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UCC File: 5331

FUNCTIONAL SERVICING REPORT

Rosedale Subdivision
City of Port Colborne
November 2023

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 residential development known as Rosedale Subdivision as part of the Draft Plan of Subdivision application process for the City of Port Colborne.

The project site is located in the City of Port Colborne as part of Lot 30 and Concession 3 and is situated south of Stonebridge Drive, west of Elm Street, with West Side Road (Highway 58) at the west site limits and at the north limit of Oxford Boulevard. The site is approximately 12.77 hectares and shall consist of 131 single family dwellings and 118 townhouse units for a total unit count of 249 units. A park block (Block 153) will be located at the south-east corner of the site and Block 154 at the north limits will consist of the proposed Stormwater Management (SWM) Facility.

Currently, separate engineering submission are being made for the easterly adjacent Meadow Heights (Phase 3) subdivision. It is expected that the Meadow Heights development will be completed prior to the Rosedale Subdivision and the servicing infrastructures from both developments will ultimately be connected. 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

The following existing watermains are located in close proximity to the proposed development:

- 400mm diameter watermain on Stonebridge Drive
- 300mm diameter watermain on Meadowlark Drive
- 150mm diameter watermain on Oxford Boulevard

It is expected as part of the adjacent Meadow Heights Subdivision development, the 300mm diameter Meadowlark Drive watermain will be extended westerly on Meadowlark Drive to the new Parkside Drive and then continue northerly to the proposed Westfield Place at the north end of the site. This 300mm diameter watermain will then continue north, immediately adjacent to the Rosedale SWM facility, and ultimately connect to the Stonebridge Drive 400mm diameter watermain providing a loop.

The servicing plan for the proposed Rosedale Subdivision will result in watermain connections at the following locations to provide both domestic and fire water supply:

- 300mm diameter Meadowlark Drive watermain extended westerly from Meadow Heights
- 300mm diameter Westfield Place watermain
- 150mm diameter Oxford Boulevard watermain

Fire protection will be provided to the proposed development with municipal fire hydrants within the subdivision. The sizes and locations of the proposed internal watermain and hydrants will be finalized as part of the future detailed design. It is expected approximately 8 proposed municipal hydrants will be required on this site to adequately provide the necessary fire protection.

Upper Canada Consultants has undertaken a watermain analysis using the EPANET software to model flows and pressures within the existing and proposed system as a result of the proposed development under various conditions. The software was used to model the conditions utilizing average day, maximum day, and peak unit consumption rates per MECP standards. The model has been calibrated utilizing hydrant test flow data provided by the municipality from tests conducted in May/June of this year and have ensured supportable conclusions for this development.

As the adjacent Meadow Heights (Phase 3) subdivision has not yet been completed, this development has included both subdivisions within the modelling. The modelling utilizes the proposed watermains to be constructed as part of the proposed development plan for Mead Heights Phase 3, and a preliminary watermain design for the proposed Rosedale Subdivision. It is proposed to extend the 300mm diameter Meadowlark Drive watermain to Street B in Rosedale Subdivision, and continue with a 150mm diameter for the remainder of the subdivision. Images detailing the proposed watermain design can be found in Appendix A. Elevations were used per the Rosedale Preliminary Grading Design page also included in Appendix A

The EPANET model has utilized flow test data from seven hydrants located at the following locations:

1. Apollo Drive at Oriole Crecent (Hyd #6300009)
2. Meadowlark Drive, 120m west of Elm Street (Hyd #63000020)
3. Fronting #59 Hillcrest Road (Hyd # 63000304)
4. Fronting #10 Oxford Boulevard (Hyd #63000157)
5. Fronting #20 Oxford Boulevard (Hyd #63000158)
6. Stonebridge Drive, 2nd hydrant east of Highway 58 (Hyd #63000160)
7. Stonebridge Drive, 2nd hydrant west of Petersburg Circle (Hyd #63000283)

The model was able to replicate the static and residual pressures in the above noted hydrants to within 5% of the values documented from in the City of Port Colbornes' hydrant testing results as shown on the calculation page in Appendix A. Different pressure zones were observed north and south of the proposed subdivision. Through the modelling, an increase of approximately 5% was noted to the static pressure at existing Oxford Boulevard hydrants while a decrease of approximately 2% was noted to the static pressures on Stonebridge Drive as the pressure equalizes with the new connections. However, this new looping is modelled to significantly increase the future calculated theoretical fire flows at 20PSI in all existing fire hydrants

Due to the extreme elevation differences on the site, the proposed hydrant located at the highest point at the intersection of Oxford Boulevard and Street 'C' will experience the lowest pressures (and therefore flows rates) through this modelling. The hydrant will provide a reduced flow rate of 150L/s at 20 PSI under peak day conditions. Per Table 8 of the 'Water Supply of Public Protection' guideline (Fire Underwriters Survey, 2020) regarding minimum required flow rates for row housing exposures, a minimum flow rate of 133.3L/s is required for townhouses experiencing exposure distances of 3 to 10m. As all townhouse structures on site are separated by approximately 3.1m, and the minimum provided fire flow is greater than 133.3L/s, the proposed watermain system is expected to provide sufficient fire flow for the development. Additionally, as shown in the Rosedale Subdivision Static Pressure imagery in Appendix A, all proposed hydrants within the system will provide static pressures within the preferred system range of 50-80 PSI (35.2-56.2 m of H2O). Only the existing hydrant fronting #59 Hillcrest Road will remain slightly below at 45.4 PSI (higher than the 40PSI minimum standard), though this is an increase from existing conditions.

This model is limited in scope with regards to the impact of the City's system. Therefore, tolerances between this analysis and the City's overall model should prioritize results obtained from the large City model. It should be noted that the pressures and flow rates observed by this model are purely theoretical, attempting to replicate information provided by the City's hydrant flow test data for hydrants within the immediate vicinity of the proposed development site. Without a complete model of the city's entire water system, a highly accurate model providing reliable flow rate data for the future development is unobtainable.

SANITARY SERVICING

There is an existing 300mm diameter municipal sanitary sewer located on Stonebridge Drive conveying flows westerly before directing flows north-east along the south limit of the Biederman Municipal Drain. The sewer conveys flows easterly along the south limit of the Elm Street Lease Free Dog Park before discharging flows to the Industrial Park Sanitary Pumping Station.

As part of the adjacent Meadow Heights (Phase 3) subdivision, a 300mm diameter sanitary sewer will be constructed immediately east of the proposed Rosedale Subdivision Stormwater Management Facility, through a servicing easement on the Van Jon Paving property (#64 Stonebridge Drive), and discharge to a maintenance hole on Stonebridge Drive at the extreme upstream limit of the sanitary sewer. It is proposed to discharge sanitary flows from the proposed

Rosedale Subdivision to the 300mm diameter Meadow Heights easement sanitary sewer. This easement sanitary sewer has been designed to convey sanitary flows from the proposed Rosedale Subdivision development.

An overall sanitary analysis has been conducted and included in Appendix B for the municipal sanitary sewer system downstream of the proposed development site from the site connection to the Regional Sanitary Sewer at the Industrial Park Sanitary Pumping Station (SPS). The analysis utilizes a flow rate of 0.2 L/s/gross hectare as well as a Peak Factor of 2.0 for industrial lands north of the site as recommended in the 'Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under an Environmental Compliance Approval' per the Ministry of the Environment, Conservation and Parks (MECP, 2023). Additionally, an Infiltration Rate of 0.28 L/s/ha is used with a Residential Flow rate of 255 L/cap/day per Regional '2021 Water and Wastewater Master Servicing Plan Update' (2023). All existing sanitary sewer information utilized in the analysis is per information provided by the City of Port Colborne.

The analysis has concluded that the proposed Rosedale Subdivision development will discharge a peak dry weather flow of approximately 8.55L/s and a peak wet weather flow of 11.87L/s to the downstream municipal sanitary sewer system. With the combination of the proposed development and surrounding properties, the existing downstream municipal sanitary sewer system reaches maximum capacities of approximately 75% upon reaching the Elm Street Dog Park south property limit. This includes numerous areas of currently undeveloped industrial lands within Drainage Areas E5, E6, E8 and E9. Therefore, it is expected that the downstream municipal sanitary infrastructure will have sufficient capacity for the proposed development.

Previous conversations occurred with the Niagara Region discussing the possibility of discharging sanitary flows from the existing Oxford Boulevard SPS into the proposed development to ultimately be included within the Industrial Park SPS Overall Drainage Area. As such, two additional calculation sheets have been included in Appendix B. The first calculation sheet includes and additional flow of 7.6L/s per the Oxford SPS ECA Firm Capacity which ultimately increases the downstream maximum sanitary sewer capacity to 93.2%. The second sanitary calculation sheet includes the sanitary flow rate calculated by UCC for the Oxford Boulevard SPS, concluding in a flow rate of 4.49L/s. This would result in a maximum downstream sanitary capacity of 85.7%. However, no further details have been provided by the Region on this matter, and as such, these additional flows are not expected to be included in the future Rosedale Subdivision sanitary sewer design.

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 City of Port Colborne and Region of Niagara for this development includes the requirement to control peak stormwater flows from the proposed development area to existing levels up to and including the 100 year design storm event and improve stormwater quality levels to MECP Normal (70% TSS removal) Protection levels prior to discharge from the development.

To limit future stormwater flows to allowable levels, and improve stormwater quality to the required TSS removal levels, a Stormwater Management (SWM) Wetpond Facility will provide the necessary controls for this development. The SWM facility will be located at the north limit of the proposed development and discharge stormwater flows to a storm sewer located at the north-west corner of the site. Stormwater flows will then be directed to the Biederman Drain north of the site. Stormwater quality levels will be treated to a Normal Standard (70% TSS removal) before discharging from the development site.

Stormwater flows up to and including the 5 year design storm event will be directed to the SWM facility via storm sewers. During major storm events greater than the 5 year event, stormwater flows unable to enter the storm sewer system will be directed overland towards to the SWM facility. Additionally, overland stormwater flows from the adjacent Meadow Heights Subdivision will be directed to the Rosedale Subdivision SWM Facility. 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 municipal watermain system will have sufficient capacity to provide both domestic and fire protection water supply.

2. The existing municipal sanitary sewer system downstream of the site will have adequate capacity for the proposed residential development.

3. Stormwater quality controls are being provided to Normal Protection (70% TSS removal) levels by a stormwater wetpond facility before outletting to the Biederman Drain.

4. Stormwater quantity controls are being provided by a stormwater management wetpond facility up to the 100 year design storm event prior to discharging from the site.

5. The site stormwater overland route from the road system is to the proposed stormwater management facility before outletting to the Biederman Drain.

Based on the above and the accompanying Stormwater Management Brief, 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,

Jason Schooley, P.Eng.
November 22, 2023

LICENSED PROFESSIONAL ENGINEER
J. P. SCHOOLEY
PROVINCE OF ONTARIO

Encl.

APPENDICES

UPPER CANADA CONSULTANTS
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APPENDIX A

EPANET – Existing Conditions Imagery (Sewer Diameters)
EPANET – Existing Conditions Imagery (Static Pressures in m of H_2O)
EPANET – Future Conditions Imagery (Sewer Diameters)
EPANET – Future Conditions Imagery (Static Pressures in m of H_2O)
EPANET Analysis Calculations
Rosedale Subdivision Preliminary Grading Design

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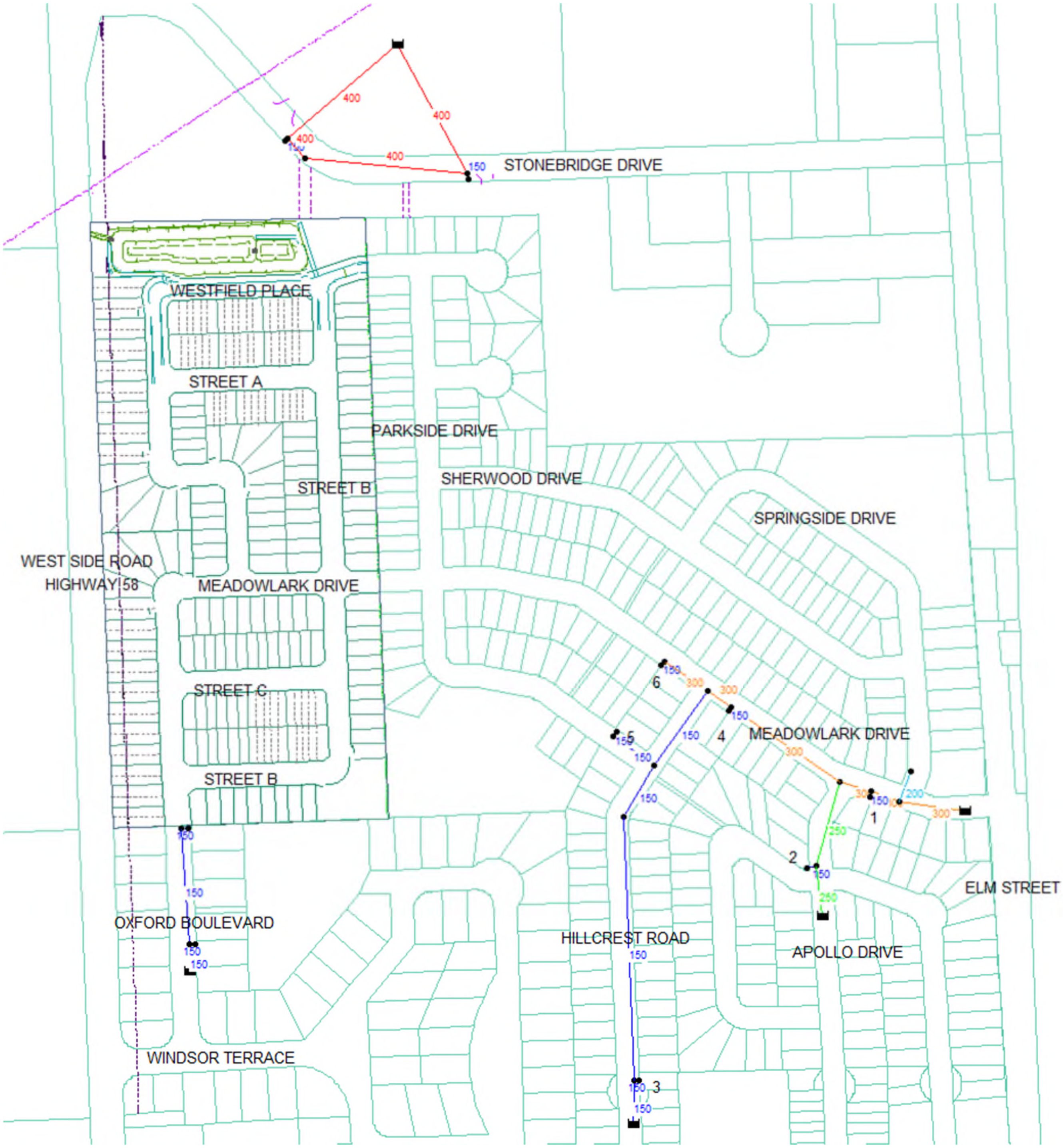
EPANET Imagery – Existing Conditions with Pipe Diameters (mm)



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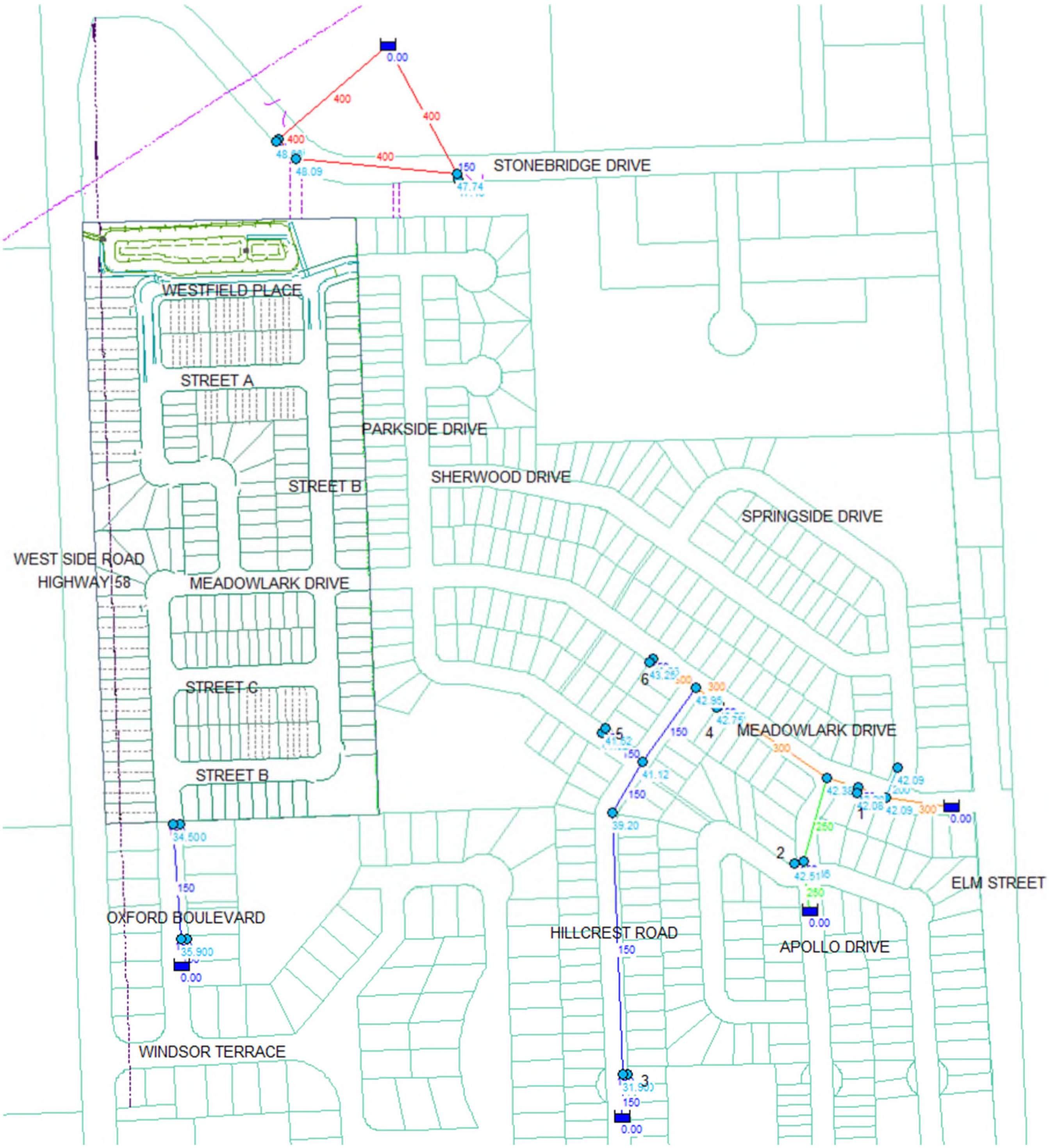
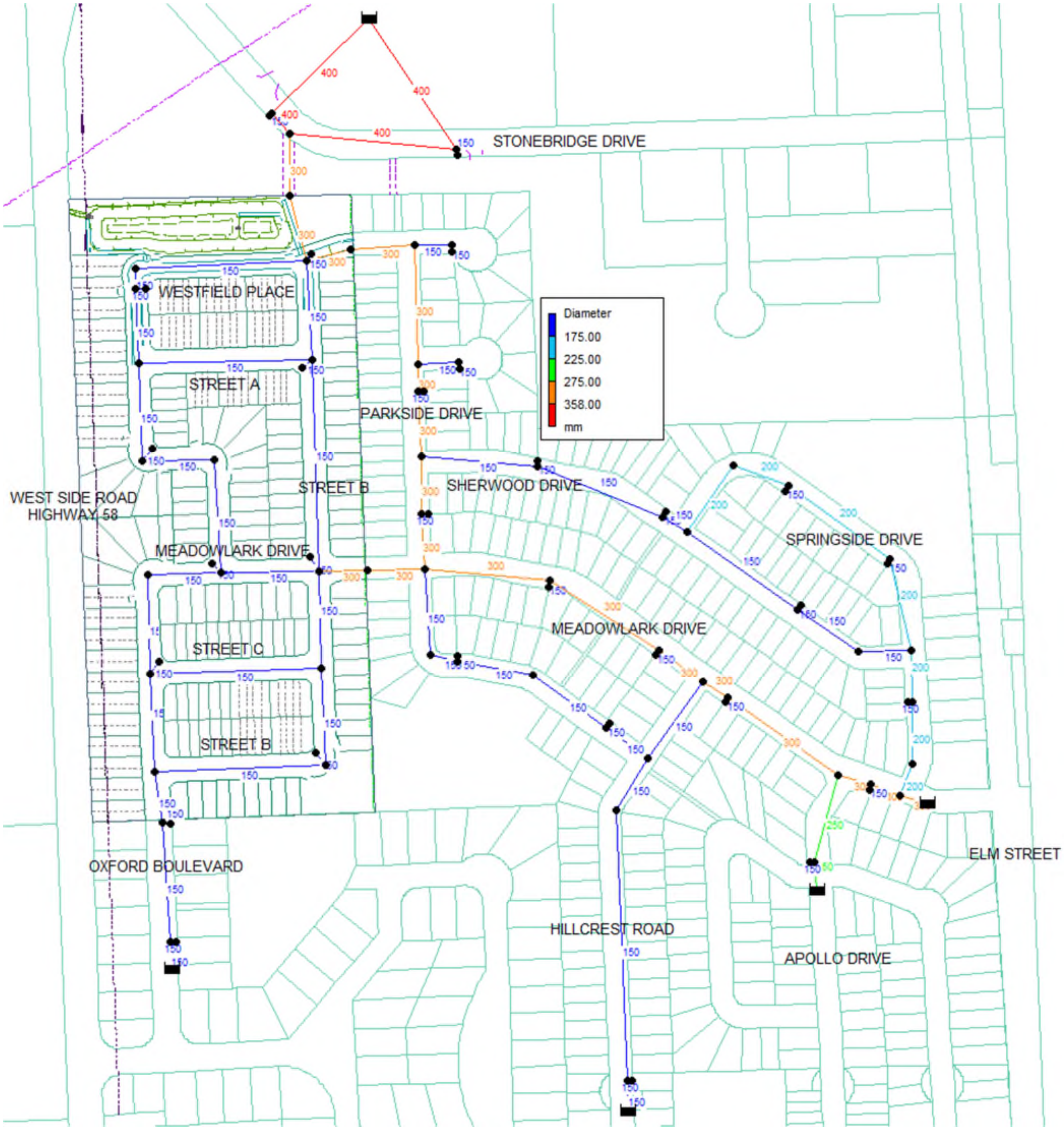
EPANET Imagery – Existing Conditions with Static Pressures (m of H2O)



EPANET Imagery – Future Conditions with Pipe Diameters (mm)



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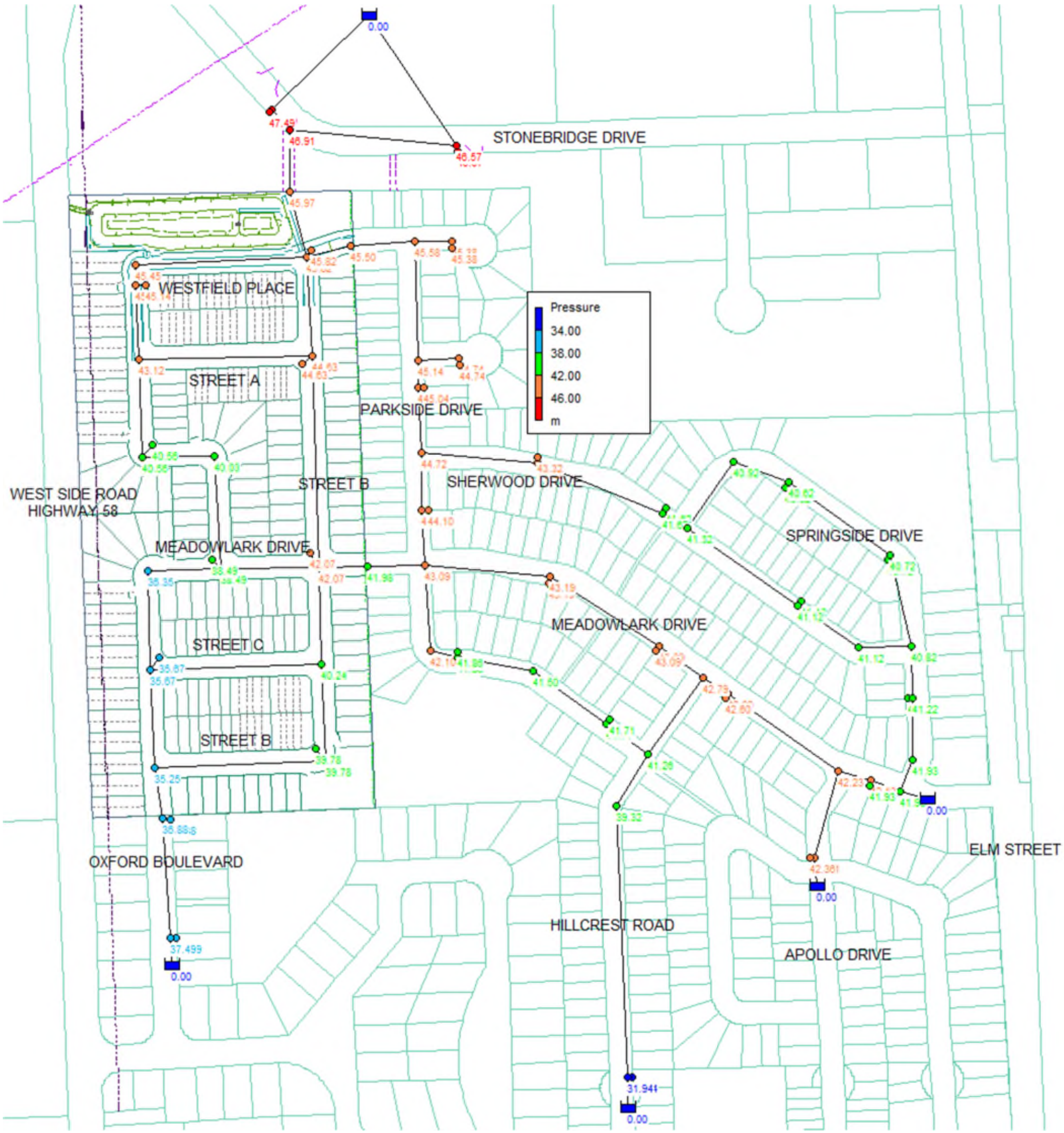
EPANET Imagery – Future Conditions with Static Pressures (m of H_2O)



UCC File: 5331
Date: November 22, 2023

ROSEDALE SUBDIVISION EPANET WATER MODEL CALCULATIONS

				A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
				Hydrant Data		Existing Modelled		Future Modelled (with Rosedale)			Hydrant Data		Existing Modelled		Hydrant Data			Hydrant Data		Existing Modelled		Future Modelled with Rosedale	
	Hyd Number	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	Residual PSI	Residual (m of H20)	Modelled Residual	% Difference	Residual Hydrant No.	Actual Flow (GPM)	Actual Flow (LPS)	Theoretical Flow (GPM @ 20psi)	Theoretical Flow (LPS @ 20psi)	Modelled Theoretical Flow (LPS @ 14.06m)	% Difference	Fire Flow (LPS @ 14.06m)	Fire Flow GPM
4	63000009	APOLLO DRIVE	APOLLO DRIVE @ ORIOLE CRESCENT	62	43.6	*42.5*	-2.5%	*42.4*	60.3	-0.2%	52	36.6	35.2	3.7%	20	1350	85.2	2930	184.9	*185*	0.1%	*293*	*4644*
5	63000020	MEADOWLARK DRIVE	120M WEST OF ELM STREET	58	40.8	*42.1*	3.2%	*41.9*	59.6	-0.5%	50	35.2	35.3	-0.4%	9	1306	82.4	3030	191.2	*186*	-2.7%	*311*	*4929*
75	63000304	HILLCREST ROAD	IN FRONT OF # 59 HILLCREST ROAD	45	31.6	*31.9*	0.8%	*31.9*	45.4	0.0%	36	25.3	25.7	-1.5%	305	1216	76.7	2111	133.2	*133*	-0.1%	*138*	*2187*
25	63000157	OXFORD BOULEVARD	IN FRONT OF # 10 OXFORD BOULEVARD	50	35.2	*35.9*	2.1%	*37.5*	53.3	4.5%	41	28.8	29.3	-1.6%	156	631	39.8	1213	76.5	*76*	-0.7%	*146*	*2314*
26	63000158	OXFORD BOULEVARD	IN FRONT OF # 20 OXFORD BOULEVARD	50	35.2	*34.5*	-1.9%	*36.9*	52.5	7.0%	39	27.4	27.3	0.5%	157	533	33.6	916	57.8	*59*	2.1%	*148*	*2346*
28	63000160	STONEBRIDGE DRIVE	2ND HYD EAST OF HWY # 58 ON STONEBRIDGE DRIVE	70	49.2	*48.7*	-1.0%	*47.5*	67.6	-2.5%	57	40.1	38.2	4.7%	159	1686	106.4	3490	220.2	*204*	-7.4%	*378*	*5991*
65	63000283	STONEBRIDGE DRIVE	2ND W. OF PETERSBURG CIRCLE ON STONEBRIDGE DRIVE	67	47.1	*47.5*	0.8%	*46.6*	66.3	-1.9%	54	38.0	38.9	-2.4%	160	1508	95.1	3019	190.5	*200*	5.0%	*365*	*5785*

Conversions

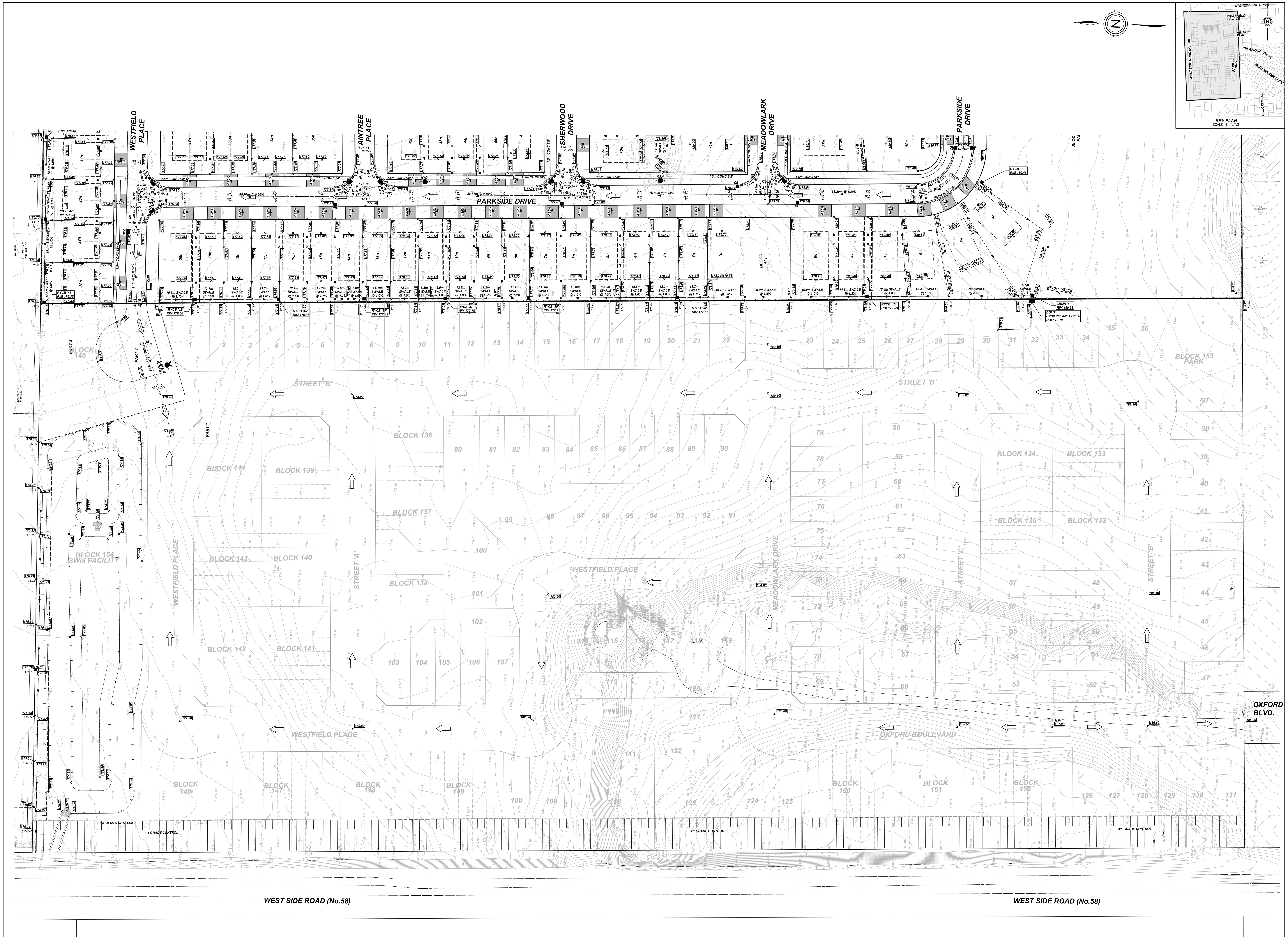
PSI	m of H2O
1	**0.703**
20	14.062
40	28.124
50	35.154
80	56.247

Column	Explanation
A	Static pressures in PSI provided by City
B	Static Pressures converted to m of H2O
C	Static Pressures (in m of H2O) from EPANET model attempting to replicate Column B values
D	% difference of Hydrant Data and Existing Model static pressures (Columns D & B)
E	New Modelled Pressures with inclusion of Rosedale and Meadow Heights Subdivisions
F	Pressures in Column E converted back to PSI
G	% difference of existing and future modelled static pressures (Columns C & E)
H	Residual Pressures in PSI provided by City
I	Residual Pressures converted to m of H2O
J	Residual Pressures (in m of H2O) from EPANET model attempting to replicate Column I values
K	% difference of Hydrant Data and Existing Model Residual Pressures (Columns Q & R)
L	Hydrant Number utilized to complete residual hydrant flow test
M	Actual Residual Flow data provided by City in GPM
N	Actual Residual Flow data provided by City converted to LPS
O	Theoretical Fire Flows in GPM at 20 PSI provided by City
P	Theoretical Fire Flows provided by City converted to LPS
Q	Theoretical Fire Flows in LPS (@ 14.06 m of H2O) from EPANET model attempting to replicate Column P values
R	% difference of city calculated existing theoretical flow and modelled theoretical flow at 20 PSI (Columns P & Q)
S	Calculated Fire Flows (@ 20PSI) calculated for future conditions with Rosedale Subdivision in LPS
T	Column S values converted to GPM

Average	320
Max Day	570
Peak	860

Node	Street	# of Houses	Population	Average Flow (LPS)	Max Day Flow (LPS)	Peak Day Flow (LPS)	Modelled Peak Day Hydrant Flow @ 20	
1	Meadowlark	16	48	0.18	0.11	0.48	311	
2	Apollo	12	36	0.13	0.24	0.36	293	
3	**Hillcrest**	**12**	**36**	0.13	0.24	**0.36**	**138**	**WORST CASE**
4	Meadowlark	11	33	0.12	0.22	0.33		
5	Parkside	7	21	0.08	0.14	0.21	183	
6	Meadowlark	9	27	0.10	0.18	0.27	347	
7	Springside	21	63	0.23	0.42	0.63		
8	Springside	19	57	0.21	0.38	0.57	193	
9	Springside	22	66	0.24	0.44	0.66	184	
10	**Sherwood**	**21**	**63**	0.23	0.42	**0.63**	**155**	**WORST NEW CASE**
11	Sherwood	19	57	0.21	0.38	0.57	179	
12	Sherwood	17	51	0.19	0.34	0.51		
13	Meadowlark	18	54	0.20	0.36	0.54		
14	Parkside	14	42	0.16	0.28	0.42	179	
15	Parkside	13	39	0.14	0.26	0.39		
16	Parkside	21	63	0.23	0.42	0.63		
17	Aintree	14	42	0.16	0.28	0.42		
18	Westfield	24	72	0.27	0.48	0.72		
19	Westfield	25	75	0.28	0.49	0.75		
20	Westfield	38	114	0.42	0.75	1.13	186	
21	Westfield	35	105	0.39	0.69	1.05	155	
22	Street B	40	120	0.44	0.79	1.19		
23	Meadowlark	28	84	0.31	0.55	0.84		
24	Meadowlark	28	84	0.31	0.55	0.84	201	
25	Oxford	34	102	0.38	0.67	1.02	169	
26	**Street B**	**39**	**117**	0.43	0.77	1.16	**150**	**WORST NEW CASE**
27	Oxford	23	69	0.26	0.46	0.69	148	
			Total Average	**0.24**	**0.42**	**0.64**		
			Rosedale Average	0.36	0.64	0.97		

Rosedale
Average Day (0.36) use 0.40 everywhere
Max Day (0.64) use 0.70 everywhere
Peak Day (0.96) use 1.0 everywhere



#	REVISION	DATE	INIT
0	ISSUED FOR REVIEW	2023-10-16	BV

NOTES:

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING BV
DESIGN MH
CHECKED BY MH
APPROVED BY AK

PORT COLBORNE

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HAMILTON, ON
L8N 1G6

MEADOW HEIGHTS- PHASE 3

ROSEDALE PRELLIMINARY GRADING DESIGN
CITY OF PORT COLBORNE

CONSULTANT FILE No. 227
DATE 2023-11-21
PRINTED 2023-11-21
SCALE 1:500 m
REF No.
DWG No. 227-3-ROSE-GP
REV 0

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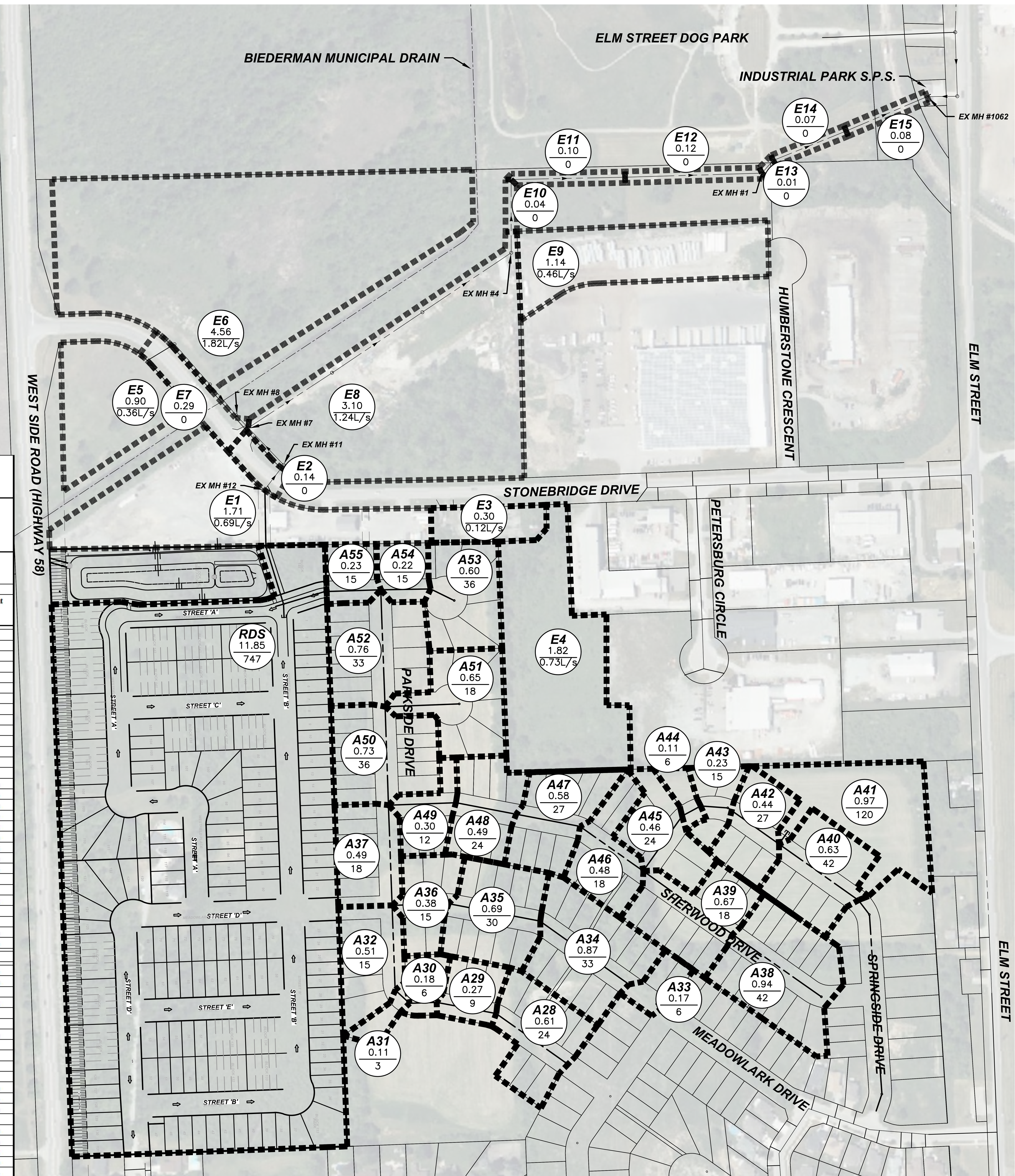
APPENDIX B

Overall Sanitary Drainage Area Plan – Proposed Conditions
Overall Sanitary Calculations – with Regional MSP Oxford SPS Flows
Overall Sanitary Calculations – with UCC Oxford SPS Flows



UPPER CANADA CONSULTANTS
3-30 HANNOVER DRIVE
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DESIGN FLOWS

RESIDENTIAL:	255 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INDUSTRIAL:	0.2 LITRES/SECOND/GROSS HECTARE (MECP ALLOWANCE IS 0.2 - 0.64)
INFILTRATION RATE:	0.28 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L / s / ha)
POPULATION DENSITY:	3.0 PERSONS / UNIT

SEWER DESIGN

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

MUNICIPALITY: CITY OF PORT COLBORNE
PROJECT : MEADOW HEIGHTS
PROJECT NO: 227

OVERALL SANITARY SEWER DESIGN SHEET

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

LOCATION			AREA		POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (persons/unit)	Population Increment	Total Population Served	Peaking Factor	Flow (L/s)	Infiltration Flow L/s	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Percent Full
A28 - PARKSIDE DRIVE			0.61	0.61	8	3.0	24	24	4.37	0.31	0.17	0.48	200	60.0	0.40	0.67	21.64	2.2%
A29 - PARKSIDE DRIVE			0.27	0.88	3	3.0	9	33	4.35	0.42	0.25	0.67	200	52.9	0.40	0.67	21.64	3.1%
A30 - PARKSIDE DRIVE			0.18	1.06	2	3.0	6	39	4.34	0.50	0.30	0.80	200	23.7	0.40	0.67	21.64	3.7%
A31 - PARKSIDE DRIVE			0.11	1.17	1	3.0	3	42	4.33	0.54	0.33	0.86	200	17.2	0.40	0.67	21.64	4.0%
A32 - PARKSIDE DRIVE			0.52	1.69	5	3.0	15	57	4.30	0.72	0.47	1.20	200	74.1	1.50	1.29	41.91	2.9%
A33 - MEADOWLARK DRIVE			0.17	0.17	2	3.0	6	6	4.43	0.08	0.05	0.13	200	29.7	0.80	0.94	30.60	0.4%
A34 - MEADOWLARK DRIVE			0.87	1.04	11	3.0	33	39	4.34	0.50	0.29	0.79	200	95.6	0.40	0.67	21.64	3.7%
A35 - MEADOWLARK DRIVE			0.69	1.73	10	3.0	30	69	4.28	0.87	0.48	1.36	200	81.7	0.40	0.67	21.64	6.3%
A36 - MEADOWLARK DRIVE			0.38	2.11	5	3.0	15	84	4.26	1.06	0.59	1.65	200	49.3	0.40	0.67	21.64	7.6%
A37 - PARKSIDE DRIVE			0.49	4.29	6	3.0	18	159	4.18	1.96	1.20	3.16	200	87.8	0.87	0.98	31.92	9.9%
A38 - SHERWOOD DRIVE			0.94	0.94	14	3.0	42	42	4.33	0.54	0.26	0.80	200	95.0	0.80	0.94	30.60	2.6%
A39 - SHERWOOD DRIVE			0.67	1.61	10	3.0	30	72	4.28	0.91	0.45	1.36	200	96.0	0.40	0.67	21.64	6.3%
A40 - SPRINGSIDE DRIVE			0.63	0.63	14	3.0	42	42	4.33	0.54	0.18	0.71	200	70.6	0.40	0.67	21.64	3.3%
A41 - CONDO			0.97	0.97	40	3.0	120	120	4.22	1.49	0.27	1.77	200	13.6	0.40	0.67	21.64	8.2%
A42 - SPRINGSIDE DRIVE			0.44	2.04	9	3.0	27	189	4.16	2.32	0.57	2.89	200	54.9	0.40	0.67	21.64	13.4%
A43 - SPRINGSIDE DRIVE			0.23	2.27	5	3.0	15	204	4.14	2.50	0.64	3.13	200	23.8	0.50	0.75	24.19	12.9%
A44 - SPRINGSIDE DRIVE			0.11	2.38	2	3.0	6	210	4.14	2.57	0.67	3.23	200	18.5	0.40	0.67	21.64	14.9%
A45 - SPRINGSIDE DRIVE			0.46	2.84	8	3.0	24	234	4.12	2.85	0.80	3.64	200	59.1	0.40	0.67	21.64	16.8%
A46 - SHERWOOD DRIVE			0.48	4.93	6	3.0	18	324	4.06	3.89	1.38	5.27	200	67.7	0.92	1.01	32.82	16.0%
A47 - SHERWOOD DRIVE			0.58	5.51	9	3.0	27	351	4.05	4.19	1.54	5.74	200	56.9	0.88	0.99	32.10	17.9%
A48 - SHERWOOD DRIVE			0.49	6.00	8	3.0	24	375	4.04	4.47	1.68	6.15	200	53.7	1.35	1.23	39.76	15.5%
A49 - SHERWOOD DRIVE			0.30	6.30	4	3.0	12	387	4.03	4.60	1.76	6.37	200	59.1	1.35	1.23	39.76	16.0%
A50 - PARKSIDE DRIVE			0.73	11.32	12	3.0	36	582	3.94	6.77	3.17	9.94	200	86.3	0.40	0.67	21.64	45.9%
A51 - AINTREE PLACE			0.65	0.65	12	3.0	36	36	4.34	0.46	0.18	0.64	200	65.0	1.00	1.06	34.22	1.9%
A52 - PARKSIDE DRIVE			0.76	12.73	15	3.0	45	663	3.91	7.65	3.56	11.21	200	102.5	0.40	0.67	21.64	51.8%
A53 - WESTFIELD PLACE			0.60	0.60	12	3.0	36	36	4.34	0.46	0.17	0.63	200	23.1	1.00	1.06	34.22	1.8%
A54 - WESTFIELD PLACE			0.22	0.82	5	3.0	15	51	4.31	0.65	0.23	0.88	200	43.7	0.40	0.67	21.64	4.1%
A55 - WESTFIELD PLACE			0.23	13.78	5	3.0	15	729	3.88	8.36	3.86	12.22	200	49.2	0.40	0.67	21.64	56.4%
WESTFIELD PLACE				13.78				729	3.88	8.36	3.86	12.22	200	37.6	0.40	0.67	21.64	56.4%
RDS - ROSEDALE			11.85		249	3.0	747	747	3.88	8.55	3.32	11.87						
EASEMENT - ROSEDALE				25.63				1476	3.68	16.05	7.18	23.23	300	52.4	0.37	0.84	61.36	37.9%
EASEMENT - VAN JON		EXMH 12		25.63				1476	3.68	16.05	7.18	23.23	300	48.8	0.43	0.91	66.15	35.1%
E1 - VAN JON PAVING			1.72						2.00	0.69								
E2 - STONEBRIDGE DR	EXMH 12	EXMH 11	0.14	27.49				1476	3.68	16.05	7.70	24.44	300	28.0	0.29	0.74	54.33	45.0%
E3 - INDUSTRIAL LANDS			0.30						2.00	0.12								
E4 - INDUSTRIAL LANDS			1.82						2.00	0.73								
STONEBRIDGE DR	EXMH 11	EXMH 7		27.49				1476	3.68	16.05	7.70	24.44	300	45.0	0.20	0.62	45.12	54.2%
E5 - INDUSTRIAL LANDS			0.90						2.00	0.36								
E6 - INDUSTRIAL LANDS			4.56						2.00	1.82								
E7 - STONEBRIDGE DR	EXMH 8	EXMH 7	0.29	5.75							1.61	3.79	300	16.0	1.09	1.44	105.32	3.6%
E8 - INDUSTRIAL LANDS		EXMH 7	3.10	3.10					2.00	1.24								
INDUSTRIAL LANDS	EXMH 7	EXMH 6		36.34				1476	3.68	16.05	10.18	30.34	300	88.8	0.20	0.62	45.12	67.2%
INDUSTRIAL LANDS	EXMH 6	EXMH 5		36.34				1476	3.68	16.05	10.18	30.34	300	94.8	0.20	0.62	45.12	67.2%
INDUSTRIAL LANDS	EXMH 5	EXMH 4		36.34				1476	3.68	16.05	10.18	30.34	300	92.6	0.24	0.68	49.42	61.4%
E9 - INDUSTRIAL LANDS		EXMH 4	1.14						2.00	0.46								
E10 - INDUSTRIAL LANDS	EXMH 4	EXMH 3	0.04	37.52				1476	3.68	16.05	10.51	31.12	300	64.7	0.27	0.72	52.42	59.4%
ELM ST DOG PARK	EXMH 3	EXMH 2	0.10	37.62				1476	3.68	16.05	10.53	31.15	300	99.8	0.17	0.57	41.59	74.9%
ELM ST DOG PARK	EXMH 2	EXMH 1	0.12	37.74				1476	3.68	16.05	10.57	31.19	300	120.4	0.21	0.63	46.23	67.5%
ELM ST DOG PARK	EXMH 1	EX 1042	0.01	37.75				1476	3.68	16.05	10.57	31.19	300	14.0	0.22	0.65	47.32	65.9%
ELM ST DOG PARK	EX 1042	EX 1043	0.07	37.82				1476	3.68	16.05	10.59	31.21	300	69.0	*0.22*	0.65	47.32	66.0%
ELM ST DOG PARK	EX 1043	EX 1062	0.08	37.90				1476	3.68	16.05	10.61	31.23	300	77.0	*0.22*	0.65	47.32	66.0%

#	REVISION	DATE	INIT
0	ISSUED FOR REVIEW		ZC

NOTES:

1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD. TO VERIFY THE ACCURACY OF THESE PROPERTY LINES, A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING KT
DESIGN KT
CHECKED BY JS
APPROVED BY JS

PORT COLBORNE

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

ROSEDALE / MEADOW HEIGHTS
CITY OF PORT COLBORNE

OVERALL SANITARY DRAINAGE AREA PLAN

CONSULTANT FILE No.	####
DATE	2023-11-22
PRINTED	2023-11-22
SCALE	1:500 m
REF No.	
DWG No.	####-
REV	0

DRAWING FILE: F:\5331\Sewer Calculations\Sanitary Analysis\5331-BASE_SAN.dwg PLOTTED: Nov 22, 2023 – 5:02pm PLOTTED BY: kurt

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

INCLUDING OXFORD BOULEVARD SANITARY SEWER FLOWS PER REGIONAL MSP UPDATE

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INDUSTRIAL: 0.2 LITRES/SECOND/GROSS HECTARE (MECP ALLOWANCE IS 0.2 - 0.64)
INFILTRATION RATE: 0.28 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L / s / ha)
POPULATION DENSITY: 3.0 PERSONS / UNIT

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

MUNICIPALITY: CITY OF PORT COLBORNE
PROJECT : MEADOW HEIGHTS
PROJECT NO: 227

OVERALL SANITARY SEWER DESIGN SHEET

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

LOCATION			AREA		POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (persons/unit)	Population Increment	Total Population Served	Peaking Factor	Flow (L/s)	Infiltration Flow L/s	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Percent Full
A28 - PARKSIDE DRIVE			0.61	0.61	8	3.0	24	24	4.37	0.31	0.17	0.48	200	60.0	0.40	0.67	21.64	2.2%
A29 - PARKSIDE DRIVE			0.27	0.88	3	3.0	9	33	4.35	0.42	0.25	0.67	200	52.9	0.40	0.67	21.64	3.1%
A30 - PARKSIDE DRIVE			0.18	1.06	2	3.0	6	39	4.34	0.50	0.30	0.80	200	23.7	0.40	0.67	21.64	3.7%
A31 - PARKSIDE DRIVE			0.11	1.17	1	3.0	3	42	4.33	0.54	0.33	0.86	200	17.2	0.40	0.67	21.64	4.0%
A32 - PARKSIDE DRIVE			0.52	1.69	5	3.0	15	57	4.30	0.72	0.47	1.20	200	74.1	1.50	1.29	41.91	2.9%
A33 - MEADOWLARK DRIVE			0.17	0.17	2	3.0	6	6	4.43	0.08	0.05	0.13	200	29.7	0.80	0.94	30.60	0.4%
A34 - MEADOWLARK DRIVE			0.87	1.04	11	3.0	33	39	4.34	0.50	0.29	0.79	200	95.6	0.40	0.67	21.64	3.7%
A35 - MEADOWLARK DRIVE			0.69	1.73	10	3.0	30	69	4.28	0.87	0.48	1.36	200	81.7	0.40	0.67	21.64	6.3%
A36 - MEADOWLARK DRIVE			0.38	2.11	5	3.0	15	84	4.26	1.06	0.59	1.65	200	49.3	0.40	0.67	21.64	7.6%
A37 - PARKSIDE DRIVE			0.49	4.29	6	3.0	18	159	4.18	1.96	1.20	3.16	200	87.8	0.87	0.98	31.92	9.9%
A38 - SHERWOOD DRIVE			0.94	0.94	14	3.0	42	42	4.33	0.54	0.26	0.80	200	95.0	0.80	0.94	30.60	2.6%
A39 - SHERWOOD DRIVE			0.67	1.61	10	3.0	30	72	4.28	0.91	0.45	1.36	200	96.0	0.40	0.67	21.64	6.3%
A40 - SPRINGSIDE DRIVE			0.63	0.63	14	3.0	42	42	4.33	0.54	0.18	0.71	200	70.6	0.40	0.67	21.64	3.3%
A41 - CONDO			0.97	0.97	40	3.0	120	120	4.22	1.49	0.27	1.77	200	13.6	0.40	0.67	21.64	8.2%
A42 - SPRINGSIDE DRIVE			0.44	2.04	9	3.0	27	189	4.16	2.32	0.57	2.89	200	54.9	0.40	0.67	21.64	13.4%
A43 - SPRINGSIDE DRIVE			0.23	2.27	5	3.0	15	204	4.14	2.50	0.64	3.13	200	23.8	0.50	0.75	24.19	12.9%
A44 - SPRINGSIDE DRIVE			0.11	2.38	2	3.0	6	210	4.14	2.57	0.67	3.23	200	18.5	0.40	0.67	21.64	14.9%
A45 - SPRINGSIDE DRIVE			0.46	2.84	8	3.0	24	234	4.12	2.85	0.80	3.64	200	59.1	0.40	0.67	21.64	16.8%
A46 - SHERWOOD DRIVE			0.48	4.93	6	3.0	18	324	4.06	3.89	1.38	5.27	200	67.7	0.92	1.01	32.82	16.0%
A47 - SHERWOOD DRIVE			0.58	5.51	9	3.0	27	351	4.05	4.19	1.54	5.74	200	56.9	0.88	0.99	32.10	17.9%
A48 - SHERWOOD DRIVE			0.49	6.00	8	3.0	24	375	4.04	4.47	1.68	6.15	200	53.7	1.35	1.23	39.76	15.5%
A49 - SHERWOOD DRIVE			0.30	6.30	4	3.0	12	387	4.03	4.60	1.76	6.37	200	59.1	1.35	1.23	39.76	16.0%
A50 - PARKSIDE DRIVE			0.73	11.32	12	3.0	36	582	3.94	6.77	3.17	9.94	200	86.3	0.40	0.67	21.64	45.9%
A51 - AINTREE PLACE			0.65	0.65	12	3.0	36	36	4.34	0.46	0.18	0.64	200	65.0	1.00	1.06	34.22	1.9%
A52 - PARKSIDE DRIVE			0.76	12.73	15	3.0	45	663	3.91	7.65	3.56	11.21	200	102.5	0.40	0.67	21.64	51.8%
A53 - WESTFIELD PLACE			0.60	0.60	12	3.0	36	36	4.34	0.46	0.17	0.63	200	23.1	1.00	1.06	34.22	1.8%
A54 - WESTFIELD PLACE			0.22	0.82	5	3.0	15	51	4.31	0.65	0.23	0.88	200	43.7	0.40	0.67	21.64	4.1%
A55 - WESTFIELD PLACE			0.23	13.78	5	3.0	15	729	3.88	8.36	3.86	12.22	200	49.2	0.40	0.67	21.64	56.4%
WESTFIELD PLACE				13.78				729	3.88	8.36	3.86	12.22	200	37.6	0.40	0.67	21.64	56.4%
RDS - ROSEDALE			11.85		249	3.0	747	747	3.88	8.55	3.32	11.87						
OXFORD SPS (Per Regional MSP Update)			12.50		2051 Projected Population & Employment			453				7.60	ECA Firm Capacity per 2021 Regional MSP Update					
EASEMENT - ROSEDALE				25.63				1476	3.68	16.05	7.18	30.83	300	52.4	0.37	0.84	61.36	50.2%
EASEMENT - VAN JON		EXMH 12		25.63				1476	3.68	16.05	7.18	30.83	300	48.8	0.43	0.91	66.15	46.6%
E1 - VAN JON PAVING			1.72						2.00	0.69								
E2 - STONEBRIDGE DR	EXMH 12	EXMH 11	0.14	27.49				1476	3.68	16.05	7.70	32.04	300	28.0	0.29	0.74	54.33	59.0%
E3 - INDUSTRIAL LANDS			0.30						2.00	0.12								
E4 - INDUSTRIAL LANDS			1.82						2.00	0.73								
STONEBRIDGE DR	EXMH 11	EXMH 7		27.49				1476	3.68	16.05	7.70	32.04	300	45.0	0.20	0.62	45.12	71.0%
E5 - INDUSTRIAL LANDS			0.90						2.00	0.36								
E6 - INDUSTRIAL LANDS			4.56						2.00	1.82								
E7 - STONEBRIDGE DR	EXMH 8	EXMH 7	0.29	5.75							1.61	3.79	300	16.0	1.09	1.44	105.32	3.6%
E8 - INDUSTRIAL LANDS		EXMH 7	3.10	3.10					2.00	1.24								
INDUSTRIAL LANDS	EXMH 7	EXMH 6		36.34				1476	3.68	16.05	10.18	37.94	300	88.8	0.20	0.62	45.12	84.1%
INDUSTRIAL LANDS	EXMH 6	EXMH 5		36.34				1476	3.68	16.05	10.18	37.94	300	94.8	0.20	0.62	45.12	84.1%
INDUSTRIAL LANDS	EXMH 5	EXMH 4		36.34				1476	3.68	16.05	10.18	37.94	300	92.6	0.24	0.68	49.42	76.8%
E9 - INDUSTRIAL LANDS		EXMH 4	1.14						2.00	0.46								
E10 - INDUSTRIAL LANDS	EXMH 4	EXMH 3	0.04	37.52				1476	3.68	16.05	10.51	38.72	300	64.7	0.27	0.72	52.42	73.9%
ELM ST DOG PARK	EXMH 3	EXMH 2	0.10	37.62				1476	3.68	16.05	10.53	38.75	300	99.8	0.17	0.57	41.59	93.2%
ELM ST DOG PARK	EXMH 2	EXMH 1	0.12	37.74				1476	3.68	16.05	10.57	38.79	300	120.4	0.21	0.63	46.23	83.9%
ELM ST DOG PARK	EXMH 1	EX 1042	0.01	37.75				1476	3.68	16.05	10.57	38.79	300	14.0	0.22	0.65	47.32	82.0%
ELM ST DOG PARK	EX 1042	EX 1043	0.07	37.82				1476	3.68	16.05	10.59	38.81	300	69.0	*0.22*	0.65	47.32	82.0%
ELM ST DOG PARK	EX 1043	EX 1062	0.08	37.90				1476	3.68	16.05	10.61	38.83	300	77.0	*0.22*	0.65	47.32	82.1%

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

INCLUDING OXFORD BOULEVARD SANITARY SEWER FLOWS PER UCC CALCULATIONS

DESIGN FLOWS

RESIDENTIAL: 255 LITRES/PERSON/DAY (AVERAGE DAILY FLOW)
INDUSTRIAL: 0.2 LITRES/SECOND/GROSS HECTARE (MECP ALLOWANCE IS 0.2 - 0.64)
INFILTRATION RATE: 0.28 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L / s / ha)
POPULATION DENSITY: 3.0 PERSONS / UNIT

SEWER DESIGN

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

MUNICIPALITY: CITY OF PORT COLBORNE
PROJECT : MEADOW HEIGHTS
PROJECT NO: 227

OVERALL SANITARY SEWER DESIGN SHEET

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

LOCATION			AREA		POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (persons/unit)	Population Increment	Total Population Served	Peaking Factor	Flow (L/s)	Infiltration Flow L/s	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Length (m)	Pipe Slope (%)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Percent Full
A28 - PARKSIDE DRIVE			0.61	0.61	8	3.0	24	24	4.37	0.31	0.17	0.48	200	60.0	0.40	0.67	21.64	2.2%
A29 - PARKSIDE DRIVE			0.27	0.88	3	3.0	9	33	4.35	0.42	0.25	0.67	200	52.9	0.40	0.67	21.64	3.1%
A30 - PARKSIDE DRIVE			0.18	1.06	2	3.0	6	39	4.34	0.50	0.30	0.80	200	23.7	0.40	0.67	21.64	3.7%
A31 - PARKSIDE DRIVE			0.11	1.17	1	3.0	3	42	4.33	0.54	0.33	0.86	200	17.2	0.40	0.67	21.64	4.0%
A32 - PARKSIDE DRIVE			0.52	1.69	5	3.0	15	57	4.30	0.72	0.47	1.20	200	74.1	1.50	1.29	41.91	2.9%
A33 - MEADOWLARK DRIVE			0.17	0.17	2	3.0	6	6	4.43	0.08	0.05	0.13	200	29.7	0.80	0.94	30.60	0.4%
A34 - MEADOWLARK DRIVE			0.87	1.04	11	3.0	33	39	4.34	0.50	0.29	0.79	200	95.6	0.40	0.67	21.64	3.7%
A35 - MEADOWLARK DRIVE			0.69	1.73	10	3.0	30	69	4.28	0.87	0.48	1.36	200	81.7	0.40	0.67	21.64	6.3%
A36 - MEADOWLARK DRIVE			0.38	2.11	5	3.0	15	84	4.26	1.06	0.59	1.65	200	49.3	0.40	0.67	21.64	7.6%
A37 - PARKSIDE DRIVE			0.49	4.29	6	3.0	18	159	4.18	1.96	1.20	3.16	200	87.8	0.87	0.98	31.92	9.9%
A38 - SHERWOOD DRIVE			0.94	0.94	14	3.0	42	42	4.33	0.54	0.26	0.80	200	95.0	0.80	0.94	30.60	2.6%
A39 - SHERWOOD DRIVE			0.67	1.61	10	3.0	30	72	4.28	0.91	0.45	1.36	200	96.0	0.40	0.67	21.64	6.3%
A40 - SPRINGSIDE DRIVE			0.63	0.63	14	3.0	42	42	4.33	0.54	0.18	0.71	200	70.6	0.40	0.67	21.64	3.3%
A41 - CONDO			0.97	0.97	40	3.0	120	120	4.22	1.49	0.27	1.77	200	13.6	0.40	0.67	21.64	8.2%
A42 - SPRINGSIDE DRIVE			0.44	2.04	9	3.0	27	189	4.16	2.32	0.57	2.89	200	54.9	0.40	0.67	21.64	13.4%
A43 - SPRINGSIDE DRIVE			0.23	2.27	5	3.0	15	204	4.14	2.50	0.64	3.13	200	23.8	0.50	0.75	24.19	12.9%
A44 - SPRINGSIDE DRIVE			0.11	2.38	2	3.0	6	210	4.14	2.57	0.67	3.23	200	18.5	0.40	0.67	21.64	14.9%
A45 - SPRINGSIDE DRIVE			0.46	2.84	8	3.0	24	234	4.12	2.85	0.80	3.64	200	59.1	0.40	0.67	21.64	16.8%
A46 - SHERWOOD DRIVE			0.48	4.93	6	3.0	18	324	4.06	3.89	1.38	5.27	200	67.7	0.92	1.01	32.82	16.0%
A47 - SHERWOOD DRIVE			0.58	5.51	9	3.0	27	351	4.05	4.19	1.54	5.74	200	56.9	0.88	0.99	32.10	17.9%
A48 - SHERWOOD DRIVE			0.49	6.00	8	3.0	24	375	4.04	4.47	1.68	6.15	200	53.7	1.35	1.23	39.76	15.5%
A49 - SHERWOOD DRIVE			0.30	6.30	4	3.0	12	387	4.03	4.60	1.76	6.37	200	59.1	1.35	1.23	39.76	16.0%
A50 - PARKSIDE DRIVE			0.73	11.32	12	3.0	36	582	3.94	6.77	3.17	9.94	200	86.3	0.40	0.67	21.64	45.9%
A51 - AINTREE PLACE			0.65	0.65	12	3.0	36	36	4.34	0.46	0.18	0.64	200	65.0	1.00	1.06	34.22	1.9%
A52 - PARKSIDE DRIVE			0.76	12.73	15	3.0	45	663	3.91	7.65	3.56	11.21	200	102.5	0.40	0.67	21.64	51.8%
A53 - WESTFIELD PLACE			0.60	0.60	12	3.0	36	36	4.34	0.46	0.17	0.63	200	23.1	1.00	1.06	34.22	1.8%
A54 - WESTFIELD PLACE			0.22	0.82	5	3.0	15	51	4.31	0.65	0.23	0.88	200	43.7	0.40	0.67	21.64	4.1%
A55 - WESTFIELD PLACE			0.23	13.78	5	3.0	15	729	3.88	8.36	3.86	12.22	200	49.2	0.40	0.67	21.64	56.4%
WESTFIELD PLACE				13.78				729	3.88	8.36	3.86	12.22	200	37.6	0.40	0.67	21.64	56.4%
RDS - ROSEDALE			11.85		249	3.0	747	747	3.88	8.55	3.32	11.87						
OXFORD SPS (UCC Calculations)			***8.63***		***56***	***3.0***	***168***	***168***	***4.17***	***2.07***	***2.42***	***4.49***	***Current Oxford SPS Flow Rate - UCC Calculated Flows***					
EASEMENT - ROSEDALE				25.63				1476	3.68	16.05	7.18	27.71	300	52.4	0.37	0.84	61.36	45.2%
EASEMENT - VAN JON		EXMH 12		25.63				1476	3.68	16.05	7.18	27.71	300	48.8	0.43	0.91	66.15	41.9%
E1 - VAN JON PAVING			1.72						2.00	0.69								
E2 - STONEBRIDGE DR	EXMH 12	EXMH 11	0.14	27.49				1476	3.68	16.05	7.70	28.92	300	28.0	0.29	0.74	54.33	53.2%
E3 - INDUSTRIAL LANDS			0.30						2.00	0.12								
E4 - INDUSTRIAL LANDS			1.82						2.00	0.73								
STONEBRIDGE DR	EXMH 11	EXMH 7		27.49				1476	3.68	16.05	7.70	28.92	300	45.0	0.20	0.62	45.12	64.1%
E5 - INDUSTRIAL LANDS			0.90						2.00	0.36								
E6 - INDUSTRIAL LANDS			4.56						2.00	1.82								
E7 - STONEBRIDGE DR	EXMH 8	EXMH 7	0.29	5.75							1.61	3.79	300	16.0	1.09	1.44	105.32	3.6%
E8 - INDUSTRIAL LANDS		EXMH 7	3.10	3.10					2.00	1.24								
INDUSTRIAL LANDS	EXMH 7	EXMH 6		36.34				1476	3.68	16.05	10.18	34.82	300	88.8	0.20	0.62	45.12	77.2%
INDUSTRIAL LANDS	EXMH 6	EXMH 5		36.34				1476	3.68	16.05	10.18	34.82	300	94.8	0.20	0.62	45.12	77.2%
INDUSTRIAL LANDS	EXMH 5	EXMH 4		36.34				1476	3.68	16.05	10.18	34.82	300	92.6	0.24	0.68	49.42	70.5%
E9 - INDUSTRIAL LANDS		EXMH 4	1.14						2.00	0.46								
E10 - INDUSTRIAL LANDS	EXMH 4	EXMH 3	0.04	37.52				1476	3.68	16.05	10.51	35.61	300	64.7	0.27	0.72	52.42	67.9%
ELM ST DOG PARK	EXMH 3	EXMH 2	0.10	37.62				1476	3.68	16.05	10.53	35.64	300	99.8	0.17	0.57	41.59	85.7%
ELM ST DOG PARK	EXMH 2	EXMH 1	0.12	37.74				1476	3.68	16.05	10.57	35.67	300	120.4	0.21	0.63	46.23	77.2%
ELM ST DOG PARK	EXMH 1	EX 1042	0.01	37.75				1476	3.68	16.05	10.57	35.68	300	14.0	0.22	0.65	47.32	75.4%
ELM ST DOG PARK	EX 1042	EX 1043	0.07	37.82				1476	3.68	16.05	10.59	35.70	300	69.0	*0.22*	0.65	47.32	75.4%
ELM ST DOG PARK	EX 1043	EX 1062	0.08	37.90				1476	3.68	16.05	10.61	35.72	300	77.0	*0.22*	0.65	47.32	75.5%

APPENDIX C

Northland Estates – Stormwater Management Plan

STORMWATER MANAGEMENT PLAN

ROSEDALE SUBDIVISION

CITY OF PORT COLBORNE

Prepared for:

Rosedale Estates Ltd.
1510-105 Main Street East
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Prepared by:

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St. Catharines, Ontario
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November 23, 2023

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REFERENCES

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

STORMWATER MANAGEMENT PLAN

ROSEDALE SUBDIVISION

PORT COLBORNE

1.0 INTRODUCTION

1.1 Study Area

The proposed residential subdivision development is located in the City of Port Colborne as part of Lot 30 and Concession 3. As shown on the enclosed Site Location Plan (Figure 1), the subject property is situated east of West Side Road (Highway 58), south of Stonebridge Drive, west of Elm Street, and north of Barrick Road at the north limit of Oxford Boulevard. This Stormwater Management Plan has been completed in support of the application for Draft Plan of Subdivision approval on the subject lands.

The 12.77-hectare property is bound by existing residential properties on the south side and future residential lands (Meadow Heights Subdivision) to the east, as well as West Side Road (Highway 58) to the west and industrial lands (Van Jon Paving) to the north. The development will have entrances on Oxford Boulevard as well as Meadowlark Drive and Westfield Place as part of the adjacent Meadow Heights subdivision development to the east.

The drainage areas contributing to this Stormwater Management (SWM) Plan will be assessed from the following areas: the subject Rosedale Subdivision lands, the adjacent Meadow Heights Subdivision development, existing residential lands to the south, and a small area of undeveloped agricultural lands on the west side of West Side Road (Highway 58). Future stormwater flows from the development area will discharge to a Stormwater Management (SWM) Facility and subsequent sewer located immediately east of the proposed SWM facility, conveying flows northerly through an easement on the Van John Paving lands to Stonebridge Drive and ultimately the Biederman Drain. This storm sewer will be constructed as part of the adjacent Meadow Heights Subdivision development prior to the Rosedale Subdivision beginning construction.

1.2 Objectives

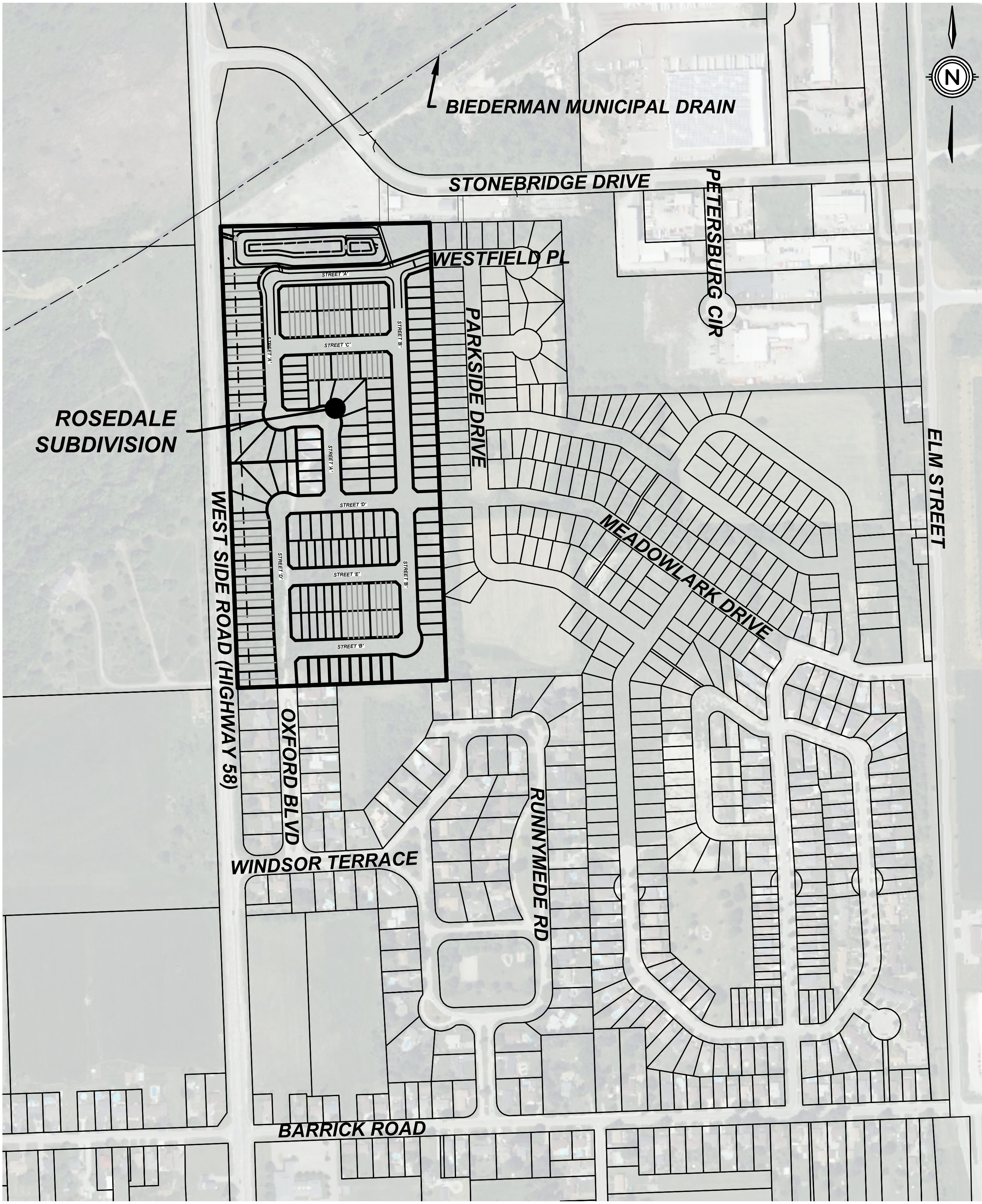
The objectives of this study are as follows:

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

2. Determine the impact of development on the stormwater peak flow & volume of 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

ROSEDALE SUBDIVISION

CITY OF PORT COLBORNE

SITE LOCATION PLAN

DATE	2023–10–06
SCALE	1:6000 m
REF No.	5331
DWG No.	FIGURE 1

DRAWING FILE: F:\5331\Engineering\5331-BASE.dwg PLOTTED: Oct 06, 2023 – 2:01pm PLOTTED BY: kurt

Figure 1. Site Location Plan

1.3 Existing & Proposed Conditions

a) Existing Conditions

The development site has been historically been the location of a single detached residential dwelling and associated garage, as well as for agricultural purposes. The gradient of the land is generally north to north-east for the majority of the site directing flows to the north site limit. Flows are then generally directed westerly at the site limit to the West Side Road (Highway 58) MTO road allowance due to the Van Jon Paving development All stormwater flows from the site ultimately discharge to the Biederman Drain north of the site and to the Welland Recreational Canal further downstream.

The majority of native soil with the study area has been characterized as a Farmington soil with rapid drainage properties though contains shallow bedrock areas close to the surface. The northern portion of the site has been classified with more imperfect to poor draining soils as part of the Franktown soil group.

b) Proposed Conditions

The proposed development will consist of 131 single-detached dwellings and 21 townhouse block (118 units) for a total of 249 residential units. A park will be built at the south-east corner of the site and a stormwater management (SWM) facility will be located at the north limit of the site. The site shall be provided with full municipal services including sanitary sewers, storm sewers, and watermain with asphalt pavement and concrete curbs and gutters.

At this time, due to the current state of approvals and intentions of known developers, it is expected that the adjacent Meadow Heights subdivision development will be constructed prior to the proposed Rosedale Subdivision discussed in this report. It is expected that a storm sewer will be constructed through an easement within the Rosedale Subdivision and northerly-adjacent Van Jon Paving lands to ultimately discharging to the Biederman Drain to provide a stormwater outlet for the Meadow Heights development. As such, calculations and conclusions discussed in this stormwater management plan have been conducted with the assumption that under future conditions, both development sites are fully developed.

2.0 STORMWATER MANAGEMENT CRITERIA

New developments are required to provide stormwater management (SWM) 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 (City of Port Colborne, Regional Municipality of Niagara, Ministry of Transportation, 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, Biederman Drain 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 MECP level of protection for stormwater management <u>quality</u> practices on all new developments shall be *Normal*.
- The site outlets to the Biederman Drain which contain 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 storm system of the Rosedale Subdivision development according to MECP guidelines. It is proposed to provide Normal Protection (70% TSS removal) quality enhancements to the stormwater before discharging to the Biederman Drain.
- Stormwater **quantity** controls are to be provided for the outlet to limit the proposed development peak flows from the 2, 5, 10, 25, 50 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 the Rosedale Subdivision development using the MIDUSS computer modelling program. A new stormwater analysis was conducted to represent the existing and future conditions to the Biederman Drain.

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 Ministry of Transportation's (MTO) Intensity-Duration-Frequency curves for the subject area in Port Colborne. The MTO's IDF Curves have been utilized for this development due to the proximity of Highway 58 (West Side Road) immediately adjacent to the site, as the results of this report directly impact their infrastructure. Hyetographs for the 25mm, 2, 5, 10, 25, 50 and 100 year events were developed using a 4-hour Chicago distribution. Table 1 summarizes the rainfall data.

Table 1. Rainfall Data

Design Storm (Return Period)	Chicago Distribution Parameters		
	a	b	c
25mm	512.000	6.00	0.800
2 Year	397.149	0.0	0.699
5 Year	524.867	0.0	0.699
10 Year	608.845	0.0	0.699
25 Year	715.568	0.0	0.699
50 Year	794.298	0.0	0.699
100 Year	871.279	0.0	0.699

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

3.2 Existing Conditions

The existing conditions were modelled to establish the stormwater peak flows and volumes prior to development within this site. The existing drainage area for this subwatershed is shown on Figure 2. This area was determined from field investigations and recent topographic surveys. Additionally, a schematic outlining the modelling process for both existing and future calculations has been included on Figure 4.

As shown in Figure 2, stormwater flows from an existing agricultural field (Drainage Area 'FX') on the west side of West Side Road (Highway 58) are conveyed east under the highway through a 1.2m x 0.9m concrete box culvert and towards the Oxford Boulevard road allowance. Stormwater flows are then captured by a series of catch basins and directed east through a park access and ultimately discharged via culvert to a ditch at the north limit of the park, east of Oxford Boulevard. The ditch passes through the south-east corner of the Rosedale Subdivision lands and through the adjacent Meadow Heights Subdivision lands. The ditch conveys stormwater flows from both Drainage Areas 'FX' and 'WT' and was included in the original approved engineering design to be accommodated in the Meadow Heights internal storm sewer system.

Through a combination of field surveys and topographical information it has been determined that existing stormwater flows from the Meadow Heights and Rosedale Subdivision lands (Drainage Areas MH and EX respectively) are directed overland westerly at the north limits of the Rosedale Subdivision lands to the Highway 58 road allowance and ultimately to the Biederman Drain at Outlet 'A'.

The adjacent Meadow Heights Subdivision was Draft Approved, Registered and obtained Certificate of Approval for all sewers without the requirement for stormwater management quality or quantity controls prior to discharging to the Biederman Drain. At the time of completing this report, Meadow Heights Phases 1 & 2 have been completed, with a complete engineering submission for the remaining subdivision lands expected to be submitted to the municipality imminently. For the purpose of this report, all calculations have been completed with the assumption that the Meadow Heights subdivision has been completely developed (see figure 2).

Due to unforeseen circumstances however, the location of the storm sewer outlet for the Meadow Heights Subdivision will be adjusted from its' originally planned path north of Parkside Drive. The Meadow Heights Subdivision storm sewer will be constructed within an easement on the Rosedale Subdivision lands, conveying flows westerly on Westfield Place/Street 'A' before being directed north on the east side of the Rosedale SWM facility and continue westerly along the north property line, actively bypassing the future Rosedale Subdivision SWM Facility. The storm sewer will be constructed within an easement through the Van Jon Paving property (#64 Stonebridge Drive and discharge flows via headwall to the Biederman Drain.

An imperviousness of 0.5% has been utilized for both Drainage Areas 'FX' and 'EX' as they are both largely undeveloped vacant properties under existing conditions. An imperviousness of 25.0% has been attributed to Drainage Area 'WT' to align with the single-family residential dwelling and significant park area uses comprising this area. Lastly, an imperviousness of 35.6% has been utilized for the Meadow Heights subdivision which is equivalent to the overall average Runoff Coefficient calculated for the Meadow Heights Subdivision development area per the storm sewer calculations.

Input parameters for the computer model for the existing conditions are shown in Table 2. Table 3 shows the stormwater peak flows and volumes generated by the various design storm events.

3.3 Proposed Conditions

The proposed Rosedale Subdivision development will result in the construction of 249 residential units with an associated park and stormwater management facility. For the purpose of this report, the future imperviousness of the development area has been conservatively increased from 0.5% under existing conditions (Drainage Area EX), to 70.0% under proposed conditions (Drainage Area FUT).

An internal storm sewer system will be constructed to convey stormwater flows up to and including the 5-year design storm event to the stormwater management facility at the north limit of the site. As well, stormwater flows unable to enter the storm sewer system during storm events greater than the 5-year event will be directed overland to the stormwater management facility within the future road allowances.

As previously stated, a storm sewer will be constructed immediately east and north of the SWM Facility as part of Meadow Heights stormwater outlet (prior to the Rosedale Subdivision development). The storm sewer will be utilized to convey flows from the stormwater management facility outlet to the Biederman Drain north of the site (Outlet A). This downstream section of storm sewer has been designed to accommodate flows from the Rosedale Subdivision SWM Facility as well as the unrestricted flows from the Meadows Heights Subdivision.

As it will not be ideal to direct major overland flows from the Meadow Heights subdivision through the servicing easement on the Van Jon Paving lands, the roadway design of Street ‘A’ and Westfield Place at the north limit of the Rosedale/Meadow Heights Subdivision will be designed to direct overland flows from both developments to the proposed SWM facility. During extreme storm events, an emergency overflow spillway will discharge stormwater flows from the SWM facility westerly to the Highway 58 (MTO) road allowance and ultimately to the Biederman Drain (Outlet A). Modelling for the proposed Rosedale Stormwater Management Facility includes overland flows during the 10-100 year storm events.

Ultimately, stormwater flows will continue to discharge flows to Outlet ‘A’ under future conditions as occurs today under existing conditions.

As the Rosedale Subdivision SWM Facility will accommodate stormwater flows from both the Rosedale (FUT) and Meadow Heights (MH) Subdivisions, modelling has been conducted to determine the peak stormwater flow rates at both the Rosedale Subdivision SWM Facility Outlet as well as the Biederman Drain Outlet (Outlet A) during the larger storm events.

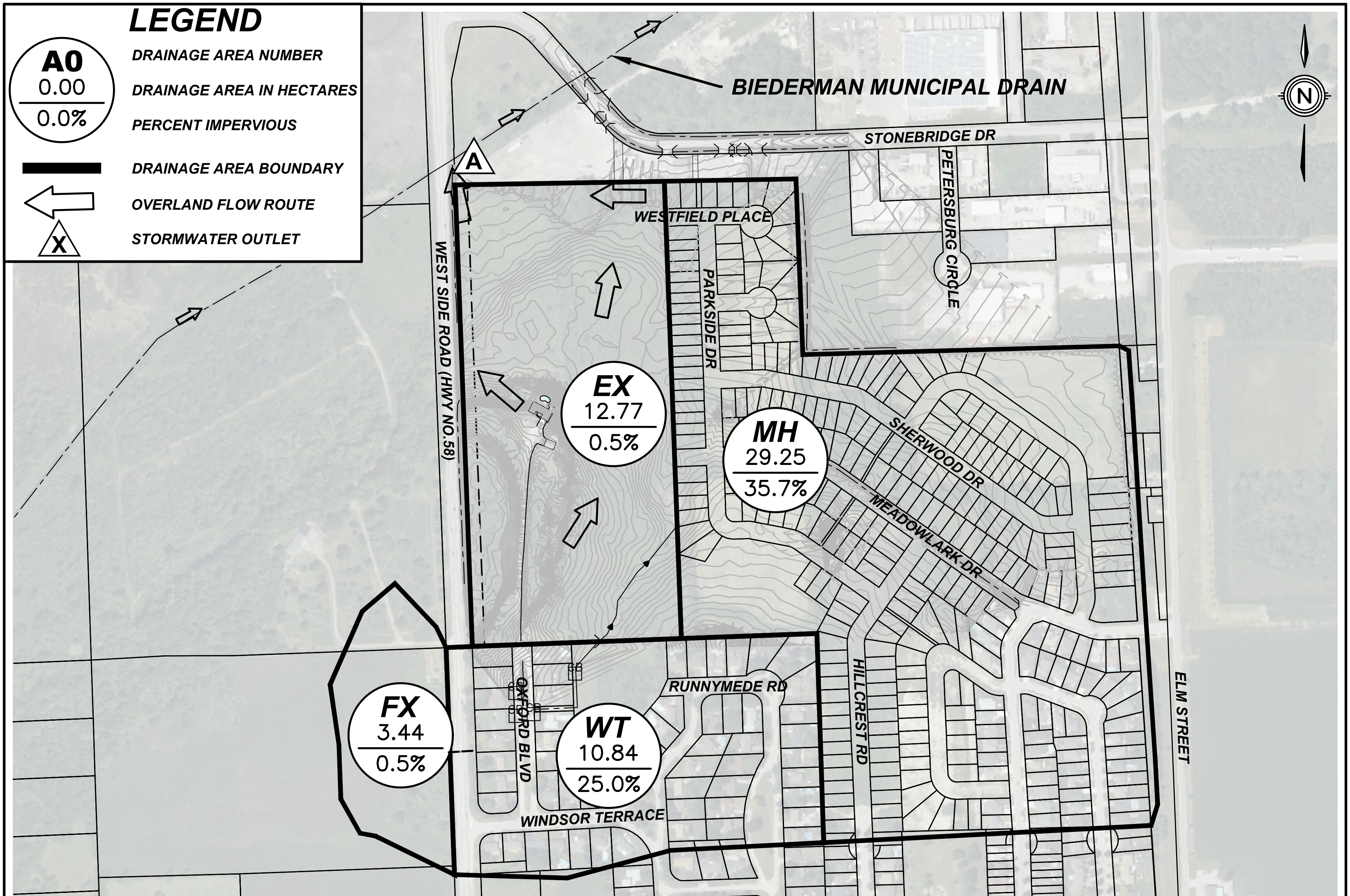
The future drainage areas for the proposed development, shown in Figure 3, were modelled to establish the stormwater peak flows and volumes once development has been completed at the proposed site. Input parameters for the computer model with the proposed development conditions are shown in Table 2.

Table 2. Hydrologic Parameters					
Area No.	**Area (ha)**	**Length (m)**	**Slope (%)**	**SCS CN**	**Percent Impervious**
Existing Conditions					
EX	12.77	400	2.0	77	0.5
FX	3.44	150	1.0	77	0.5
WT	10.84	300	1.0	77	25.0
MH	29.25	500	2.0	77	35.7
	56.30	**Total Area**			
Future Conditions					
FUT	12.77	400	2.0	77	70.0
FX	3.44	150	1.0	77	0.5
WT	10.84	300	1.0	77	25.0
MH	29.25	500	2.0	77	35.7
	56.30	**Total Area**			

Table 3 below outlines existing peak flows to the Biederman Drain under existing conditions (Outlet A) and combined peak flows to the Biederman Drain under future conditions without stormwater management quantity controls (Outlets A & C). Peak flows and runoff volumes were calculated for the 2-, 5-, 10-, 25-, 50-, and 100-year design storm events.

Table 3. Peak Flows and Volumes for Future Development Conditions						
Design Storm	**Peak Flow (m^3/s)**			**Volume (m^3)**		
	Existing	**Future***	**Change**	**Existing**	**Future***	**Change**
2 Year	1.512	2.697	+ 78%	6,864	8,843	+ 1,979
5 Year	2.224	3.822	+ 72%	10,757	13,207	+ 2,450
10 Year	2.707	4.498	+ 66%	13,539	16,232	+ 2,693
25 Year	3.340	5.425	+ 62%	17,283	20,226	+ 2,943
50 Year	3.824	6.117	+ 60%	20,164	23,257	+ 3,093
100 Year	4.585	7.069	+ 54%	23,078	26,294	+ 3,216
*Note: outlines peak stormwater flows without quantity controls						

As seen above in Table 3, stormwater quantity controls are considered necessary for the proposed development since the peak flows and volumes discharging into the Biederman Drain significantly increase as a result of the proposed development. The existing and future stormwater drainage areas shown on Figures 2 and 3 were used to assess the stormwater management plan for this study. A modelling schematic has also been included per Figure 4 to detail how the model was created.



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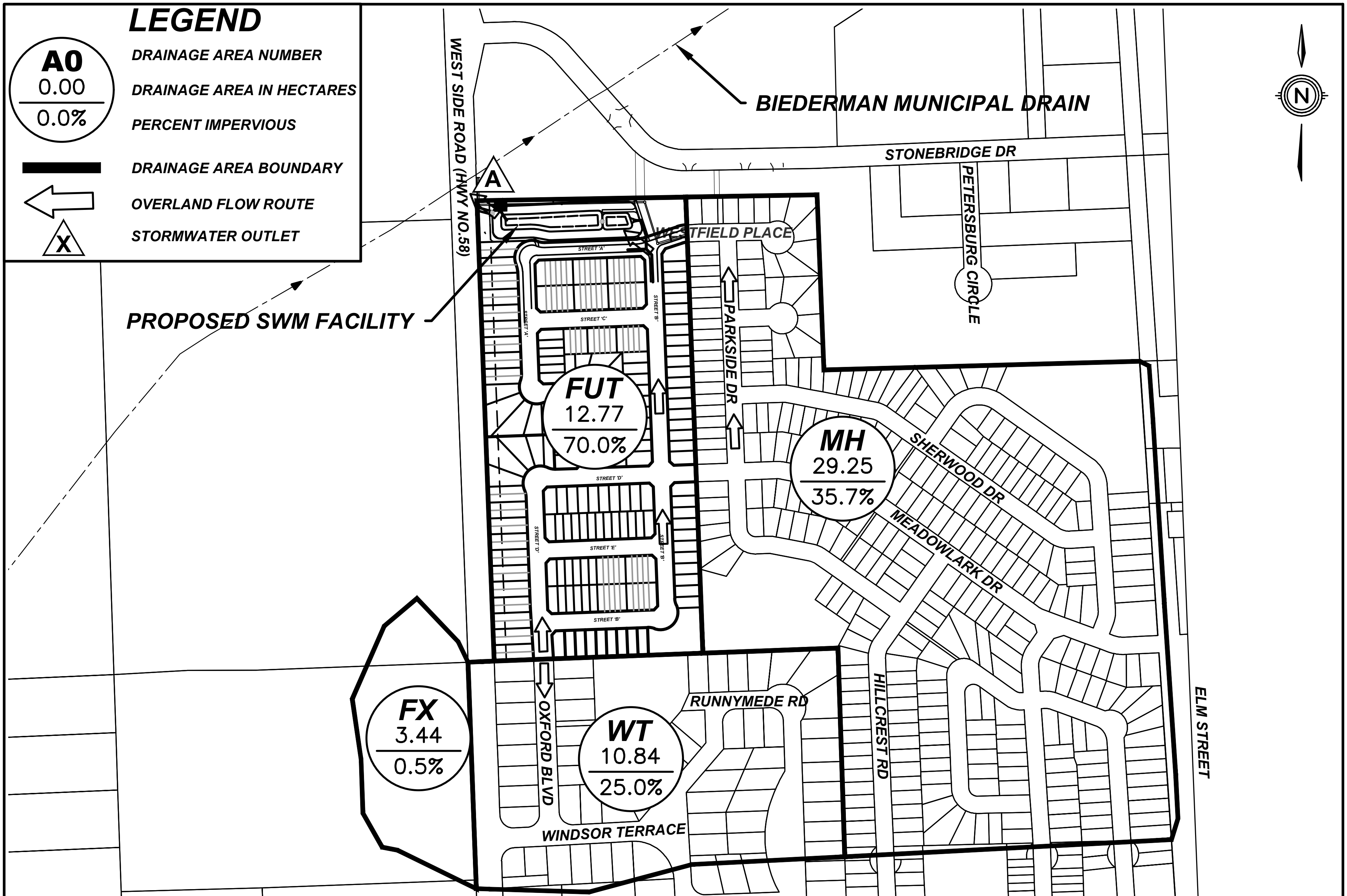
EXISTING OVERALL STORM DRAINAGE AREA PLAN

DATE	2023-09-19
SCALE	1:6000 m
REF No.	5331
DWG No.	FIGURE 2

DRAWING FILE: F:\5331\Engineering\5331-BASE.dwg PLOTTED: Sep 21, 2023 – 8:54am PLOTTED BY: kurt



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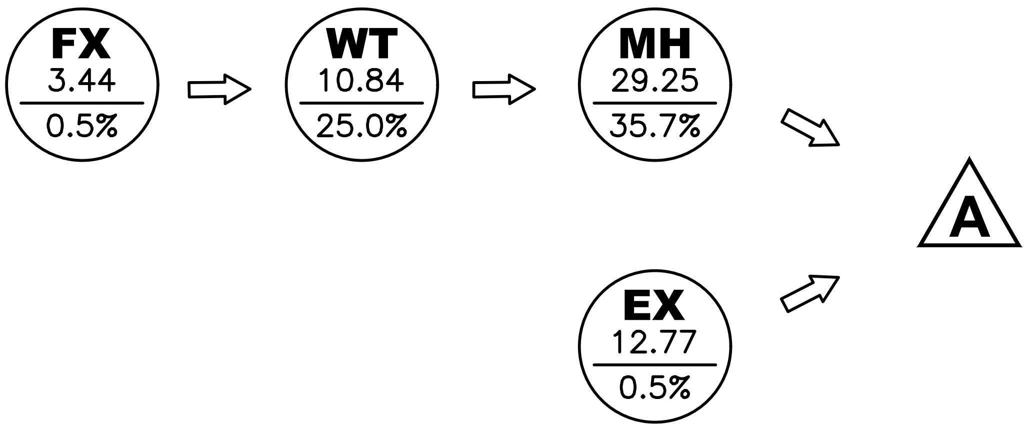
CITY OF PORT COLBORNE

FUTURE OVERALL STORM DRAINAGE AREA PLAN

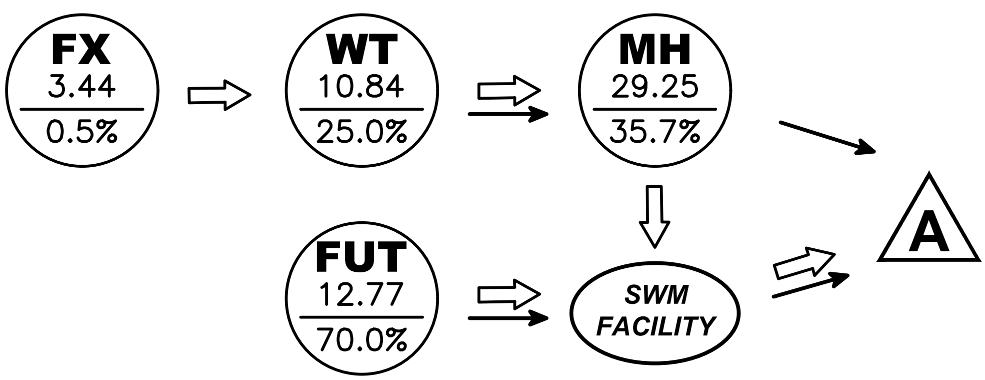
DATE	2023–10–06
SCALE	1:6000 m
REF No.	5331
DWG No.	FIGURE 3

DRAWING FILE: F:\5331\Engineering\5331-BASE.dwg PLOTTED: Oct 06, 2023 – 11:52am PLOTTED BY: kurt

EXISTING CONDITIONS

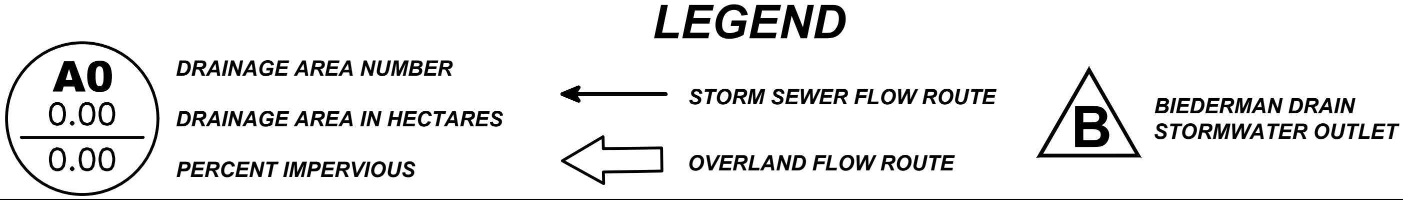


FUTURE CONDITIONS



OUTLET A: BIEDERMAN DRAIN (WEST SIDE ROAD),
OUTLET B: ROSEDALE SWM FACILITY OUTLET PIPE,
OUTLET C: BIEDERMAN DRAIN (STONEBRIDGE DRIVE)

LEGEND



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SWM MODELLING SCHEMATIC

DATE	2023–10–06
SCALE	N/A
REF No.	5331
DWG No.	FIGURE 4

DRAWING FILE: F:\5331\Engineering\5331–BASE.dwg PLOTTED: Oct 06, 2023 – 11:54am 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) Lot Level Controls

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) Vegetative Alternatives

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) Infiltration Alternatives

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) End-of-Pipe Alternatives

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								
	Criteria for Implementation of Stormwater Management Practices (SWMP)							
Rosedale Subdivision	**Topography**	**Soils**	**Bedrock**	**Groundwater**	**Area**	**Technical Effectiveness (10 high)**	**Recommend Implementation Yes / No**	**Comments**
Site Conditions	***Variable 1 to 3%***	***Silty Sand ±13.3mm/hr***	***At Considerable Depth***	***At Considerable Depth***	***± 12.77ha***			
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	No	Unsuitable 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	No	Limited benefit/area too large

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

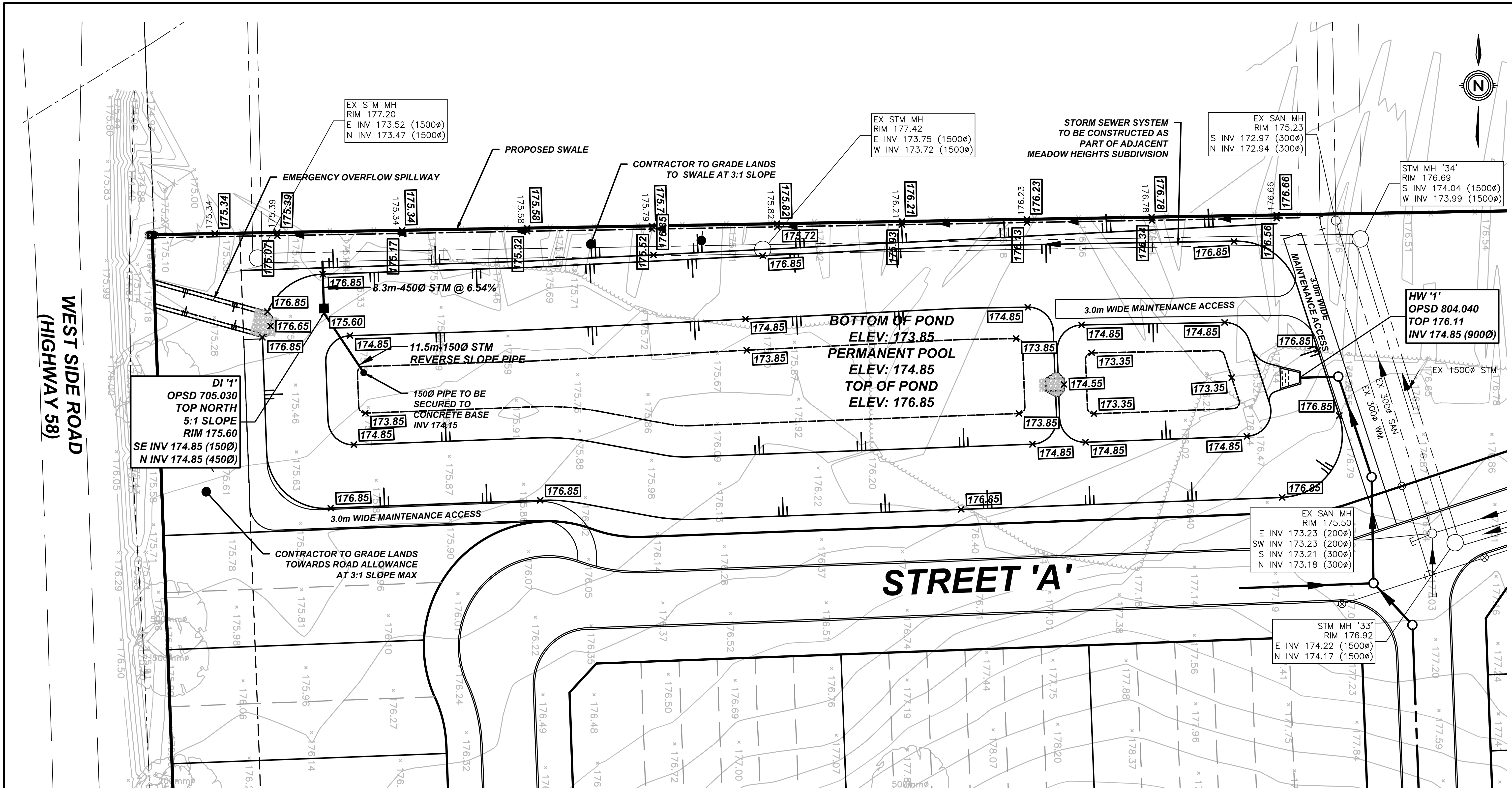
A MIDUSS model was created to assess existing, future and ultimate development peak flows and stormwater volumes generated by the proposed subdivision. The stormwater management facility was sized according to MECP Guidelines (MECP, March 2003) as follows:

5.1 Proposed Stormwater Management Facility

5.1.1 Stormwater Quality

The stormwater drainage outlet for the proposed development is the Biederman Drain, 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 on all new developments shall be Normal.

Based on Table 3.2 of SWMP & Design Manual, the water quality storage requirement is approximately 130m^3/ha for *Normal* protection for developments with 70% impervious areas. The drainage area requiring stormwater quality improvement draining to the proposed facility is 12.77 hectares. The storage volumes required for this proposed facility are shown in Table 5.



UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

ROSEDALE SUBDIVISION

CITY OF PORT COLBORNE

PROPOSED STORMWATER MANAGEMENT FACILITY DETAIL

DATE	2023-11-23
SCALE	1:600 m
REF No.	5331
DWG No.	FIGURE 5

DRAWING FILE: F:\5331\Engineering\5331-BASE.dwg PLOTTED: Nov 23, 2023 – 2:20pm PLOTTED BY: kurt

Table 5. Stormwater Quality Volume Calculations	
Total Water Quality Volume = 12.77 ha x 130 m^3/ha = 1,660 m^3	Reference: Table 3.2, SWMP & Design Manual (MECP 2003)
Minimum Permanent Pool Volume = 12.77 ha x 90 m^3/ha = 1,149 m^3	**Minimum Extended Detention Volume** = 12.77 ha x 40 m^3/ha = 511 m^3

As per the Stormwater Management Facility Calculations in Appendix A, the proposed stormwater management facility will have a Permanent Pool volume of 1,693m^3 as well as an extended detention volume of 2,746m^3. These are both greater than the minimum required.

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 and surrounding lands 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.

As described previously, overland flows during storm events greater than the 5-year event from the Rosedale Subdivision development area as well as the adjacent Meadow Heights Subdivision and upstream lands shall be directed proposed stormwater management facility. Modelling for the proposed Rosedale Stormwater Management Facility includes overland flow volumes during the 10-100 year storm events.

5.1.3 Stormwater Management Facility Configuration

As seen on the proposed Stormwater Management Facility detail (Figure 5), the layout of the SWM facility is providing a single storm sewer outlet to the future easement storm sewer from Meadow Heights.

It is proposed to construct a three-stage outlet for the stormwater management facility as shown in Figure 5. The first stage of control consists of a reverse slope pipe acting as a 150mm 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 complete the third stage providing an outlet for flows exceeding the capacity of the ditch inlet catch basin and outlet pipe during extreme storm events.

The proposed effective bottom elevation of the facility is 173.85m, and the permanent pool water level is 174.85m for a water depth of 1.0 metre. The configuration of the facility provides 1,693m^3 of permanent pool volume, which is more than the required 1,149m^3. The ditch inlet will be constructed at an elevation of 175.60m providing an extended detention of 2,746m^3, greater than the 511m^3 required. The proposed top of pond is at an elevation of 176.85m which will provide a total active volume of 9,663m^3.

Based on the configuration of the proposed facility, it was determined that a 150mm diameter quality orifice shall provide approximately 28 hours of detention for the 25mm design storm event (24 hours is the minimum).

The outflow pipe from the stormwater management facility is to be 450mm in diameter and will convey stormwater flows from the ditch inlet and quality pipe to 1500mm diameter storm sewer which will be constructed immediately north of the SWM Facility as part of the Meadow Heights Subdivision stormwater outlet. A stage-storage-discharge relationship was determined for the facility and is included in Appendix A for reference purposes.

As the facility will be discharging flows from multiple areas, a comparison of flows from existing to future conditions for specifically the Rosedale Subdivision development will not be attainable. Therefore, Table 6 below outlines the characteristics of the SWM facility during all storm events, though Table 7 on the following page outlines the overall peak stormwater flows discharging to the Biederman Drain.

Table 6. Stormwater Management Wet Pond Facility Characteristics

Design Storm (Return Period)	Peak Flows (m^3/s)		Maximum Elevation	Maximum Volume (m^3)
	Inflow	Outflow		
25mm	0.821	0.028	175.31	1,562
2 Year	1.342	0.040	175.59	2,711
5 Year	1.643	0.072	175.73	3,327
10 Year	1.991	0.083	175.87	4,001
25 Year	2.918	0.083	176.11	5,254
50 Year	3.610	0.083	176.29	6,247
100 Year	4.562	0.083	176.52	7,568

Based on the MIDUSS model, Table 6 shows the maximum wet pond elevation of 176.52m, and an active storage volume of 7,568 m^3 for the 100-year design storm event. Therefore, as the SWM facility has a top elevation of 176.85m, a freeboard of 0.33m will be provided by this Stormwater Management Plan.

During all storm events, stormwater flows from the development area are ultimately conveyed towards Outlet ‘A’ (West Side Road, MTO road allowance) under existing conditions. An emergency overflow spillway has been included as part of the SWM Facility design, discharging flows towards the West Side Road MTO road allowance. However, due to the size of the SWM Facility, no stormwater flows will be conveyed to the MTO road allowance as part of Outlet ‘A’ (West Side Road) during any of the modelled storm events.

The storm sewer system immediately downstream of the SWM facility outlet to the Biederman Drain was designed to convey peak stormwater flows up to and including the 5-year design storm event. During the 5-year event, the Rosedale SWM Facility will discharge approximately 72L/s to the downstream storm sewer system according to the MIDUSS modelling. As part of the design of this storm sewer, a conservatively increased flow allocation from the Rosedale SWM Facility of 100L/s was included in the calculations to ensure sufficient capacity was provided. With this allocation, the sewers experience flows reaching approximately 87% of their capacity during the 5-year event.

During events greater than the 5-year storm event, it has been conservatively assumed that storm sewers can accommodate flow at an additional 15% on top of their full flow capacity due to surcharged conditions. Therefore, for the purpose of modelling the stormwater management facility, a maximum discharge rate of 83 L/s (72L/s + 15%) has been utilized for flows being discharged at the outlet pipe. Additional outflow capacity is included once stormwater flows within the SWM facility reach the spillway elevation of 176.65m.

Table 7 details the difference in peak stormwater flows ultimately discharging to the Biederman Drain at Outlet A under existing conditions as well as to the Biederman Drain at Stonebridge Drive (Outlet C) under future conditions with the stormwater management facility in place.

Table 7. Impacts of Wet Pond Facility on Peak Flows to Biederman Drain

Design Storm	Peak Flow (m^3/s)		
	Existing	**Future with SWM**	**Change***
2 Year	1.512	1.512	0.0%
5 Year	2.224	2.206	- 0.8%
10 Year	2.707	2.540	- 6.2%
25 Year	3.340	2.545	- 23.8%
50 Year	3.824	2.590	-32.3%
100 Year	4.585	2.589	- 43.5%

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

Therefore, as outlined in Table 7 above, stormwater flows discharging to the Biederman Drain will remain relatively unchanged during storm events up to and including the 5-year event, and experience significant peak flow reductions as a result of the proposed stormwater management plan during storms greater than the 5-year event. As discussed previously, it should be noted again that overland flows from the adjacent Meadow Heights Subdivision during storms greater than the 5-year event will be directed to the Rosedale SWM Facility and ultimately be provided quantity controls as a result.

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 to localize maintenance activities. Calculations for the forebay sizing follow MECP Guidelines and are shown in Tables 8 for the storm sewer outlet.

Table 8. 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 =	2.3	:1	(Length:Width Ratio)
Q_p =	0.03	m^3/s	(25mm Storm Pond Discharge)
V_s =	0.0003	m/s	(Settling Velocity)

Settling Length = **15.22 m**

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

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

Q =	1.643	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 = **17.53 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

17.53 m (minimum required length)

Width = **2.19 m** (minimum required width)

d) Average Velocity of Flow

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

Q =	0.839	m^3/s	(Quality Design Inflow)
A =	21.00	m^2	(Cross Sectional Area)
D =	1.50	m	(Depth of Forebay)
W =	9.50	m	(Proposed Bottom Width)
S =	3	:1	(Side slopes - minimum)

Average Velocity = **0.04 m/s**

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

e) Cleanout Frequency

Is this Acceptable? **Yes**

L =	22.0	m	(Proposed Bottom Length)
ASL =	2.8	m^3/ha	(Annual Sediment Loading)
A =	12.77	ha	(Drainage Area)
FRC =	70	%	(Facility Removal Efficiency)
FV =	586.9	m^3	(Forebay Volume)

Cleanout Frequency = **11.5 years**

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

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 Biederman Drain.

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.

8.0 CONCLUSIONS AND RECOMMENDATIONS

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

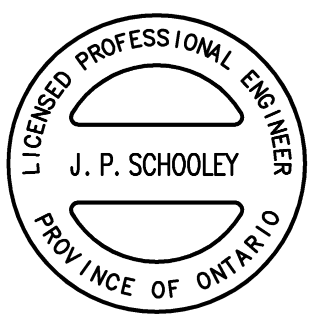
- Infiltration techniques are not suitable for this site as the primary control facility due to the low soil infiltration rates and the large drainage area for this development.
- The proposed stormwater management facility will provide stormwater quality controls for the proposed Rosedale Subdivision and quantity controls for the Rosedale Subdivision as well as the adjacent Meadow Heights Subdivision during larger storm events.
- 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 a stormwater management wet pond facility be constructed to provide stormwater quality protection to MECP *Normal* Protection levels and quantity controls as outlined in this report.
- That additional lot level controls and vegetative stormwater management practices as described previously in this report be implemented.

Prepared By:

Kurt Tiessen, E.I.T.



Reviewed By:

Jason Schooley, P.Eng.
November 23, 2023

APPENDICES

APPENDIX A

Stormwater Management Facility Calculations

Upper Canada Consultants
30 HANNOVER DRIVE, UNIT 3
St. Catharines, Ontario L2W 1A3 **DATE: SEPTEMBER 2023**
PROJECT NAME: ROSEDALE SUBDIVISION
PROJECT NO.: 5331

STORMWATER MANAGEMENT FACILITY WETPOND

Quality Requirements		**Quality Orifice**	**Ditch Inlet Weir**	**Outflow Pipe Orifice**	**Overflow Spillway**
Drainage Area (ha) = 12.77		Diameter (m) = 0.150	Length (m) = 0.60	Diameter (m) = 0.450	Minor Length (m) = 3.00
Normal (m^3/ha) = 130	(@ 70%)	Cd = 0.63	Width (m) = 0.60	Cd = 0.63	Slopes (X:1) = 3.00
Perm Pool (m^3/ha) = 90		Invert (m) = 174.85	Grate Slope (X:1) = 4	Invert (m) = 174.85	Minor Invert (m) = 176.65
Perm Pool Vol (m^3) = 1,149			Inlet Elevation (m) = 175.60	Overt (m) = 175.30	Major Length (m) = 0.00
Active Vol (m^3) 511			Cd = 1.84		Major Invert (m) = 176.85
25mm MOEE (m^3)	m^3				
Perm. Pool Elev. = 174.85	m				

MOE Equation 4.10 Drawdown Coefficient 'C2' = 1,945
MOE Equation 4.10 Drawdown Coefficient 'C3' = 2,939
MOE Equation 4.10 Drawdown Time (h) = **28.7**

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)**	**Max Outflow (5yr+15%) (m^3/s)**	**Overflow Spillway (m^3/s)**	**Total Outflow (m^3/s)**	**Average Discharge (m^3/s)**	**Side Slope (H:V)**
173.85		-1.00	1,077			0									
	0.50			1,380	690										
174.35		-0.50	1,683			690									
	0.50			2,006	1,003										
174.85		0.00	**2,329**			1,693									PERM
	0.00			2,634	0									0.00	
174.85		0.00	2,939				0.0	0.000	0.000	0.00		0.00	0.00		PERM
	0.50			3,425	1,713									0.016	5:1
175.35		0.50	3,911				1712.6	0.031	0.000	0.198		0.000	0.031		
	0.25			4,135	1,034									0.024	5:1
175.60		0.75	4,359				2746.4	0.040	0.000	0.298		0.000	0.040		
	0.16			4,505	721									0.067	5:1
175.76		0.91	4,651				3467.2	0.044	0.035	0.347		0.000	0.080		
	0.09			4,734	426									0.081	5:1
175.85		1.00	4,817				3893.3	0.047	0.069	0.371	0.083	0.000	0.083		
	0.50			5,289	2,645									0.083	5:1
176.35		1.50	5,762				6538.0	0.058	0.359	0.486	0.083	0.000	0.083		
	0.30			6,055	1,816									0.083	5:1
176.65		1.80	6,348				8354.4	0.064	0.594	0.544	0.083	0.000	0.083		
	0.10			6,447	645									0.158	5:1
176.75		1.90	6,546				8999.1	0.066	0.681	0.561	0.083	0.150	0.233		
	0.10			6,646	665									0.353	5:1
176.85		2.00	**6,746**				9663.7	0.068	0.771	0.579	0.083	0.390	0.473		

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.

APPENDIX B

MIDUSS Output Files

Existing Conditions

```
         Output File (4.7) EX.OUT      opened 2023-09-22   9:56
         Units used are defined by G =    9.810
            24  144   10.000       are MAXDT MAXHYD & DTMIN values
         Licensee: UPPER CANADA CONSULTANTS
   35    COMMENT
        4    line(s) of comment
         ROSEDALE SUBDIVISION
         STORMWATER MANAGEMENT PLAN
         EXISTING CONDITIONS TO BIEDERMAN DRAIN
         OCTOBER 2022
   35    COMMENT
        1    line(s) of comment
         UTILIZED FULL SITE AREA
   14    START
        1    1=Zero; 2=Define
   35    COMMENT
        3    line(s) of comment
         ***************************
         * 25MM DESIGN 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  240 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
   35    COMMENT
        1    line(s) of comment
         *** ROSEDALE - DRAINAGE AREA EX  ***
    4    CATCHMENT
        1.000    ID No.ó 99999
       12.770    Area in hectares
      400.000    Length (PERV) metres
        2.000    Gradient (%)
         .500    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
              .024      .000      .000      .000 c.m/s
              .130      .799      .134    C perv/imperv/total
   27    HYDROGRAPH DISPLAY
        4    is # of Hyeto/Hydrograph chosen
         Volume  =  .4272098E+03 c.m
   15    ADD RUNOFF
              .024      .024      .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
              .024      .024      .024      .000 c.m/s
   17    COMBINE
        3    Junction Node No.
              .024      .024      .024      .024 c.m/s
   14    START
        1    1=Zero; 2=Define
   35    COMMENT
        1    line(s) of comment
         *** FIELD - DRAINAGE AREA FX  ***
    4    CATCHMENT
        1.000    ID No.ó 99999
        3.440    Area in hectares
      150.000    Length (PERV) metres
        1.000    Gradient (%)
         .500    Per cent Impervious
      150.000    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
              .009      .000      .024      .024 c.m/s
              .130      .804      .134    C perv/imperv/total
   15    ADD RUNOFF
              .009      .009      .024      .024 c.m/s
   11    CHANNEL
         .300    Base Width    =
        3.000    Left  bank slope  1:
        3.000    Right bank slope  1:
         .030    Manning's "n"
         .500    O/a Depth in metres
        1.000    Select Grade in %
         Depth        =     .052 metres
         Velocity     =     .373 m/sec
         Flow Capacity  =    1.222 c.m/s
         Critical depth =     .039 metres
    9    ROUTE
      400.000    Conduit Length
         .493    Supply X-factor <.5
      401.782    Supply K-lag (sec)
         .500    Beta weighting factor
      600.000    Routing timestep
            2    No. of sub-reaches
              .009      .009      .009      .024 c.m/s
   16    NEXT LINK
              .009      .009      .009      .024 c.m/s
   35    COMMENT
        1    line(s) of comment
         *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
    4    CATCHMENT
        1.000    ID No.ó 99999
       10.840    Area in hectares
      300.000    Length (PERV) metres
        1.000    Gradient (%)
       25.000    Per cent Impervious
      300.000    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
              .248      .009      .009      .024 c.m/s
              .130      .802      .298    C perv/imperv/total
   15    ADD RUNOFF
              .248      .249      .009      .024 c.m/s
   11    CHANNEL
         .300    Base Width    =
        3.000    Left  bank slope  1:
        3.000    Right bank slope  1:
         .030    Manning's "n"
         .500    O/a Depth in metres
        1.000    Select Grade in %
         Depth        =     .256 metres
         Velocity     =     .909 m/sec
         Flow Capacity  =    1.222 c.m/s
         Critical depth =     .224 metres
    9    ROUTE
      200.000    Conduit Length
         .472    Supply X-factor <.5
      164.970    Supply K-lag (sec)
         .500    Beta weighting factor
      150.000    Routing timestep
            1    No. of sub-reaches
              .248      .249      .207      .024 c.m/s
   16    NEXT LINK
              .248      .207      .207      .024 c.m/s
   35    COMMENT
        1    line(s) of comment
         *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
    4    CATCHMENT
        1.000    ID No.ó 99999
       29.250    Area in hectares
      500.000    Length (PERV) metres
        2.000    Gradient (%)
       35.700    Per cent Impervious
      500.000    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
              .928      .207      .207      .024 c.m/s
              .130      .806      .372    C perv/imperv/total
   15    ADD RUNOFF
              .928     1.135      .207      .024 c.m/s
   27    HYDROGRAPH DISPLAY
        5    is # of Hyeto/Hydrograph chosen
         Volume  =  .3644621E+04 c.m
    8    PIPE
         .500    Minimum velocity  m/sec
        2.920    Maximum velocity  m/sec
         .013    Pipe Manning's 'n'
        1.350    Diameter in metres
         .600    Select Grade in %
         Depth        =     .484 metres
         Velocity     =    2.464 m/sec
         Pipe Capacity =    4.134 c.m/s
         Critical depth=     .558 metres
    9    ROUTE
      500.000    Conduit Length
         .455    Supply X-factor <.5
      152.187    Supply K-lag (sec)
         .500    Beta weighting factor
      150.000    Routing timestep
            1    No. of sub-reaches
              .928     1.135      .943      .024 c.m/s
   17    COMBINE
        3    Junction Node No.
              .928     1.135      .943      .951 c.m/s
   18    CONFLUENCE
        3    Junction Node No.
              .928      .951      .943      .000 c.m/s
   27    HYDROGRAPH DISPLAY
        5    is # of Hyeto/Hydrograph chosen
         Volume  =  .4069800E+04 c.m
   14    START
        1    1=Zero; 2=Define
   35    COMMENT
        3    line(s) of comment
         *********************************
         * MTO 2 YEAR DESIGN STORM EVENT *
         *********************************
    2    STORM
            1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      397.149    Coefficient  a
         .000    Constant  b   (min)
         .699    Exponent  c
         .450    Fraction to peak  r
      240.000    Duration ó  240 min
              34.451 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
         *** ROSEDALE - DRAINAGE AREA EX  ***
    4    CATCHMENT
        1.000    ID No.ó 99999
       12.770    Area in hectares
      400.000    Length (PERV) metres
        2.000    Gradient (%)
         .500    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
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      .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
           .063      .000      .943      .000 c.m/s
           .204      .850      .207    C perv/imperv/total
27    HYDROGRAPH DISPLAY
    4     is # of Hyeto/Hydrograph chosen
     Volume  =  .9111658E+03 c.m
15    ADD RUNOFF
           .063      .063      .943      .000 c.m/s
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1     No. of sub-reaches
           .063      .063      .063      .000 c.m/s
17    COMBINE
    3     Junction Node No.
           .063      .063      .063      .063 c.m/s
14    START
    1     1=Zero; 2=Define
35    COMMENT
    1     line(s) of comment
     *** FIELD - DRAINAGE AREA FX  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
     3.440    Area in hectares
   150.000    Length (PERV) metres
     1.000    Gradient (%)
      .500    Per cent Impervious
   150.000    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
           .023      .000      .063      .063 c.m/s
           .204      .841      .207    C perv/imperv/total
15    ADD RUNOFF
           .023      .023      .063      .063 c.m/s
11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth         =      .084 metres
     Velocity      =      .488 m/sec
     Flow Capacity  =    1.222 c.m/s
     Critical depth =      .067 metres
 9    ROUTE
   400.000    Conduit Length
      .489    Supply X-factor <.5
   307.501    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        2     No. of sub-reaches
           .023      .023      .023      .063 c.m/s
16    NEXT LINK
           .023      .023      .023      .063 c.m/s
35    COMMENT
    1     line(s) of comment
     *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    10.840    Area in hectares
   300.000    Length (PERV) metres
     1.000    Gradient (%)
    25.000    Per cent Impervious
   300.000    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
           .367      .023      .023      .063 c.m/s
           .204      .849      .365    C perv/imperv/total
15    ADD RUNOFF
           .367      .370      .023      .063 c.m/s
11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth         =      .304 metres
     Velocity      =    1.006 m/sec
     Flow Capacity  =    1.222 c.m/s
     Critical depth =      .270 metres
 9    ROUTE
   200.000    Conduit Length
      .468    Supply X-factor <.5
   149.160    Supply K-lag (sec)
      .500    Beta weighting factor
   150.000    Routing timestep
        1     No. of sub-reaches
           .367      .370      .325      .063 c.m/s
16    NEXT LINK
           .367      .325      .325      .063 c.m/s
35    COMMENT
    1     line(s) of comment
     *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    29.250    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
    35.700    Per cent Impervious
   500.000    Length (IMPERV)
      .000    %Imp. with Zero Dpth
        1     Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
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      .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
          1.385      .325      .325      .063 c.m/s
           .204      .841      .431    C perv/imperv/total
15    ADD RUNOFF
          1.385     1.710      .325      .063 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .5955855E+04 c.m
 8    PIPE
      .500    Minimum velocity  m/sec
     2.920    Maximum velocity  m/sec
      .013    Pipe Manning's 'n'
     1.350    Diameter in metres
      .600    Select Grade in %
     Depth        =      .605 metres
     Velocity     =     2.750 m/sec
     Pipe Capacity =    4.134 c.m/s
     Critical depth=      .692 metres
 9    ROUTE
   500.000    Conduit Length
      .442    Supply X-factor <.5
   136.363    Supply K-lag (sec)
      .500    Beta weighting factor
   150.000    Routing timestep
        1     No. of sub-reaches
          1.385     1.710     1.493      .063 c.m/s
17    COMBINE
    3     Junction Node No.
          1.385     1.710     1.493     1.512 c.m/s
18    CONFLUENCE
    3     Junction Node No.
          1.385     1.512     1.493      .000 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .6864000E+04 c.m
14    START
    1     1=Zero; 2=Define
35    COMMENT
    3     line(s) of comment
     *********************************
     * MTO 5 YEAR DESIGN STORM EVENT *
     *********************************
 2    STORM
        1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   524.867    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .450    Fraction to peak  r
   240.000    Duration ó  240 min
          45.530 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
     *** ROSEDALE - DRAINAGE AREA EX  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    12.770    Area in hectares
   400.000    Length (PERV) metres
     2.000    Gradient (%)
      .500    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
           .147      .000     1.493      .000 c.m/s
           .278      .883      .281    C perv/imperv/total
27    HYDROGRAPH DISPLAY
    4     is # of Hyeto/Hydrograph chosen
     Volume  =  .1632299E+04 c.m
15    ADD RUNOFF
           .147      .147     1.493      .000 c.m/s
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1     No. of sub-reaches
           .147      .147      .147      .000 c.m/s
17    COMBINE
    3     Junction Node No.
           .147      .147      .147      .147 c.m/s
14    START
    1     1=Zero; 2=Define
35    COMMENT
    1     line(s) of comment
     *** FIELD - DRAINAGE AREA FX  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
     3.440    Area in hectares
   150.000    Length (PERV) metres
     1.000    Gradient (%)
      .500    Per cent Impervious
   150.000    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
           .055      .000      .147      .147 c.m/s
           .278      .859      .280    C perv/imperv/total
15    ADD RUNOFF
           .055      .055      .147      .147 c.m/s
11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
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     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth        =     .129 metres
     Velocity     =     .616 m/sec
     Flow Capacity =    1.222 c.m/s
     Critical depth =     .106 metres
  9    ROUTE
   400.000    Conduit Length
      .492    Supply X-factor <.5
   487.040    Supply K-lag (sec)
      .500    Beta weighting factor
   300.000    Routing timestep
       1    No. of sub-reaches
          .055      .055      .053      .147 c.m/s
 16    NEXT LINK
          .055      .053      .053      .147 c.m/s
 35    COMMENT
    1    line(s) of comment
    *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4    CATCHMENT
     1.000    ID No.ó 99999
    10.840    Area in hectares
   300.000    Length (PERV) metres
     1.000    Gradient (%)
    25.000    Per cent Impervious
   300.000    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
          .515      .053      .053      .147 c.m/s
          .278      .884      .429    C perv/imperv/total
 15    ADD RUNOFF
          .515      .525      .053      .147 c.m/s
 11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth        =     .352 metres
     Velocity     =    1.098 m/sec
     Flow Capacity =    1.222 c.m/s
     Critical depth =     .317 metres
  9    ROUTE
   200.000    Conduit Length
      .463    Supply X-factor <.5
   136.564    Supply K-lag (sec)
      .500    Beta weighting factor
   120.000    Routing timestep
       1    No. of sub-reaches
          .515      .525      .476      .147 c.m/s
 16    NEXT LINK
          .515      .476      .476      .147 c.m/s
 35    COMMENT
    1    line(s) of comment
    *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4    CATCHMENT
     1.000    ID No.ó 99999
    29.250    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
    35.700    Per cent Impervious
   500.000    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
         1.941      .476      .476      .147 c.m/s
          .278      .882      .493    C perv/imperv/total
 15    ADD RUNOFF
         1.941     2.416      .476      .147 c.m/s
 27    HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .9128701E+04 c.m
  8    PIPE
      .500    Minimum velocity  m/sec
     2.920    Maximum velocity  m/sec
      .013    Pipe Manning's 'n'
     1.350    Diameter in metres
      .600    Select Grade in %
     Depth        =     .741 metres
     Velocity     =    3.000 m/sec
     Pipe Capacity =    4.134 c.m/s
     Critical depth=     .829 metres
  9    ROUTE
   500.000    Conduit Length
      .424    Supply X-factor <.5
   124.986    Supply K-lag (sec)
      .500    Beta weighting factor
   120.000    Routing timestep
       1    No. of sub-reaches
         1.941     2.416     2.180      .147 c.m/s
 17    COMBINE
    3    Junction Node No.
         1.941     2.416     2.180     2.224 c.m/s
 18    CONFLUENCE
    3    Junction Node No.
         1.941     2.224     2.180      .000 c.m/s
 27    HYDROGRAPH DISPLAY
    5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1075680E+05 c.m
 14    START
    1    1=Zero; 2=Define
 35    COMMENT
    3    line(s) of comment
    *********************************
    * MTO 10 YEAR DESIGN STORM EVENT *
    *********************************
  2    STORM
       1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   608.845    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .450    Fraction to peak  r
   240.000    Duration ó  240 min
            52.815 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
    *** ROSEDALE - DRAINAGE AREA EX  ***
  4    CATCHMENT
     1.000    ID No.ó 99999
    12.770    Area in hectares
   400.000    Length (PERV) metres
     2.000    Gradient (%)
      .500    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
          .225      .000     2.180      .000 c.m/s
          .320      .897      .322    C perv/imperv/total
 27    HYDROGRAPH DISPLAY
    4    is # of Hyeto/Hydrograph chosen
     Volume  =  .2174500E+04 c.m
 15    ADD RUNOFF
          .225      .225     2.180      .000 c.m/s
  9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
       1    No. of sub-reaches
          .225      .225      .225      .000 c.m/s
 17    COMBINE
    3    Junction Node No.
          .225      .225      .225      .225 c.m/s
 14    START
    1    1=Zero; 2=Define
 35    COMMENT
    1    line(s) of comment
    *** FIELD - DRAINAGE AREA FX  ***
  4    CATCHMENT
     1.000    ID No.ó 99999
     3.440    Area in hectares
   150.000    Length (PERV) metres
     1.000    Gradient (%)
      .500    Per cent Impervious
   150.000    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      .225      .225 c.m/s
          .320      .878      .322    C perv/imperv/total
 15    ADD RUNOFF
          .079      .079      .225      .225 c.m/s
 11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth        =     .154 metres
     Velocity     =     .679 m/sec
     Flow Capacity =    1.222 c.m/s
     Critical depth =     .129 metres
  9    ROUTE
   400.000    Conduit Length
      .491    Supply X-factor <.5
   441.992    Supply K-lag (sec)
      .500    Beta weighting factor
   300.000    Routing timestep
       1    No. of sub-reaches
          .079      .079      .077      .225 c.m/s
 16    NEXT LINK
          .079      .077      .077      .225 c.m/s
 35    COMMENT
    1    line(s) of comment
    *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4    CATCHMENT
     1.000    ID No.ó 99999
    10.840    Area in hectares
   300.000    Length (PERV) metres
     1.000    Gradient (%)
    25.000    Per cent Impervious
   300.000    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
          .613      .077      .077      .225 c.m/s
          .320      .897      .464    C perv/imperv/total
 15    ADD RUNOFF
          .613      .632      .077      .225 c.m/s
 11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth        =     .381 metres
     Velocity     =    1.150 m/sec
     Flow Capacity =    1.222 c.m/s
```

```
     Critical depth =     .344 metres
  9   ROUTE
    200.000    Conduit Length
       .460    Supply X-factor <.5
    130.387    Supply K-lag (sec)
       .500    Beta weighting factor
    120.000    Routing timestep
         1     No. of sub-reaches
             .613      .632      .579      .225 c.m/s
 16   NEXT LINK
             .613      .579      .579      .225 c.m/s
 35   COMMENT
     1    line(s) of comment
     *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4   CATCHMENT
      1.000    ID No.ó 99999
     29.250    Area in hectares
    500.000    Length (PERV) metres
      2.000    Gradient (%)
     35.700    Per cent Impervious
    500.000    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
           2.305      .579      .579      .225 c.m/s
             .320      .898      .526    C perv/imperv/total
 15   ADD RUNOFF
           2.305     2.884      .579      .225 c.m/s
 27   HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1137058E+05 c.m
  8   PIPE
       .500    Minimum velocity  m/sec
      2.920    Maximum velocity  m/sec
       .013    Pipe Manning's 'n'
      1.350    Diameter in metres
       .600    Select Grade in %
     Depth        =     .830 metres
     Velocity     =    3.123 m/sec
     Pipe Capacity =    4.134 c.m/s
     Critical depth=     .908 metres
  9   ROUTE
    500.000    Conduit Length
       .407    Supply X-factor <.5
    120.096    Supply K-lag (sec)
       .500    Beta weighting factor
    120.000    Routing timestep
         1     No. of sub-reaches
           2.305     2.884     2.637      .225 c.m/s
 17   COMBINE
     3    Junction Node No.
           2.305     2.884     2.637     2.707 c.m/s
 18   CONFLUENCE
     3    Junction Node No.
           2.305     2.707     2.637      .000 c.m/s
 27   HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1353900E+05 c.m
 14   START
     1    1=Zero; 2=Define
 35   COMMENT
     3    line(s) of comment
     **********************************
     * MTO 25 YEAR DESIGN STORM EVENT *
     **********************************
  2   STORM
         1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    715.568    Coefficient  a
       .000    Constant  b   (min)
       .699    Exponent  c
       .450    Fraction to peak  r
    240.000    Duration ó  240 min
               62.073 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
     *** ROSEDALE - DRAINAGE AREA EX  ***
  4   CATCHMENT
      1.000    ID No.ó 99999
     12.770    Area in hectares
    400.000    Length (PERV) metres
      2.000    Gradient (%)
       .500    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
             .331      .000     2.637      .000 c.m/s
             .367      .910      .370    C perv/imperv/total
 27   HYDROGRAPH DISPLAY
     4    is # of Hyeto/Hydrograph chosen
     Volume  =  .2929079E+04 c.m
 15   ADD RUNOFF
             .331      .331     2.637      .000 c.m/s
  9   ROUTE
       .000    Conduit Length
       .500    Supply X-factor <.5
       .000    Supply K-lag (sec)
       .500    Beta weighting factor
    600.000    Routing timestep
         1     No. of sub-reaches
             .331      .331      .331      .000 c.m/s
 17   COMBINE
     3    Junction Node No.
             .331      .331      .331      .331 c.m/s
 14   START
     1    1=Zero; 2=Define
 35   COMMENT
     1    line(s) of comment
     *** FIELD - DRAINAGE AREA FX  ***
  4   CATCHMENT
      1.000    ID No.ó 99999
      3.440    Area in hectares
    150.000    Length (PERV) metres
      1.000    Gradient (%)
       .500    Per cent Impervious
    150.000    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
             .127      .000      .331      .331 c.m/s
             .367      .898      .369    C perv/imperv/total
 15   ADD RUNOFF
             .127      .127      .331      .331 c.m/s
 11   CHANNEL
       .300    Base Width    =
      3.000    Left  bank slope  1:
      3.000    Right bank slope  1:
       .030    Manning's "n"
       .500    O/a Depth in metres
      1.000    Select Grade in %
     Depth        =     .190 metres
     Velocity      =     .766 m/sec
     Flow Capacity  =    1.222 c.m/s
     Critical depth =     .162 metres
  9   ROUTE
    400.000    Conduit Length
       .489    Supply X-factor <.5
    391.534    Supply K-lag (sec)
       .500    Beta weighting factor
    300.000    Routing timestep
         1     No. of sub-reaches
             .127      .127      .122      .331 c.m/s
 16   NEXT LINK
             .127      .122      .122      .331 c.m/s
 35   COMMENT
     1    line(s) of comment
     *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4   CATCHMENT
      1.000    ID No.ó 99999
     10.840    Area in hectares
    300.000    Length (PERV) metres
      1.000    Gradient (%)
     25.000    Per cent Impervious
    300.000    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
             .742      .122      .122      .331 c.m/s
             .367      .911      .503    C perv/imperv/total
 15   ADD RUNOFF
             .742      .775      .122      .331 c.m/s
 11   CHANNEL
       .300    Base Width    =
      3.000    Left  bank slope  1:
      3.000    Right bank slope  1:
       .030    Manning's "n"
       .500    O/a Depth in metres
      1.000    Select Grade in %
     Depth        =     .415 metres
     Velocity      =    1.211 m/sec
     Flow Capacity  =    1.222 c.m/s
     Critical depth =     .377 metres
  9   ROUTE
    200.000    Conduit Length
       .457    Supply X-factor <.5
    123.848    Supply K-lag (sec)
       .500    Beta weighting factor
    120.000    Routing timestep
         1     No. of sub-reaches
             .742      .775      .720      .331 c.m/s
 16   NEXT LINK
             .742      .720      .720      .331 c.m/s
 35   COMMENT
     1    line(s) of comment
     *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4   CATCHMENT
      1.000    ID No.ó 99999
     29.250    Area in hectares
    500.000    Length (PERV) metres
      2.000    Gradient (%)
     35.700    Per cent Impervious
    500.000    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
           2.767      .720      .720      .331 c.m/s
             .367      .911      .561    C perv/imperv/total
 15   ADD RUNOFF
           2.767     3.486      .720      .331 c.m/s
 27   HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
     Volume  =  .1435864E+05 c.m
  8   PIPE
       .500    Minimum velocity  m/sec
      2.920    Maximum velocity  m/sec
       .013    Pipe Manning's 'n'
      1.350    Diameter in metres
       .600    Select Grade in %
     Depth        =     .950 metres
     Velocity     =    3.238 m/sec
     Pipe Capacity =    4.134 c.m/s
     Critical depth=     .999 metres
  9   ROUTE
    500.000    Conduit Length
       .377    Supply X-factor <.5
    115.797    Supply K-lag (sec)
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      .500    Beta weighting factor
   120.000    Routing timestep
        1    No. of sub-reaches
          2.767     3.486     3.226      .331 c.m/s
17    COMBINE
     3    Junction Node No.
          2.767     3.486     3.226     3.340 c.m/s
18    CONFLUENCE
     3    Junction Node No.
          2.767     3.340     3.226      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .1728300E+05 c.m
14    START
     1    1=Zero; 2=Define
35    COMMENT
     3    line(s) of comment
      **********************************
      * MTO 50 YEAR DESIGN STORM EVENT *
      **********************************
 2    STORM
        1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   794.298    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .450    Fraction to peak  r
   240.000    Duration ó  240 min
           68.903 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
      *** ROSEDALE - DRAINAGE AREA EX  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    12.770    Area in hectares
   400.000    Length (PERV) metres
     2.000    Gradient (%)
      .500    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
           .431      .000     3.226      .000 c.m/s
           .398      .915      .400    C perv/imperv/total
27    HYDROGRAPH DISPLAY
     4    is # of Hyeto/Hydrograph chosen
      Volume  =  .3521674E+04 c.m
15    ADD RUNOFF
           .431      .431     3.226      .000 c.m/s
 9    ROUTE
      .000    Conduit Length
      .500    Supply X-factor <.5
      .000    Supply K-lag (sec)
      .500    Beta weighting factor
   600.000    Routing timestep
        1    No. of sub-reaches
           .431      .431      .431      .000 c.m/s
17    COMBINE
     3    Junction Node No.
           .431      .431      .431      .431 c.m/s
14    START
     1    1=Zero; 2=Define
35    COMMENT
     1    line(s) of comment
      *** FIELD - DRAINAGE AREA FX  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
     3.440    Area in hectares
   150.000    Length (PERV) metres
     1.000    Gradient (%)
      .500    Per cent Impervious
   150.000    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
           .161      .000      .431      .431 c.m/s
           .397      .909      .400    C perv/imperv/total
15    ADD RUNOFF
           .161      .161      .431      .431 c.m/s
11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth        =     .211 metres
     Velocity      =     .814 m/sec
     Flow Capacity  =    1.222 c.m/s
     Critical depth =     .182 metres
 9    ROUTE
   400.000    Conduit Length
      .488    Supply X-factor <.5
   368.744    Supply K-lag (sec)
      .500    Beta weighting factor
   300.000    Routing timestep
        1    No. of sub-reaches
           .161      .161      .154      .431 c.m/s
16    NEXT LINK
           .161      .154      .154      .431 c.m/s
35    COMMENT
     1    line(s) of comment
      *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    10.840    Area in hectares
   300.000    Length (PERV) metres
     1.000    Gradient (%)
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    25.000    Per cent Impervious
   300.000    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
           .841      .154      .154      .431 c.m/s
           .397      .917      .527    C perv/imperv/total
15    ADD RUNOFF
           .841      .888      .154      .431 c.m/s
11    CHANNEL
      .300    Base Width    =
     3.000    Left  bank slope  1:
     3.000    Right bank slope  1:
      .030    Manning's "n"
      .500    O/a Depth in metres
     1.000    Select Grade in %
     Depth        =     .439 metres
     Velocity      =    1.253 m/sec
     Flow Capacity  =    1.222 c.m/s
     Critical depth =     .400 metres
 9    ROUTE
   200.000    Conduit Length
      .455    Supply X-factor <.5
   119.694    Supply K-lag (sec)
      .500    Beta weighting factor
   120.000    Routing timestep
        1    No. of sub-reaches
           .841      .888      .829      .431 c.m/s
16    NEXT LINK
           .841      .829      .829      .431 c.m/s
35    COMMENT
     1    line(s) of comment
      *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    29.250    Area in hectares
   500.000    Length (PERV) metres
     2.000    Gradient (%)
    35.700    Per cent Impervious
   500.000    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
          3.111      .829      .829      .431 c.m/s
           .397      .919      .584    C perv/imperv/total
15    ADD RUNOFF
          3.111     3.940      .829      .431 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .1664564E+05 c.m
 8    PIPE
      .500    Minimum velocity  m/sec
     2.920    Maximum velocity  m/sec
      .013    Pipe Manning's 'n'
     1.350    Diameter in metres
      .600    Select Grade in %
     Depth       =    1.053 metres
     Velocity     =    3.288 m/sec
     Pipe Capacity =    4.134 c.m/s
     Critical depth=    1.060 metres
 9    ROUTE
   500.000    Conduit Length
      .344    Supply X-factor <.5
   114.065    Supply K-lag (sec)
      .500    Beta weighting factor
   120.000    Routing timestep
        1    No. of sub-reaches
          3.111     3.940     3.669      .431 c.m/s
17    COMBINE
     3    Junction Node No.
          3.111     3.940     3.669     3.824 c.m/s
18    CONFLUENCE
     3    Junction Node No.
          3.111     3.824     3.669      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .2016420E+05 c.m
14    START
     1    1=Zero; 2=Define
35    COMMENT
     3    line(s) of comment
      ***********************************
      * MTO 100 YEAR DESIGN STORM EVENT *
      ***********************************
 2    STORM
        1    1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
   871.279    Coefficient  a
      .000    Constant  b   (min)
      .699    Exponent  c
      .450    Fraction to peak  r
   240.000    Duration ó  240 min
           75.581 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
      *** ROSEDALE - DRAINAGE AREA EX  ***
 4    CATCHMENT
     1.000    ID No.ó 99999
    12.770    Area in hectares
   400.000    Length (PERV) metres
     2.000    Gradient (%)
      .500    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
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      7.587    Initial Abstraction
         1    Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
            .550      .000     3.669      .000 c.m/s
            .425      .919      .427    C perv/imperv/total
27    HYDROGRAPH DISPLAY
     4    is # of Hyeto/Hydrograph chosen
      Volume  =  .4124768E+04 c.m
15    ADD RUNOFF
            .550      .550     3.669      .000 c.m/s
 9    ROUTE
       .000    Conduit Length
       .500    Supply X-factor <.5
       .000    Supply K-lag (sec)
       .500    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
            .550      .550      .550      .000 c.m/s
17    COMBINE
     3    Junction Node No.
            .550      .550      .550      .550 c.m/s
14    START
     1    1=Zero; 2=Define
35    COMMENT
     1    line(s) of comment
      *** FIELD - DRAINAGE AREA FX  ***
 4    CATCHMENT
      1.000    ID No.ó 99999
      3.440    Area in hectares
    150.000    Length (PERV) metres
      1.000    Gradient (%)
       .500    Per cent Impervious
    150.000    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
            .196      .000      .550      .550 c.m/s
            .425      .917      .427    C perv/imperv/total
15    ADD RUNOFF
            .196      .196      .550      .550 c.m/s
11    CHANNEL
       .300    Base Width    =
      3.000    Left  bank slope  1:
      3.000    Right bank slope  1:
       .030    Manning's "n"
       .500    O/a Depth in metres
      1.000    Select Grade in %
      Depth         =     .231 metres
      Velocity      =     .856 m/sec
      Flow Capacity  =    1.222 c.m/s
      Critical depth =     .200 metres
 9    ROUTE
    400.000    Conduit Length
       .487    Supply X-factor <.5
    350.564    Supply K-lag (sec)
       .500    Beta weighting factor
    300.000    Routing timestep
         1    No. of sub-reaches
            .196      .196      .186      .550 c.m/s
16    NEXT LINK
            .196      .186      .186      .550 c.m/s
35    COMMENT
     1    line(s) of comment
      *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
 4    CATCHMENT
      1.000    ID No.ó 99999
     10.840    Area in hectares
    300.000    Length (PERV) metres
      1.000    Gradient (%)
     25.000    Per cent Impervious
    300.000    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
            .924      .186      .186      .550 c.m/s
            .425      .922      .549    C perv/imperv/total
15    ADD RUNOFF
            .924      .988      .186      .550 c.m/s
11    CHANNEL
       .300    Base Width    =
      3.000    Left  bank slope  1:
      3.000    Right bank slope  1:
       .030    Manning's "n"
       .500    O/a Depth in metres
      1.000    Select Grade in %
      Depth         =     .458 metres
      Velocity      =    1.287 m/sec
      Flow Capacity  =    1.222 c.m/s
      Critical depth =     .420 metres
 9    ROUTE
    200.000    Conduit Length
       .453    Supply X-factor <.5
    116.540    Supply K-lag (sec)
       .500    Beta weighting factor
    120.000    Routing timestep
         1    No. of sub-reaches
            .924      .988      .929      .550 c.m/s
16    NEXT LINK
            .924      .929      .929      .550 c.m/s
35    COMMENT
     1    line(s) of comment
      *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
 4    CATCHMENT
      1.000    ID No.ó 99999
     29.250    Area in hectares
    500.000    Length (PERV) metres
      2.000    Gradient (%)
     35.700    Per cent Impervious
    500.000    Length (IMPERV)
       .000    %Imp. with Zero Dpth
         1    Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
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       .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
           3.453      .929      .929      .550 c.m/s
            .425      .926      .604    C perv/imperv/total
15    ADD RUNOFF
           3.453     4.381      .929      .550 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .1895659E+05 c.m
 8    PIPE
       .500    Minimum velocity  m/sec
      2.920    Maximum velocity  m/sec
       .013    Pipe Manning's 'n'
      1.350    Diameter in metres
       .600    Select Grade in %
      Surcharged HGL=     .674 %
      Velocity     =    3.061 m/sec
      Pipe Capacity =    4.134 c.m/s
      Critical depth=    1.113 metres
 9    ROUTE
    500.000    Conduit Length
       .500    Supply X-factor <.5
       .000    Supply K-lag (sec)
       .500    Beta weighting factor
    600.000    Routing timestep
         1    No. of sub-reaches
           3.453     4.381     4.381      .550 c.m/s
17    COMBINE
     3    Junction Node No.
           3.453     4.381     4.381     4.585 c.m/s
18    CONFLUENCE
     3    Junction Node No.
           3.453     4.585     4.381      .000 c.m/s
27    HYDROGRAPH DISPLAY
     5    is # of Hyeto/Hydrograph chosen
      Volume  =  .2307839E+05 c.m
20    MANUAL
```

Development Conditions without SWM

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          Output File (4.7) NOSWM.OUT    opened 2023-09-21   9:54
          Units used are defined by G =    9.810
              24   144    10.000        are MAXDT MAXHYD & DTMIN values
          Licensee: UPPER CANADA CONSULTANTS
 35       COMMENT
         4     line(s) of comment
          ROSEDALE SUBDIVISION
          STORMWATER MANAGEMENT PLAN
          FUTURE CONDITIONS TO BIEDERMAN DRAIN
          OCTOBER 2022
 14       START
         1     1=Zero; 2=Define
 35       COMMENT
         3     line(s) of comment
          *********************************
          * MTO 2 YEAR DESIGN STORM EVENT *
          *********************************
  2       STORM
              1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
        397.149     Coefficient  a
           .000     Constant  b    (min)
           .699     Exponent  c
           .450     Fraction to peak  r
        240.000     Duration ó  240 min
                 34.451 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
          *** FIELD - DRAINAGE AREA FX  ***
  4       CATCHMENT
          1.000     ID No.ó 99999
          3.440     Area in hectares
        150.000     Length (PERV) metres
          1.000     Gradient (%)
           .500     Per cent Impervious
        150.000     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
                 .023       .000       .000       .000 c.m/s
                 .204       .841       .207     C perv/imperv/total
 15       ADD RUNOFF
                 .023       .023       .000       .000 c.m/s
 11       CHANNEL
           .300     Base Width     =
          3.000     Left  bank slope  1:
          3.000     Right bank slope  1:
           .030     Manning's "n"
           .500     O/a Depth in metres
          1.000     Select Grade in %
          Depth          =      .084 metres
          Velocity       =      .488 m/sec
          Flow Capacity  =     1.222 c.m/s
          Critical depth =      .067 metres
  9       ROUTE
        400.000     Conduit Length
           .489     Supply X-factor <.5
        307.501     Supply K-lag (sec)
           .500     Beta weighting factor
        600.000     Routing timestep
              2     No. of sub-reaches
                 .023       .023       .023       .000 c.m/s
 16       NEXT LINK
                 .023       .023       .023       .000 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4       CATCHMENT
          1.000     ID No.ó 99999
         10.840     Area in hectares
        300.000     Length (PERV) metres
          1.000     Gradient (%)
         25.000     Per cent Impervious
        300.000     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
                 .367       .023       .023       .000 c.m/s
                 .204       .849       .365     C perv/imperv/total
 15       ADD RUNOFF
                 .367       .370       .023       .000 c.m/s
 11       CHANNEL
           .300     Base Width     =
          3.000     Left  bank slope  1:
          3.000     Right bank slope  1:
           .030     Manning's "n"
           .500     O/a Depth in metres
          1.000     Select Grade in %
          Depth          =      .304 metres
          Velocity       =     1.006 m/sec
          Flow Capacity  =     1.222 c.m/s
          Critical depth =      .270 metres
  9       ROUTE
        200.000     Conduit Length
           .468     Supply X-factor <.5
        149.160     Supply K-lag (sec)
           .500     Beta weighting factor
        150.000     Routing timestep
              1     No. of sub-reaches
                 .367       .370       .325       .000 c.m/s
 16       NEXT LINK
```

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                 .367       .325       .325       .000 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4       CATCHMENT
          1.000     ID No.ó 99999
         29.250     Area in hectares
        500.000     Length (PERV) metres
          2.000     Gradient (%)
         35.700     Per cent Impervious
        500.000     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
                1.385       .325       .325       .000 c.m/s
                 .204       .841       .431     C perv/imperv/total
 15       ADD RUNOFF
                1.385      1.710       .325       .000 c.m/s
 27       HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .5951399E+04 c.m
  8       PIPE
           .500     Minimum velocity  m/sec
          2.920     Maximum velocity  m/sec
           .013     Pipe Manning's 'n'
          1.350     Diameter in metres
           .600     Select Grade in %
          Depth         =      .605 metres
          Velocity      =     2.750 m/sec
          Pipe Capacity =     4.134 c.m/s
          Critical depth=      .692 metres
  9       ROUTE
        500.000     Conduit Length
           .442     Supply X-factor <.5
        136.363     Supply K-lag (sec)
           .500     Beta weighting factor
        150.000     Routing timestep
              1     No. of sub-reaches
                1.385      1.710      1.493       .000 c.m/s
 16       NEXT LINK
                1.385      1.493      1.493       .000 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** ROSEDALE - DRAINAGE AREA FUT  ***
  4       CATCHMENT
          1.000     ID No.ó 99999
         12.770     Area in hectares
        400.000     Length (PERV) metres
          3.000     Gradient (%)
         70.000     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
                1.204      1.493      1.493       .000 c.m/s
                 .204       .852       .657     C perv/imperv/total
 15       ADD RUNOFF
                1.204      2.697      1.493       .000 c.m/s
 27       HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .8842857E+04 c.m
 14       START
         1     1=Zero; 2=Define
 35       COMMENT
         3     line(s) of comment
          *********************************
          * MTO 5 YEAR DESIGN STORM EVENT *
          *********************************
  2       STORM
              1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
        524.867     Coefficient  a
           .000     Constant  b    (min)
           .699     Exponent  c
           .450     Fraction to peak  r
        240.000     Duration ó  240 min
                 45.530 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
          *** FIELD - DRAINAGE AREA FX  ***
  4       CATCHMENT
          1.000     ID No.ó 99999
          3.440     Area in hectares
        150.000     Length (PERV) metres
          1.000     Gradient (%)
           .500     Per cent Impervious
        150.000     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
                 .055       .000      1.493       .000 c.m/s
                 .278       .859       .280     C perv/imperv/total
 15       ADD RUNOFF
                 .055       .055      1.493       .000 c.m/s
 11       CHANNEL
           .300     Base Width     =
          3.000     Left  bank slope  1:
          3.000     Right bank slope  1:
           .030     Manning's "n"
           .500     O/a Depth in metres
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          1.000      Select Grade in %
          Depth           =       .129 metres
          Velocity        =       .616 m/sec
          Flow Capacity  =      1.222 c.m/s
          Critical depth =       .106 metres
    9     ROUTE
        400.000      Conduit Length
           .492      Supply X-factor <.5
        487.040      Supply K-lag (sec)
           .500      Beta weighting factor
        300.000      Routing timestep
              1      No. of sub-reaches
                .055       .055       .053       .000 c.m/s
   16     NEXT LINK
                .055       .053       .053       .000 c.m/s
   35     COMMENT
          1     line(s) of comment
          *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
    4     CATCHMENT
          1.000      ID No.ó 99999
         10.840      Area in hectares
        300.000      Length (PERV) metres
          1.000      Gradient (%)
         25.000      Per cent Impervious
        300.000      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
                .515       .053       .053       .000 c.m/s
                .278       .884       .429     C perv/imperv/total
   15     ADD RUNOFF
                .515       .525       .053       .000 c.m/s
   11     CHANNEL
           .300      Base Width     =
          3.000      Left  bank slope  1:
          3.000      Right bank slope  1:
           .030      Manning's "n"
           .500      O/a Depth in metres
          1.000      Select Grade in %
          Depth           =       .352 metres
          Velocity        =      1.098 m/sec
          Flow Capacity  =      1.222 c.m/s
          Critical depth =       .317 metres
    9     ROUTE
        200.000      Conduit Length
           .463      Supply X-factor <.5
        136.564      Supply K-lag (sec)
           .500      Beta weighting factor
        120.000      Routing timestep
              1      No. of sub-reaches
                .515       .525       .476       .000 c.m/s
   16     NEXT LINK
                .515       .476       .476       .000 c.m/s
   35     COMMENT
          1     line(s) of comment
          *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
    4     CATCHMENT
          1.000      ID No.ó 99999
         29.250      Area in hectares
        500.000      Length (PERV) metres
          2.000      Gradient (%)
         35.700      Per cent Impervious
        500.000      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
               1.941       .476       .476       .000 c.m/s
                .278       .882       .493     C perv/imperv/total
   15     ADD RUNOFF
               1.941      2.416       .476       .000 c.m/s
   27     HYDROGRAPH DISPLAY
          5     is # of Hyeto/Hydrograph chosen
          Volume  =  .9127035E+04 c.m
    8     PIPE
           .500      Minimum velocity  m/sec
          2.920      Maximum velocity  m/sec
           .013      Pipe Manning's 'n'
          1.350      Diameter in metres
           .600      Select Grade in %
          Depth          =       .741 metres
          Velocity       =      3.000 m/sec
          Pipe Capacity =      4.134 c.m/s
          Critical depth=       .829 metres
    9     ROUTE
        500.000      Conduit Length
           .424      Supply X-factor <.5
        124.986      Supply K-lag (sec)
           .500      Beta weighting factor
        120.000      Routing timestep
              1      No. of sub-reaches
               1.941      2.416      2.180       .000 c.m/s
   16     NEXT LINK
               1.941      2.180      2.180       .000 c.m/s
   35     COMMENT
          1     line(s) of comment
          *** ROSEDALE - DRAINAGE AREA RD  ***
    4     CATCHMENT
          1.000      ID No.ó 99999
         12.770      Area in hectares
        400.000      Length (PERV) metres
          2.000      Gradient (%)
         70.000      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
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              1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
               1.643      2.180      2.180       .000 c.m/s
                .278       .883       .702     C perv/imperv/total
   15     ADD RUNOFF
               1.643      3.822      2.180       .000 c.m/s
   27     HYDROGRAPH DISPLAY
          5     is # of Hyeto/Hydrograph chosen
          Volume  =  .1320661E+05 c.m
   14     START
          1     1=Zero; 2=Define
   35     COMMENT
          3     line(s) of comment
          **********************************
          * MTO 10 YEAR DESIGN STORM EVENT *
          **********************************
    2     STORM
              1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
        608.845      Coefficient  a
           .000      Constant  b    (min)
           .699      Exponent  c
           .450      Fraction to peak  r
        240.000      Duration ó  240 min
                    52.815 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
          *** FIELD - DRAINAGE AREA FX  ***
    4     CATCHMENT
          1.000      ID No.ó 99999
          3.440      Area in hectares
        150.000      Length (PERV) metres
          1.000      Gradient (%)
           .500      Per cent Impervious
        150.000      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      2.180       .000 c.m/s
                .320       .878       .322     C perv/imperv/total
   15     ADD RUNOFF
                .079       .079      2.180       .000 c.m/s
   11     CHANNEL
           .300      Base Width     =
          3.000      Left  bank slope  1:
          3.000      Right bank slope  1:
           .030      Manning's "n"
           .500      O/a Depth in metres
          1.000      Select Grade in %
          Depth           =       .154 metres
          Velocity        =       .679 m/sec
          Flow Capacity  =      1.222 c.m/s
          Critical depth =       .129 metres
    9     ROUTE
        400.000      Conduit Length
           .491      Supply X-factor <.5
        441.992      Supply K-lag (sec)
           .500      Beta weighting factor
        300.000      Routing timestep
              1      No. of sub-reaches
                .079       .079       .077       .000 c.m/s
   16     NEXT LINK
                .079       .077       .077       .000 c.m/s
   35     COMMENT
          1     line(s) of comment
          *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
    4     CATCHMENT
          1.000      ID No.ó 99999
         10.840      Area in hectares
        300.000      Length (PERV) metres
          1.000      Gradient (%)
         25.000      Per cent Impervious
        300.000      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
                .613       .077       .077       .000 c.m/s
                .320       .897       .464     C perv/imperv/total
   15     ADD RUNOFF
                .613       .632       .077       .000 c.m/s
   11     CHANNEL
           .300      Base Width     =
          3.000      Left  bank slope  1:
          3.000      Right bank slope  1:
           .030      Manning's "n"
           .500      O/a Depth in metres
          1.000      Select Grade in %
          Depth           =       .381 metres
          Velocity        =      1.150 m/sec
          Flow Capacity  =      1.222 c.m/s
          Critical depth =       .344 metres
    9     ROUTE
        200.000      Conduit Length
           .460      Supply X-factor <.5
        130.387      Supply K-lag (sec)
           .500      Beta weighting factor
        120.000      Routing timestep
              1      No. of sub-reaches
                .613       .632       .579       .000 c.m/s
   16     NEXT LINK
                .613       .579       .579       .000 c.m/s
   35     COMMENT
          1     line(s) of comment
          *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
    4     CATCHMENT
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       1.000     ID No.ó 99999
      29.250     Area in hectares
     500.000     Length (PERV) metres
       2.000     Gradient (%)
      35.700     Per cent Impervious
     500.000     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
           2.305       .579       .579       .000 c.m/s
            .320       .898       .526     C perv/imperv/total
 15    ADD RUNOFF
           2.305      2.884       .579       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1136950E+05 c.m
  8    PIPE
        .500     Minimum velocity  m/sec
       2.920     Maximum velocity  m/sec
        .013     Pipe Manning's 'n'
       1.350     Diameter in metres
        .600     Select Grade in %
       Depth          =      .830 metres
       Velocity       =     3.123 m/sec
       Pipe Capacity =     4.134 c.m/s
       Critical depth=      .908 metres
  9    ROUTE
     500.000     Conduit Length
        .407     Supply X-factor <.5
     120.096     Supply K-lag (sec)
        .500     Beta weighting factor
     120.000     Routing timestep
          1      No. of sub-reaches
           2.305      2.884      2.637       .000 c.m/s
 16    NEXT LINK
           2.305      2.637      2.637       .000 c.m/s
 35    COMMENT
      1     line(s) of comment
       *** ROSEDALE - DRAINAGE AREA FUT  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      12.770     Area in hectares
     400.000     Length (PERV) metres
       3.000     Gradient (%)
      70.000     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
           1.861      2.637      2.637       .000 c.m/s
            .320       .893       .721     C perv/imperv/total
 15    ADD RUNOFF
           1.861      4.498      2.637       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1623196E+05 c.m
 14    START
      1     1=Zero; 2=Define
 35    COMMENT
      3     line(s) of comment
       **********************************
       * MTO 25 YEAR DESIGN STORM EVENT *
       **********************************
  2    STORM
          1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     715.568     Coefficient  a
        .000     Constant  b    (min)
        .699     Exponent  c
        .450     Fraction to peak  r
     240.000     Duration ó  240 min
              62.073 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
       *** FIELD - DRAINAGE AREA FX  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
       3.440     Area in hectares
     150.000     Length (PERV) metres
       1.000     Gradient (%)
        .500     Per cent Impervious
     150.000     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
            .127       .000      2.637       .000 c.m/s
            .367       .898       .369     C perv/imperv/total
 15    ADD RUNOFF
            .127       .127      2.637       .000 c.m/s
 11    CHANNEL
        .300     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .030     Manning's "n"
        .500     O/a Depth in metres
       1.000     Select Grade in %
       Depth          =      .190 metres
       Velocity       =      .766 m/sec
       Flow Capacity  =     1.222 c.m/s
       Critical depth =      .162 metres
  9    ROUTE
     400.000     Conduit Length
        .489     Supply X-factor <.5
     391.534     Supply K-lag (sec)
        .500     Beta weighting factor
     300.000     Routing timestep
          1      No. of sub-reaches
            .127       .127       .122       .000 c.m/s
 16    NEXT LINK
            .127       .122       .122       .000 c.m/s
 35    COMMENT
      1     line(s) of comment
       *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      10.840     Area in hectares
     300.000     Length (PERV) metres
       1.000     Gradient (%)
      25.000     Per cent Impervious
     300.000     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
            .742       .122       .122       .000 c.m/s
            .367       .911       .503     C perv/imperv/total
 15    ADD RUNOFF
            .742       .775       .122       .000 c.m/s
 11    CHANNEL
        .300     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .030     Manning's "n"
        .500     O/a Depth in metres
       1.000     Select Grade in %
       Depth          =      .415 metres
       Velocity       =     1.211 m/sec
       Flow Capacity  =     1.222 c.m/s
       Critical depth =      .377 metres
  9    ROUTE
     200.000     Conduit Length
        .457     Supply X-factor <.5
     123.848     Supply K-lag (sec)
        .500     Beta weighting factor
     120.000     Routing timestep
          1      No. of sub-reaches
            .742       .775       .720       .000 c.m/s
 16    NEXT LINK
            .742       .720       .720       .000 c.m/s
 35    COMMENT
      1     line(s) of comment
       *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      29.250     Area in hectares
     500.000     Length (PERV) metres
       2.000     Gradient (%)
      35.700     Per cent Impervious
     500.000     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
           2.767       .720       .720       .000 c.m/s
            .367       .911       .561     C perv/imperv/total
 15    ADD RUNOFF
           2.767      3.486       .720       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1435674E+05 c.m
  8    PIPE
        .500     Minimum velocity  m/sec
       2.920     Maximum velocity  m/sec
        .013     Pipe Manning's 'n'
       1.350     Diameter in metres
        .600     Select Grade in %
       Depth          =      .950 metres
       Velocity       =     3.238 m/sec
       Pipe Capacity =     4.134 c.m/s
       Critical depth=      .999 metres
  9    ROUTE
     500.000     Conduit Length
        .377     Supply X-factor <.5
     115.797     Supply K-lag (sec)
        .500     Beta weighting factor
     120.000     Routing timestep
          1      No. of sub-reaches
           2.767      3.486      3.226       .000 c.m/s
 16    NEXT LINK
           2.767      3.226      3.226       .000 c.m/s
 35    COMMENT
      1     line(s) of comment
       *** ROSEDALE - DRAINAGE AREA FUT  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      12.770     Area in hectares
     400.000     Length (PERV) metres
       3.000     Gradient (%)
      70.000     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
           2.199      3.226      3.226       .000 c.m/s
            .367       .901       .740     C perv/imperv/total
 15    ADD RUNOFF
           2.199      5.425      3.226       .000 c.m/s
```

```
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .2022603E+05 c.m
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        **********************************
        * MTO 50 YEAR DESIGN STORM EVENT *
        **********************************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      794.298     Coefficient  a
         .000     Constant  b    (min)
         .699     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó  240 min
               68.903 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
        *** FIELD - DRAINAGE AREA FX  ***
  4     CATCHMENT
        1.000     ID No.ó 99999
        3.440     Area in hectares
      150.000     Length (PERV) metres
        1.000     Gradient (%)
         .500     Per cent Impervious
      150.000     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
              .161       .000      3.226       .000 c.m/s
              .397       .909       .400     C perv/imperv/total
 15     ADD RUNOFF
              .161       .161      3.226       .000 c.m/s
 11     CHANNEL
         .300     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .030     Manning's "n"
         .500     O/a Depth in metres
        1.000     Select Grade in %
        Depth          =      .211 metres
        Velocity       =      .814 m/sec
        Flow Capacity  =     1.222 c.m/s
        Critical depth =      .182 metres
  9     ROUTE
      400.000     Conduit Length
         .488     Supply X-factor <.5
      368.744     Supply K-lag (sec)
         .500     Beta weighting factor
      300.000     Routing timestep
            1     No. of sub-reaches
              .161       .161       .154       .000 c.m/s
 16     NEXT LINK
              .161       .154       .154       .000 c.m/s
 35     COMMENT
       1     line(s) of comment
        *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4     CATCHMENT
        1.000     ID No.ó 99999
       10.840     Area in hectares
      300.000     Length (PERV) metres
        1.000     Gradient (%)
       25.000     Per cent Impervious
      300.000     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
              .841       .154       .154       .000 c.m/s
              .397       .917       .527     C perv/imperv/total
 15     ADD RUNOFF
              .841       .888       .154       .000 c.m/s
 11     CHANNEL
         .300     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .030     Manning's "n"
         .500     O/a Depth in metres
        1.000     Select Grade in %
        Depth          =      .439 metres
        Velocity       =     1.253 m/sec
        Flow Capacity  =     1.222 c.m/s
        Critical depth =      .400 metres
  9     ROUTE
      200.000     Conduit Length
         .455     Supply X-factor <.5
      119.694     Supply K-lag (sec)
         .500     Beta weighting factor
      120.000     Routing timestep
            1     No. of sub-reaches
              .841       .888       .829       .000 c.m/s
 16     NEXT LINK
              .841       .829       .829       .000 c.m/s
 35     COMMENT
       1     line(s) of comment
        *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4     CATCHMENT
        1.000     ID No.ó 99999
       29.250     Area in hectares
      500.000     Length (PERV) metres
        2.000     Gradient (%)
       35.700     Per cent Impervious
      500.000     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
              3.111       .829       .829       .000 c.m/s
               .397       .919       .584     C perv/imperv/total
 15     ADD RUNOFF
              3.111      3.940       .829       .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1664438E+05 c.m
  8     PIPE
         .500     Minimum velocity  m/sec
        2.920     Maximum velocity  m/sec
         .013     Pipe Manning's 'n'
        1.350     Diameter in metres
         .600     Select Grade in %
        Depth         =     1.053 metres
        Velocity      =     3.288 m/sec
        Pipe Capacity =     4.134 c.m/s
        Critical depth=     1.060 metres
  9     ROUTE
      500.000     Conduit Length
         .344     Supply X-factor <.5
      114.065     Supply K-lag (sec)
         .500     Beta weighting factor
      120.000     Routing timestep
            1     No. of sub-reaches
              3.111      3.940      3.669       .000 c.m/s
 16     NEXT LINK
              3.111      3.669      3.669       .000 c.m/s
 35     COMMENT
       1     line(s) of comment
        *** ROSEDALE - DRAINAGE AREA FUT  ***
  4     CATCHMENT
        1.000     ID No.ó 99999
       12.770     Area in hectares
      400.000     Length (PERV) metres
        3.000     Gradient (%)
       70.000     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
              2.448      3.669      3.669       .000 c.m/s
               .398       .903       .752     C perv/imperv/total
 15     ADD RUNOFF
              2.448      6.117      3.669       .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .2325709E+05 c.m
 14     START
       1     1=Zero; 2=Define
 35     COMMENT
       3     line(s) of comment
        ***********************************
        * MTO 100 YEAR DESIGN STORM EVENT *
        ***********************************
  2     STORM
            1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
      871.279     Coefficient  a
         .000     Constant  b    (min)
         .699     Exponent  c
         .450     Fraction to peak  r
      240.000     Duration ó  240 min
               75.581 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
        *** FIELD - DRAINAGE AREA FX  ***
  4     CATCHMENT
        1.000     ID No.ó 99999
        3.440     Area in hectares
      150.000     Length (PERV) metres
        1.000     Gradient (%)
         .500     Per cent Impervious
      150.000     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
               .196       .000      3.669       .000 c.m/s
               .425       .917       .427     C perv/imperv/total
 15     ADD RUNOFF
               .196       .196      3.669       .000 c.m/s
 11     CHANNEL
         .300     Base Width     =
        3.000     Left  bank slope  1:
        3.000     Right bank slope  1:
         .030     Manning's "n"
         .500     O/a Depth in metres
        1.000     Select Grade in %
        Depth          =      .231 metres
        Velocity       =      .856 m/sec
        Flow Capacity  =     1.222 c.m/s
        Critical depth =      .200 metres
  9     ROUTE
      400.000     Conduit Length
         .487     Supply X-factor <.5
      350.564     Supply K-lag (sec)
         .500     Beta weighting factor
```

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      300.000     Routing timestep
            1     No. of sub-reaches
               .196       .196       .186       .000 c.m/s
  16     NEXT LINK
               .196       .186       .186       .000 c.m/s
  35     COMMENT
        1     line(s) of comment
         *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
        10.840     Area in hectares
       300.000     Length (PERV) metres
         1.000     Gradient (%)
        25.000     Per cent Impervious
       300.000     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
               .924       .186       .186       .000 c.m/s
               .425       .922       .549     C perv/imperv/total
  15     ADD RUNOFF
               .924       .988       .186       .000 c.m/s
  11     CHANNEL
          .300     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .030     Manning's "n"
          .500     O/a Depth in metres
         1.000     Select Grade in %
         Depth          =      .458 metres
         Velocity       =     1.287 m/sec
         Flow Capacity  =     1.222 c.m/s
         Critical depth =      .420 metres
   9     ROUTE
       200.000     Conduit Length
          .453     Supply X-factor <.5
       116.540     Supply K-lag (sec)
          .500     Beta weighting factor
       120.000     Routing timestep
             1     No. of sub-reaches
               .924       .988       .929       .000 c.m/s
  16     NEXT LINK
               .924       .929       .929       .000 c.m/s
  35     COMMENT
        1     line(s) of comment
         *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
        29.250     Area in hectares
       500.000     Length (PERV) metres
         2.000     Gradient (%)
        35.700     Per cent Impervious
       500.000     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
              3.453       .929       .929       .000 c.m/s
               .425       .926       .604     C perv/imperv/total
  15     ADD RUNOFF
              3.453      4.381       .929       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .1895466E+05 c.m
   8     PIPE
          .500     Minimum velocity  m/sec
         2.920     Maximum velocity  m/sec
          .013     Pipe Manning's 'n'
         1.350     Diameter in metres
          .600     Select Grade in %
         Surcharged HGL=      .674 %
         Velocity      =     3.061 m/sec
         Pipe Capacity =     4.134 c.m/s
         Critical depth=     1.113 metres
   9     ROUTE
       500.000     Conduit Length
          .500     Supply X-factor <.5
          .000     Supply K-lag (sec)
          .500     Beta weighting factor
       600.000     Routing timestep
             1     No. of sub-reaches
              3.453      4.381      4.381       .000 c.m/s
  16     NEXT LINK
              3.453      4.381      4.381       .000 c.m/s
  35     COMMENT
        1     line(s) of comment
         *** ROSEDALE - DRAINAGE AREA FUT  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
        12.770     Area in hectares
       400.000     Length (PERV) metres
         3.000     Gradient (%)
        70.000     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
              2.688      4.381      4.381       .000 c.m/s
               .425       .904       .760     C perv/imperv/total
  15     ADD RUNOFF
              2.688      7.069      4.381       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .2629441E+05 c.m
  20     MANUAL
```

Development Conditions with SWM

```
         Output File (4.7) SWM.OUT      opened 2023-10-06  13:45
         Units used are defined by G =     9.810
             24   144    10.000        are MAXDT MAXHYD & DTMIN values
         Licensee: UPPER CANADA CONSULTANTS
  35     COMMENT
        4     line(s) of comment
         ROSEDALE SUBDIVISION
         STORMWATER MANAGEMENT PLAN
         FUTURE CONDITIONS TO BIEDERMAN DRAIN
         OCTOBER 2022
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        3     line(s) of comment
         ***************************
         * 25MM DESIGN 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  240 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
   4     CATCHMENT
         1.000     ID No.ó 99999
        12.770     Area in hectares
       400.000     Length (PERV) metres
         2.000     Gradient (%)
        70.000     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
                .821       .000       .000       .000 c.m/s
                .130       .799       .598     C perv/imperv/total
  15     ADD RUNOFF
                .821       .821       .000       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .1907682E+04 c.m
  10     POND
        9 Depth - Discharge - Volume sets
         174.850        .000          .0
         175.350       .0310      1713.0
         175.600       .0400      2746.0
         175.760       .0800      3467.0
         175.850       .0829      3893.0
         176.350       .0830      6538.0
         176.650       .0831      8354.0
         176.750        .233      8999.0
         176.850        .473      9663.0
         Peak Outflow    =      .028 c.m/s
         Maximum Depth   =   175.306 metres
         Maximum Storage =     1562. c.m
                .821       .821       .028       .000 c.m/s
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        3     line(s) of comment
         *********************************
         * MTO 2 YEAR DESIGN STORM EVENT *
         *********************************
   2     STORM
             1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       397.149     Coefficient  a
          .000     Constant  b    (min)
          .699     Exponent  c
          .450     Fraction to peak  r
       240.000     Duration ó  240 min
                34.451 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
         *** FIELD - DRAINAGE AREA FX  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
         3.440     Area in hectares
       150.000     Length (PERV) metres
         1.000     Gradient (%)
          .500     Per cent Impervious
       150.000     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
                .023       .000       .028       .000 c.m/s
                .204       .841       .207     C perv/imperv/total
  15     ADD RUNOFF
                .023       .023       .028       .000 c.m/s
  11     CHANNEL
          .300     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .030     Manning's "n"
```

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          .500     O/a Depth in metres
         1.000     Select Grade in %
         Depth          =      .084 metres
         Velocity       =      .488 m/sec
         Flow Capacity  =     1.222 c.m/s
         Critical depth =      .067 metres
   9     ROUTE
       400.000     Conduit Length
          .489     Supply X-factor <.5
       307.501     Supply K-lag (sec)
          .500     Beta weighting factor
       600.000     Routing timestep
             2     No. of sub-reaches
                .023       .023       .023       .000 c.m/s
  16     NEXT LINK
                .023       .023       .023       .000 c.m/s
  35     COMMENT
        1     line(s) of comment
         *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
        10.840     Area in hectares
       300.000     Length (PERV) metres
         1.000     Gradient (%)
        25.000     Per cent Impervious
       300.000     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
                .367       .023       .023       .000 c.m/s
                .204       .849       .365     C perv/imperv/total
  15     ADD RUNOFF
                .367       .370       .023       .000 c.m/s
  11     CHANNEL
          .300     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .030     Manning's "n"
          .500     O/a Depth in metres
         1.000     Select Grade in %
         Depth          =      .304 metres
         Velocity       =     1.006 m/sec
         Flow Capacity  =     1.222 c.m/s
         Critical depth =      .270 metres
   9     ROUTE
       200.000     Conduit Length
          .468     Supply X-factor <.5
       149.160     Supply K-lag (sec)
          .500     Beta weighting factor
       150.000     Routing timestep
             1     No. of sub-reaches
                .367       .370       .325       .000 c.m/s
  16     NEXT LINK
                .367       .325       .325       .000 c.m/s
  35     COMMENT
        1     line(s) of comment
         *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
        29.250     Area in hectares
       500.000     Length (PERV) metres
         2.000     Gradient (%)
        35.700     Per cent Impervious
       500.000     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
               1.385       .325       .325       .000 c.m/s
                .204       .841       .431     C perv/imperv/total
  15     ADD RUNOFF
               1.385      1.710       .325       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .5951403E+04 c.m
   8     PIPE
          .500     Minimum velocity  m/sec
         2.920     Maximum velocity  m/sec
          .013     Pipe Manning's 'n'
         1.350     Diameter in metres
          .600     Select Grade in %
         Depth         =      .605 metres
         Velocity      =     2.750 m/sec
         Pipe Capacity =     4.134 c.m/s
         Critical depth=      .692 metres
   9     ROUTE
       500.000     Conduit Length
          .442     Supply X-factor <.5
       136.363     Supply K-lag (sec)
          .500     Beta weighting factor
       150.000     Routing timestep
             1     No. of sub-reaches
               1.385      1.710      1.493       .000 c.m/s
  17     COMBINE
        1     Junction Node No.
               1.385      1.710      1.493      1.493 c.m/s
  14     START
        1     1=Zero; 2=Define
  35     COMMENT
        1     line(s) of comment
         *** ROSEDALE - DRAINAGE AREA FUT  ***
   4     CATCHMENT
         1.000     ID No.ó 99999
        14.230     Area in hectares
       400.000     Length (PERV) metres
         3.000     Gradient (%)
        70.000     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
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          .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
               1.342       .000      1.493      1.493 c.m/s
                .204       .852       .657     C perv/imperv/total
 15     ADD RUNOFF
               1.342      1.342      1.493      1.493 c.m/s
 27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .3222296E+04 c.m
 35     COMMENT
        1     line(s) of comment
         *** SITE - EX FLOWS OF 63 L/S DURING 2 YR  ***
 10     POND
        9 Depth - Discharge - Volume sets
         174.850        .000          .0
         175.350       .0310      1713.0
         175.600       .0400      2746.0
         175.760       .0800      3467.0
         175.850       .0829      3893.0
         176.350       .0830      6538.0
         176.650       .0831      8354.0
         176.750        .233      8999.0
         176.850        .473      9663.0
         Peak Outflow    =      .040 c.m/s
         Maximum Depth   =   175.591 metres
         Maximum Storage =     2711. c.m
               1.342      1.342       .040      1.493 c.m/s
 17     COMBINE
        1     Junction Node No.
               1.342      1.342       .040      1.512 c.m/s
 35     COMMENT
        1     line(s) of comment
         *** OVERALL - EX FLOWS OF 1512 L/S DURING 2 YR  ***
 18     CONFLUENCE
        1     Junction Node No.
               1.342      1.512       .040       .000 c.m/s
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        3     line(s) of comment
         *********************************
         * MTO 5 YEAR DESIGN STORM EVENT *
         *********************************
  2     STORM
             1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       524.867     Coefficient  a
          .000     Constant  b    (min)
          .699     Exponent  c
          .450     Fraction to peak  r
       240.000     Duration ó  240 min
                45.530 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
         *** FIELD - DRAINAGE AREA FX  ***
  4     CATCHMENT
         1.000     ID No.ó 99999
         3.440     Area in hectares
       150.000     Length (PERV) metres
         1.000     Gradient (%)
          .500     Per cent Impervious
       150.000     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
                .055       .000       .040       .000 c.m/s
                .278       .859       .280     C perv/imperv/total
 15     ADD RUNOFF
                .055       .055       .040       .000 c.m/s
 11     CHANNEL
          .300     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .030     Manning's "n"
          .500     O/a Depth in metres
         1.000     Select Grade in %
         Depth          =      .129 metres
         Velocity       =      .616 m/sec
         Flow Capacity  =     1.222 c.m/s
         Critical depth =      .106 metres
  9     ROUTE
       400.000     Conduit Length
          .492     Supply X-factor <.5
       487.040     Supply K-lag (sec)
          .500     Beta weighting factor
       300.000     Routing timestep
             1     No. of sub-reaches
                .055       .055       .053       .000 c.m/s
 16     NEXT LINK
                .055       .053       .053       .000 c.m/s
 35     COMMENT
        1     line(s) of comment
         *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4     CATCHMENT
         1.000     ID No.ó 99999
        10.840     Area in hectares
       300.000     Length (PERV) metres
         1.000     Gradient (%)
        25.000     Per cent Impervious
       300.000     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
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         7.587     Initial Abstraction
             1     Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .515       .053       .053       .000 c.m/s
                .278       .884       .429     C perv/imperv/total
 15     ADD RUNOFF
                .515       .525       .053       .000 c.m/s
 11     CHANNEL
          .300     Base Width     =
         3.000     Left  bank slope  1:
         3.000     Right bank slope  1:
          .030     Manning's "n"
          .500     O/a Depth in metres
         1.000     Select Grade in %
         Depth          =      .352 metres
         Velocity       =     1.098 m/sec
         Flow Capacity  =     1.222 c.m/s
         Critical depth =      .317 metres
  9     ROUTE
       200.000     Conduit Length
          .463     Supply X-factor <.5
       136.564     Supply K-lag (sec)
          .500     Beta weighting factor
       120.000     Routing timestep
             1     No. of sub-reaches
                .515       .525       .476       .000 c.m/s
 16     NEXT LINK
                .515       .476       .476       .000 c.m/s
 35     COMMENT
        1     line(s) of comment
         *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4     CATCHMENT
         1.000     ID No.ó 99999
        29.250     Area in hectares
       500.000     Length (PERV) metres
         2.000     Gradient (%)
        35.700     Per cent Impervious
       500.000     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
               1.941       .476       .476       .000 c.m/s
                .278       .882       .493     C perv/imperv/total
 15     ADD RUNOFF
               1.941      2.416       .476       .000 c.m/s
 27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .9127035E+04 c.m
  8     PIPE
          .500     Minimum velocity  m/sec
         2.920     Maximum velocity  m/sec
          .013     Pipe Manning's 'n'
         1.350     Diameter in metres
          .600     Select Grade in %
         Depth        =      .741 metres
         Velocity     =     3.000 m/sec
         Pipe Capacity =    4.134 c.m/s
         Critical depth=      .829 metres
  9     ROUTE
       500.000     Conduit Length
          .424     Supply X-factor <.5
       124.986     Supply K-lag (sec)
          .500     Beta weighting factor
       120.000     Routing timestep
             1     No. of sub-reaches
               1.941      2.416      2.180       .000 c.m/s
 22     FILE HYDROGRAPH
        2     1=READ: 2=WRITE
        7     MEADOWS      .5YR    is Filename
        3     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
               1.844       .428      2.086      2.086 c.m/s
               1.941      2.416      2.180       .000 c.m/s
 17     COMBINE
        0     Junction Node No.
               1.941      2.416      2.180      2.180 c.m/s
 14     START
        1     1=Zero; 2=Define
 35     COMMENT
        1     line(s) of comment
         *** ROSEDALE - DRAINAGE AREA RD  ***
  4     CATCHMENT
         1.000     ID No.ó 99999
        12.770     Area in hectares
       400.000     Length (PERV) metres
         2.000     Gradient (%)
        70.000     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
               1.643       .000      2.180      2.180 c.m/s
                .278       .883       .702     C perv/imperv/total
 15     ADD RUNOFF
               1.643      1.643      2.180      2.180 c.m/s
 27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .4079595E+04 c.m
 35     COMMENT
        1     line(s) of comment
         *** SITE - EX FLOWS OF 147 L/S DURING 5 YR  ***
 10     POND
        9 Depth - Discharge - Volume sets
         174.850        .000          .0
         175.350       .0310      1713.0
         175.600       .0400      2746.0
         175.760       .0800      3467.0
         175.850       .0829      3893.0
         176.350       .0830      6538.0
         176.650       .0831      8354.0
         176.750        .233      8999.0
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          176.850        .473      9663.0
          Peak Outflow    =      .072 c.m/s
          Maximum Depth   =   175.729 metres
          Maximum Storage =     3327. c.m
             1.643      1.643       .072      2.180 c.m/s
 22       FILE HYDROGRAPH
         2     1=READ: 2=WRITE
         7     ROSEDAL      .5YR    is Filename
         3     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
             1.844       .428      2.086      2.086 c.m/s
             1.643      1.643       .072      2.180 c.m/s
 17       COMBINE
         0     Junction Node No.
             1.643      1.643       .072      2.206 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** OVERALL - EX FLOWS OF 2224 L/S DURING 5 YR  ***
 18       CONFLUENCE
         0     Junction Node No.
             1.643      2.206       .072       .000 c.m/s
 14       START
         1     1=Zero; 2=Define
 35       COMMENT
         3     line(s) of comment
          **********************************
          * MTO 10 YEAR DESIGN STORM EVENT *
          **********************************
  2       STORM
             1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
       608.845      Coefficient  a
          .000      Constant  b    (min)
          .699      Exponent  c
          .450      Fraction to peak  r
       240.000      Duration ó  240 min
                  52.815 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
          *** FIELD - DRAINAGE AREA FX  ***
  4       CATCHMENT
         1.000      ID No.ó 99999
         3.440      Area in hectares
       150.000      Length (PERV) metres
         1.000      Gradient (%)
          .500      Per cent Impervious
       150.000      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       .072       .000 c.m/s
              .320       .878       .322     C perv/imperv/total
 15       ADD RUNOFF
              .079       .079       .072       .000 c.m/s
 11       CHANNEL
          .300      Base Width     =
         3.000      Left  bank slope  1:
         3.000      Right bank slope  1:
          .030      Manning's "n"
          .500      O/a Depth in metres
         1.000      Select Grade in %
          Depth          =      .154 metres
          Velocity       =      .679 m/sec
          Flow Capacity  =     1.222 c.m/s
          Critical depth =      .129 metres
  9       ROUTE
       400.000      Conduit Length
          .491      Supply X-factor <.5
       441.992      Supply K-lag (sec)
          .500      Beta weighting factor
       300.000      Routing timestep
             1      No. of sub-reaches
              .079       .079       .077       .000 c.m/s
 16       NEXT LINK
              .079       .077       .077       .000 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4       CATCHMENT
         1.000      ID No.ó 99999
        10.840      Area in hectares
       300.000      Length (PERV) metres
         1.000      Gradient (%)
        25.000      Per cent Impervious
       300.000      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
              .613       .077       .077       .000 c.m/s
              .320       .897       .464     C perv/imperv/total
 15       ADD RUNOFF
              .613       .632       .077       .000 c.m/s
 11       CHANNEL
          .300      Base Width     =
         3.000      Left  bank slope  1:
         3.000      Right bank slope  1:
          .030      Manning's "n"
          .500      O/a Depth in metres
         1.000      Select Grade in %
          Depth          =      .381 metres
          Velocity       =     1.150 m/sec
          Flow Capacity  =     1.222 c.m/s
          Critical depth =      .344 metres
  9       ROUTE
       200.000      Conduit Length
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          .460      Supply X-factor <.5
       130.387      Supply K-lag (sec)
          .500      Beta weighting factor
       120.000      Routing timestep
             1      No. of sub-reaches
              .613       .632       .579       .000 c.m/s
 16       NEXT LINK
              .613       .579       .579       .000 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4       CATCHMENT
         1.000      ID No.ó 99999
        29.250      Area in hectares
       500.000      Length (PERV) metres
         2.000      Gradient (%)
        35.700      Per cent Impervious
       500.000      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
             2.305       .579       .579       .000 c.m/s
              .320       .898       .526     C perv/imperv/total
 15       ADD RUNOFF
             2.305      2.884       .579       .000 c.m/s
 27       HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .1136950E+05 c.m
  8       PIPE
          .500      Minimum velocity  m/sec
         2.920      Maximum velocity  m/sec
          .013      Pipe Manning's 'n'
         1.350      Diameter in metres
          .600      Select Grade in %
          Depth         =      .830 metres
          Velocity      =     3.123 m/sec
          Pipe Capacity =     4.134 c.m/s
          Critical depth=      .908 metres
  9       ROUTE
       500.000      Conduit Length
          .407      Supply X-factor <.5
       120.096      Supply K-lag (sec)
          .500      Beta weighting factor
       120.000      Routing timestep
             1      No. of sub-reaches
             2.305      2.884      2.637       .000 c.m/s
 16       NEXT LINK
             2.305      2.637      2.637       .000 c.m/s
 35       COMMENT
         3     line(s) of comment
          ** DIVERSION OF 5 YEAR FLOWS + 15% TO STORM SEWER **
          ** 2180L/S + 15% = 2507L/S **
          ** ALL FLOWS GREATER THAN THE 5YR+15% DIRECTED TO WETPOND **
 12       DIVERT
             1      U/S Node No.ó 99999
         2.507      Threshold Discharge
         2.507      Max. Outflow reqd.
               Qmax & Vol.Diverted =      .130 c.m/s        78.1 c.m
               No flow diverted
             2.305      2.637      2.507       .000 c.m/s
 17       COMBINE
         1     Junction Node No.
             2.305      2.637      2.507      2.507 c.m/s
 22       FILE HYDROGRAPH
         1     1=READ: 2=WRITE
        12     DIV00001.010        is Filename
         2     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
             2.305       .130      2.507      2.507 c.m/s
 35       COMMENT
         1     line(s) of comment
          *** ROSEDALE - DRAINAGE AREA FUT  ***
  4       CATCHMENT
         1.000      ID No.ó 99999
        12.770      Area in hectares
       400.000      Length (PERV) metres
         3.000      Gradient (%)
        70.000      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
             1.861       .130      2.507      2.507 c.m/s
              .320       .893       .721     C perv/imperv/total
 15       ADD RUNOFF
             1.861      1.991      2.507      2.507 c.m/s
 27       HYDROGRAPH DISPLAY
         5     is # of Hyeto/Hydrograph chosen
          Volume  =  .4940556E+04 c.m
 35       COMMENT
         1     line(s) of comment
          *** SITE - EX FLOWS OF 225 L/S DURING 10 YR  ***
 10       POND
         9 Depth - Discharge - Volume sets
          174.850        .000          .0
          175.350       .0310      1713.0
          175.600       .0400      2746.0
          175.760       .0800      3467.0
          175.850       .0829      3893.0
          176.350       .0830      6538.0
          176.650       .0831      8354.0
          176.750        .233      8999.0
          176.850        .473      9663.0
          Peak Outflow    =      .083 c.m/s
          Maximum Depth   =   175.870 metres
          Maximum Storage =     4001. c.m
             1.861      1.991       .083      2.507 c.m/s
 17       COMBINE
         1     Junction Node No.
             1.861      1.991       .083      2.540 c.m/s
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 35     COMMENT
      1     line(s) of comment
       *** OVERALL - EX FLOWS OF 2707 L/S DURING 10 YR  ***
 18     CONFLUENCE
      1     Junction Node No.
            1.861      2.540       .083       .000 c.m/s
 14     START
      1     1=Zero; 2=Define
 35     COMMENT
      3     line(s) of comment
       **********************************
       * MTO 25 YEAR DESIGN STORM EVENT *
       **********************************
  2     STORM
          1     1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
    715.568     Coefficient  a
       .000     Constant  b    (min)
       .699     Exponent  c
       .450     Fraction to peak  r
    240.000     Duration ó  240 min
               62.073 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
       *** FIELD - DRAINAGE AREA FX  ***
  4     CATCHMENT
      1.000     ID No.ó 99999
      3.440     Area in hectares
    150.000     Length (PERV) metres
      1.000     Gradient (%)
       .500     Per cent Impervious
    150.000     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
            .127       .000       .083       .000 c.m/s
            .367       .898       .369     C perv/imperv/total
 15     ADD RUNOFF
            .127       .127       .083       .000 c.m/s
 11     CHANNEL
       .300     Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .030     Manning's "n"
       .500     O/a Depth in metres
      1.000     Select Grade in %
      Depth          =      .190 metres
      Velocity       =      .766 m/sec
      Flow Capacity  =     1.222 c.m/s
      Critical depth =      .162 metres
  9     ROUTE
    400.000     Conduit Length
       .489     Supply X-factor <.5
    391.534     Supply K-lag (sec)
       .500     Beta weighting factor
    300.000     Routing timestep
          1     No. of sub-reaches
            .127       .127       .122       .000 c.m/s
 16     NEXT LINK
            .127       .122       .122       .000 c.m/s
 35     COMMENT
      1     line(s) of comment
       *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4     CATCHMENT
      1.000     ID No.ó 99999
     10.840     Area in hectares
    300.000     Length (PERV) metres
      1.000     Gradient (%)
     25.000     Per cent Impervious
    300.000     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
            .742       .122       .122       .000 c.m/s
            .367       .911       .503     C perv/imperv/total
 15     ADD RUNOFF
            .742       .775       .122       .000 c.m/s
 11     CHANNEL
       .300     Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
       .030     Manning's "n"
       .500     O/a Depth in metres
      1.000     Select Grade in %
      Depth          =      .415 metres
      Velocity       =     1.211 m/sec
      Flow Capacity  =     1.222 c.m/s
      Critical depth =      .377 metres
  9     ROUTE
    200.000     Conduit Length
       .457     Supply X-factor <.5
    123.848     Supply K-lag (sec)
       .500     Beta weighting factor
    120.000     Routing timestep
          1     No. of sub-reaches
            .742       .775       .720       .000 c.m/s
 16     NEXT LINK
            .742       .720       .720       .000 c.m/s
 35     COMMENT
      1     line(s) of comment
       *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4     CATCHMENT
      1.000     ID No.ó 99999
     29.250     Area in hectares
    500.000     Length (PERV) metres
      2.000     Gradient (%)
     35.700     Per cent Impervious
    500.000     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
          2.767       .720       .720       .000 c.m/s
           .367       .911       .561     C perv/imperv/total
 15     ADD RUNOFF
          2.767      3.486       .720       .000 c.m/s
 27     HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
      Volume  =  .1435674E+05 c.m
  8     PIPE
       .500     Minimum velocity  m/sec
      2.920     Maximum velocity  m/sec
       .013     Pipe Manning's 'n'
      1.350     Diameter in metres
       .600     Select Grade in %
      Depth         =      .950 metres
      Velocity      =     3.238 m/sec
      Pipe Capacity =     4.134 c.m/s
      Critical depth=      .999 metres
  9     ROUTE
    500.000     Conduit Length
       .377     Supply X-factor <.5
    115.797     Supply K-lag (sec)
       .500     Beta weighting factor
    120.000     Routing timestep
          1     No. of sub-reaches
          2.767      3.486      3.226       .000 c.m/s
 16     NEXT LINK
          2.767      3.226      3.226       .000 c.m/s
 35     COMMENT
      3     line(s) of comment
      ** DIVERSION OF 5 YEAR FLOWS + 15% TO STORM SEWER **
      ** 2180L/S + 15% = 2507L/S **
      ** ALL FLOWS GREATER THAN THE 5YR+15% DIRECTED TO WETPOND **
 12     DIVERT
          1     U/S Node No.ó 99999
      2.507     Threshold Discharge
      2.507     Max. Outflow reqd.
           Qmax & Vol.Diverted =      .719 c.m/s      431.6 c.m
           No flow diverted
          2.767      3.226      2.507       .000 c.m/s
 17     COMBINE
      1     Junction Node No.
          2.767      3.226      2.507      2.507 c.m/s
 22     FILE HYDROGRAPH
      1     1=READ: 2=WRITE
     12     DIV00001.025        is Filename
      2     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
          2.767       .719      2.507      2.507 c.m/s
 35     COMMENT
      1     line(s) of comment
      *** ROSEDALE - DRAINAGE AREA FUT  ***
  4     CATCHMENT
      1.000     ID No.ó 99999
     12.770     Area in hectares
    400.000     Length (PERV) metres
      3.000     Gradient (%)
     70.000     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
          2.199       .719      2.507      2.507 c.m/s
           .367       .901       .740     C perv/imperv/total
 15     ADD RUNOFF
          2.199      2.918      2.507      2.507 c.m/s
 27     HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
      Volume  =  .6300912E+04 c.m
 35     COMMENT
      1     line(s) of comment
      *** SITE - EX FLOWS OF 331 L/S DURING 25 YR  ***
 10     POND
      9 Depth - Discharge - Volume sets
       174.850        .000          .0
       175.350       .0310      1713.0
       175.600       .0400      2746.0
       175.760       .0800      3467.0
       175.850       .0829      3893.0
       176.350       .0830      6538.0
       176.650       .0831      8354.0
       176.750        .233      8999.0
       176.850        .473      9663.0
      Peak Outflow    =      .083 c.m/s
      Maximum Depth   =   176.107 metres
      Maximum Storage =     5254. c.m
          2.199      2.918       .083      2.507 c.m/s
 17     COMBINE
      1     Junction Node No.
          2.199      2.918       .083      2.545 c.m/s
 35     COMMENT
      1     line(s) of comment
      *** OVERALL - EX FLOWS OF 3340 L/S DURING 25 YR  ***
 18     CONFLUENCE
      1     Junction Node No.
          2.199      2.545       .083       .000 c.m/s
 14     START
      1     1=Zero; 2=Define
 35     COMMENT
      3     line(s) of comment
      **********************************
      * MTO 50 YEAR DESIGN STORM EVENT *
      **********************************
  2     STORM
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         1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     794.298    Coefficient  a
        .000    Constant  b    (min)
        .699    Exponent  c
        .450    Fraction to peak  r
     240.000    Duration ó  240 min
              68.903 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
      *** FIELD - DRAINAGE AREA FX  ***
 4    CATCHMENT
      1.000     ID No.ó 99999
      3.440     Area in hectares
     150.000    Length (PERV) metres
      1.000     Gradient (%)
        .500    Per cent Impervious
     150.000    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
           .161       .000       .083       .000 c.m/s
           .397       .909       .400     C perv/imperv/total
15    ADD RUNOFF
           .161       .161       .083       .000 c.m/s
11    CHANNEL
        .300    Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
        .030    Manning's "n"
        .500    O/a Depth in metres
      1.000     Select Grade in %
      Depth          =      .211 metres
      Velocity       =      .814 m/sec
      Flow Capacity  =     1.222 c.m/s
      Critical depth =      .182 metres
 9    ROUTE
     400.000    Conduit Length
        .488    Supply X-factor <.5
     368.744    Supply K-lag (sec)
        .500    Beta weighting factor
     300.000    Routing timestep
         1      No. of sub-reaches
           .161       .161       .154       .000 c.m/s
16    NEXT LINK
           .161       .154       .154       .000 c.m/s
35    COMMENT
      1     line(s) of comment
      *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
 4    CATCHMENT
      1.000     ID No.ó 99999
      10.840    Area in hectares
     300.000    Length (PERV) metres
      1.000     Gradient (%)
      25.000    Per cent Impervious
     300.000    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
           .841       .154       .154       .000 c.m/s
           .397       .917       .527     C perv/imperv/total
15    ADD RUNOFF
           .841       .888       .154       .000 c.m/s
11    CHANNEL
        .300    Base Width     =
      3.000     Left  bank slope  1:
      3.000     Right bank slope  1:
        .030    Manning's "n"
        .500    O/a Depth in metres
      1.000     Select Grade in %
      Depth          =      .439 metres
      Velocity       =     1.253 m/sec
      Flow Capacity  =     1.222 c.m/s
      Critical depth =      .400 metres
 9    ROUTE
     200.000    Conduit Length
        .455    Supply X-factor <.5
     119.694    Supply K-lag (sec)
        .500    Beta weighting factor
     120.000    Routing timestep
         1      No. of sub-reaches
           .841       .888       .829       .000 c.m/s
16    NEXT LINK
           .841       .829       .829       .000 c.m/s
35    COMMENT
      1     line(s) of comment
      *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
 4    CATCHMENT
      1.000     ID No.ó 99999
      29.250    Area in hectares
     500.000    Length (PERV) metres
      2.000     Gradient (%)
      35.700    Per cent Impervious
     500.000    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
          3.111       .829       .829       .000 c.m/s
           .397       .919       .584     C perv/imperv/total
15    ADD RUNOFF
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          3.111      3.940       .829       .000 c.m/s
27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
      Volume  =  .1664438E+05 c.m
 8    PIPE
        .500    Minimum velocity  m/sec
      2.920     Maximum velocity  m/sec
        .013    Pipe Manning's 'n'
      1.350     Diameter in metres
        .600    Select Grade in %
      Depth          =     1.053 metres
      Velocity       =     3.288 m/sec
      Pipe Capacity  =     4.134 c.m/s
      Critical depth=     1.060 metres
 9    ROUTE
     500.000    Conduit Length
        .344    Supply X-factor <.5
     114.065    Supply K-lag (sec)
        .500    Beta weighting factor
     120.000    Routing timestep
         1      No. of sub-reaches
          3.111      3.940      3.669       .000 c.m/s
16    NEXT LINK
          3.111      3.669      3.669       .000 c.m/s
35    COMMENT
      3     line(s) of comment
      ** DIVERSION OF 5 YEAR FLOWS + 15% TO STORM SEWER **
      ** 2180L/S + 15% = 2507L/S **
      ** ALL FLOWS GREATER THAN THE 5YR+15% DIRECTED TO WETPOND **
12    DIVERT
         1      U/S Node No.ó 99999
      2.507     Threshold Discharge
      2.507     Max. Outflow reqd.
           Qmax & Vol.Diverted =     1.162 c.m/s       720.0 c.m
           No flow diverted
          3.111      3.669      2.507       .000 c.m/s
17    COMBINE
      1     Junction Node No.
          3.111      3.669      2.507      2.507 c.m/s
22    FILE HYDROGRAPH
      1     1=READ: 2=WRITE
     12     DIV00001.050         is Filename
      2     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
          3.111      1.162      2.507      2.507 c.m/s
35    COMMENT
      1     line(s) of comment
      *** ROSEDALE - DRAINAGE AREA FUT  ***
 4    CATCHMENT
      1.000     ID No.ó 99999
      12.770    Area in hectares
     400.000    Length (PERV) metres
      3.000     Gradient (%)
      70.000    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
          2.448      1.162      2.507      2.507 c.m/s
           .398       .903       .752     C perv/imperv/total
15    ADD RUNOFF
          2.448      3.610      2.507      2.507 c.m/s
27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
      Volume  =  .7332710E+04 c.m
35    COMMENT
      1     line(s) of comment
      *** SITE - EX FLOWS OF 431 L/S DURING 50 YR  ***
10    POND
      9 Depth - Discharge - Volume sets
      174.850        .000          .0
      175.350       .0310      1713.0
      175.600       .0400      2746.0
      175.760       .0800      3467.0
      175.850       .0829      3893.0
      176.350       .0830      6538.0
      176.650       .0831      8354.0
      176.750        .233      8999.0
      176.850        .473      9663.0
      Peak Outflow    =      .083 c.m/s
      Maximum Depth   =   176.295 metres
      Maximum Storage =     6247. c.m
          2.448      3.610       .083      2.507 c.m/s
17    COMBINE
      1     Junction Node No.
          2.448      3.610       .083      2.590 c.m/s
35    COMMENT
      1     line(s) of comment
      *** OVERALL - EX FLOWS OF 3824 L/S DURING 50 YR  ***
18    CONFLUENCE
      1     Junction Node No.
          2.448      2.590       .083       .000 c.m/s
14    START
      1     1=Zero; 2=Define
35    COMMENT
      3     line(s) of comment
      **********************************
      * MTO 100 YEAR DESIGN STORM EVENT *
      **********************************
 2    STORM
         1      1=Chicago;2=Huff;3=User;4=Cdn1hr;5=Historic
     871.279    Coefficient  a
        .000    Constant  b    (min)
        .699    Exponent  c
        .450    Fraction to peak  r
     240.000    Duration ó  240 min
              75.581 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
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      1     line(s) of comment
      *** FIELD - DRAINAGE AREA FX  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
       3.440     Area in hectares
     150.000     Length (PERV) metres
       1.000     Gradient (%)
        .500     Per cent Impervious
     150.000     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
              .196       .000       .083       .000 c.m/s
              .425       .917       .427     C perv/imperv/total
 15    ADD RUNOFF
              .196       .196       .083       .000 c.m/s
 11    CHANNEL
        .300     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .030     Manning's "n"
        .500     O/a Depth in metres
       1.000     Select Grade in %
       Depth          =      .231 metres
       Velocity       =      .856 m/sec
       Flow Capacity  =     1.222 c.m/s
       Critical depth =      .200 metres
  9    ROUTE
     400.000     Conduit Length
        .487     Supply X-factor <.5
     350.564     Supply K-lag (sec)
        .500     Beta weighting factor
     300.000     Routing timestep
           1     No. of sub-reaches
              .196       .196       .186       .000 c.m/s
 16    NEXT LINK
              .196       .186       .186       .000 c.m/s
 35    COMMENT
      1     line(s) of comment
      *** EXISTING RESIDENTIAL - DRAINAGE AREA WT  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      10.840     Area in hectares
     300.000     Length (PERV) metres
       1.000     Gradient (%)
      25.000     Per cent Impervious
     300.000     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
              .924       .186       .186       .000 c.m/s
              .425       .922       .549     C perv/imperv/total
 15    ADD RUNOFF
              .924       .988       .186       .000 c.m/s
 11    CHANNEL
        .300     Base Width     =
       3.000     Left  bank slope  1:
       3.000     Right bank slope  1:
        .030     Manning's "n"
        .500     O/a Depth in metres
       1.000     Select Grade in %
       Depth          =      .458 metres
       Velocity       =     1.287 m/sec
       Flow Capacity  =     1.222 c.m/s
       Critical depth =      .420 metres
  9    ROUTE
     200.000     Conduit Length
        .453     Supply X-factor <.5
     116.540     Supply K-lag (sec)
        .500     Beta weighting factor
     120.000     Routing timestep
           1     No. of sub-reaches
              .924       .988       .929       .000 c.m/s
 16    NEXT LINK
              .924       .929       .929       .000 c.m/s
 35    COMMENT
      1     line(s) of comment
      *** MEADOW HEIGHTS - DRAINAGE AREA MH  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      29.250     Area in hectares
     500.000     Length (PERV) metres
       2.000     Gradient (%)
      35.700     Per cent Impervious
     500.000     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
             3.453       .929       .929       .000 c.m/s
              .425       .926       .604     C perv/imperv/total
 15    ADD RUNOFF
             3.453      4.381       .929       .000 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .1895466E+05 c.m
  8    PIPE
        .500     Minimum velocity  m/sec
       2.920     Maximum velocity  m/sec
        .013     Pipe Manning's 'n'
       1.350     Diameter in metres
        .600     Select Grade in %
       Surcharged HGL=      .674 %
       Velocity      =     3.061 m/sec
       Pipe Capacity =     4.134 c.m/s
       Critical depth=     1.113 metres
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  9    ROUTE
     500.000     Conduit Length
        .500     Supply X-factor <.5
        .000     Supply K-lag (sec)
        .500     Beta weighting factor
     600.000     Routing timestep
           1     No. of sub-reaches
             3.453      4.381      4.381       .000 c.m/s
 16    NEXT LINK
             3.453      4.381      4.381       .000 c.m/s
 35    COMMENT
      3     line(s) of comment
      ** DIVERSION OF 5 YEAR FLOWS + 15% TO STORM SEWER **
      ** 2180L/S + 15% = 2507L/S **
      ** ALL FLOWS GREATER THAN THE 5YR+15% DIRECTED TO WETPOND **
 12    DIVERT
           1     U/S Node No.ó 99999
       2.507     Threshold Discharge
       2.507     Max. Outflow reqd.
           Qmax & Vol.Diverted =     1.874 c.m/s      1354.0 c.m
           No flow diverted
             3.453      4.381      2.507       .000 c.m/s
 17    COMBINE
      1     Junction Node No.
             3.453      4.381      2.507      2.507 c.m/s
 22    FILE HYDROGRAPH
      1     1=READ: 2=WRITE
     12     DIV00001.100         is Filename
      2     1=Overland: 2=Inflow: 3=Outflow: 4=Temp'ary
             3.453      1.874      2.507      2.507 c.m/s
 35    COMMENT
      1     line(s) of comment
      *** ROSEDALE - DRAINAGE AREA FUT  ***
  4    CATCHMENT
       1.000     ID No.ó 99999
      12.770     Area in hectares
     400.000     Length (PERV) metres
       3.000     Gradient (%)
      70.000     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
             2.688      1.874      2.507      2.507 c.m/s
              .425       .904       .760     C perv/imperv/total
 15    ADD RUNOFF
             2.688      4.562      2.507      2.507 c.m/s
 27    HYDROGRAPH DISPLAY
      5     is # of Hyeto/Hydrograph chosen
       Volume  =  .8693769E+04 c.m
 35    COMMENT
      1     line(s) of comment
      *** SITE - EX FLOWS OF 550 L/S DURING 100 YR  ***
 10    POND
      9 Depth - Discharge - Volume sets
       174.850       .000          .0
       175.350      .0310      1713.0
       175.600      .0400      2746.0
       175.760      .0800      3467.0
       175.850      .0829      3893.0
       176.350      .0830      6538.0
       176.650      .0831      8354.0
       176.750       .233      8999.0
       176.850       .473      9663.0
       Peak Outflow    =      .083 c.m/s
       Maximum Depth   =   176.520 metres
       Maximum Storage =     7568. c.m
             2.688      4.562       .083      2.507 c.m/s
 17    COMBINE
      1     Junction Node No.
             2.688      4.562       .083      2.589 c.m/s
 35    COMMENT
      1     line(s) of comment
      *** OVERALL - EX FLOWS OF 4585 L/S DURING 100 YR  ***
 18    CONFLUENCE
      1     Junction Node No.
             2.688      2.589       .083       .000 c.m/s
 20    MANUAL
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