UPPER CANADA CONSULTANTS
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UCC File: 2300

FUNCTIONAL SERVICING REPORT

Stonebridge Village Subdivision
City of Port Colborne
May 2024

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 subdivision development known as Stonebridge Village 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 31 and Concession 3 and is situated west of West Side Road (Highway 58), north of Barrick Road and south/east of the Biederman Municipal Drain with two site entrances on Barrick Road. The site is bound by vacant agricultural lands to the north, residential properties to the west and south, and West Side Road (Highway 48) to the east. The development lands have historically been agricultural/vacant lands.

The development site is approximately 8.34 hectares and shall consist of 53 single detached units, 2 semi-detached units, 136 townhouse units (various styles), and 2 condominium blocks (194 units) for a total of 385 residential units. The development will include two entrances to Barrick Road, as well as a park block (Block 77) and a Stormwater Management (SWM) Facility (Block 78). The site shall include associated asphalt road, concrete curb, catch basins, storm sewers, sanitary sewers, and watermain.

The objectives of this study are as follows:

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

WATER SERVICING

There is an existing 300mm diameter municipal PVC watermain located on the north side of Barrick Road fronting the proposed development entrances. Two connections will be made to the existing Barrick Road watermain to provide an internal loop within the subdivision. The watermain will provide both domestic and fire water supply for the buildings in this development.

Municipal hydrants will be constructed at various locations within the development to provide sufficient fire protection. The sizes and locations of the proposed internal watermain will be finalized as part of the future detailed design.

The table below outlines flow and pressure information from Hydrant Flow Test Data provided by the City of Port Colborne for hydrants located on Barrick Road in front of the proposed development. All tests noted below were taken on behalf of the City of Port Colborne on May 25, 2023.

Table 1. Municipal Hydrant Flow Test Data

Hydrant Number	Location	Static Pressure (psi)	Residual Pressure (psi)	Actual Flow Rate (GPM)	Theoretical Flow @ 20psi (GPM)
63000025	Fronting #643 Barrick Rd.	50	40	1262	2284
63000026	Across #590 Barrick Rd.	50	40	1168	2114
63000027	Fronting #547 Barrick Rd.	50	40	1168	2114

Therefore, the hydrants on Barrick Road fronting the site would meet a 'Blue' rating as the fire flows experience levels greater than 1499 GPM at 20psi. It is expected that the City will process this data through their modelling software to determine the capability of the existing municipal watermain system to provide sufficient fire protection once extended into the development. A preliminary watermain servicing layout within the development can be see on the Preliminary Servicing and Grading Plan including in Appendix A.

SANITARY SERVICING

The following sanitary sewers are in proximity to the proposed development:

- 250mm diameter municipal sanitary sewer on Barrick Road fronting the development entrances conveying flows westerly before directing flows south on West Side Road (Highway 58). Flows entering this sanitary sewer are conveyed to the Steele Street SPS, which discharges to the Omer Avenue SPS system and then ultimately conveyed to the Seaway WWTP.
- 250mm diameter municipal sanitary sewer located on Barrick Road just east of the intersection of West Side Road (Highway 58) conveying flows to the Omer Avenue SPS prior to the Seaway WWTP.

An Overall Sanitary Analysis has been conducted on the municipal sanitary sewer system downstream of the proposed development (Drainage Area SV) to determine the most suitable sanitary outlet for the proposed development. An Overall Sanitary Drainage Area Plan has been included with peak sanitary flow calculations that include sanitary flows from the proposed Stonebridge Village Subdivision discharging to the Omer Avenue sanitary sewer system on Barrick Road on the east side of West Side Road.

Additional calculations have been conducted to determine the impact of the proposed Stonebridge Village development as well as an assumed density factor of 100 persons/hectare for the lands to the north (Drainage Area SVN) as it is expected that the north development lands will ultimately discharge sanitary flows through the Stonebridge Village development to the ultimate outlet. The analysis includes calculations for discharging sanitary flows from the combined full development (SV + SVN) to each of the above noted sanitary sewers and impact it cause to the downstream sewer capacities. All sanitary calculations for this development can be found in Appendix B.

The sanitary analysis conducted by UCC utilizes a residential flow rate of 255 L/cap/day as well as an infiltration rate of 0.28 L/s/ha to remain consistent with the 2021 Niagara Regional Water and Wastewater Servicing Plan Update (MSP). Existing residential areas have been conservatively attributed a density of 2.4 persons per unit, greater than the 2.34 persons per household noted in Table 4-1 of the Niagara Regional Official Plan. Commercial/Institutional areas have been attributed a flow rate of 28 m^3/ha/day with a peaking factor of 1.5 per the MECP's Design Criteria for sanitary, storm sewer and forcemains under an ECA (2023). Additionally, industrial areas have been attributed a flow rate of 0.2 L/s/gross hectare with a peaking factor of 2.0. The analysis includes flows from the Draft Approved Northland Estates and Meadow Heights (Phase 3) developments within the calculations.

The proposed Stonebridge Village development (SV) will result in a total peak wet weather flow of 12.60L/s discharging from the site from a total population of 924 people. The addition of the north development lands (SVN) will add an additional 11.02 hectares with an estimated population density of 100 people per hectare (1102 people). This will increase the total peak sanitary wet weather outflow to the ultimate sanitary outlet to be approximately 26.68L/s.

Steele Street SPS Sanitary System

Under existing conditions, the existing downstream sanitary sewers discharging to the Steele Street SPS reach a maximum capacity of 83.6% on Northland Avenue. The inclusion of peak sanitary flows from Stonebridge Village (SV) increases almost all sanitary sewers on Northland Avenue between West Side Road and Steele Street to above 100% capacity, requiring sanitary sewer replacement. Furthermore, the addition of sanitary flows from the northerly development lands (SVN) would result in all sanitary sewers on West Side Road between Barrick Road and Northland Avenue also reach capacities above 100%.

Per the 2021 Niagara Regional MSP Update, the Steele Street SPS currently has an operational capacity of 25.2L/s. It has been calculated that a total peak wet weather flow of 24.1L/s is currently directed to the SPS under existing conditions. With the addition of the Stonebridge Village (SV) development, peak wet weather flows will increase to 33.6L/s, and approximately 46.9L/s with the additional northerly development (SVN). It should be noted that upgrading the Steele Street SPS to levels sufficient for Stonebridge Village would require further upgrades at the Omer Avenue Pumping Station as well.

Therefore, upgrades would be required to both the Regional Steele Street SPS, the Omer Avenue SPS, as well as the Northland Avenue sanitary sewers prior to discharging flows to the existing 250mm diameter sanitary sewer fronting the proposed development.

Omer Avenue SPS Sanitary System

Under existing conditions, sanitary sewers downstream of the Stonebridge Village connection, discharging to the Omer Avenue SPS experience maximum capacities of 81.5% (on Omer Avenue). The inclusion of peak sanitary flows from Stonebridge Village (SV) increases capacities within the 450mm diameter Omer Avenue sanitary sewer to a maximum of 89.9%. No mainline downstream municipal sanitary sewers experience flows at levels greater than 90% of their capacity. However, the additional sanitary flows from potential future development on the northerly lands (SVN) will increase sanitary capacities to greater than 90% on sections of Elm Street and approximately 99.9% on Omer Avenue.

Per the 2021 Niagara Regional MSP Update, the Omer Avenue SPS currently has an ECA firm capacity of 107.0L/s. UCC calculations have determined that a peak sanitary wet weather flows of 101.0L/s are experienced by the Omer Avenue SPS under existing conditions. With the addition of the Stonebridge Village development (SV), peak wet weather flows will increase to approximately 111.2L/s, as well as 123.5L/s with the additional north development (SVN).

Sanitary Servicing Strategy

Therefore, in order to construct the proposed Stonebridge Village Subdivision development, and if discharging sanitary flows directly to the Omer Avenue SPS sanitary sewer system, no upgrades would be required to the existing downstream municipal sanitary sewer system. However, it will be required to increase both the ECA and Operational capacities of the Omer Avenue SPS to accommodate the additional peak sanitary flows. As such, discharging sanitary flows to the Omer Avenue SPS will result in less downstream deficiencies and is a better alternative for this development.

As shown non the Preliminary Site Servicing and Grading Plan in Appendix B, it is proposed to connect a 250mm diameter sanitary sewer to the existing maintenance hole on Barrick Road just east of West Side Road (Highway 58). The sewer will be extended westerly to approximately 50m west of the West Side Road road allowance before turning north to enter the proposed Stonebridge Village development. A single-family dwelling is proposed to be constructed within the entering property fronting Barrick Road, and as such the proposed 250mm diameter sanitary sewer will be placed within an easement on the east side of this property.

Although the downstream Omer Avenue sanitary sewer system has adequate capacity for the proposed development, the elevation of the existing end-of-line sanitary sewer invert at the connection point is much higher (±184.25m) than the invert of the existing Barrick Road sanitary sewer (±182.38m) fronting the site. In order for sufficient cover to be provided for the proposed sanitary sewer to service basements via gravity, as well as ensure adequate depth is provided for the future northern development lands, the 250mm diameter sanitary sewer will be constructed at a minimum slope and extended as a 250mm diameter sewer throughout the development.

STORMWATER MANAGEMENT PLAN

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

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 up to and including the 100-year design storm event to existing levels 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) wet pond facility will provide the necessary controls for this development. Stormwater quality levels will be provided to a Normal Standard (70% TSS removal), and quantity controls will be provided for the 2 – 100year design storm events prior to discharge from the development site.

A stormwater system may need to be constructed on Barrick Road from the westerly site entrance to the north Minor Road road allowance to provide a sufficient stormwater outlet for stormwater flows discharging from the SWM facility. A sufficient stormwater system will be extended north into the Minor Road road allowance where stormwater flows will ultimately discharge to the Biederman Drain.

An internal storm sewer system will be constructed within the development to convey stormwater flows to the proposed SWM Facility up to and including the 5-year design storm event. Overland flows unable to enter the storm sewer system will also be directed to the SWM facility per the grading design of the development. During extreme storm events greater than the 100-year storm, stormwater flows surpassing the capacity of the SWM facility will be directed to the Street 'A' road allowance via an emergency overflow spillway and be directed to the Barrick Road road allowance.

Cost sharing would ultimately occur with future development to the north discharging stormwater flows into the Stonebridge Village storm sewer system for the internal storm sewers, the Stormwater Management Facility, as well as the downstream Barrick Road/Minor Road stormwater system.

A complete Stormwater Management Plan for this development has been created and can be found in Appendix C.

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. Upgrades may be required to the Omer Avenue Sanitary Pumping Station.

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

4. Stormwater quantity controls are being provided by a stormwater management wet pond 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 discharging to Barrick Road.

Based on the above and the accompanying calculations and Stormwater Management Report, 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.
May 1, 2024

LICENSED PROFESSIONAL ENGINEER
J. P. SCHOOLEY
PROVINCE OF ONTARIO

Encl.

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APPENDICES

UPPER CANADA CONSULTANTS
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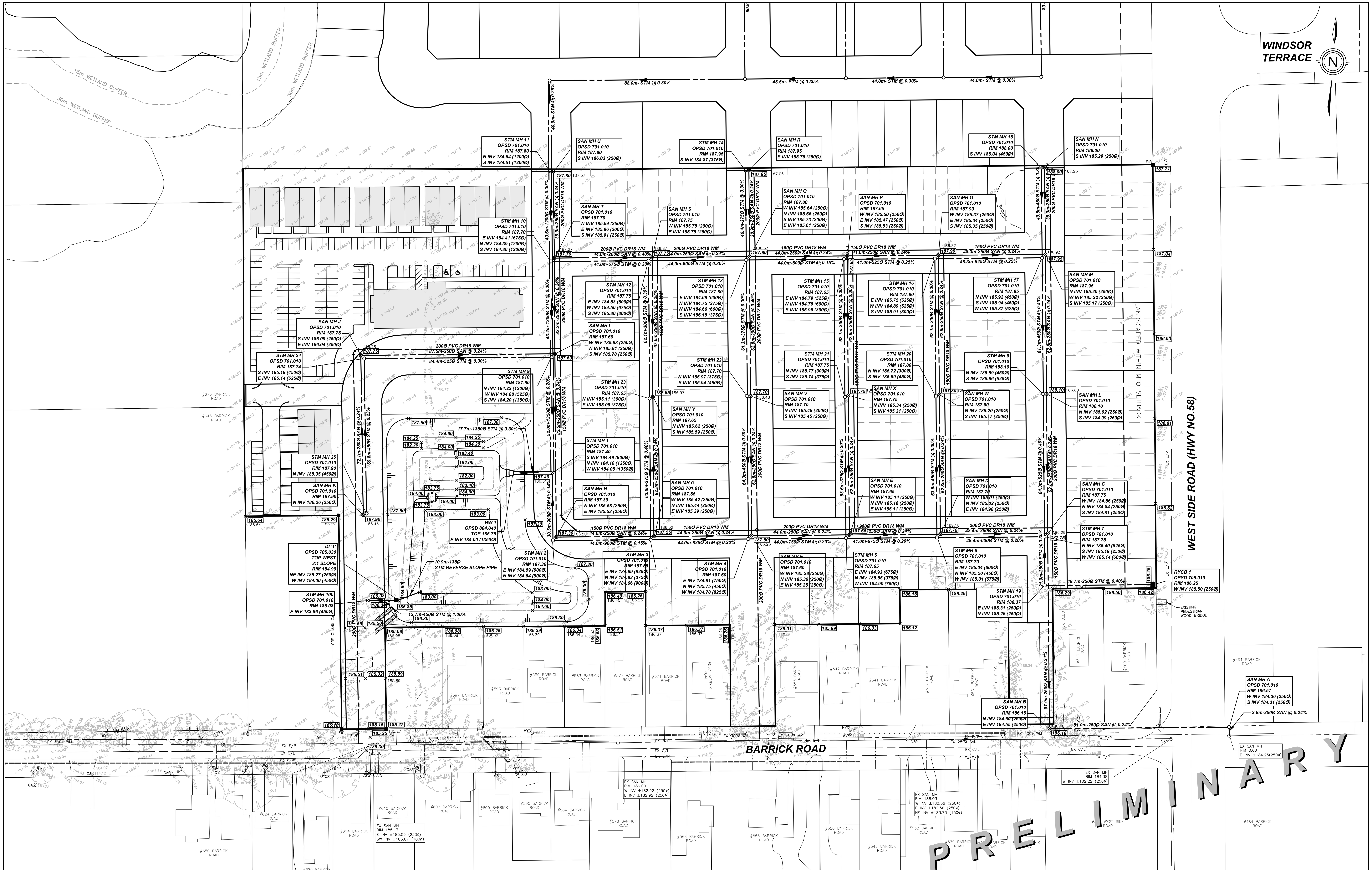
APPENDIX A

Preliminary Site Servicing and Grading Plan



#	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 Z.C
DESIGN K.T
CHECKED BY J.S
APPROVED BY J.S

OWNER
ELEVATE FOURTH DEVELOPEMENTS
13 CARLTON STREET SOUTH
THOROLD, ON
L2V1Z5

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STONEBRIDGE VILLAGE
CITY OF PORT COLBORNE
PRELIMINARY SITE SERVICING & GRADING PLAN

CONSULTANT FILE No.	2300
DATE	2024-03-28
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SCALE	1:750 m
REF No.	
DWG No.	2300-SGP
REV	0

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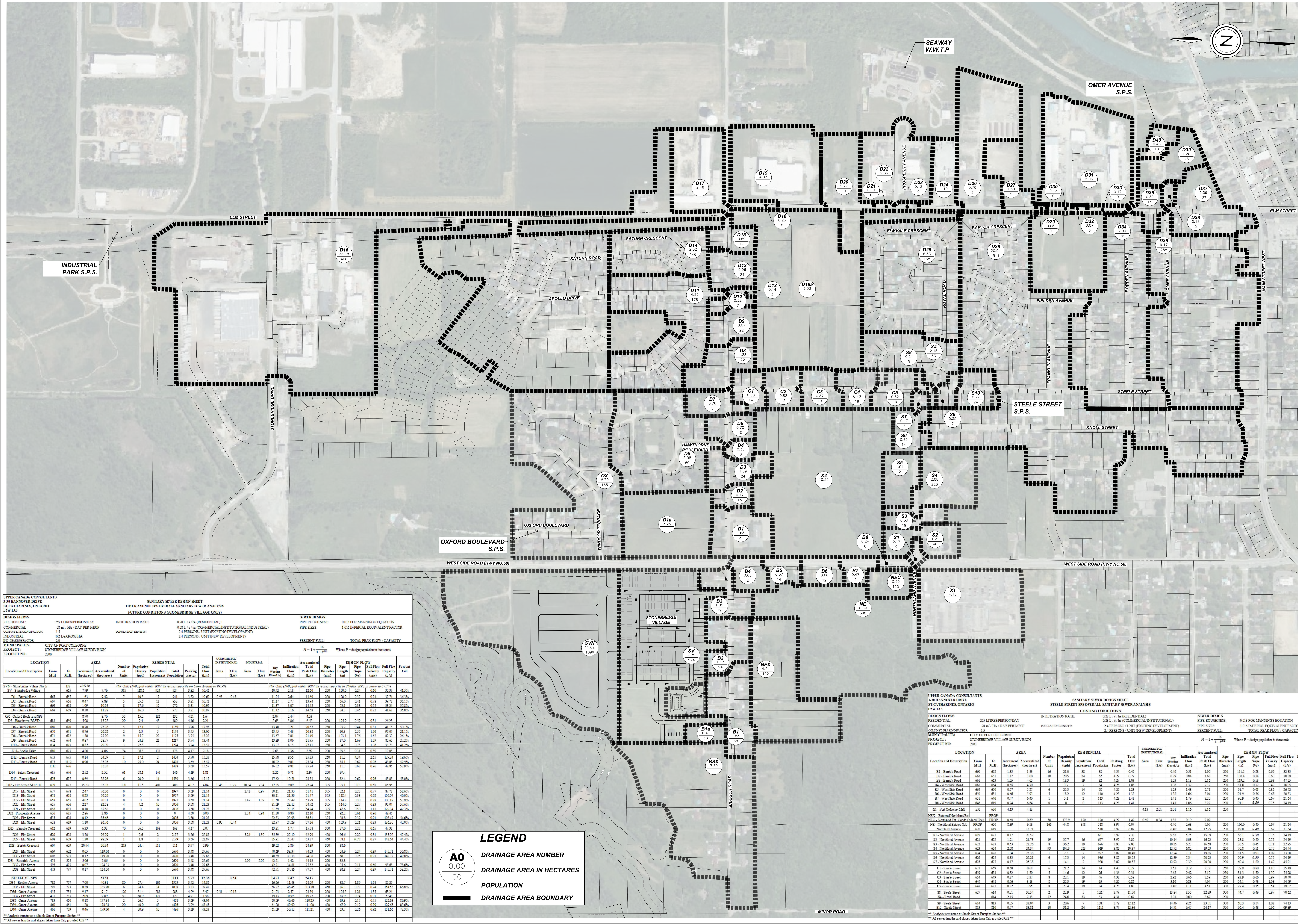
APPENDIX B

Overall Sanitary Drainage Area Plan – Proposed Conditions

Sanitary Sewer Calculations – Steele St. SPS (Existing Conditions)
Sanitary Sewer Calculations– Steele St. SPS (Future with Stonebridge Village)
Sanitary Sewer Calculations– Steele St. SPS (Future with Stonebridge Village & North)

Sanitary Sewer Calculations – Omer Ave. SPS (Existing Conditions)
Sanitary Sewer Calculations – Omer Ave. SPS (Future with Stonebridge Village)
Sanitary Sewer Calculations– Omer Ave. SPS (Future with Stonebridge Village & North)



LEGEND

A0 — DRAINAGE AREA NUMBER
0.00 — DRAINAGE AREA IN HECTARES
00 — POPULATION
DRAINAGE AREA BOUNDARY

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SANITARY SEWER DESIGN SHEET
OMER AVENUE SPS OVERALL SANITARY SEWER ANALYSIS
FUTURE CONDITIONS (STONEBRIDGE VILLAGE ONLY)

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY
COMMERCIAL: 28 m³ / HA / DAY PER MECP
COM/INST. PEAKING FACTOR: 1.5
INDUSTRIAL: 0.2 L/s/GROSS HA
IND. PEAKING FACTOR: 2.0

INFILTRATION RATE: 0.28 L / s / ha (RESIDENTIAL); 0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL/INDUSTRIAL)
POPULATION DENSITY: 2.4 PERSONS / UNIT (EXISTING DEVELOPMENT); 2.4 PERSONS / UNIT (NEW DEVELOPMENT)

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: STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL		INDUSTRIAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
SVN - Stonebridge Village North		BS	11.02 ha		458 Units (100 pph) within 'BSN' increases capacity on Omer Avenue to 99.9%										458 Units (100 pph) within 'BSN' increases capacity in 250dia. 'BS' san sewer to 87.7%								
SV - Stonebridge Village		665	7.79	7.79	385	118.6	924	924	3.82	10.42					10.42	2.18	12.60	250	100.0	0.24	0.60	30.39	41.5%
D1 - Barrick Road	665	667	1.63	9.42	7	10.3	17	941	3.82	10.60	0.93	0.45			11.05	2.64	13.69	250	108.0	0.37	0.74	37.74	36.3%
D2 - Barrick Road	667	666	0.47	9.89	5	25.5	12	953	3.81	10.72					11.17	2.77	13.94	250	56.0	0.41	0.78	39.72	35.1%
D3 - Barrick Road	666	668	1.09	10.98	8	17.6	19	972	3.81	10.92					11.37	3.07	14.45	250	73.1	0.38	0.75	38.24	37.8%
D4 - Barrick Road	668	669	0.30	11.28	2	16.0	5	977	3.81	10.97					11.42	3.16	14.58	250	24.3	0.45	0.82	41.62	35.0%
OX - Oxford Boulevard SPS			8.70	8.70	55	15.2	132	132	4.21	1.64					2.09	2.44	4.53						
D5 - Hawthorne BLVD	683	669	5.08	13.78	20	9.4	48	180	4.16	2.21					2.66	3.86	6.52	200	125.9	0.59	0.81	26.28	
D6 - Barrick Road	669	670	0.70	25.76	5	17.1	12	1169	3.76	12.95					13.40	7.21	20.62	250	75.2	0.44	0.81	41.15	50.1%
D7 - Barrick Road	670	671	0.76	26.52	2	6.3	5	1174	3.75	13.00					13.45	7.43	20.88	250	60.3	2.55	1.96	99.07	21.1%
D8 - Barrick Road	671	672	1.38	27.90	9	15.7	22	1195	3.75	13.22					13.67	7.81	21.49	250	103.1	1.76	1.62	82.30	26.1%
D9 - Barrick Road	672	674	0.87	28.77	9	24.8	22	1217	3.74	13.44					13.89	8.06	21.95	250	87.0	1.69	1.59	80.65	27.2%
D10 - Barrick Road	674	673	0.32	29.09	3	22.5	7	1224	3.74	13.52					13.97	8.15	22.11	250	34.5	0.75	1.06	53.73	41.2%
D11- Apollo Drive	680	673	4.86	4.86	74	36.5	178	178	4.17	2.18					2.63	1.36	3.99	200	93.5	0.31	0.59	19.05	
D12 - Barrick Road	673	675	0.14	34.09	1	17.1	2	1404	3.70	15.33					15.78	9.55	25.33	250	11.3	4.34	2.55	129.24	19.6%
D13 - Barrick Road	675	1112	0.96	35.05	10	25.0	24	1428	3.69	15.57					16.02	9.81	25.84	250	85.1	0.62	0.96	48.85	52.9%
	1112	676		35.05				1428	3.69	15.57					16.02	9.81	25.84	250	11.7	0.62	0.96	48.85	52.9%
D14 - Saturn Crescent	685	676	2.52	2.52	61	58.1	146	146	4.19	1.81					2.26	0.71	2.97	200	97.4				
D15 - Barrick Road	676	677	0.69	38.26	6	20.9	14	1589	3.66	17.17					17.62	10.71	28.33	250	82.4	0.62	0.96	48.85	58.0%
D16 - Elm Street NORTH	679	677	35.33	35.33	170	11.5	408	408	4.02	4.84	0.46	0.22	18.34	7.34	12.85	9.89	22.74	375	75.1	0.13	0.58	65.95	
D17 - Elm Street	677	678	2.47	76.06	0	0	0	1997	3.59	21.14			2.42	0.97	30.11	21.30	51.41	375	22.1	0.23	0.77	87.72	58.6%
D18 - Elm Street	678	658	0.23	76.29	0	0	0	1997	3.59	21.14					30.11	21.36	51.47	375	118.4	0.33	0.92	105.07	49.0%
D19 - Elm Street	658	655	4.02	80.31	0	0	0	1997	3.59	21.14			3.47	1.39	31.50	22.49	53.99	375	114.8	0.30	0.88	100.18	53.9%
D20 - Elm Street	655	656	2.27	82.58	4	4.2	10	2006	3.58	21.23					31.59	23.12	54.72	375	114.0	0.27	0.83	95.04	57.6%
D21 - Elm Street	656	635	0.10	82.68	0	0	0	2006	3.58	21.23					31.59	23.15	54.74	375	47.6	0.50	1.13	129.34	42.3%
D22 - Prosperity Avenue	636	635	2.86	2.86	0	0	0	0	4.50	0.00			2.34	0.94	11.30	0.80	12.10	250	92.2	0.61	0.96	48.45	
D23 - Elm Street	635	628	0.12	85.66	0	0	0	2006	3.58	21.23					32.53	23.98	56.51	375	58.8	0.32	0.91	103.47	54.6%
D24 - Elm Street	628	629	1.10	86.76	0	0	0	2006	3.58	21.23	0.90	0.44			32.97	24.29	57.26	450	103.9	0.21	0.83	136.30	42.0%
D25 - Elmvale Crescent	612	629	6.33	6.33	70	26.5	168	168	4.17	2.07					13.81	1.77	15.58	300	37.0	0.22	0.65	47.32	
D26 - Elm Street	629	608	3.70	96.79	1	0.6	2	2177	3.56	22.85			3.24	1.30	35.89	27.10	62.99	450	96.6	0.20	0.81	133.02	47.4%
D27 - Elm Street	608	609	1.30	98.09	1	1.8	2	2179	3.56	22.87					35.91	27.47	63.37	450	78.1	0.23	0.87	142.64	44.4%
D28 - Bartok Crescent	607	609	20.94	20.94	213	24.4	511	511	3.97	5.99					19.02	5.86	24.89	300	88.6				
D29 - Elm Street	609	602	0.05	119.08	0	0	0	2690	3.48	27.65					40.69	33.34	74.03	450	24.9	0.24	0.89	145.71	50.8%
D30 - Elm Street	602	595	0.12	119.20	0	0	0	2690	3.48	27.65					40.69	33.38	74.06	450	60.7	0.25	0.91	148.72	49.8%
D31 - Rosedale Avenue	474	595	5.06	5.06	0	0	0	2690	3.48	27.65			5.06	2.02	42.71	1.42	44.13	200	83.8				
D32 - Elm Street	595	473	0.07	124.33	0	0	0	2690	3.48	27.65					42.71	34.81	77.52	450	35.6	0.11	0.60	98.65	78.6%
D33 - Elm Street	473	797	0.17	124.50	0	0	0	2690	3.48	27.65					42.71	34.86	77.57	450	98.8	0.24	0.89	145.71	53.2%
STEELE ST. SPS				**33.81**				**1111**	**3.77**	**12.36**		**2.34**			**14.71**	**9.47**	**24.17**						
D34 - Borden Avenue	782	797	7.00	40.81	80	27.4	192	1303	3.72	14.32					16.66	11.43	28.09	250	82.7	1.89	1.68	85.29	
D35 - Elm Street	797	783	0.59	165.90	6	24.4	14	4008	3.33	39.42					56.82	46.45	103.28	450	86.3	0.27	0.94	154.55	66.8%
D36 - Omer Avenue	455	783	9.17	9.17	120	31.4	288	288	4.09	3.47	0.31	0.15			21.03	2.57	23.59	250	105.5	1.21	1.35	68.24	
D37 - Elm Street	437	783	2.09	2.09	53	60.9	127	127	4.21	1.58					19.13	0.59	19.72	200	83.9	0.74	0.91	29.43	
D38 - Omer Avenue	783	460	0.18	177.34	2	26.7	5	4428	3.29	43.04					60.59	49.66	110.25	450	63.3	0.17	0.75	122.63	89.9%
D39 - Omer Avenue	460	461	1.20	178.54	20	40.0	48	4476	3.29	43.45					61.00	49.99	111.00	450	67.0	0.19	0.79	129.65	85.6%
D40 - Omer Avenue	461	759	0.46	179.00	4	20.9	10	4486	3.29	43.53					61.09	50.12	111.21	450	53.7	0.26	0.92	151.66	73.3%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

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

SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS
EXISTING CONDITIONS

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY
COMMERCIAL: 28 m³ / HA / DAY PER MECP
COM/INST. PEAKING FACTOR: 1.5

INFILTRATION RATE: 0.28 L / s / ha (RESIDENTIAL); 0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)
POPULATION DENSITY: 2.4 PERSONS / UNIT (EXISTING DEVELOPMENT); 2.4 PERSONS / UNIT (NEW DEVELOPMENT)

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: STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
B1 - Barrick Road	660	662	1.83	1.83	16	21.0	38	38	4.34	0.49			0.49	0.51	1.00	250	111.5	0.28	0.65	32.83	3.1%
B2 - Barrick Road	662	661	1.17	3.00	10	20.5	24	62	4.29	0.79			0.79	0.84	1.63	250	130.4	0.24	0.60	30.39	5.4%
B3 - Barrick Road	661	663	1.05	4.05	8	18.3	19	82	4.27	1.03			1.03	1.13	2.16	250	119.2	0.58	0.93	47.25	4.6%
B4 - West Side Road	663	664	0.65	4.70	1	3.7	2	84	4.26	1.06			1.06	1.32	2.37	200	81.8	0.22	0.49	16.05	14.8%
B5 - West Side Road	664	650	0.57	5.27	6	25.3	14	98	4.25	1.23			1.23	1.48	2.71	200	91.7	0.61	0.82	26.72	10.1%
B6 - West Side Road	650	651	0.66	5.93	5	18.2	12	110	4.23	1.38			1.38	1.66	3.04	200	91.9	0.36	0.63	20.53	14.8%
B7 - West Side Road	651	646	0.47	6.40	1	5.1	2	113	4.23	1.41			1.41	1.79	3.20	200	90.9	0.40	0.67	21.64	14.8%
B8 - West Side Road	646	619	0.24	6.64	0	0	0	113	4.23	1.41			1.41	1.86	3.27	200	91.1	0.50	0.75	24.19	13.5%
X1 - Port Colborne Mall	EX	620	4.13	4.13							4.13	2.01	2.01	1.16	3.16	200					
NEX - External Northland Est.		PROP																			
NEC - Northland Est. Condo (Mixed Use)		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	9.58	166	44.8	398	518	3.97	6.07			6.40	2.68	9.09	200	100.0	0.40	0.67	21.64	42.0%
Northland Avenue	620	619		13.71				518	3.97	6.07			6.40	3.84	12.25	200	19.0	0.40	0.67	21.64	56.6%
S1 - Northland Avenue	619	621	0.17	20.52				631	3.92	7.30			9.65	5.75	15.39	200	66.1	0.50	0.75	24.19	63.6%
S2 - Northland Avenue	621	622	1.21	21.73	19	37.7	46	677	3.90	7.80			10.14	6.08	16.22	200	23.8	0.50	0.75	24.19	67.1%
S3 - Northland Avenue	622	623	0.53	22.26	8	36.2	19	696	3.90	8.00			10.35	6.23	16.58	200	26.5	0.45	0.71	22.95	72.2%
S4 - Northland Avenue	623	624	2.08	24.34	93	107.3	223	919	3.82	10.37			12.72	6.82	19.53	200	70.8	0.51	0.75	24.44	79.9%
S5 - Northland Avenue	624	626	1.04	25.38	1	2.3	2	922	3.82	10.40			12.74	7.11	19.85	200	81.5	0.93	1.02	33.00	60.1%
S6 - Northland Avenue	626	625	0.83	26.21	6	17.3	14	936	3.82	10.55			12.89	7.34	20.23	200	90.9	0.50	0.75	24.19	**83.6%**
S7 - Northland Avenue	625	627	0.17	26.38	1	14.1	2	938	3.82	10.57			12.92	7.39	20.30	200	60.4	1.80	1.42	45.91	44.2%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			2.53	0.19	2.72	250	79.9	0.80	1.10	55.49	4.9%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			2.68	0.42	3.10	250	81.3	1.50	1.50	75.98	4.1%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			2.92	0.66	3.59	250	93.9	0.66	0.99	50.40	7.1%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			3.16	0.88	4.04	250	94.1	0.78	1.08	54.79	7.4%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			3.40	1.11	4.51	300	97.4	0.15	0.54	39.07	11.5%
S8 - Steele Street	627	614	0.21	30.54	2	22.9	5	1027	3.79	11.50			13.84	8.55	22.39	300	44.7	0.49	0.97	70.62	31.7%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			3.01	0.60	3.62	200					
S9 - Steele Street	614	813	0.35	33.04	3	20.6	7	1087	3.78	12.12			14.46	9.25	23.71	300	50.3	0.54	1.02	74.13	32.0%
S10 - Steele Street	813	810	0.77	33.81	10	31.2	24	1111	3.77	12.36			14.71	9.47	24.17	300	96.4	0.48	0.96	69.89	34.6%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

#	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: Z.C
DESIGN: K.T
CHECKED BY: J.S
APPROVED BY: J.S

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

OWNER
ELEVATE FOURTH DEVELOPMENTS LTD.
13 CARLETON STREET SOUTH
THOROLD, ON.
L2V 1Z5

STONEBRIDGE VILLAGE
CITY OF PORT COLBORNE
OVERALL SANITARY DRAINAGE AREA PLAN

CONSULTANT FILE No. 2300
DATE 2024-03-28
PRINTED 2024-03-28
SCALE 1:2000 m
REF No. 2300
DWG No. SANDA-OVL
REV 0

DRAWING FILE: F:\2300\Engineering\2300-base(REDUCED).dwg PLOTTED: Mar 28, 2024 - 2:54pm PLOTTED BY: kurt

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

SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS

EXISTING CONDITIONS

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY
COMMERCIAL 28 m^3 / HA / DAY PER MECP
COM/INST. PEAKING FACT(1.5

INFILTRATION RATE: 0.28 L / s / ha (RESIDENTIAL)
0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)
POPULATION DENSITY: 2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)
2.4 PERSONS / UNIT (NEW DEVELOPMENT)

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 : STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
B1 - Barrick Road	660	662	1.83	1.83	16	21.0	38	38	4.34	0.49			0.49	0.51	1.00	250	111.5	0.28	0.65	32.83	3.1%
B2 - Barrick Road	662	661	1.17	3.00	10	20.5	24	62	4.29	0.79			0.79	0.84	1.63	250	130.4	0.24	0.60	30.39	5.4%
B3 - Barrick Road	661	663	1.05	4.05	8	18.3	19	82	4.27	1.03			1.03	1.13	2.16	250	119.2	0.58	0.93	47.25	4.6%
B4 - West Side Road	663	664	0.65	4.70	1	3.7	2	84	4.26	1.06			1.06	1.32	2.37	200	81.8	0.22	0.49	16.05	14.8%
B5 - West Side Road	664	650	0.57	5.27	6	25.3	14	98	4.25	1.23			1.23	1.48	2.71	200	91.7	0.61	0.82	26.72	10.1%
B6 - West Side Road	650	651	0.66	5.93	5	18.2	12	110	4.23	1.38			1.38	1.66	3.04	200	91.9	0.36	0.63	20.53	14.8%
B7 - West Side Road	651	646	0.47	6.40	1	5.1	2	113	4.23	1.41			1.41	1.79	3.20	200	90.9	0.40	0.67	21.64	14.8%
B8 - West Side Road	646	619	0.24	6.64	0	0	0	113	4.23	1.41			1.41	1.86	3.27	200	91.1	***0.50***	0.75	24.19	13.5%
X1 - Port Colborne Mall	EX	620	4.13	4.13							4.13	2.01	2.01	1.16	3.16	200					
NEX - External Northland Est.		PROP																			
NEC - Northland Est. Condo (Mixed Us		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	9.58	166	44.8	398	518	3.97	6.07			6.40	2.68	9.09	200	100.0	0.40	0.67	21.64	42.0%
Northland Avenue	620	619		13.71				518	3.97	6.07			6.40	3.84	12.25	200	19.0	*0.40*	0.67	21.64	56.6%
S1 - Northland Avenue	619	621	0.17	20.52				631	3.92	7.30			9.65	5.75	15.39	200	66.1	*0.50*	0.75	24.19	63.6%
S2 - Northland Avenue	621	622	1.21	21.73	19	37.7	46	677	3.90	7.80			10.14	6.08	16.22	200	23.8	0.50	0.75	24.19	67.1%
S3 - Northland Avenue	622	623	0.53	22.26	8	36.2	19	696	3.90	8.00			10.35	6.23	16.58	200	26.5	0.45	0.71	22.95	72.2%
S4 - Northland Avenue	623	624	2.08	24.34	93	107.3	223	919	3.82	10.37			12.72	6.82	19.53	200	70.8	0.51	0.75	24.44	79.9%
S5 - Northland Avenue	624	626	1.04	25.38	1	2.3	2	922	3.82	10.40			12.74	7.11	19.85	200	81.5	0.93	1.02	33.00	60.1%
S6 - Northland Avenue	626	625	0.83	26.21	6	17.3	14	936	3.82	10.55			12.89	7.34	20.23	200	90.9	*0.50*	0.75	24.19	**83.6%**
S7 - Northland Avenue	625	627	0.17	26.38	1	14.1	2	938	3.82	10.57			12.92	7.39	20.30	200	60.4	1.80	1.42	45.91	44.2%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			2.53	0.19	2.72	250	79.9	0.80	1.10	55.49	4.9%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			2.68	0.42	3.10	250	81.3	1.50	1.50	75.98	4.1%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			2.92	0.66	3.59	250	93.9	0.66	0.99	50.40	7.1%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			3.16	0.88	4.04	250	94.1	0.78	1.08	54.79	7.4%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			3.40	1.11	4.51	300	97.4	0.15	0.54	39.07	11.5%
S8 - Steele Street	627	614	0.21	30.54	2	22.9	5	1027	3.79	11.50			13.84	8.55	22.39	300	44.7	0.49	0.97	70.62	31.7%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			3.01	0.60	3.62	200					
S9 - Steele Street	614	813	0.35	33.04	3	20.6	7	1087	3.78	12.12			14.46	9.25	23.71	300	50.3	0.54	1.02	74.13	32.0%
S10 - Steele Street	813	810	0.77	33.81	10	31.2	24	1111	3.77	12.36			14.71	9.47	24.17	300	96.4	0.48	0.96	69.89	34.6%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

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

SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS
WITH STONEBRIDGE VILLAGE

DESIGN FLOWS		INFILTRATION RATE:	0.28 L / s / ha (RESIDENTIAL)
RESIDENTIAL:	255 LITRES/PERSON/DAY		0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)
COMMERCIAL	28 m^3 / HA / DAY PER MECP	POPULATION DENSITY:	2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)
COM/INST. PEAKING FACT(	1.5		2.4 PERSONS / UNIT (NEW DEVELOPMENT)

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 : STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
B1a - Future Dev *(towns)*		660	0.41	0.41	16	93.7	38	38	4.34	0.49			0.49	0.11	0.61	200	90.0	0.40	0.67	21.64	
B1 - Barrick Road	660	662	1.83	2.24	16	21.0	38	77	4.27	0.97			0.97	0.63	1.60	250	111.5	0.28	0.65	32.83	4.9%
SVN - Stonebridge Village North			***11.02***																		
SV - Stonebridge Village		661	**7.79**	7.79	***385***	118.6	924	924	3.82	10.42			10.42	2.18	12.60	250		0.28	0.65	32.83	38.4%
B2 - Barrick Road	662	661	1.17	11.20	10	20.5	24	1025	3.79	11.47			11.47	3.14	14.61	250	130.4	0.24	0.60	30.39	48.1%
B3 - Barrick Road	661	663	1.05	12.25	8	18.3	19	1044	3.79	11.67			11.67	3.43	15.10	250	119.2	0.58	0.93	47.25	32.0%
B4 - West Side Road	663	664	0.65	12.90	1	3.7	2	1046	3.79	11.70			11.70	3.61	15.31	200	81.8	0.22	0.49	16.05	95.4%
B5 - West Side Road	664	650	0.57	13.47	6	25.3	14	1061	3.78	11.84			11.84	3.77	15.62	200	91.7	0.61	0.82	26.72	58.4%
B6 - West Side Road	650	651	0.66	14.13	5	18.2	12	1073	3.78	11.97			11.97	3.96	15.93	200	91.9	0.36	0.63	20.53	77.6%
B7 - West Side Road	651	646	0.47	14.60	1	5.1	2	1075	3.78	11.99			11.99	4.09	16.08	200	90.9	0.40	0.67	21.64	74.3%
B8 - West Side Road	646	619	0.24	14.84	0	0	0	1075	3.78	11.99			11.99	4.16	16.15	200	91.1	***0.50***	0.75	24.19	66.7%
X1 - Port Colborne Mall	EX	620	4.13	4.13							4.13	2.01	2.01	1.16	3.16	200					
EX - External Northland Est.		PROP	0.00	0.00	***0***		0	0	4.50	0.00			0.00	0.00	0.00						
NEC - Northland Est. Condo (Mixed U		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	9.58	166	44.8	398	518	3.97	6.07			6.40	2.68	9.09	200	100.0	0.40	0.67	21.64	42.0%
Northland Avenue	620	619		13.71				518	3.97	6.07			6.40	3.84	12.25	200	19.0	*0.40*	0.67	21.64	56.6%
S1 - Northland Avenue	619	621	0.17	28.72				1594	3.66	17.22			19.56	8.04	27.60	200	66.1	*0.50*	0.75	24.19	114.1%
S2 - Northland Avenue	621	622	1.21	29.93	19	37.7	46	1639	3.65	17.66			20.01	8.38	28.39	200	23.8	0.50	0.75	24.19	117.3%
S3 - Northland Avenue	622	623	0.53	30.46	8	36.2	19	1658	3.65	17.85			20.20	8.53	28.73	200	26.5	0.45	0.71	22.95	125.1%
S4 - Northland Avenue	623	624	2.08	32.54	93	107.3	223	1882	3.61	20.03			22.37	9.11	31.48	200	70.8	0.51	0.75	24.44	128.8%
S5 - Northland Avenue	624	626	1.04	33.58	1	2.3	2	1884	3.61	20.05			22.39	9.40	31.80	200	81.5	0.93	1.02	33.00	96.4%
S6 - Northland Avenue	626	625	0.83	34.41	6	17.3	14	1898	3.60	20.19			22.53	9.63	32.17	200	90.9	*0.50*	0.75	24.19	**132.9%**
S7 - Northland Avenue	625	627	0.17	34.58	1	14.1	2	1901	3.60	20.21			22.56	9.68	32.24	200	60.4	1.80	1.42	45.91	70.2%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			2.53	0.19	2.72	250	79.9	0.80	1.10	55.49	4.9%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			2.68	0.42	3.10	250	81.3	1.50	1.50	75.98	4.1%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			2.92	0.66	3.59	250	93.9	0.66	0.99	50.40	7.1%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			3.16	0.88	4.04	250	94.1	0.78	1.08	54.79	7.4%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			3.40	1.11	4.51	300	97.4	0.15	0.54	39.07	11.5%
S8 - Steele Street	627	614	0.21	38.74	2	22.9	5	1990	3.59	21.07			23.41	10.85	32.25	300	44.7	0.49	0.97	70.62	45.7%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			3.01	0.60	1.61	200					
S9 - Steele Street	614	813	0.35	41.24	3	20.6	7	2050	3.58	21.64			23.98	11.55	33.19	300	50.3	0.54	1.02	74.13	44.8%
S10 - Steele Street	813	810	0.77	42.01	10	31.2	24	2074	3.57	21.87			24.21	11.76	33.63	300	96.4	0.48	0.96	69.89	48.1%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

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

SANITARY SEWER DESIGN SHEET
STEELE STREET SPS OVERALL SANITARY SEWER ANALYSIS

FULLY DEVELOPED CONDITIONS

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY
COMMERCIAL 28 m^3 / HA / DAY PER MECP
COM/INST. PEAKING FACT 1.5

INFILTRATION RATE: 0.28 L / s / ha (RESIDENTIAL)
0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL)
POPULATION DENSITY: 2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)
2.4 PERSONS / UNIT (NEW DEVELOPMENT)

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 : STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
BSX - Barrick Road West (Not Included)			***7.69***	*7.69*	***240***	***74.9***	*576*	*576*	*3.94*	*6.70*			*6.70*	*2.15*	*8.85*						
B1a - Future Dev *(towns)*		660	0.41	0.41	16	93.7	38	38	4.34	0.49			0.49	0.11	0.61	200	90.0	0.40	0.67	21.64	
B1 - Barrick Road	660	662	1.70	2.11	16	22.6	38	77	4.27	0.97			0.97	0.59	1.56	250	111.5	0.28	0.65	32.83	4.8%
SVN - Stonebridge Village North			**11.02**	11.02	***459***	100.0	1102	1102	3.77	12.27			12.27	3.09	15.35	200		0.40	0.67	21.64	70.9%
SV - Stonebridge Village		661	**7.79**	18.81	***385***	118.6	924	2026	3.58	21.41			21.41	5.27	26.68	250		0.24	0.60	30.39	87.8%
B2 - Barrick Road	662	661	1.17	22.09	10	20.5	24	2126	3.56	22.37			22.37	6.19	28.56	250	130.4	0.24	0.60	30.39	94.0%
B3 - Barrick Road	661	663	1.05	23.14	8	18.3	19	2146	3.56	22.56			22.56	6.48	29.03	250	119.2	0.58	0.93	47.25	61.5%
B4 - West Side Road	663	664	0.65	23.79	1	3.7	2	2148	3.56	22.58			22.58	6.66	29.24	200	81.8	0.22	0.49	16.05	182.2%
B5 - West Side Road	664	650	0.57	24.36	6	25.3	14	2162	3.56	22.71			22.71	6.82	29.54	200	91.7	0.61	0.82	26.72	110.5%
B6 - West Side Road	650	651	0.66	25.02	5	18.2	12	2174	3.56	22.83			22.83	7.01	29.83	200	91.9	0.36	0.63	20.53	145.3%
B7 - West Side Road	651	646	0.47	25.49	1	5.1	2	2177	3.56	22.85			22.85	7.14	29.99	200	90.9	0.40	0.67	21.64	138.6%
B8 - West Side Road	646	619	0.24	25.73	0	0.0	0	2177	3.56	22.85			22.85	7.20	30.06	200	91.1	***0.50***	0.75	24.19	124.2%
X1 - Port Colborne Mall	EX	620	4.13	4.13		0.0					4.13	2.01	2.01	1.16	3.16	200					
NEX - External Northland Est.		PROP	0.00	0.00	***0***		0	0	4.50	0.00			0.00	0.00	0.00						
NEC - Northland Est. Condo (Mixed Us		PROP	0.69	0.69	50	173.9	120	120	4.22	1.49	0.69	0.34	1.83	0.19	2.02						
NE - Northland Estates Sub	PROP	620	8.89	9.58	166	44.8	398	518	3.97	6.07			6.40	2.68	9.09	200	100.0	0.40	0.67	21.64	42.0%
Northland Avenue	620	619		13.71				518	3.97	6.07			6.40	3.84	12.25	200	19.0	*0.40*	0.67	21.64	56.6%
S1 - Northland Avenue	619	621	0.17	39.61				2695	3.48	27.69			30.04	11.09	41.13	200	66.1	*0.50*	0.75	24.19	170.0%
S2 - Northland Avenue	621	622	1.21	40.82	19	37.7	46	2741	3.48	28.11			30.46	11.43	41.89	200	23.8	0.50	0.75	24.19	173.1%
S3 - Northland Avenue	622	623	0.53	41.35	8	36.2	19	2760	3.47	28.29			30.63	11.58	42.21	200	26.5	0.45	0.71	22.95	183.9%
S4 - Northland Avenue	623	624	2.08	43.43	93	107.3	223	2983	3.44	30.33			32.67	12.16	44.83	200	70.8	0.51	0.75	24.44	183.5%
S5 - Northland Avenue	624	626	1.04	44.47	1	2.3	2	2986	3.44	30.35			32.69	12.45	45.14	200	81.5	0.93	1.02	33.00	136.8%
S6 - Northland Avenue	626	625	0.83	45.30	6	17.3	14	3000	3.44	30.48			32.82	12.68	45.51	200	90.9	*0.50*	0.75	24.19	**188.1%**
S7 - Northland Avenue	625	627	0.17	45.47	1	14.1	2	3002	3.44	30.50			32.84	12.73	45.58	200	60.4	1.80	1.42	45.91	99.3%
C1 - Steele Street	671	659	0.68	0.68	6	21.2	14	14	4.40	0.19			2.53	0.19	2.72	250	79.9	0.80	1.10	55.49	4.9%
C2 - Steele Street	659	654	0.82	1.50	5	14.6	12	26	4.36	0.34			2.68	0.42	3.10	250	81.3	1.50	1.50	75.98	4.1%
C3 - Steele Street	654	649	0.87	2.37	8	22.1	19	46	4.32	0.58			2.92	0.66	3.59	250	93.9	0.66	0.99	50.40	7.1%
C4 - Steele Street	649	648	0.76	3.13	8	25.3	19	65	4.29	0.82			3.16	0.88	4.04	250	94.1	0.78	1.08	54.79	7.4%
C5 - Steele Street	648	627	0.82	3.95	8	23.4	19	84	4.26	1.06			3.40	1.11	4.51	300	97.4	0.15	0.54	39.07	11.5%
S8 - Steele Street	627	614	0.21	49.63	2	22.9	5	3091	3.43	31.31			33.65	13.90	45.54	300	44.7	0.49	0.97	70.62	64.5%
X4 - Royal Road		614	2.15	2.15	22	24.6	53	53	4.31	0.67			3.01	0.60	1.61	200					
S9 - Steele Street	614	813	0.35	52.13	3	20.6	7	3151	3.42	31.85			34.19	14.60	46.44	300	50.3	0.54	1.02	74.13	62.6%
S10 - Steele Street	813	810	0.77	52.90	10	31.2	24	3175	3.42	32.06			34.41	14.81	46.87	300	96.4	0.48	0.96	69.89	67.1%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

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

SANITARY SEWER DESIGN SHEET
OMER AVENUE SPS OVERALL SANITARY SEWER ANALYSIS

EXISTING CONDITIONS (NOT INCLUDING ANY FUTURE DEVELOPMENT)

DESIGN FLOWS

RESIDENTIAL:	255 LITRES/PERSON/DAY	INFILTRATION RATE:	0.28 L / s / ha (RESIDENTIAL)	
COMMERCIAL	28 m^3 / HA / DAY PER MECP		0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL/INDUSTRIAL)	
COM/INST. PEAKING FACTO	1.5	POPULATION DENSITY:	2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)	
INDUSTRIAL	0.2 L/s/GROSS HA		2.4 PERSONS / UNIT (NEW DEVELOPMENT)	
IND. PEAKING FACTOR	2.0			

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 : STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL		INDUSTRIAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
D1 - Barrick Road	665	667	1.63	1.63	7	10.3	17	17	4.39	0.22	0.93	0.45			0.67	0.46	1.12	250	108.0	0.37	0.74	37.74	3.0%
D2 - Barrick Road	667	666	0.47	2.10	5	25.5	12	29	4.36	0.37					0.82	0.59	1.41	250	56.0	0.41	0.78	39.72	3.5%
D3 - Barrick Road	666	668	1.09	3.19	8	17.6	19	48	4.32	0.61					1.06	0.89	1.96	250	73.1	0.38	0.75	38.24	5.1%
D4 - Barrick Road	668	669	0.30	3.49	2	16.0	5	53	4.31	0.67					1.12	0.98	2.10	250	24.3	0.45	0.82	41.62	5.0%
OX - Oxford Boulevard SPS			*8.70*	8.70	55	15.2	132	132	4.21	1.64					2.09	2.44	4.53						
D5 - Hawthorne BLVD	683	669	5.08	13.78	20	9.4	48	180	4.16	2.21					2.66	3.86	6.52	200	125.9	0.59	0.81	26.28	
D6 - Barrick Road	669	670	0.70	17.97	5	17.1	12	245	4.11	2.97					3.42	5.03	8.45	250	75.2	0.44	0.81	41.15	20.5%
D7 - Barrick Road	670	671	0.76	18.73	2	6.3	5	250	4.11	3.03					3.48	5.24	8.72	250	60.3	2.55	1.96	99.07	8.8%
D8 - Barrick Road	671	672	1.38	20.11	9	15.7	22	271	4.10	3.28					3.73	5.63	9.36	250	103.1	1.76	1.62	82.30	11.4%
D9 - Barrick Road	672	674	0.87	20.98	9	24.8	22	293	4.08	3.53					3.98	5.87	9.85	250	87.0	1.69	1.59	80.65	12.2%
D10 - Barrick Road	674	673	0.32	21.30	3	22.5	7	300	4.08	3.61					4.06	5.96	10.03	250	34.5	0.75	1.06	53.73	18.7%
D11- Apollo Drive	680	673	4.86	4.86	74	36.5	178	178	4.17	2.18					2.63	1.36	3.99	200	93.5	0.31	0.59	19.05	
D12 - Barrick Road	673	675	0.14	26.30	1	17.1	2	480	3.98	5.64					6.09	7.36	13.46	250	11.3	4.34	2.55	129.24	10.4%
D13 - Barrick Road	675	1112	0.96	27.26	10	25.0	24	504	3.97	5.91					6.36	7.63	13.99	250	85.1	0.62	0.96	48.85	28.6%
	1112	676		27.26				504	3.97	5.91					6.36	7.63	13.99	250	11.7	0.62	0.96	48.85	28.6%
D14 - Saturn Crescent	685	676	2.52	2.52	61	58.1	146	146	4.19	1.81					2.26	0.71	2.97	200	97.4				
D15 - Barrick Road	676	677	0.69	30.47	6	20.9	14	665	3.91	7.67					8.12	8.53	16.65	250	82.4	0.62	0.96	48.85	34.1%
D16 - Elm Street NORTH	679	677	35.33	35.33	170	11.5	408	408	4.02	4.84	0.46	0.22	18.34	7.34	12.85	9.89	22.74	375	75.1	0.13	0.58	65.95	
D17 - Elm Street	677	678	2.47	68.27	0	0	0	1073	3.78	11.97			2.42	0.97	20.95	19.12	40.06	375	22.1	0.23	0.77	87.72	45.7%
D18 - Elm Street	678	658	0.23	68.50	0	0	0	1073	3.78	11.97					20.95	19.18	40.13	375	118.4	0.33	0.92	105.07	38.2%
D19 - Elm Street	658	655	4.02	72.52	0	0	0	1073	3.78	11.97			3.47	1.39	22.33	20.31	42.64	375	114.8	0.30	0.88	100.18	42.6%
D20 - Elm Street	655	656	2.27	74.79	4	4.2	10	1082	3.78	12.07					22.43	20.94	43.37	375	114.0	0.27	0.83	95.04	45.6%
D21 - Elm Street	656	635	0.10	74.89	0	0	0	1082	3.78	12.07					22.43	20.97	43.40	375	47.6	0.50	1.13	129.34	33.6%
D22 - Prosperity Avenue	636	635	2.86	2.86	0	0	0	0	4.50	0.00			2.34	0.94	11.30	0.80	12.10	250	92.2	0.61	0.96	48.45	
D23 - Elm Street	635	628	0.12	77.87	0	0	0	1082	3.78	12.07					23.37	21.80	45.17	375	58.8	0.32	0.91	103.47	43.7%
D24 - Elm Street	628	629	1.10	78.97	0	0	0	1082	3.78	12.07	0.90	0.44			23.81	22.11	45.92	450	103.9	0.21	0.83	136.30	33.7%
D25 - Elmvale Crescent	612	629	6.33	6.33	70	26.5	168	168	4.17	2.07					13.81	1.77	15.58	300	37.0	0.22	0.65	47.32	
D26 - Elm Street	629	608	3.70	89.00	1	0.6	2	1253	3.73	13.81			3.24	1.30	26.84	24.92	51.76	450	96.6	0.20	0.81	133.02	38.9%
D27 - Elm Street	608	609	1.30	90.30	1	1.8	2	1255	3.73	13.83					26.87	25.28	52.15	450	78.1	*0.23*	0.87	142.64	36.6%
D28 - Bartok Crescent	607	609	20.94	20.94	213	24.4	511	511	3.97	5.99					19.02	5.86	24.89	300	88.6				
D29 - Elm Street	609	602	0.05	111.29	0	0	0	1766	3.63	18.91					31.94	31.16	63.11	450	24.9	0.24	0.89	145.71	43.3%
D30 - Elm Street	602	595	0.12	111.41	0	0	0	1766	3.63	18.91					31.94	31.19	63.14	450	60.7	0.25	0.91	148.72	42.5%
D31 - Rosedale Avenue	474	595	5.06	5.06	0	0	0	1766	3.63	18.91			5.06	2.02	33.97	1.42	35.39	200	83.8				
D32 - Elm Street	595	473	0.07	116.54	0	0	0	1766	3.63	18.91					33.97	32.63	66.60	450	35.6	0.11	0.60	98.65	67.5%
D33 - Elm Street	473	797	0.17	116.71	0	0	0	1766	3.63	18.91					33.97	32.68	66.65	450	98.8	0.24	0.89	145.71	45.7%
STEELE ST. SPS				**33.81**				**1111**	**3.77**	**12.36**		**2.34**			**14.71**	**9.47**	**24.17**						
D34 - Borden Avenue	782	797	7.00	40.81	80	27.4	192	1303	3.72	14.32					16.66	11.43	28.09	250	82.7	1.89	1.68	85.29	
D35 - Elm Street	797	783	0.59	158.11	6	24.4	14	3084	3.43	31.24					48.64	44.27	92.91	450	86.3	0.27	0.94	154.55	60.1%
D36 - Omer Avenue	455	783	9.17	9.17	120	31.4	288	288	4.09	3.47	0.31	0.15			21.03	2.57	23.59	250	105.5	1.21	1.35	68.24	
D37 - Elm Street	437	783	2.09	2.09	53	60.9	127	127	4.21	1.58					19.13	0.59	19.72	200	83.9	0.74	0.91	29.43	
D38 - Omer Avenue	783	460	0.18	169.55	2	26.7	5	3504	3.38	35.00					52.55	47.47	100.03	450	63.3	0.17	0.75	122.63	81.6%
D39 - Omer Avenue	460	461	1.20	170.75	20	40.0	48	3552	3.38	35.42					52.98	47.81	100.79	450	67.0	0.19	0.79	129.65	77.7%
D40 - Omer Avenue	461	759	0.46	171.21	4	20.9	10	3562	3.38	35.51					53.06	47.94	101.00	450	53.7	0.26	0.92	151.66	66.6%

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

SANITARY SEWER DESIGN SHEET
OMER AVENUE SPS OVERALL SANITARY SEWER ANALYSIS
FUTURE CONDITIONS (STONEBRIDGE VILLAGE ONLY)

DESIGN FLOWS
RESIDENTIAL: 255 LITRES/PERSON/DAY
COMMERCIAL 28 m^3 / HA / DAY PER MECP
COM/INST. PEAKING FACT(1.5
INDUSTRIAL 0.2 L/s/GROSS HA
IND. PEAKING FACTOR 2.0

INFILTRATION RATE: 0.28 L / s / ha (RESIDENTIAL)
0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL/INDUSTRIAL)
POPULATION DENSITY: 2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)
2.4 PERSONS / UNIT (NEW DEVELOPMENT)

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 : STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL		INDUSTRIAL					DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Area	Flow (L/s)	Dry Weather Flow (L/s)	Infiltration Flow (L/s)	Accumulated 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
SVN - Stonebridge Village North		BS	*11.02 ha*		*458 Units (100 pph) within 'BSN' increases capacity on Omer Avenue to 99.9%*										*458 Units (100 pph) within 'BSN' increases capacity in 250dia. 'BS' san sewer to 87.7%*								
SV - Stonebridge Village		665	7.79	7.79	385	118.6	924	924	3.82	10.42					10.42	2.18	12.60	250	100.0	0.24	0.60	30.39	41.5%
D1 - Barrick Road	665	667	1.63	9.42	7	10.3	17	941	3.82	10.60	0.93	0.45			11.05	2.64	13.69	250	108.0	0.37	0.74	37.74	36.3%
D2 - Barrick Road	667	666	0.47	9.89	5	25.5	12	953	3.81	10.72					11.17	2.77	13.94	250	56.0	0.41	0.78	39.72	35.1%
D3 - Barrick Road	666	668	1.09	10.98	8	17.6	19	972	3.81	10.92					11.37	3.07	14.45	250	73.1	0.38	0.75	38.24	37.8%
D4 - Barrick Road	668	669	0.30	11.28	2	16.0	5	977	3.81	10.97					11.42	3.16	14.58	250	24.3	0.45	0.82	41.62	35.0%
OX - Oxford Boulevard SPS			8.70	8.70	55	15.2	132	132	4.21	1.64					2.09	2.44	4.53						
D5 - Hawthorne BLVD	683	669	5.08	13.78	20	9.4	48	180	4.16	2.21					2.66	3.86	6.52	200	125.9	0.59	0.81	26.28	
D6 - Barrick Road	669	670	0.70	25.76	5	17.1	12	1169	3.76	12.95					13.40	7.21	20.62	250	75.2	0.44	0.81	41.15	50.1%
D7 - Barrick Road	670	671	0.76	26.52	2	6.3	5	1174	3.75	13.00					13.45	7.43	20.88	250	60.3	2.55	1.96	99.07	21.1%
D8 - Barrick Road	671	672	1.38	27.90	9	15.7	22	1195	3.75	13.22					13.67	7.81	21.49	250	103.1	1.76	1.62	82.30	26.1%
D9 - Barrick Road	672	674	0.87	28.77	9	24.8	22	1217	3.74	13.44					13.89	8.06	21.95	250	87.0	1.69	1.59	80.65	27.2%
D10 - Barrick Road	674	673	0.32	29.09	3	22.5	7	1224	3.74	13.52					13.97	8.15	22.11	250	34.5	0.75	1.06	53.73	41.2%
D11- Apollo Drive	680	673	4.86	4.86	74	36.5	178	178	4.17	2.18					2.63	1.36	3.99	200	93.5	0.31	0.59	19.05	
D12 - Barrick Road	673	675	0.14	34.09	1	17.1	2	1404	3.70	15.33					15.78	9.55	25.33	250	11.3	4.34	2.55	129.24	19.6%
D13 - Barrick Road	675	1112	0.96	35.05	10	25.0	24	1428	3.69	15.57					16.02	9.81	25.84	250	85.1	0.62	0.96	48.85	52.9%
	1112	676		35.05				1428	3.69	15.57					16.02	9.81	25.84	250	11.7	0.62	0.96	48.85	52.9%
D14 - Saturn Crescent	685	676	2.52	2.52	61	58.1	146	146	4.19	1.81					2.26	0.71	2.97	200	97.4				
D15 - Barrick Road	676	677	0.69	38.26	6	20.9	14	1589	3.66	17.17					17.62	10.71	28.33	250	82.4	0.62	0.96	48.85	58.0%
D16 - Elm Street NORTH	679	677	35.33	35.33	170	11.5	408	408	4.02	4.84	0.46	0.22	18.34	7.34	12.85	9.89	22.74	375	75.1	0.13	0.58	65.95	
D17 - Elm Street	677	678	2.47	76.06	0	0	0	1997	3.59	21.14			2.42	0.97	30.11	21.30	51.41	375	22.1	0.23	0.77	87.72	58.6%
D18 - Elm Street	678	658	0.23	76.29	0	0	0	1997	3.59	21.14					30.11	21.36	51.47	375	118.4	0.33	0.92	105.07	49.0%
D19 - Elm Street	658	655	4.02	80.31	0	0	0	1997	3.59	21.14			3.47	1.39	31.50	22.49	53.99	375	114.8	0.30	0.88	100.18	53.9%
D20 - Elm Street	655	656	2.27	82.58	4	4.2	10	2006	3.58	21.23					31.59	23.12	54.72	375	114.0	0.27	0.83	95.04	57.6%
D21 - Elm Street	656	635	0.10	82.68	0	0	0	2006	3.58	21.23					31.59	23.15	54.74	375	47.6	0.50	1.13	129.34	42.3%
D22 - Prosperity Avenue	636	635	2.86	2.86	0	0	0	0	4.50	0.00			2.34	0.94	11.30	0.80	12.10	250	92.2	0.61	0.96	48.45	
D23 - Elm Street	635	628	0.12	85.66	0	0	0	2006	3.58	21.23					32.53	23.98	56.51	375	58.8	0.32	0.91	103.47	54.6%
D24 - Elm Street	628	629	1.10	86.76	0	0	0	2006	3.58	21.23	0.90	0.44			32.97	24.29	57.26	450	103.9	0.21	0.83	136.30	42.0%
D25 - Elmvale Crescent	612	629	6.33	6.33	70	26.5	168	168	4.17	2.07					13.81	1.77	15.58	300	37.0	0.22	0.65	47.32	
D26 - Elm Street	629	608	3.70	96.79	1	0.6	2	2177	3.56	22.85			3.24	1.30	35.89	27.10	62.99	450	96.6	0.20	0.81	133.02	47.4%
D27 - Elm Street	608	609	1.30	98.09	1	1.8	2	2179	3.56	22.87					35.91	27.47	63.37	450	78.1	0.23	0.87	142.64	44.4%
D28 - Bartok Crescent	607	609	20.94	20.94	213	24.4	511	511	3.97	5.99					19.02	5.86	24.89	300	88.6				
D29 - Elm Street	609	602	0.05	119.08	0	0	0	2690	3.48	27.65					40.69	33.34	74.03	450	24.9	0.24	0.89	145.71	50.8%
D30 - Elm Street	602	595	0.12	119.20	0	0	0	2690	3.48	27.65					40.69	33.38	74.06	450	60.7	0.25	0.91	148.72	49.8%
D31 - Rosedale Avenue	474	595	5.06	5.06	0	0	0	2690	3.48	27.65			5.06	2.02	42.71	1.42	44.13	200	83.8				
D32 - Elm Street	595	473	0.07	124.33	0	0	0	2690	3.48	27.65					42.71	34.81	77.52	450	35.6	0.11	0.60	98.65	78.6%
D33 - Elm Street	473	797	0.17	124.50	0	0	0	2690	3.48	27.65					42.71	34.86	77.57	450	98.8	0.24	0.89	145.71	53.2%
STEELE ST. SPS				**33.81**				**1111**	**3.77**	**12.36**		**2.34**			**14.71**	**9.47**	**24.17**						
D34 - Borden Avenue	782	797	7.00	40.81	80	27.4	192	1303	3.72	14.32					16.66	11.43	28.09	250	82.7	1.89	1.68	85.29	
D35 - Elm Street	797	783	0.59	165.90	6	24.4	14	4008	3.33	39.42					56.82	46.45	103.28	450	86.3	0.27	0.94	154.55	66.8%
D36 - Omer Avenue	455	783	9.17	9.17	120	31.4	288	288	4.09	3.47	0.31	0.15			21.03	2.57	23.59	250	105.5	1.21	1.35	68.24	
D37 - Elm Street	437	783	2.09	2.09	53	60.9	127	127	4.21	1.58					19.13	0.59	19.72	200	83.9	0.74	0.91	29.43	
D38 - Omer Avenue	783	460	0.18	177.34	2	26.7	5	4428	3.29	43.04					60.59	49.66	110.25	450	63.3	0.17	0.75	122.63	89.9%
D39 - Omer Avenue	460	461	1.20	178.54	20	40.0	48	4476	3.29	43.45					61.00	49.99	111.00	450	67.0	0.19	0.79	129.65	85.6%
D40 - Omer Avenue	461	759	0.46	179.00	4	20.9	10	4486	3.29	43.53					61.09	50.12	111.21	450	53.7	0.26	0.92	151.66	73.3%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

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ST.CATHARINES, ONTARIO
L2W 1A3

SANITARY SEWER DESIGN SHEET
OMER AVENUE SPS OVERALL SANITARY SEWER ANALYSIS

FUTURE CONDITIONS (WITH STONEBRIDGE VILLAGE NORTH)

DESIGN FLOWS

RESIDENTIAL:	255 LITRES/PERSON/DAY	INFILTRATION RATE:	0.28 L / s / ha (RESIDENTIAL)		
COMMERCIAL	28 m^3 / HA / DAY PER MECP		0.28 L / s / ha (COMMERCIAL/INSTITUTIONAL/INDUSTRIAL)		
COM/INST. PEAKING FACTO	1.5	POPULATION DENSITY:	2.4 PERSONS / UNIT (EXISTING DEVELOPMENT)		
INDUSTRIAL	0.2 L/s/GROSS HA		2.4 PERSONS / UNIT (NEW DEVELOPMENT)		
IND. PEAKING FACTOR	2.0				

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 : STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO: 2300

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

Where P = design population in thousands

LOCATION			AREA		RESIDENTIAL						COMMERCIAL/ INSTITUTIONAL		INDUSTRIAL				Accumulated	DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Population Density (pph)	Population Increment	Total Population	Peaking Factor	Total Flow (L/s)	Area	Flow (L/s)	Area	Flow (L/s)	Dry Weather 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
SVN - Stonebridge Village North		BS	11.02	11.02	458	99.7	1099	1099	3.77	12.24					12.24	3.09	15.33	250	100.0	0.24	0.60	30.39	50.4%
SV - Stonebridge Village		665	7.79	18.81	385	118.6	924	2023	3.58	21.39					21.39	5.27	26.66	250	100.0	0.24	0.60	30.39	87.7%
D1 - Barrick Road	665	667	1.63	20.44	7	10.3	17	2040	3.58	21.55	0.93	0.45			22.00	5.72	27.72	250	108.0	0.37	0.74	37.74	73.5%
D2 - Barrick Road	667	666	0.47	20.91	5	25.5	12	2052	3.58	21.66					22.11	5.85	27.97	250	56.0	0.41	0.78	39.72	70.4%
D3 - Barrick Road	666	668	1.09	22.00	8	17.6	19	2071	3.57	21.85					22.30	6.16	28.46	250	73.1	0.38	0.75	38.24	74.4%
D4 - Barrick Road	668	669	0.30	22.30	2	16.0	5	2076	3.57	21.89					22.34	6.24	28.59	250	24.3	0.45	0.82	41.62	68.7%
OX - Oxford Boulevard SPS			8.70	8.70	55	15.2	132	132	4.21	1.64					2.09	2.44	4.53						
D5 - Hawthorne BLVD	683	669	5.08	13.78	20	9.4	48	180	4.16	2.21					2.66	3.86	6.52	200	125.9	0.59	0.81	26.28	
D6 - Barrick Road	669	670	0.70	36.78	5	17.1	12	2268	3.54	23.71					24.16	10.30	34.46	250	75.2	0.44	0.81	41.15	83.7%
D7 - Barrick Road	670	671	0.76	37.54	2	6.3	5	2273	3.54	23.76					24.21	10.51	34.72	250	60.3	2.55	1.96	99.07	35.0%
D8 - Barrick Road	671	672	1.38	38.92	9	15.7	22	2294	3.54	23.96					24.41	10.90	35.31	250	103.1	1.76	1.62	82.30	42.9%
D9 - Barrick Road	672	674	0.87	39.79	9	24.8	22	2316	3.54	24.17					24.62	11.14	35.76	250	87.0	1.69	1.59	80.65	44.3%
D10 - Barrick Road	674	673	0.32	40.11	3	22.5	7	2323	3.53	24.23					24.68	11.23	35.91	250	34.5	0.75	1.06	53.73	66.8%
D11- Apollo Drive	680	673	4.86	4.86	74	36.5	178	178	4.17	2.18					2.63	1.36	3.99	200	93.5	0.31	0.59	19.05	
D12 - Barrick Road	673	675	0.14	45.11	1	17.1	2	2503	3.51	25.92					26.37	12.63	39.00	250	11.3	4.34	2.55	129.24	30.2%
D13 - Barrick Road	675	1112	0.96	46.07	10	25.0	24	2527	3.50	26.14					26.59	12.90	39.49	250	85.1	0.62	0.96	48.85	80.8%
	1112	676		46.07				2527	3.50	26.14					26.59	12.90	39.49	250	11.7	0.62	0.96	48.85	80.8%
D14 - Saturn Crescent	685	676	2.52	2.52	61	58.1	146	146	4.19	1.81					2.26	0.71	2.97	200	97.4				
D15 - Barrick Road	676	677	0.69	49.28	6	20.9	14	2688	3.48	27.63					28.08	13.80	41.88	250	82.4	0.62	0.96	48.85	85.7%
D16 - Elm Street NORTH	679	677	35.33	35.33	170	11.5	408	408	4.02	4.84	0.46	0.22	18.34	7.34	12.85	9.89	22.74	375	75.1	0.13	0.58	65.95	
D17 - Elm Street	677	678	2.47	87.08	0	0	0	3096	3.43	31.35			2.42	0.97	40.33	24.38	64.71	375	22.1	0.23	0.77	87.72	73.8%
D18 - Elm Street	678	658	0.23	87.31	0	0	0	3096	3.43	31.35					40.33	24.45	64.77	375	118.4	0.33	0.92	105.07	61.6%
D19 - Elm Street	658	655	4.02	91.33	0	0	0	3096	3.43	31.35			3.47	1.39	41.71	25.57	67.29	375	114.8	0.30	0.88	100.18	67.2%
D20 - Elm Street	655	656	2.27	93.60	4	4.2	10	3106	3.43	31.44					41.80	26.21	68.01	375	114.0	0.27	0.83	95.04	71.6%
D21 - Elm Street	656	635	0.10	93.70	0	0	0	3106	3.43	31.44					41.80	26.24	68.04	375	47.6	0.50	1.13	129.34	52.6%
D22 - Prosperity Avenue	636	635	2.86	2.86	0	0	0	0	4.50	0.00			2.34	0.94	11.30	0.80	12.10	250	92.2	0.61	0.96	48.45	
D23 - Elm Street	635	628	0.12	96.68	0	0	0	3106	3.43	31.44					42.74	27.07	69.81	375	58.8	0.32	0.91	103.47	67.5%
D24 - Elm Street	628	629	1.10	97.78	0	0	0	3106	3.43	31.44	0.90	0.44			43.17	27.38	70.55	450	103.9	0.21	0.83	136.30	51.8%
D25 - Elmvale Crescent	612	629	6.33	6.33	70	26.5	168	168	4.17	2.07					13.81	1.77	15.58	300	37.0	0.22	0.65	47.32	
D26 - Elm Street	629	608	3.70	107.81	1	0.6	2	3276	3.41	32.97			3.24	1.30	46.00	30.19	76.19	450	96.6	0.20	0.81	133.02	57.3%
D27 - Elm Street	608	609	1.30	109.11	1	1.8	2	3278	3.41	32.99					46.02	30.55	76.57	450	78.1	*0.23*	0.87	142.64	53.7%
D28 - Bartok Crescent	607	609	20.94	20.94	213	24.4	511	511	3.97	5.99					19.02	5.86	24.89	300	88.6				
D29 - Elm Street	609	602	0.05	130.10	0	0	0	3790	3.35	37.52					50.55	36.43	86.98	450	24.9	0.24	0.89	145.71	59.7%
D30 - Elm Street	602	595	0.12	130.22	0	0	0	3790	3.35	37.52					50.55	36.46	87.01	450	60.7	0.25	0.91	148.72	58.5%
D31 - Rosedale Avenue	474	595	5.06	5.06	0	0	0	3790	3.35	37.52			5.06	2.02	52.58	1.42	53.99	200	83.8				
D32 - Elm Street	595	473	0.07	135.35	0	0	0	3790	3.35	37.52					52.58	37.90	90.47	450	35.6	0.11	0.60	98.65	91.7%
D33 - Elm Street	473	797	0.17	135.52	0	0	0	3790	3.35	37.52					52.58	37.95	90.52	450	98.8	0.24	0.89	145.71	62.1%
STEELE ST. SPS				**33.81**				**1111**	**3.77**	**12.36**		**2.34**			**14.71**	**9.47**	**24.17**						
D34 - Borden Avenue	782	797	7.00	40.81	80	27.4	192	1303	3.72	14.32					16.66	11.43	28.09	250	82.7	1.89	1.68	85.29	
D35 - Elm Street	797	783	0.59	176.92	6	24.4	14	5107	3.24	48.78					66.19	49.54	115.72	450	86.3	0.27	0.94	154.55	74.9%
D36 - Omer Avenue	455	783	9.17	9.17	120	31.4	288	288	4.09	3.47	0.31	0.15			21.03	2.57	23.59	250	105.5	1.21	1.35	68.24	
D37 - Elm Street	437	783	2.09	2.09	53	60.9	127	127	4.21	1.58					19.13	0.59	19.72	200	83.9	0.74	0.91	29.43	
D38 - Omer Avenue	783	460	0.18	188.36	2	26.7	5	5527	3.20	52.27					69.83	52.74	122.57	450	63.3	0.17	0.75	122.63	99.9%
D39 - Omer Avenue	460	461	1.20	189.56	20	40.0	48	5575	3.20	52.67					70.22	53.08	123.30	450	67.0	0.19	0.79	129.65	95.1%
D40 - Omer Avenue	461	759	0.46	190.02	4	20.9	10	5585	3.20	52.75					70.30	53.21	123.51	450	53.7	0.26	0.92	151.66	81.4%

** Analysis terminates at Steele Street Pumping Station **
** All sewer lengths and slopes taken from City provided GIS **

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

APPENDIX B

Stonebridge Village Subdivision Stormwater Management Plan

STORMWATER MANAGEMENT PLAN

STONEBRIDGE VILLAGE SUBDIVISION

CITY OF PORT COLBORNE

Prepared for:

Elevate Fourth Developments Ltd.

Prepared by:

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

March 28, 2024

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REFERENCES

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

STORMWATER MANAGEMENT PLAN

STONEBRIDGE VILLAGE SUBDIVISION

CITY OF PORT COLBORNE

1.0 INTRODUCTION

1.1 Study Area

The proposed residential development is located in the City of Port Colborne as part of Lot 31 and Concession 3. As shown on the enclosed Site Location Plan (Figure 1), the subject property is situated west of West Side Road (Highway 58), north of Barrick Road and south/east of the Biederman Municipal Drain.

The 8.34-hectare property is bound by West Side Road (Highway 58) to the east, existing agricultural lands to the north and residential lands to the south and west. The proposed development will include two roadway entrances to Barrick Road, a park block, a Stormwater Management (SWM) Facility block, as well as two separate condo blocks. The current development plan will result in a residential subdivision consisting of a total of 385 residential units and has been designed to allow for future development expansion to the available vacant agricultural lands north of the site.

The drainage areas contributing to the Stormwater Management (SWM) Plan consist of the development site, as well as the available development area to the north. All stormwater flows from the proposed development site are ultimately conveyed to the Biederman Municipal Drain north-west of the property, however flows are conveyed there through four (4) separate paths as outlined further in this report. The intention of this Stormwater Management Plan is to prove and outline an overall stormwater management model for the entire development area consisting of Stonebridge Village as well as the outlined available northern development lands.

1.2 Objectives

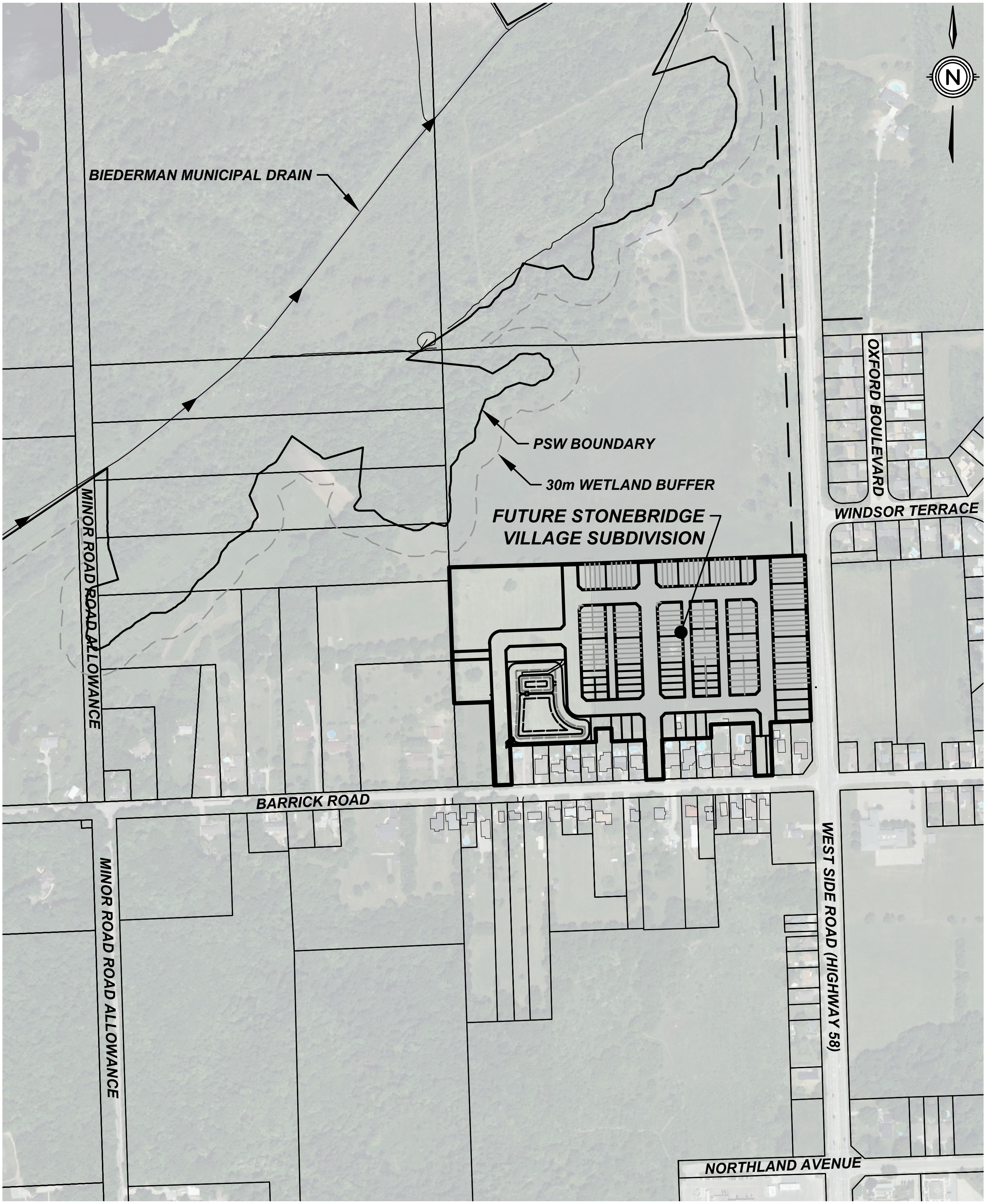
The objectives of this study are as follows:

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
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STONEBRIDGE VILLAGE

CITY OF PORT COLBORNE

SITE LOCATION PLAN

DATE	2024-03-04
SCALE	1:6,000 m
REF No.	2300
DWG No.	FIGURE 1

DRAWING FILE: F:\2300\Engineering\2300-base.dwg PLOTTED: Mar 04, 2024 – 5:11pm PLOTTED BY: kurt

1.3 Existing & Proposed Conditions

a) Existing Conditions

Historically, the proposed development site has always been utilized for agricultural purposes, though recently has remained vacant lands. The 8.34-hectare property is limited by residential properties/Barrick Road to the south, West Side Road (Highway 58) to the east, and vacant agricultural lands to the north.

The vast majority of stormwater flows from the development site are conveyed south towards Barrick Road under existing conditions, then flowing west before ultimately discharging to the Biederman Drain. However as discussed previously, it is expected that future residential development will occur within the lands to the north, connecting to the proposed development. As such, the available development area north of the site has been included in the proposed SWM Plan for Barrick Road Subdivision.

The native soils within the development site have been characterized as Silty Clay via borehole information provided from a preliminary geotechnical analysis conducted by Niagara Testing & Inspection (NTIL). Seven boreholes were conducted (including 5 monitoring wells) noting that bedrock was found approximately 0.5 – 1.1m beneath the existing grade across the site.

b) Proposed Conditions

The development property is 8.34 hectares and will result in the construction of 2 condominium blocks (157 units), with various single detached/semi/townhouse areas for a total of 341 residential units. The current layout accounts for expected additional single-detached dwellings along the south limits, increasing the fully developed layout to 348 units. The site shall be provided with full municipal services including sanitary sewers, storm sewers and watermain with asphalt pavement, concrete curbs and gutters. The proposed SWM plan discusses the proposed development under fully developed conditions.

2.0 STORMWATER MANAGEMENT CRITERIA

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

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

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

- The receiving watercourse, 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 quality 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) 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 Barrick 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 Intensity-Duration-Frequency curves for the subject area in Port Colborne. 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

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

3.2 Existing Conditions

Existing conditions were modelled to establish peak stormwater flows and volumes prior to any development within this site. The existing drainage areas for this subwatershed (shown on Figure 2) were determined from field investigations and a combination of recent topographic surveys and Ontario LIDAR data. Stormwater from all drainage areas outlined on Figure 2 are ultimately directed to the Biederman Drain, however the drainage areas have been delineated based on their immediate stormwater outlets from the site. It should be noted that the entire development area considered as part of this SWM Plan was included in the Biederman Drain watershed area as noted in the Spriet Associates Municipal Drain Report (January 12, 2023).

Drainage Area EX10 represents the area directing stormwater to the Barrick Road road allowance (Outlet A). Outlet A consists of a series of ditches and storm sewers currently directing stormwater flows westerly on Barrick Road, to a tributary watercourse conveying flows north between #805 & #825 Barrick Road, prior to ultimate discharge to the Biederman Drain. This drainage area consists largely of the proposed Stonebridge Village Subdivision lands as well as a portion of the property to the north.

Stormwater flows from Drainage Area EX20 are conveyed overland via sheet flow to north-westerly to Outlet B. Stormwater Outlet B consists of the Provincially Significant Wetland (PSW) as part of the Wainfleet Bog Wetland Complex, with all stormwater flows conveyed to the Biederman Drain approximately 200m north-west. These lands consist of a large portion of the northerly agricultural lands as well as the existing residential dwelling/driveway located at municipal address #503 West Side Road.

Drainage Area EX30 consists of the agricultural lands on the north development area directing stormwater flows to a 1.2m x 0.9m concrete box culvert (Outlet C) crossing West Side Road (Highway 58). Stormwater flows from this area are currently directed easterly across Oxford Boulevard and then northerly through the future Rosedale Subdivision/Meadow Heights Subdivision Development Area prior to ultimately being discharged to the Biederman Drain. This identical area has been included in the Stormwater Management Plan for the previously named downstream subdivisions within their calculations.

Lastly, Drainage Area EX40 consists of lands within the delineated future northerly development lands discharging stormwater flows directly to the West Side Road (Highway 58) road allowance (Outlet D), continuing northerly within the MTO road allowance before discharging to the Biederman Drain. These lands consist of the cleared, though undeveloped, front yard of the existing residential dwelling at #503 West Side Road.

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. A Weighted Impervious Calculation Sheet has been included in Appendix A for the existing drainage area conditions.

3.3 Proposed Conditions

It is proposed to construct a Stormwater Management Wet Pond Facility to provide the necessary quantity and quality controls for stormwater flows discharging from the development area under fully developed conditions. As stated previously, the available development lands as part of the two properties north of the Stonebridge Village development have been included in this SWM Plan as they are both included within the urban boundary of Port Colborne and are expected to be developed in the future. Without proper planning, these northern properties will not have a suitable proper stormwater outlet, and as such, have been included in the calculations within this report.

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					
EX10	11.26	300	1.0	77	3.0%
EX20	5.13	100	1.0	77	1.9%
EX30	3.44	100	2.0	77	0.5%
EX40	0.48	30	1.0	77	0.5%
	20.31	**Total Area**			
Future Conditions					
A1	19.41	450	1.0	77	70.0
A2	0.88	20	1.0	77	28.6
	20.31	**Total Area**			

As outlined within the Proposed Overall Storm Drainage Area Plan in Figure 3, the modelling for this SWM Plan has been conducted to allow the vast majority of stormwater flows from the overall development area to be conveyed to the proposed SWM Facility. As stormwater flows from Drainage Area EX20 are currently conveying stormwater flows to the existing PSW area as part of Outlet B, this SWM Plan is obligated to continue to discharge stormwater flows to these lands at a similar rate, and not completely remove this source of stormwater from the PSW lands. Therefore, Drainage Area A20 has been delineated representing the expected rear yard area from single family dwellings conveying stormwater flows to the PSW lands via sheet flow. As these would be rear-yards and a non-significant source of TSS, quality controls would not be required for this area.

To remain conservative, the lands as part of Drainage Areas EX30 and EX40 have been included in the modelling for this SWM Facility. As the northern lands are outside of the Stonebridge Village development area, they will remain untouched and are still expected to drain to their current outlets until such time that development occurs. However, all expected future development lands north of the site not included in Drainage Area A20 have been included in sizing the proposed SWM Facility, and no future flows have been modelled to drain to Outlets C and D under future conditions. This may change under future development applications for these northern lands.

As the proposed Stonebridge Village development consists of mainly townhouses with an additional mix of apartments, single detached dwellings as well as park area, an imperviousness of 70% has been utilized for the entire development area as it is expected these land densities will remain consistent within future development on the northern lands.

As stated previously, the stormwater infrastructure on Barrick Road consists of a series of ditches, culverts and storm sewers, ultimately conveying stormwater flows to a tributary flowing north between #805 and #825 Barrick Road to the Biederman Drain. As part of the proposed SWM Plan, a stormwater system will be constructed on Barrick Road to provide a suitable stormwater outlet for the SWM Facility. The system will be constructed from the west development entrance and continue westerly to the Minor Road road allowance, before directing flows north within the road allowance.

As part of the preliminary design of the internal subdivision storm sewer system, the vast majority of stormwater flows from the northern lands have been included as discharging to the storm sewer on at the northern limit of Street ‘D’. Therefore, cost sharing will be required for the northern lands for: the downstream storm sewers to the SWM Facility, the SWM Facility itself, and the downstream stormwater system to the ultimate Biederman Drain outlet. It is also expected that cost sharing will occur with the City of Port Colborne to construct the stormwater system on Barrick Road/Minor Road to the Biederman Drain.

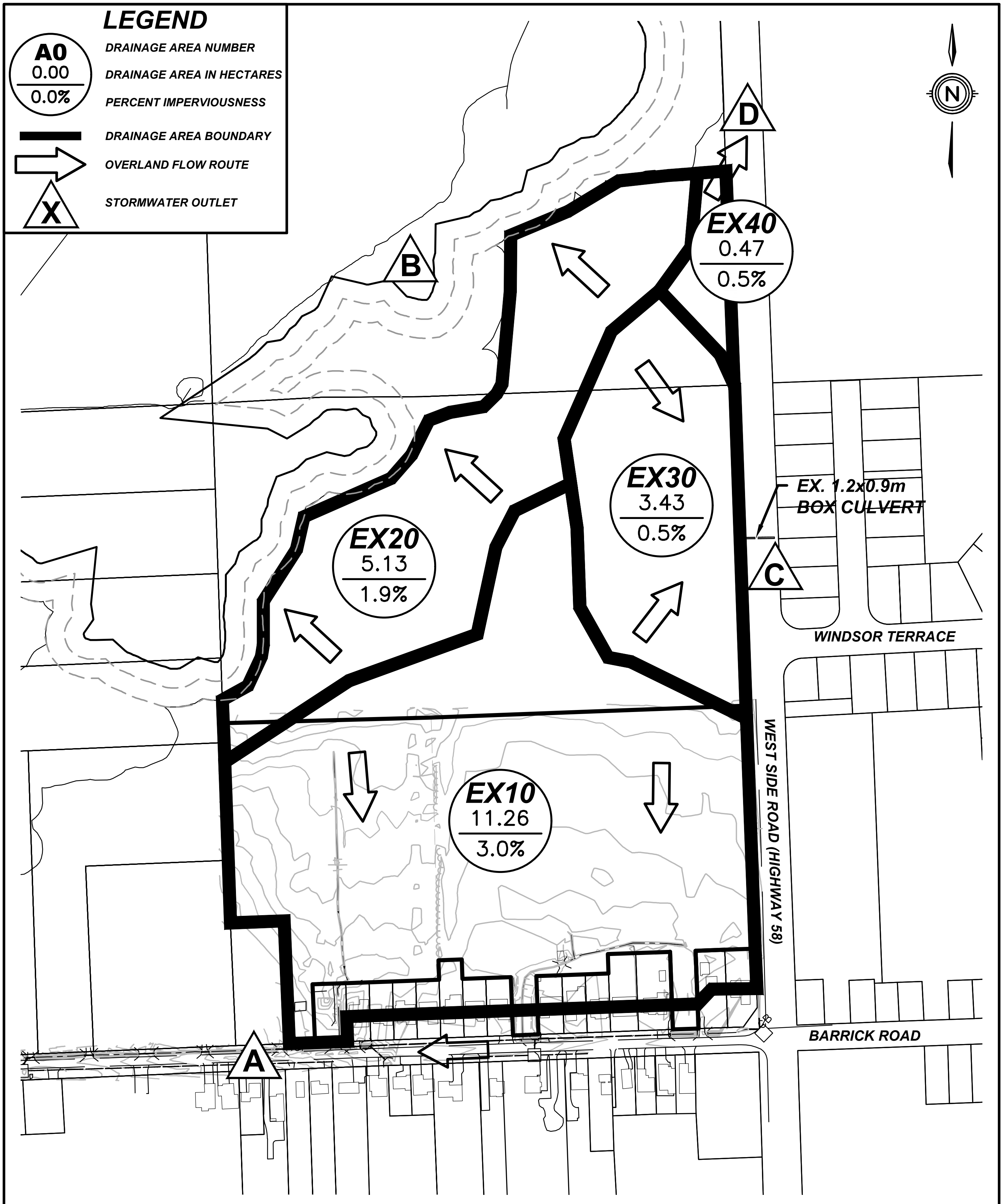
The peak stormwater flows and volumes have been calculated and outlined in Table 3 below for various stormwater outlets depicted in Figures 2 and 3 under existing and fully developed conditions for the 2, 5, 20, 25, 50- and 100-year design storm events.

Stated previously, Table 3 shows no stormwater flows have been modelled to discharge to outlets ‘C’ or ‘D’ for the northern development lands, though this may change under future development applications. Peak stormwater flows discharging to Outlet B via sheet flow will be maintained during the 2-year event and reduced under larger storm events. However, stormwater flows being directed to Outlet A (Barrick Road road allowance) will be significantly increased during all storm events under proposed conditions and therefore, stormwater quantity controls will be required.

Table 3. Peak Flow and Volume for Future Development Conditions

Outlet	Peak Flow (L/s)			Volume (m^3)		
	Existing	Future*	Change	Existing	Future*	Change
2 Year Design Storm Event						
A	56	1,737	+3,002%	866	4,398	+3,532
B	43	43	-	382	116	-266
C	32	0	-100%	245	0	-245
D	7	0	-100%	34	0	-34
5 Year Design Storm Event						
A	129	2,444	+1,795%	1517	6,149	+4,632
B	96	64	-33%	675	177	-498
C	74	0	-100%	439	0	-439
D	14	0	-100%	61	0	-61
10 Year Design Storm Event						
A	188	2904	+1,445%	2004	7,371	+5,367
B	146	79	-46%	895	221	-674
C	108	0	-100%	586	0	-586
D	20	0	-100%	82	0	-82
25 Year Design Storm Event						
A	288	3,480	+1,108%	2677	8,995	+6,328
B	211	96	-55%	1198	279	-919
C	178	0	-100%	787	0	-787
D	31	0	-100%	109	0	-109
50 Year Design Storm Event						
A	366	3,897	+965%	3203	10,198	+6,995
B	271	113	-58%	1440	323	-1117
C	224	0	-100%	948	0	-948
D	41	0	-100%	132	0	-132
100 Year Design Storm Event						
A	477	4,300	+801%	3743	11,379	+7,636
B	345	131	-61%	1682	368	-1,314
C	272	0	-100%	1109	0	-1109
D	58	0	-100%	155	0	-155

Stormwater Outlets are as follows:
Outlet A – Barrick Road
Outlet B – Forested Lands Northwest of the Development
Outlet C – Existing Box Culvert Crossing West Side Road (Highway 58)
Outlet D – West Side Road (Highway 58) Road Allowance



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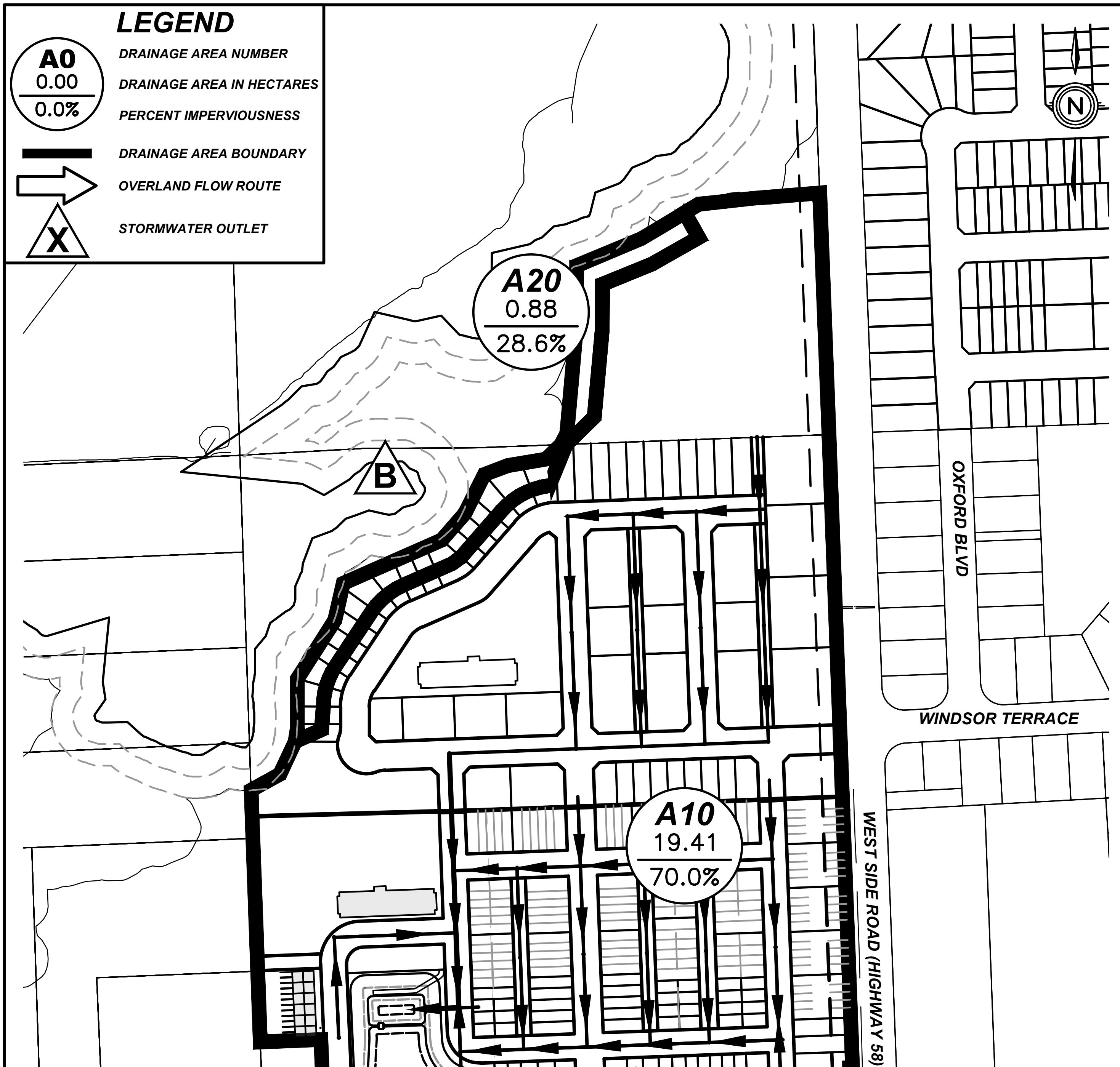
CITY OF PORT COLBORNE

EXISTING OVERALL STORM DRAINAGE AREA PLAN

DATE	2024–03–25
SCALE	1:4000 m
REF No.	2300
DWG No.	FIGURE 2

DRAWING FILE: F:\2300\Engineering\2300–base(REDUCED).dwg PLOTTED: Mar 25, 2024 – 10:33am PLOTTED BY: kurt



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FUTURE OVERALL STORM DRAINAGE AREA PLAN

DATE	2024-03-25
SCALE	1:4000 m
REF No.	2300
DWG No.	FIGURE 3

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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

Stonebridge Village Subdivision	Criteria for Implementation of Stormwater Management Practices (SWMP)					Technical Effectiveness (10 high)	Recommend Implementation Yes / No	Comments
	Topography	**Soils**	**Bedrock**	**Groundwater**	**Area**			
Site Conditions	***Variable 1 to 3%***	***Silty Clay <10mm/hr***	***At Considerable Depth***	***At Considerable Depth***	***± 19.4ha***			
Lot Level Controls								
Lot Grading	<5%	nlc	nlc	nlc	nlc	2	Yes	Quality/quantity benefits
Roof Leaders to Surface	nlc	nlc	nlc	nlc	nlc	2	Yes	Quality/quantity benefits
Roof Ldrs.to Soakaway Pits	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 0.5 ha	6	No	Unsuitable site conditions
Sump Pump Fdtn. Drains	nlc	nlc	nlc	nlc	nlc	2	Yes	Suitable site conditions
Vegetative								
Grassed Swales	< 5 %	nlc	nlc	nlc	nlc	7	Yes	Quality/quantity benefits
Filter Strips(Veg. Buffer)	< 10 %	nlc	nlc	>.5m Below Bottom	< 2 ha	5	No	Unsuitable site conditions
Infiltration								
Infiltration Basins	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 5 ha	2	No	Unsuitable site conditions
Infiltration Trench	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 2 ha	4	No	Unsuitable site conditions
Rear Yard Infiltration	< 2.0 %	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	< 0.5 ha	7	No	Unsuitable site conditions
Perforated Pipes	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	nlc	4	No	Unsuitable site conditions
Pervious Catch basins	nlc	loam, infiltr. > 15 mm/hr	>1m Below Bottom	>1m Below Bottom	nlc	3	No	Unsuitable site conditions
Sand Filters	nlc	nlc	nlc	>.5m Below Bottom	< 5 ha	5	No	High maintenance/poor aesthetics
Surface Storage								
Dry Ponds	nlc	nlc	nlc	nlc	> 5 ha	7	No	No quality control
Wet Ponds	nlc	nlc	nlc	nlc	> 5 ha	9	Yes	Very effective quality control
Wetlands	nlc	nlc	nlc	nlc	> 5 ha	10	No	Very effective quality control
Other								
Oil/Grit Separator	nlc	nlc	nlc	nlc	<2 ha	3	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

As part of the Stormwater Management Plan for this development, an internal storm sewer system will be constructed within the subdivision to convey stormwater flows up to and including the 5-year design storm event to the proposed SWM Facility. The overall grading design for the roadway system will direct overland stormwater flows, unable to enter the storm sewer system, during major storm events to the SWM Facility.

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 Control

The stormwater drainage outlet for the proposed development is Biederman Municipal 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*. It is proposed to provide Normal (70% TSS removals) Protection quality controls prior to discharge to the Biederman Drain.

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 19.41 hectares. The storage volumes required for this proposed facility are shown in Table 5.

Table 5. Stormwater Quality Volume Calculations	
Total Water Quality Volume = 19.41 ha x 130 m^3/ha = 2,523 m^3	Reference: Table 3.2, SWMP & Design Manual (MECP 2003)
Permanent Pool Volume = 19.41 ha x 90 m^3/ha = 1,747 m^3	**Extended Detention Volume** = 19.41 ha x 40 m^3/ha = 776 m^3

5.1.2 Stormwater Quantity Control

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

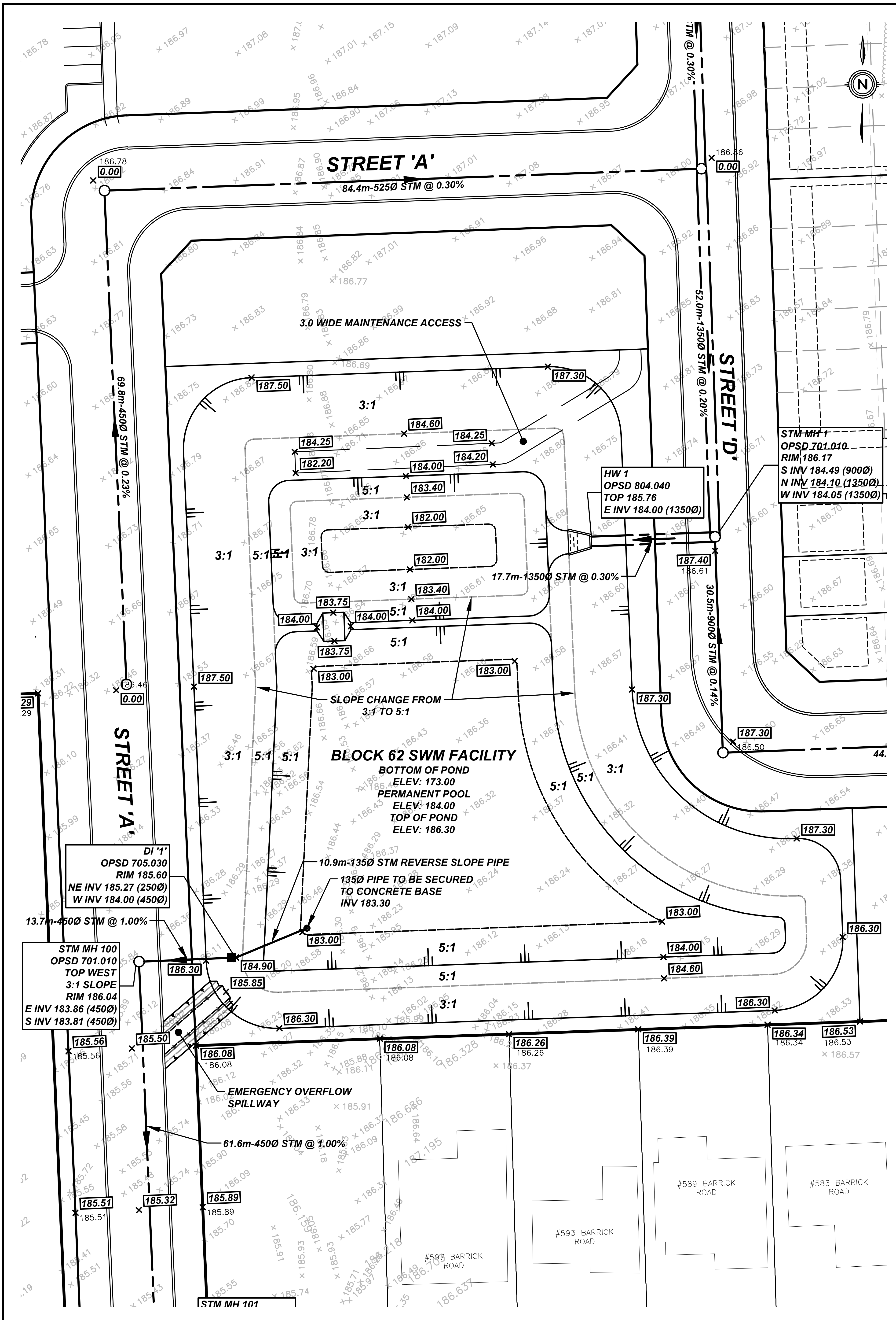
5.1.3 Stormwater Management Facility Configuration

As seen within the Proposed Stormwater Management Facility detail (Figure 5), the layout is providing a single sewer outlet from the SWM Facility to the storm sewer on Street ‘A’ directing flows to the proposed storm sewer on Barrick Road.

It is proposed to construct a three-stage outlet for the proposed stormwater management facility. The first stage of control consists of a reverse slope pipe acting as a 133mm (5”) diameter orifice to provide the required quality controls. The second stage of control consists of a ditch inlet catch basin and outlet pipe which provides an outlet for flows exceeding the extended detention volume. An emergency spillway will 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 183.00m, and the permanent pool water level is 184.00m for a water depth of 1.0 metre. The configuration of the facility provides 1,805 m^3 of permanent pool volume, which is more than the required 1,747m^3. The proposed top of pond is at an elevation of 186.30m which provides a total active volume of approximately 10,235m^3.

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



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STORMWATER MANAGEMENT FACILITY DETAIL

DATE	2024-03-04
SCALE	1:500 m
REF No.	2300
DWG No.	FIGURE 4

DRAWING FILE: F:\2300\Engineering\2300-base.dwg PLOTTED: Mar 04, 2024 - 3:41pm PLOTTED BY: kurt

Table 6. Stormwater Management Facility Forebay Sizing

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

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

r =	4.1	:1	(Length:Width Ratio)
Q_p =	0.038	m^3/s	(25mm Storm Pond Discharge)
V_s =	0.0003	m/s	(Settling Velocity)

Settling Length = **22.74 m**

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

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

Q =	2.444	m^3/s	(5 Yr Stm Sew Design Inflow)
D =	2.00	m	(Depth of Forebay)
V_f =	0.5	m/s	(Desired Velocity)

Dispersion Length = **19.55 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

22.74 m (minimum required length)

Width = **2.84 m** (minimum required width)

d) Average Velocity of Flow

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

Q =	1.014	m^3/s	(Quality Design Inflow)
A =	24.00	m^2	(Cross Sectional Area)
D =	2.00	m	(Depth of Forebay)
W =	6.00	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 =	24.5	m	(Proposed Bottom Length)
ASL =	2.8	m^3/ha	(Annual Sediment Loading)
A =	19.41	ha	(Drainage Area)
FRC =	70	%	(Facility Removal Efficiency)
FV =	804.0	m^3	(Forebay Volume)

Cleanout Frequency = **10.4 years**

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

Based on the configuration of the proposed facility, it was determined that a 133mm (5”) diameter quality orifice shall provide 41.9 hours of detention (24-hour minimum required duration of detention). The rim elevation for the proposed ditch inlet catch basin is 184.90m and will provide an extended detention volume of 3,482m^3, which is more than the required 776m^3.

The outflow pipe from the stormwater management facility is to be 450mm in diameter and will convey the stormwater flows from the ditch inlet to a storm sewer on Street ‘A’ discharging flows to the proposed Barrick Road Stormwater System. During extreme storm events greater than the 100-year event, stormwater flows will crest over an emergency overflow spillway located at the south west corner of the facility, and be directed to the Street ‘A’ road allowance continuing towards Barrick Road. The grade of Barrick Road will direct major overland stormwater flows easterly, and therefore, no stormwater flows will be conveyed to the MTO road allowance as part of the proposed Stormwater Management Plan.

Table 7 summarizes the peak inflows and outflows for the Stormwater Management Facility along with corresponding pond elevations. A stage-storage-discharge relationship was determined for the facility and is included in Appendix A for reference purposes.

Table 7. Stormwater Management Facility Characteristics

Design Storm	Peak Flows (L/s)			Maximum Elevation (m)	Maximum Storage (m3)
	Existing Outflow	Future Inflow	Future Outflow		
25mm	-	1,014	29	184.66	2,461
2 Year	56	1,737	52	184.96	3,732
5 Year	129	2,444	128	185.19	4,804
10 Year	188	2,904	147	185.36	5,626
25 Year	288	3,480	148	185.64	7,027
50 Year	366	3,897	159	185.86	8,127
100 Year	477	4,300	289	185.97	8,719

Therefore, peak stormwater flows to Outlet A will be reduced during all storm events from existing conditions. As the 25mm design storm is only modelled for stormwater quality purposes, an existing peak flow rate has not been provided.

Based on the MIDUSS model, Table 7 shows the maximum wet pond elevation of 185.97m, and an active storage volume of 8,719m^3 for the 100-year design storm event. approximately 0.33m of free board will be provided by the stormwater management facility during the 100-year design storm event.

The stormwater sewer system immediately downstream of the SWM facility outlet will be designed to convey peak stormwater flows up to and including the 5-year event. During the 5-year event, the SWM facility will discharge approximately 128L/s to the downstream stormwater system according to the MIDUSS Modelling. As part of the design of this storm sewer, a conservatively increased flow allocation from the Stonebridge Village SWM Facility of 130L/s will be included to ensure sufficient capacity is provided.

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 SWM facility, a maximum discharge rate of 148.4L/s (129L/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 minor spillway elevation of 185.80m.

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 Bartlett Creek.

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

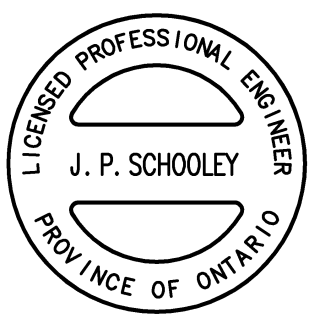
Based on the findings of this study, the following conclusions are offered:

- 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 facilities will provide stormwater quality and quantity controls for the approximately 19.41 hectare catchment area.
- 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: Reviewed By:



Kurt Tiessen, E.I.T.
March 28, 2024

Jason Schooley, P.Eng.

APPENDICES

APPENDIX A

Weighted Impervious Calculation Sheet
Stormwater Management Facility Calculations

Weighted Imperviousness Percentage Calculation Worksheet

Project Name:	Barrick Road Subdivision
Project Number:	2300
Date:	March 2024
Person:	K.Tiessen

EX10 - EXISTING CONDITIONS

	Footprint	*% Impervious*	*Effective Impervious Area*
Buildings	2324.6 m^2	100%	2324.6 m^2
Concrete/Asphalt/Granular Driveways	1190.9 m^2	80%	952.7 m^2
Landscape/Greenspace	109116.7 m^2	0.1%	109.1 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			3,386 m^2
TOTAL CATCHMENT AREA			112,632 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS	**3.0 %**
		RUNOFF COEFFICIENT	**0.22**

EX20 - EXISTING CONDITIONS

	Footprint	*% Impervious*	*Effective Impervious Area*
Buildings	91.3 m^2	100%	91.3 m^2
Granular Driveways	1160.5 m^2	70%	812.4 m^2
Landscape/Greenspace	50008.2 m^2	0.1%	50.0 m^2
TOTAL CATCHMENT IMPERVIOUS AREAS			954 m^2
TOTAL CATCHMENT AREA			51,260 m^2
		EFFECTIVE WEIGHTED CATCHMENT % IMPERVIOUS	**1.9 %**
		RUNOFF COEFFICIENT	**0.21**

Upper Canada Consultants
30 HANNOVER DRIVE, UNIT 3
St. Catharines, Ontario L2W 1A3 **DATE: MARCH 2024**
PROJECT NAME: STONEBRIDGE VILLAGE SUBDIVISION
PROJECT NO.: 2300

STORMWATER MANAGEMENT FACILITY WETPOND

Quality Requirements
Drainage Area (ha) = 19.41
Normal (m^3/ha) = 130 (@ 70%)
Perm Pool (m^3/ha) = 90
Perm Pool Vol (m^3) = 1,747
Active Vol (m^3) 776
Perm. Pool Elev. = 184.00 m

Quality Orifice
Diameter (m) = 0.133
Cd = 0.63
Invert (m) = 184.00
5" Ring-Tite PVC DR28

Ditch Inlet Weir
Length (m) = 0.60
Width (m) = 0.60
Grate Slope (X:1) = 4
Inlet Elevation (m) = 184.90
Cd = 1.84

Outflow Pipe Orifice
Diameter (m) = 0.450
Cd = 0.63
Invert (m) = 184.00
Overt (m) = 184.45

Overflow Spillway
Minor Length (m) = 2.00
Slopes (X:1) = 2.00
Minor Invert (m) = 185.85
Major Length (m) = 4.00
Major Invert (m) = 186.00

MOE Equation 4.10 Drawdown Coefficient 'C2' = 1,623
MOE Equation 4.10 Drawdown Coefficient 'C3' = 3,175
MOE Equation 4.10 Drawdown Time (h) = **41.9**

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)
183.00		-1.00	**1,335**			0					*5yr flow = 129 L/s*				BOTTOM
	0.40			1,509	604										3:1
183.40		-0.60	1,684			604									
	0.60			2,003	1,202										5:1
184.00		0.00	**2,322**			1,805									PERM
	0.00			2,740	0										
184.00		0.00	3,158				0.0	0.000	0.000	0.00	0.00	0.00	0.000		PERM
	0.30			3,428	1,028									0.015	5:1
184.30		0.30	3,698				1028.3	0.018	0.000	0.000	0.148	0.000	0.0178		
	0.30			3,915	1,174									0.023	3:1
184.60		0.60	4,132				2202.7	0.028	0.000	0.243	0.148	0.000	0.0277		
	0.30			4,266	1,280									0.031	3:1
184.90		0.90	4,399				3482.4	0.035	0.000	0.344	0.148	0.000	0.0349		
	0.35			4,559	1,596									0.092	3:1
185.25		1.25	4,718				5077.9	0.042	0.114	0.433	0.148	0.000	0.1484		
	0.60			4,999	2,999									0.148	3:1
185.85		1.85	5,280				8077.3	0.051	0.511	0.553	0.148	0.000	0.1484		
	0.15			5,352	803									0.236	3:1
186.00		2.00	5,424				8880.1	0.054	0.637	0.579	0.148	0.176	0.3242		
	0.30			5,569	1,671									0.972	3:1
186.30		2.30	5,715				10550.9	0.058	0.914	0.628	0.148	1.471	1.6197		

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 2024-02-09  10:42
          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
          PROJECT NAME: BARRICK SUBDIVISION
          PROJECT NO.:  2300
          STORMWATER MANAGEMENT ANALYSIS JULY 2023
          EXISTING CONDITIONS
   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
           .400      Fraction to peak  r
        240.000      Duration ó  240 min
                   25.036 mm     Total depth
    3     IMPERVIOUS
              1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .013      Manning "n"
         98.000      SCS Curve No or C
           .100      Ia/S Coefficient
           .518      Initial Abstraction
    4     CATCHMENT
         10.000      ID No.ó 99999
         11.260      Area in hectares
        300.000      Length (PERV) metres
          1.000      Gradient (%)
          3.000      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
                 .032       .000       .000       .000 c.m/s
                 .130       .797       .150     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .4237393E+03 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
    4     CATCHMENT
         10.000      ID No.ó 99999
         11.260      Area in hectares
        300.000      Length (PERV) metres
          1.000      Gradient (%)
          3.000      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
                 .056       .000       .000       .000 c.m/s
                 .204       .849       .223     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .8657618E+03 c.m
    4     CATCHMENT
         20.000      ID No.ó 99999
          5.130      Area in hectares
        100.000      Length (PERV) metres
          1.000      Gradient (%)
          1.900      Per cent Impervious
        100.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
              1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
              1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                 .043       .000       .000       .000 c.m/s
                 .204       .838       .216     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .3815630E+03 c.m
    4     CATCHMENT
         30.000      ID No.ó 99999
          3.440      Area in hectares
        100.000      Length (PERV) metres
          2.000      Gradient (%)
           .500      Per cent Impervious
        100.000      Length (IMPERV)
           .000      %Imp. with Zero Dpth
              1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
           .250      Manning "n"
         77.000      SCS Curve No or C
           .100      Ia/S Coefficient
          7.587      Initial Abstraction
              1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                 .032       .000       .000       .000 c.m/s
                 .204       .847       .207     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .2453878E+03 c.m
    4     CATCHMENT
         40.000      ID No.ó 99999
           .480      Area in hectares
         30.000      Length (PERV) metres
          1.000      Gradient (%)
           .500      Per cent Impervious
         30.000      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
                 .007       .000       .000       .000 c.m/s
                 .203       .839       .206     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .3414280E+02 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
    4     CATCHMENT
         10.000      ID No.ó 99999
         11.260      Area in hectares
        300.000      Length (PERV) metres
          1.000      Gradient (%)
          3.000      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
                 .129       .000       .000       .000 c.m/s
                 .278       .884       .296     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .1517193E+04 c.m
    4     CATCHMENT
         20.000      ID No.ó 99999
          5.130      Area in hectares
        100.000      Length (PERV) metres
          1.000      Gradient (%)
          1.900      Per cent Impervious
        100.000      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
                 .096       .000       .000       .000 c.m/s
                 .278       .876       .289     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .6748363E+03 c.m
    4     CATCHMENT
         30.000      ID No.ó 99999
          3.440      Area in hectares
        100.000      Length (PERV) metres
          2.000      Gradient (%)
           .500      Per cent Impervious
        100.000      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
                 .074       .000       .000       .000 c.m/s
                 .278       .880       .281     C perv/imperv/total
   27     HYDROGRAPH DISPLAY
         4     is # of Hyeto/Hydrograph chosen
          Volume  =  .4396343E+03 c.m
    4     CATCHMENT
         40.000      ID No.ó 99999
           .480      Area in hectares
         30.000      Length (PERV) metres
          1.000      Gradient (%)
           .500      Per cent Impervious
```

```
       30.000     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
               .014       .000       .000       .000 c.m/s
               .277       .865       .280     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .6120665E+02 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
  4     CATCHMENT
       10.000     ID No.ó 99999
       11.260     Area in hectares
      300.000     Length (PERV) metres
        1.000     Gradient (%)
        3.000     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
               .188       .000       .000       .000 c.m/s
               .320       .897       .337     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .2004478E+04 c.m
  4     CATCHMENT
       20.000     ID No.ó 99999
        5.130     Area in hectares
      100.000     Length (PERV) metres
        1.000     Gradient (%)
        1.900     Per cent Impervious
      100.000     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
               .146       .000       .000       .000 c.m/s
               .319       .892       .330     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .8946319E+03 c.m
  4     CATCHMENT
       30.000     ID No.ó 99999
        3.440     Area in hectares
      100.000     Length (PERV) metres
        2.000     Gradient (%)
         .500     Per cent Impervious
      100.000     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
               .108       .000       .000       .000 c.m/s
               .320       .894       .322     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .5859025E+03 c.m
  4     CATCHMENT
       40.000     ID No.ó 99999
         .480     Area in hectares
       30.000     Length (PERV) metres
        1.000     Gradient (%)
         .500     Per cent Impervious
       30.000     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
               .020       .000       .000       .000 c.m/s
               .319       .876       .322     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .8161620E+02 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
  4     CATCHMENT
       10.000     ID No.ó 99999
       11.260     Area in hectares
      300.000     Length (PERV) metres
        1.000     Gradient (%)
        3.000     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
               .288       .000       .000       .000 c.m/s
               .367       .911       .383     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .2677228E+04 c.m
  4     CATCHMENT
       20.000     ID No.ó 99999
        5.130     Area in hectares
      100.000     Length (PERV) metres
        1.000     Gradient (%)
        1.900     Per cent Impervious
      100.000     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
               .211       .000       .000       .000 c.m/s
               .366       .908       .376     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .1197842E+04 c.m
  4     CATCHMENT
       30.000     ID No.ó 99999
        3.440     Area in hectares
      100.000     Length (PERV) metres
        2.000     Gradient (%)
         .500     Per cent Impervious
      100.000     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
               .178       .000       .000       .000 c.m/s
               .366       .904       .369     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .7870166E+03 c.m
  4     CATCHMENT
       40.000     ID No.ó 99999
         .480     Area in hectares
       30.000     Length (PERV) metres
        1.000     Gradient (%)
         .500     Per cent Impervious
       30.000     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
               .031       .000       .000       .000 c.m/s
               .365       .886       .368     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .1095012E+03 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
  4     CATCHMENT
       10.000     ID No.ó 99999
       11.260     Area in hectares
      300.000     Length (PERV) metres
        1.000     Gradient (%)
        3.000     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
                .366       .000       .000       .000 c.m/s
                .397       .917       .413     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .3203910E+04 c.m
  4     CATCHMENT
        20.000     ID No.ó 99999
         5.130     Area in hectares
       100.000     Length (PERV) metres
         1.000     Gradient (%)
         1.900     Per cent Impervious
       100.000     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
                .271       .000       .000       .000 c.m/s
                .398       .916       .408     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1440367E+04 c.m
  4     CATCHMENT
        30.000     ID No.ó 99999
         3.440     Area in hectares
       100.000     Length (PERV) metres
         2.000     Gradient (%)
          .500     Per cent Impervious
       100.000     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
                .224       .000       .000       .000 c.m/s
                .398       .910       .400     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .9483638E+03 c.m
  4     CATCHMENT
        40.000     ID No.ó 99999
          .480     Area in hectares
        30.000     Length (PERV) metres
         1.000     Gradient (%)
          .500     Per cent Impervious
        30.000     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
                .041       .000       .000       .000 c.m/s
                .397       .891       .400     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1321806E+03 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
  4     CATCHMENT
        10.000     ID No.ó 99999
        11.260     Area in hectares
       300.000     Length (PERV) metres
         1.000     Gradient (%)
         3.000     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
                .477       .000       .000       .000 c.m/s
                .425       .922       .440     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .3743332E+04 c.m
  4     CATCHMENT
        20.000     ID No.ó 99999
         5.130     Area in hectares
       100.000     Length (PERV) metres
         1.000     Gradient (%)
         1.900     Per cent Impervious
       100.000     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
                .345       .000       .000       .000 c.m/s
                .424       .923       .434     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1682262E+04 c.m
  4     CATCHMENT
        30.000     ID No.ó 99999
         3.440     Area in hectares
       100.000     Length (PERV) metres
         2.000     Gradient (%)
          .500     Per cent Impervious
       100.000     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
                .272       .000       .000       .000 c.m/s
                .424       .915       .427     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1109006E+04 c.m
  4     CATCHMENT
        40.000     ID No.ó 99999
          .480     Area in hectares
        30.000     Length (PERV) metres
         1.000     Gradient (%)
          .500     Per cent Impervious
        30.000     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
                .058       .000       .000       .000 c.m/s
                .424       .896       .427     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1548541E+03 c.m
 20     MANUAL
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Future Conditions – WITH SWM

```
         Output File (4.7) SWM.OUT      opened 2024-03-04  13:12
         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
         PROJECT NAME: BARRICK SUBDIVISION
         PROJECT NO.:  2300
         STORMWATER MANAGEMENT ANALYSIS JULY 2023
         PROPOSED CONDITIONS
  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
          .400      Fraction to peak  r
       240.000      Duration ó  240 min
                  25.036 mm     Total depth
   3     IMPERVIOUS
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .013      Manning "n"
        98.000      SCS Curve No or C
          .100      Ia/S Coefficient
          .518      Initial Abstraction
   4     CATCHMENT
        10.000      ID No.ó 99999
        19.410      Area in hectares
       450.000      Length (PERV) metres
         1.000      Gradient (%)
        70.000      Per cent Impervious
       450.000      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
               1.014       .000       .000       .000 c.m/s
                .130       .807       .604     C perv/imperv/total
  15     ADD RUNOFF
               1.014      1.014       .000       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .2925692E+04 c.m
  10     POND
        8 Depth - Discharge - Volume sets
         184.000        .000          .0
         184.300       .0178      1028.3
         184.600       .0277      2202.7
         184.900       .0349      3482.4
         185.250        .147      5077.9
         185.850        .148      8077.3
         186.000        .324      8880.1
         186.300       1.899     10550.9
         Peak Outflow    =      .029 c.m/s
         Maximum Depth   =   184.661 metres
         Maximum Storage =     2461. c.m
               1.014      1.014       .029       .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
   4     CATCHMENT
        20.000      ID No.ó 99999
          .880      Area in hectares
        20.000      Length (PERV) metres
         1.000      Gradient (%)
        28.600      Per cent Impervious
        20.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .043       .000       .029       .000 c.m/s
                .203       .828       .382     C perv/imperv/total
  27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1157704E+03 c.m
   4     CATCHMENT
         1.000      ID No.ó 99999
        19.410      Area in hectares
       450.000      Length (PERV) metres
         1.000      Gradient (%)
        70.000      Per cent Impervious
       450.000      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
               1.737       .000       .029       .000 c.m/s
                .204       .853       .658     C perv/imperv/total
  15     ADD RUNOFF
               1.737      1.737       .029       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .4398207E+04 c.m
  10     POND
        8 Depth - Discharge - Volume sets
         184.000        .000          .0
         184.300       .0178      1028.3
         184.600       .0277      2202.7
         184.900       .0349      3482.4
         185.250        .147      5077.9
         185.850        .148      8077.3
         186.000        .324      8880.1
         186.300       1.899     10550.9
         Peak Outflow    =      .052 c.m/s
         Maximum Depth   =   184.955 metres
         Maximum Storage =     3732. c.m
               1.737      1.737       .052       .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
   4     CATCHMENT
        20.000      ID No.ó 99999
          .880      Area in hectares
        20.000      Length (PERV) metres
         1.000      Gradient (%)
        28.600      Per cent Impervious
        20.000      Length (IMPERV)
          .000      %Imp. with Zero Dpth
             1      Option 1=SCS CN/C; 2=Horton; 3=Green-Ampt; 4=Repeat
          .250      Manning "n"
        77.000      SCS Curve No or C
          .100      Ia/S Coefficient
         7.587      Initial Abstraction
             1      Option 1=Trianglr; 2=Rectanglr; 3=SWM HYD; 4=Lin. Reserv
                .064       .000       .052       .000 c.m/s
                .276       .853       .441     C perv/imperv/total
  27     HYDROGRAPH DISPLAY
        4     is # of Hyeto/Hydrograph chosen
         Volume  =  .1767936E+03 c.m
   4     CATCHMENT
         1.000      ID No.ó 99999
        19.410      Area in hectares
       450.000      Length (PERV) metres
         1.000      Gradient (%)
        70.000      Per cent Impervious
       450.000      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
               2.444       .000       .052       .000 c.m/s
                .278       .875       .696     C perv/imperv/total
  15     ADD RUNOFF
               2.444      2.444       .052       .000 c.m/s
  27     HYDROGRAPH DISPLAY
        5     is # of Hyeto/Hydrograph chosen
         Volume  =  .6149111E+04 c.m
  10     POND
        8 Depth - Discharge - Volume sets
         184.000        .000          .0
         184.300       .0178      1028.3
         184.600       .0277      2202.7
         184.900       .0349      3482.4
         185.250        .147      5077.9
         185.850        .148      8077.3
         186.000        .324      8880.1
         186.300       1.899     10550.9
         Peak Outflow    =      .128 c.m/s
         Maximum Depth   =   185.190 metres
         Maximum Storage =     4804. c.m
               2.444      2.444       .128       .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
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      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
 4    CATCHMENT
    20.000      ID No.ó 99999
      .880      Area in hectares
    20.000      Length (PERV) metres
     1.000      Gradient (%)
    28.600      Per cent Impervious
    20.000      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       .128       .000 c.m/s
           .319       .864       .475     C perv/imperv/total
27    HYDROGRAPH DISPLAY
    4     is # of Hyeto/Hydrograph chosen
     Volume  =  .2207980E+03 c.m
 4    CATCHMENT
     1.000      ID No.ó 99999
    19.410      Area in hectares
   450.000      Length (PERV) metres
     1.000      Gradient (%)
    70.000      Per cent Impervious
   450.000      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
          2.904       .000       .128       .000 c.m/s
           .320       .890       .719     C perv/imperv/total
15    ADD RUNOFF
          2.904      2.904       .128       .000 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .7370755E+04 c.m
10    POND
    8 Depth - Discharge - Volume sets
     184.000        .000          .0
     184.300       .0178      1028.3
     184.600       .0277      2202.7
     184.900       .0349      3482.4
     185.250        .147      5077.9
     185.850        .148      8077.3
     186.000        .324      8880.1
     186.300       1.899     10550.9
     Peak Outflow    =      .147 c.m/s
     Maximum Depth   =   185.360 metres
     Maximum Storage =     5626. c.m
          2.904      2.904       .147       .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
 4    CATCHMENT
    20.000      ID No.ó 99999
      .880      Area in hectares
    20.000      Length (PERV) metres
     1.000      Gradient (%)
    28.600      Per cent Impervious
    20.000      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
           .096       .000       .147       .000 c.m/s
           .365       .875       .511     C perv/imperv/total
27    HYDROGRAPH DISPLAY
    4     is # of Hyeto/Hydrograph chosen
     Volume  =  .2789290E+03 c.m
 4    CATCHMENT
     1.000      ID No.ó 99999
    19.410      Area in hectares
   450.000      Length (PERV) metres
     1.000      Gradient (%)
    70.000      Per cent Impervious
   450.000      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
          3.480       .000       .147       .000 c.m/s
           .367       .909       .747     C perv/imperv/total
15    ADD RUNOFF
          3.480      3.480       .147       .000 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .8994581E+04 c.m
10    POND
    8 Depth - Discharge - Volume sets
     184.000        .000          .0
     184.300       .0178      1028.3
     184.600       .0277      2202.7
     184.900       .0349      3482.4
     185.250        .147      5077.9
     185.850        .148      8077.3
     186.000        .324      8880.1
     186.300       1.899     10550.9
     Peak Outflow    =      .148 c.m/s
     Maximum Depth   =   185.640 metres
     Maximum Storage =     7027. c.m
          3.480      3.480       .148       .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
         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
 4    CATCHMENT
    20.000      ID No.ó 99999
      .880      Area in hectares
    20.000      Length (PERV) metres
     1.000      Gradient (%)
    28.600      Per cent Impervious
    20.000      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
           .113       .000       .148       .000 c.m/s
           .392       .881       .532     C perv/imperv/total
27    HYDROGRAPH DISPLAY
    4     is # of Hyeto/Hydrograph chosen
     Volume  =  .3227145E+03 c.m
 4    CATCHMENT
     1.000      ID No.ó 99999
    19.410      Area in hectares
   450.000      Length (PERV) metres
     1.000      Gradient (%)
    70.000      Per cent Impervious
   450.000      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
          3.897       .000       .148       .000 c.m/s
           .397       .919       .763     C perv/imperv/total
15    ADD RUNOFF
          3.897      3.897       .148       .000 c.m/s
27    HYDROGRAPH DISPLAY
    5     is # of Hyeto/Hydrograph chosen
     Volume  =  .1019831E+05 c.m
10    POND
    8 Depth - Discharge - Volume sets
     184.000        .000          .0
     184.300       .0178      1028.3
     184.600       .0277      2202.7
     184.900       .0349      3482.4
     185.250        .147      5077.9
     185.850        .148      8077.3
     186.000        .324      8880.1
     186.300       1.899     10550.9
     Peak Outflow    =      .159 c.m/s
     Maximum Depth   =   185.859 metres
     Maximum Storage =     8127. c.m
          3.897      3.897       .159       .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
 4    CATCHMENT
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```
       20.000     ID No.ó 99999
         .880     Area in hectares
       20.000     Length (PERV) metres
        1.000     Gradient (%)
       28.600     Per cent Impervious
       20.000     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
               .131       .000       .159       .000 c.m/s
               .421       .886       .554     C perv/imperv/total
 27     HYDROGRAPH DISPLAY
       4     is # of Hyeto/Hydrograph chosen
        Volume  =  .3683710E+03 c.m
  4     CATCHMENT
        1.000     ID No.ó 99999
       19.410     Area in hectares
      450.000     Length (PERV) metres
        1.000     Gradient (%)
       70.000     Per cent Impervious
      450.000     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
              4.300       .000       .159       .000 c.m/s
               .425       .926       .776     C perv/imperv/total
 15     ADD RUNOFF
              4.300      4.300       .159       .000 c.m/s
 27     HYDROGRAPH DISPLAY
       5     is # of Hyeto/Hydrograph chosen
        Volume  =  .1137934E+05 c.m
 10     POND
       8 Depth - Discharge - Volume sets
        184.000        .000          .0
        184.300       .0178      1028.3
        184.600       .0277      2202.7
        184.900       .0349      3482.4
        185.250        .147      5077.9
        185.850        .148      8077.3
        186.000        .324      8880.1
        186.300       1.899     10550.9
        Peak Outflow    =      .289 c.m/s
        Maximum Depth   =   185.970 metres
        Maximum Storage =     8719. c.m
              4.300      4.300       .289       .000 c.m/s
 20     MANUAL
```