                                21488.       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
                                  ====================================
                                                     PERVIOUS AREA     IMPERVIOUS AREA     TOTAL SUBCATCHMENT AREA
                                                    ------------------  ----------------  ------------------------
                                        TOTAL     TOTAL        PEAK              PEAK              PEAK    PEAK
             GUTTER                   SIMULATED   RUNOFF TOTAL RUNOFF    RUNOFF  RUNOFF      RUNOFF  RUNOFF   UNIT
   SUBCATCH-  OR INLET  AREA  PERCENT  RAINFALL   DEPTH LOSSES  RATE      DEPTH   RATE        DEPTH   RATE    RUNOFF
   MENT NO.     NO.     (HA)   IMPER.   (MM)      (MM)   (MM)  (CMS)      (MM)   (CMS)        (MM)  (CMS)   (MM/HR)
  ---------------------------------------------------------------------------------------------------------------------
       300        200    2.35    30.019262.47    37.510********   0.16217444.924    0.384  5259.735    0.546   84.358

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

                                       SUMMARY STATISTICS FOR CHANNEL/PIPES
                                    ================================================
                                        MAXIMUM   MAXIMUM   MAXIMUM  MAXIMUM     TIME        LENGTH     MAXIMUM     RATIO OF  RATIO OF
            FULL     FULL      FULL    COMPUTED  COMPUTED  COMPUTED COMPUTED      OF           OF      SURCHARGE   MAX. TO  MAX. DEPTH
   CHANNEL  FLOW   VELOCITY    DEPTH     INFLOW   OUTFLOW     DEPTH   VELOCITY OCCURRENCE     SURCHARGE   VOLUME      FULL      TO FULL
    NUMBER  (CMS)    (M/S)      (M)      (CMS)    (CMS)       (M)     (M/S)    DAY   HR.      (HOUR)     (CU-M)     FLOW       DEPTH
  -------- ------------------------   -------------------------------------------------   --------------------- ------------------
       201                                 0.00                            1/ 0/1900  0.00
       200                                 0.55                            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........       51.
 2. TOTAL SURFACE BUILDUP.......    24555.
 3. INITIAL CATCHBASIN LOAD.....        0.
 4. TOTAL CATCHBASIN LOAD.......        0.
 5. TOTAL CATCHBASIN AND
    SURFACE BUILDUP (2+4).......    24555.

Remaining Loads
---------------
 6. LOAD REMAINING ON SURFACE...       36.
 7. REMAINING IN CATCHBASINS....        0.
 8. REMAINING IN CHANNEL/PIPES..        0.

Removals
--------
 9. STREET SWEEPING REMOVAL.....     3691.
10. NET SURFACE BUILDUP (2-9)...    20864.
11. SURFACE WASHOFF.............    20825.
12. CATCHBASIN WASHOFF..........        0.
13. TOTAL WASHOFF (11+12).......    20825.
14. LOAD FROM OTHER CONSTITUENTS        0.
15. PRECIPITATION LOAD..........        0.
15a.SUM SURFACE LOAD (13+14+15).    20825.
16. TOTAL GROUNDWATER LOAD......        0.
16a.TOTAL I/I LOAD.............        0.
17. NET SUBCATCHMENT LOAD
    (15a-15b-15c-15d+16+16a)....    20825.
>>Removal in channel/pipes (17a, 17b):
17a.REMOVE BY BMP FRACTION......        0.
17b.REMOVE BY 1st ORDER DECAY...        0.
18. TOTAL LOAD TO INLETS........    20825.
19. FLOW WT'D AVE.CONCENTRATION  mg/l
    (INLET LOAD/TOTAL FLOW).....      169.

Percentages
-----------
20. STREET SWEEPING (9/2).......       15.
21. SURFACE WASHOFF (11/2)......       85.
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 (um)	%	Specific Gravity	Settling Velocity (m/s)	Critical Peclet Number
20.	20.0	2.65	0.000267	0.093400
30.	10.0	2.65	0.000597	0.113900
50.	10.0	2.65	0.001629	0.152500
100.	20.0	2.65	0.006044	0.235000
250.	20.0	2.65	0.026615	0.391296
1000.	20.0	2.65	0.111334	0.928988

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

TSS Removal based on Lab Performance Curve

Model #	Low Q Treated (cms)	High Q Treated (cms)	Runoff Treated (%)	TSS Removed (%)
Unavailabl	0.070	0.070	99.2	68.2
HD 4	0.070	0.070	99.2	76.8
HD 5	0.070	0.070	99.2	82.8
HD 6	0.070	0.070	99.2	87.1
HD 7	0.070	0.070	99.2	89.9
HD 8	0.070	0.070	99.2	92.5
HD 10	0.070	0.070	99.2	95.4
HD 12	0.070	0.070	99.2	97.5

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

HD 4

Year	Flow Vol (m3)	Flow Treated (m3)	TSS In (kg)	TSS Rem (kg)	TSS Out (kg)	TSS Byp (kg)	Flow Treated (%)	TSS Removal (%)
1971.	15976.	15108.	414.	293.	121.	8.	94.6	69.5
1972.	20245.	18536.	538.	413.	124.	21.	91.6	73.9
1973.	19677.	19677.	567.	439.	128.	0.	100.0	77.3
1974.	20011.	19837.	586.	486.	100.	5.	99.1	82.2
1975.	17013.	16722.	511.	378.	133.	6.	98.3	73.1
1976.	25314.	24940.	677.	524.	153.	11.	98.5	76.2
1977.	27206.	26751.	698.	493.	204.	12.	98.3	69.6
1978.	21740.	21740.	625.	460.	166.	0.	100.0	73.5
1979.	25913.	25631.	722.	565.	157.	6.	98.9	77.6
1980.	20918.	20906.	632.	481.	151.	0.	99.9	76.1
1981.	28900.	28857.	759.	600.	159.	1.	99.8	79.0
1982.	20338.	20338.	581.	468.	114.	0.	100.0	80.5
1983.	26765.	26684.	754.	598.	156.	4.	99.7	78.9
1984.	21598.	21598.	603.	448.	155.	0.	100.0	74.3
1985.	18834.	18834.	560.	438.	122.	0.	100.0	78.1
1986.	27461.	27461.	783.	623.	159.	0.	100.0	79.6
1987.	28332.	28181.	807.	625.	182.	4.	99.5	77.1
1988.	22872.	22711.	655.	529.	126.	2.	99.3	80.5
1989.	25017.	24867.	668.	532.	136.	3.	99.4	79.3
1990.	28392.	28390.	809.	664.	146.	0.	100.0	82.0
1991.	26543.	26400.	759.	607.	152.	3.	99.5	79.6
1992.	33813.	33813.	932.	709.	223.	0.	100.0	76.1
1993.	22996.	22996.	696.	582.	114.	0.	100.0	83.6
1994.	24609.	23873.	638.	469.	169.	16.	97.0	71.7
1995.	28576.	28565.	776.	585.	191.	0.	100.0	75.3
1998.	7412.	7412.	247.	181.	65.	0.	100.0	73.5

1999.	18154.	18154.	547.	412.	135.	0.	100.0	75.3
2000.	20912.	20912.	550.	387.	164.	0.	100.0	70.3
2001.	16516.	16516.	454.	376.	78.	0.	100.0	82.9
2002.	17257.	17257.	515.	411.	104.	0.	100.0	79.8
2003.	19627.	19627.	548.	414.	135.	0.	100.0	75.5
2004.	23631.	23631.	605.	453.	152.	0.	100.0	74.9
2005.	17013.	16626.	454.	305.	149.	8.	97.7	66.0

HD 5

Year	Flow Vol (m3)	Flow Treated (m3)	TSS In (kg)	TSS Rem (kg)	TSS Out (kg)	TSS Byp (kg)	Flow Treated (%)	TSS Removal (%)
1971.	15976.	15108.	414.	325.	89.	8.	94.6	77.1
1972.	20245.	18536.	538.	441.	97.	21.	91.6	78.8
1973.	19677.	19677.	567.	476.	91.	0.	100.0	83.9
1974.	20011.	19837.	586.	511.	74.	5.	99.1	86.6
1975.	17013.	16722.	511.	415.	96.	6.	98.3	80.2
1976.	25314.	24940.	677.	567.	110.	11.	98.5	82.4
1977.	27206.	26751.	698.	547.	150.	12.	98.3	77.2
1978.	21740.	21740.	625.	503.	123.	0.	100.0	80.4
1979.	25913.	25631.	722.	600.	122.	6.	98.9	82.4
1980.	20918.	20906.	632.	525.	107.	0.	99.9	83.1
1981.	28900.	28857.	759.	644.	115.	1.	99.8	84.8
1982.	20338.	20338.	581.	503.	79.	0.	100.0	86.5
1983.	26765.	26684.	754.	635.	119.	4.	99.7	83.8
1984.	21598.	21598.	603.	492.	111.	0.	100.0	81.6
1985.	18834.	18834.	560.	471.	89.	0.	100.0	84.1
1986.	27461.	27461.	783.	669.	114.	0.	100.0	85.5
1987.	28332.	28181.	807.	676.	131.	4.	99.5	83.4
1988.	22872.	22711.	655.	562.	93.	2.	99.3	85.6
1989.	25017.	24867.	668.	572.	96.	3.	99.4	85.2
1990.	28392.	28390.	809.	707.	102.	0.	100.0	87.4
1991.	26543.	26400.	759.	644.	115.	3.	99.5	84.5
1992.	33813.	33813.	932.	776.	156.	0.	100.0	83.3
1993.	22996.	22996.	696.	616.	80.	0.	100.0	88.5
1994.	24609.	23873.	638.	510.	129.	16.	97.0	77.9
1995.	28576.	28565.	776.	633.	143.	0.	100.0	81.5
1998.	7412.	7412.	247.	201.	46.	0.	100.0	81.3
1999.	18154.	18154.	547.	448.	99.	0.	100.0	81.9
2000.	20912.	20912.	550.	427.	124.	0.	100.0	77.5
2001.	16516.	16516.	454.	399.	55.	0.	100.0	87.9
2002.	17257.	17257.	515.	437.	78.	0.	100.0	84.9
2003.	19627.	19627.	548.	446.	102.	0.	100.0	81.4
2004.	23631.	23631.	605.	491.	114.	0.	100.0	81.1
2005.	17013.	16626.	454.	338.	115.	8.	97.7	73.4

HD 6

Year	Flow Vol (m3)	Flow Treated (m3)	TSS In (kg)	TSS Rem (kg)	TSS Out (kg)	TSS Byp (kg)	Flow Treated (%)	TSS Removal (%)
1971.	15976.	15108.	414.	344.	71.	8.	94.6	81.4
1972.	20245.	18536.	538.	470.	68.	21.	91.6	84.1
1973.	19677.	19677.	567.	500.	67.	0.	100.0	88.2
1974.	20011.	19837.	586.	537.	49.	5.	99.1	90.9
1975.	17013.	16722.	511.	439.	73.	6.	98.3	84.7
1976.	25314.	24940.	677.	599.	77.	11.	98.5	87.1
1977.	27206.	26751.	698.	580.	118.	12.	98.3	81.7
1978.	21740.	21740.	625.	527.	98.	0.	100.0	84.3
1979.	25913.	25631.	722.	631.	91.	6.	98.9	86.7
1980.	20918.	20906.	632.	548.	84.	0.	99.9	86.6
1981.	28900.	28857.	759.	680.	79.	1.	99.8	89.5
1982.	20338.	20338.	581.	527.	54.	0.	100.0	90.7
1983.	26765.	26684.	754.	669.	85.	4.	99.7	88.3
1984.	21598.	21598.	603.	515.	88.	0.	100.0	85.4
1985.	18834.	18834.	560.	496.	64.	0.	100.0	88.6
1986.	27461.	27461.	783.	703.	80.	0.	100.0	89.8
1987.	28332.	28181.	807.	705.	102.	4.	99.5	87.0
1988.	22872.	22711.	655.	587.	68.	2.	99.3	89.4
1989.	25017.	24867.	668.	600.	68.	3.	99.4	89.4
1990.	28392.	28390.	809.	740.	69.	0.	100.0	91.4
1991.	26543.	26400.	759.	678.	81.	3.	99.5	88.9
1992.	33813.	33813.	932.	811.	121.	0.	100.0	87.0
1993.	22996.	22996.	696.	637.	59.	0.	100.0	91.5
1994.	24609.	23873.	638.	539.	99.	16.	97.0	82.4
1995.	28576.	28565.	776.	668.	108.	0.	100.0	86.1
1998.	7412.	7412.	247.	211.	36.	0.	100.0	85.4
1999.	18154.	18154.	547.	471.	76.	0.	100.0	86.1
2000.	20912.	20912.	550.	452.	98.	0.	100.0	82.2
2001.	16516.	16516.	454.	418.	36.	0.	100.0	92.1
2002.	17257.	17257.	515.	459.	56.	0.	100.0	89.2
2003.	19627.	19627.	548.	468.	81.	0.	100.0	85.3
2004.	23631.	23631.	605.	519.	86.	0.	100.0	85.8
2005.	17013.	16626.	454.	363.	91.	8.	97.7	78.6

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

Rainfall Intensity (mm/h)	Flow (L/s)	Percentage %
1.50	4.2	39.4
2.25	6.2	9.6
3.00	8.3	6.8
3.75	10.4	5.4
4.75	13.2	5.6
5.75	16.0	5.0
8.00	22.2	6.1
10.00	27.7	3.9
15.50	43.0	7.1
23.25	64.5	11.0

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

```
****************************************************

  Concession 7 Storm Sewer
 Niagara-on-the-Lake

     Date     Time        Flow   Total Su
 Mo/Da/Year  Hr:Min        cum/s  mg/l
 ----------  -------    -------  --------
Flow wtd means.....        0.002      169.
Flow wtd std devs..        0.006       68.
Maximum value......        0.546     3974.
Minimum value......        0.000        0.
Total loads........      123270.    20782.
                        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... August      1, 2025                *
*          Time...         13:33:58.460               *
*   Ending Date... August      1, 2025                *
*          Time...         13:34: 1.228               *
*  Elapsed Time...               0.046 minutes.       *
*  Elapsed Time...               2.768 seconds.       *
*******************************************************
```

SAMPLE INSPECTION REPORT

Owner:

Location:

Manhole Oil/Grit Separator:

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: __________________