BAYVIEW WATERIDGE INC.

1375 HEMLOCK ROAD, 1345 HEMLOCK ROAD, AND 375 CODD'S ROAD, RESIDENTIAL DEVELOPMENT, OTTAWA, ON

STORMWATER MANAGEMENT REPORT

JANUARY 16, 2023

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BAYVIEW WATERIDGE INC.

2ND SUBMISSION

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1 INTRODUCTION

1.1 SCOPE

WSP Canada Inc. was retained by Bayview Wateridge Inc. to prepare a Stormwater Management (SWM) report for the proposed new residential development which consists of three sites across 1375 Hemlock Road, 1345 Hemlock Road, and 375 Codd's Road within the Wateridge Subdivision (File No. D07-12-22-0122 and D07-12-22-0127). This SWM report examines the potential water quality and quantity impacts of the proposed residential development and summarizes how each will be addressed in accordance with applicable guidelines.

1.2 SITE LOCATION

The sites of the proposed residential developments are located at 1375 Hemlock Road, 1345 Hemlock Road, and 375 Codd's Road, Ottawa, Ontario. The subject area is bounded by Hemlock Road to the south, Codd's Road to the north and west, and Michael Stoqua Street to the east. The site location is shown in Figure 1.

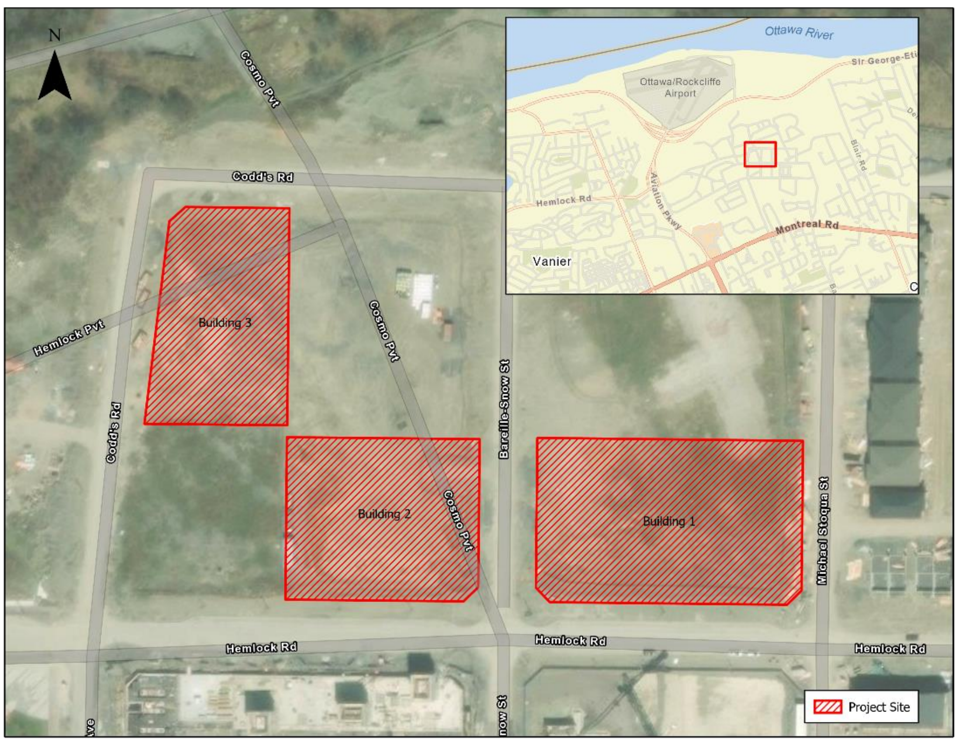

Figure 1: Site Location

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

→ Collect and review background information
→ Determine the site-specific stormwater management requirements to ensure that the proposals are in conformance with the applicable Provincial, Municipal and Conservation Authority stormwater management and development guidelines.
→ Evaluate various stormwater management practices that meet the applicable SWM and development requirements and recommend a preferred strategy.
→ Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities.

1.4 DESIGN CRITERIA

Pre-consultation with the City of Ottawa, RVCA, and MECP was conducted by IBI group and detailed in the IBI Group Phase 2B Design Brief (**Appendix A**). A hydrologic model for the entire larger development area has been created by IBI Group, which defines the storage required for each parcel. Criteria for 1375 Hemlock Road, 1345 Hemlock Road, and 375 Codd's Road are as follows:

→ **Stormwater Quantity**
  - **Building 1 (1375 Hemlock Road):** Parcel 2 Minor system capture 105 L/s
  - **Building 2 (1345 Hemlock Road):** Parcel 3 Minor system capture 95 L/s
  - **Building 3 (375 Codd's Road):** Parcel 5 Minor system capture 139 L/s

→ **Storm Quality -** LID design targets have been identified for the proposed site and are outlined in the Wateridge Phase 2B Developer's Checklist (Aquafor Beech, May 13 2018). Targets are indicated in the table below.

LID Design Targets		
Infiltration*	**Erosion***	**Water Quality†**
LID Infiltration target = 4mm Maintain groundwater recharge per the existing conditions water budget. Groundwater recharge includes hydrological connection and linkages to wetlands, woodlots, streams and other natural features. LID lot-level and conveyance controls shall infiltrate an equivalent volume a 4mm event applied to the full catchment area.	LID Erosion Control Target = 4mm LID lot-level and conveyance controls shall match the existing conditions water balance through the application of the infiltration targets in order to reduce or eliminate the effects of hydro-modification (magnitude, duration and frequency) form the contributing drainage area. As such the infiltration targets shall be considered the erosion control targets for LID controls.	Min. Target = 15mm The minimum water quality event for LID lot-level and conveyance controls for the Former CFB Rockcliffe shall be the 15mm event. LID controls shall treat the runoff from a 15mm event through filtration, detention, evapotranspiration, detention and release and infiltration. Drainage areas which achieve the minimum 15mm water quality target shall be required to discharge to another LID in the treatment train and or an end-of-pipe pond to achieve the full enhanced level of control per the MOE SWMPD. Enhanced Target = 25mm To achieve the enhanced level of control, per the MSS, the target water quality event for LID lot-level and conveyance controls shall be the 25mm event. LID controls shall treat the runoff from a 25mm event through filtration, detention, evapotranspiration, detention and release and infiltration. Drainage areas which achieve the enhanced water quality target do not require treatment in an end-of-pipe facility.
*Catchment Based Target – target applied over the full catchment area †Contributing Impervious Area Target – applied to the directly contributing impervious area to the LID control and should focus on the "treatment" of the required event through a combination of filtration, storage and release, evaporation and infiltration. Note: the water quality target shall include the required water balance (infiltration) targets i.e. water quality treatment = 15mm water quality event – 4mm infiltration/erosion target.		

1.5 RAINFALL INFORMATION

The rainfall intensity is calculated in accordance with Section 5.4.2 of the Ottawa Sewer Design Guidelines (October, 2012):

$$i = \left[\frac{A}{(Td + C)^{B}}\right]$$

Where;

- A, B, C = regression constants for each return period (defined in section 5.4.2)
- i = rainfall intensity (mm/hour)
- Td = storm duration (minutes)

The IDF parameters/regression constants are per the Ottawa Sewer Design Guidelines (October, 2012).

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The subjected property is located within the Wateridge Subdivision Development area east of Codd's Road, north of Hemlock Street and south of Tawadina Road. Runoff from the subjected lands is ultimately directed to the existing SWM pond next to Sir-George-Etienne-Cartier Parkway. The existing SWM pond ultimately outlets to the Ottawa River. The available drainage outlet for Building 1 and 2 is the 525 mm diameter concrete storm sewer on Bareille-Snow Street. The available drainage outlet for Building 3 is the 750 mm diameter concrete storm sewer on Codd's Road. Runoff from these sewers will eventually be conveyed to the existing SWM pond via the 3000 mm diameter concrete trunk sewer along Hemlock Road, east of Codd's Road and Hemlock Road intersection.

Based on the IBI Assessment of Revised Block 11 and 12 Storm and Sanitary Servicing (April 26, 2022), drainage released from the site to the City storm sewers are as shown in **Table 1**. The revised IBI Assessment is included in **Appendix A**.

Table 1: IBI Group Storm Water Modelling Results April 2022

Drainage Area ID	Parcel	Building	Area (ha)	Imperviousness (%)	Minor System Capture Peak Flow Rate (L/s)
B309_2	2	1	0.52	86	105
B340_3	3	2	0.34	86	95
B340_5	5	3	0.37	86	139

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed project is a residential development in Ottawa, Ontario. Post development condition catchment characteristics are summarized in Table 2 and illustrated in the storm drainage plan. The proposed development includes three (3) parcels which are analyzed separately.

To meet stormwater management objectives, as defined by the design criteria outlined in Section 1.4, the following components have been proposed:

- → Underground infiltration chambers
- → Inlet control devices

The application and sizing of these proposed stormwater management facilities is outlined in the following sections.

Table 2: Catchment Characteristics

CATCHMENT ID	AREA (HA)	RUNOFF COEFFICIENT
Building 1 - 1375 Hemlock Road		
S101	0.159	0.80
S102	0.084	0.68
S103	0.079	0.58
S-BLDG1	0.197	0.90
Building 2 - 1345 Hemlock Road		
S201	0.098	0.74
S202	0.105	0.59
S203	0.047	0.66
S-BLDG2	0.124	0.90
Building 3 - 375 Codd's Road		
S301	0.062	0.51
S302	0.030	0.53
S303	0.123	0.70
S-BLDG3	0.159	0.90

3.2 WATER QUANTITY

As noted previously, it is required that the post-development discharge rate from each parcel match discharge rate defined in the IBI Group modelling for the minor storm event, and that all flows up to the 100-year event be controlled on site.

A HydroCAD model was created for each parcel to represent the controlled flow, the uncontrolled flow, and the storage provided. The modelling has informed the maximum active storage volume required within the storage unit. Note that the results provided describe the performance of each system at multiple storm durations which have been solved iteratively within HydroCAD to represent critical conditions (i.e. maximum storage utilized within the storage feature, and peak release rate at the system discharge point). The results demonstrate that the target release rates have been met for each analyzed parcel.

3.2.1 BUILDING 1 - 1375 HEMLOCK ROAD

Building 1 is located on Parcel 2, which has a target release rate of 105 L/s. The HydroCAD model created for this site includes:

- Underground storage unit with a footprint of 149 m^2 to detain 0.44 ha of the new development with a runoff coefficient of 0.82 (+25% for 100-year event as per OSDG 5.4.5.2.1; C = 0.97). Outflow controlled by 240 mm orifice.
- Uncontrolled runoff from 0.079 ha with C = 0.58 (+25% for 100-year event as per OSDG 5.4.5.2.1; C = 0.72).

A summary of the HydroCAD results is shown in Table 3. HydroCAD modelling output is included in **Appendix C1.**

Table 3: Summary of Modelling Results - Building 1

Return Period (years)	Time of Duration (min)	Utilized Storage (m^3)	Peak Water Elevation in Storage (m)	Peak Flow Rate at Control (L/s)	Peak Flow Rate from Site (L/s)	Target Peak Flow Rate (L/s)
5 (Peak Discharge)	16	34	86.586	53	61	105
100 (Peak Discharge)	18	81	86.900	88	104	
100 (Peak Storage)	18	81	86.900	88	104	

3.2.2 BUILDING 2 - 1345 HEMLOCK ROAD

Building 1 is located on Parcel 3, which has a target release rate of 95 L/s. The HydroCAD model created for this site includes:

- Underground storage unit with a footprint of 101 m^2 to detain 0.33 ha of the new development with a runoff coefficient of 0.75 (+25% for 100-year event as per OSDG 5.4.5.2.1; C = 0.89). Outflow controlled by 255 mm orifice.

- Uncontrolled runoff from 0.047 ha with C = 0.66 (+25% for 100-year event as per OSDG 5.4.5.2.1; C = 0.82).

A summary of the HydroCAD results is shown in Table 4. HydroCAD modelling output is included in **Appendix C2**.

Table 4: Summary of Modelling Results - Building 2

Return Period (years)	Time of Duration (min)	Utilized Storage (m^3)	Peak Water Elevation in Storage (m)	Peak Flow Rate at Control (L/s)	Peak Flow Rate from Site (L/s)	Target Peak Flow Rate (L/s)
5 (Peak Discharge)	12	14	86.606	47	54	95
100 (Peak Discharge)	14	36	86.828	82	94	
100 (Peak Storage)	14	36	86.828	82	94	

3.2.3 BUILDING 3 - 375 CODD'S ROAD

Building 3 is located on Parcel 5, which has a target release rate of 139 L/s. The HydroCAD model created for this site includes:

- Underground storage unit with a footprint of 88 m^2 to detain 0.37 ha of the new development with a runoff coefficient of 0.74 (+25% for 100-year event as per OSDG 5.4.5.2.1; C = 0.87).

A summary of the HydroCAD results is shown in Table 5. HydroCAD modelling output is included in **Appendix C3**.

Table 5: Summary of Modelling Results - Building 3

Return Period (years)	Time of Duration (min)	Utilized Storage (m^3)	Peak Water Elevation in Storage (m)	Peak Flow Rate at Control (L/s)	Peak Flow Rate from Site (L/s)	Target Peak Flow Rate (L/s)
5 (Peak Discharge)	11	14	86.599	64	64	139
100 (Peak Discharge)	11	25	86.727	128	128	

There is no uncontrolled area for this parcel.

3.3 WATER QUALITY

As noted in Section 1.4, LID design targets have been specified which prescribe infiltration, erosion, and water quality targets for the proposed development. The minimum water quality target of 15 mm has been used as there is an existing SWM pond downstream which provides additional treatment capacity to achieve the full enhanced level of control per the MOE SWMPD Manual. Calculations for the required volumes are included in **Appendix B** and summarized in Table 6.

Table 6: LID Volume Targets

Building	Required Water Quality Volume (m^3)	Required Infiltration Volume (m^3)	Required Erosion Control Volume (m^3)
1	64	13	13
2	43	9	9
3	38	8	8

The proposed design meets the required volumes by using underground infiltration chambers. Based on the available geotechnical information (included in **Appendix A**), the design infiltration rate was determined to be 6 mm/hr. Using the design guidance from the TRCA LID SWM Planning and Design Guide (2010), the maximum depth of clearstone below the outlet was determined to be 1.1 m in order for the infiltration chamber to drain within 72 hours. This informed the infiltration chamber design parameters, which are shown in Table 7.

Table 7: Proposed infiltration chamber characteristics

Building	Base Area (m^2)	Depth of clearstone below chamber (m)	Depth of chamber below the outlet (m)	Volume below the outlet (m^3)
1	149	0.23	0.34	64
2	101	0.23	0.34	43
3	88	0.23	0.34	38

A shown, the proposed infiltration chambers provide the infiltration volume required to meet the LID design targets.

4 CONCLUSIONS

A stormwater management report has been prepared to support the feasibility study for the proposed development at 1375 Hemlock Road, 1345 Hemlock Road, and 375 Codd's Road in the City of Ottawa. The key points are summarized below.

WATER QUALITY

LID design targets outlined in the Wateridge Phase 2B Developer's Checklist have been achieved through use of underground infiltration chambers. These infiltration volumes combined with the existing downstream SWM pond are sufficient to meet the water quality requirements.

WATER QUANTITY

Quantity control will be provided within the underground infiltration chambers on each site to provide control up to the 100-year event.

APPENDIX

A RELEVANT REPORTS

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Memorandum

To/Attention	John Bernier, City of Ottawa Shawn Wessel, City of Ottawa	**Date**	April 26, 2022
From	Meghan Black Jim Moffatt	**Project No**	118863-5.3.1.5
cc	Mary Jarvis, Canada Lands Company		
Subject	Assessment of Revised Block 11 and 12 Storm and Sanitary Servicing		

1. Background

Blocks 11 and 12 are located within Phase 2B of the Wateridge development and are indicated in **Figure 1**. The municipal servicing of the two blocks was addressed in, “Design Brief, Wateridge Village at Rockcliffe Phase 2B,” prepared by IBI Group in April 2019. Subsequent to the approval of the Phase 2B detailed design, Canada Lands Company has sub-divided the subject blocks into five parcels for development. The parcels, identified as Parcels 1-5, are being considered for purchase by various parties. IBI has been engaged to assess the impact of this change on adjacent existing storm and sanitary sewers. Enclosed **Figure 1** depicts Blocks 11 and 12 and the respective five parcels.

2. Stormwater Management

2.1 Objective

The objective of the evaluation is to assess the impact on the dual drainage system of discretizing Blocks 11 and 12 into Parcels 1-5 and the associated impacts to the storm servicing. The detailed design of Parcels 1-5 will be carried out by others.

2.2 Dual Drainage Design

Per the Phase 2B design brief, minor storm runoff from Block 11 (identified as drainage area B309) drains to Bareille-Snow Street, with major flow tipping to Bareille-Snow Street at Hemlock Road. Minor flow from Block 12 (identified as drainage area B340) drains to Codd’s Road with major flow draining to Hemlock Road. The minor system restriction for the two development blocks corresponds to between the 5 and 100 year storm event, and no on-site storage was proposed. The storm drainage area plan (Drawing 750) from the Phase 2B submission is enclosed in **Appendix A** for reference. With the proposed adjustments to the storm servicing for the sub-divided or discretized parcels, minor system capture and on-site storage has been re-assessed.

2.3 Hydrological Analysis

Hydrological analysis of the dual drainage system of the subject site has been conducted using DDSWMM, consistent with the simulations completed for the Phase 2B design brief.

2.3.1 Storm and Design Parameters

The following storms and design parameters have been used in the evaluation. The main hydrological parameters are summarized in **Table 2.1**, with a comparison of what was included in the Phase 2B evaluation.

- **Design Storms:** The subject site has been evaluated with the following storms, consistent with the Phase 2B evaluation:

  - 5 and 100 year 3 hour Chicago storm events, and associated stress test; applied for the evaluation of the trunk storm sewers;
  - 100 year 24 hour SCS Type II storm event, applied for the evaluation of the trunk storm sewers;
  - July 1979, August 1988, August 1996 historical storms per the OSDG.

- **Area and Imperviousness:** Block 11 (identified as drainage area B309) and Block 12 (identified as drainage area B340) have been discretized into Parcels 1 through 5. An imperviousness value of 86% has been applied to the parcels, consistent with the values applied for B309 and B340 in the Phase 2B design brief.

- **Infiltration:** Infiltration losses were selected to be consistent with the OSDG. The Horton values are as follows: f_o = 76.2 mm/h, f_c = 13.2 mm/h, k = 0.00115 s^{-1}.

- **Subcatchment Width:** The catchment width for the parcels was based on 225 m/ha.

- **Slope:** The ground slope was based upon the average slope for both impervious and pervious area. Generally, the slope is approximately 2% (0.02 m/m). This assumes a slope of approximately 1% for impervious or road surfaces and 3% for pervious surfaces (lot grading).

- **Initial Abstraction (Detention Storage):** Detention storage depths of 1.5 mm and 4.67 mm were used for impervious and pervious areas, respectively. These values are consistent with the OSDG.

- **Manning's roughness:** Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.

- **Baseflow:** No baseflow components were assumed for any of the areas contributing runoff to the minor system within the DDSWMM model.

- **Minor System Capture:** The minor system capture for the parcels ranges from the 5 year to the 100 year, with three parcels capturing between the 5 and 100 year simulated flow.

- **Major System Storage and Routing:** In order to continue to satisfy City design guidelines, on-site storage has been introduced on four of the parcels, as noted below.

A summary of parameters and minor system and on-site storage is presented in the following tables. A summary from the Phase 2B detailed design is included to facilitate review. Refer to

Figure 2 for the overall storm sewer network and to **Figure 3** for a depiction of the minor and major system connectivity for the five parcels.

Table 2.1 Hydrological Parameters

Block	Phase 2B Design Brief							Current Evaluation							
	Drainage Area ID	Area (ha)	Major System: D/S Segment ID	Minor System: MH ID	IMP Ratio	Segment Length (m)	Sub-catchment Width (m)	Parcel	Drainage Area ID	Area (ha)	Major System: D/S Segment ID	Minor System: MH ID	IMP Ratio	Segment Length (m)	Sub-catchment Width (m)
11	B309	1.24	S308A on Bareille-Snow	MH309 on Bareille-Snow	0.86	135.1	270.2	1	B309_1	0.72	S308 on Bareille-Snow	MH309 on Bareille-Snow	0.86	81	162
								2	B309_2	0.52	S308A on Bareille-Snow	MH310 on Michael Stoqua	0.86	58.5	117
12	B340	1.24	S207 on Hemlock	MH305 on Codd's Road	0.86	173.1	346.3	3	B340_3	0.34	S308A on Bareille-Snow	MH308 on Bareille-Snow	0.86	38.25	76.5
								4	B340_4	0.53	S308 on Bareille-Snow	MH309 on Bareille-Snow	0.86	59.63	119.25
								5	B340_5	0.37	S340 on Codd's	MH305 on Codd's Road	0.86	41.63	83.25

Table 2.2 Minor System Restriction and On-site Storage

Block	Phase 2B Design Brief				Current Evaluation					
	Drainage Area ID	Minor System Capture		Required On-Site Storage (cu-m)	Parcel	Drainage Area ID	Minor System Capture		Major System	
		Simulated Flow (l/s)	Corresponding Design Storm				Simulated Flow (l/s)	Corresponding Design Storm	Required On-Site Storage (cu-m)	Comment
11	B309	370	Between 5 and 100	None	1	B309_1	195	Between 5 and 100 year	43	Control up to the 100 year event
					2	B309_2	105	5 year	64	Control up to the 100 year event
12	B340	366	Between 5 and 100	None	3	B340_3	95	Between 5 and 100 year	18	Control up to the 100 year event
					4	B340_4	150	Between 5 and 100 year	21	Control up to the 100 year event
					5	B340_5	139	100 year	None	N/A

2.4 Results of Hydrological Modeling

2.4.1 Minor System

The minor system hydrographs generated by the hydrological model were exported to the hydraulic model for analysis, discussed in **Section 2.5**.

2.4.2 Major System

Due to the adjustment in major system connectivity, the major system has been reassessed. Refer to drainage areas on Drawing 750 from the Phase 2B submission in **Appendix A**.

2.4.2.1 Street Segment Storage

The available and utilized street sag storage is summarized in the below table for street segments in affected by the revised storm servicing of Parcels 1-5.

Table 2.3 Summary of On-site Street Storage (Available and Utilized) During Target Minor System Design Storm in Vicinity of Parcels 1-5

Street	Drainage Area ID	Minor System Design Storm	Available Static Storage (cu-m)	Total Storage Utilized During Minor System Design Storm (cu-m)	Overflow During Minor System Design Storm (l/s)
Michael Stocqua	S310A	5	61.39	0	0
Bareille-Snow	S308A	5	40.38	0	0
Hemlock	S176C	5	1.14	0	0

The results indicate that there is no ponding on the street segments during the minor system design storm.

2.4.2.2 Velocity x Depth

According to the City of Ottawa Sewer Design Guidelines (October 2012), the maximum depth of flow should not exceed 350 mm and the product of velocity and depth on all the street segments should not exceed 0.6 m^2/s during the 100 year storm event.

The cascading overflow is the flow exiting a drainage area when maximum minor system inflow and maximum available ponding has been utilized. To determine velocity of the cascading overflow, a SWMHYMO file was created (118863VD.dat).

To determine velocity of the cascading overflow at critical locations, SWMHYMO was used. The ROW sections were entered into the model with the appropriate longitudinal slopes to obtain the maximum velocity of flow using the Route Channel routine. The overflow is obtained from the respective DDSWMM output file and is noted in the footnotes of the below tables.

To determine depth of the cascading overflow, the *Calculation Sheet: Overflow From Typical Road Ponding Area* provided at the February 2014 Technical Bulletin ISDTB-2014-01 was used. The exception to this is where the road is on grade in which case the depths were obtained from the SWMHYMO model.

The results are presented in **Table 2.4** and **Table 2.5** and the supporting calculations are included in **Appendix A**.

Table 2.4 Summary of Cascading Flow during the 100 year 3 hour Chicago storm

Street	Drainage Area ID	Dummy Segment ID	Overflow (l/s)[1]	Velocity (m/s)[2]	Max. Static Ponding Depth (m)	Depth of Dynamic Flow (m)[3]	Max. Depth (Static + Dynamic) (m)	Velocity x Depth (m^2/s)
Michael Stoqua	S311A	N/A	49	0.73	N/A	0.04	0.04	0.03
Michael Stoqua	S310A	D14	0	0	0.29	0	0.29	0
Bareille-Snow	S309	N/A	43	0.50	N/A	0.05	0.05	0.03
Bareille-Snow	S308	N/A	65	0.84	N/A	0.05	0.05	0.04
Bareille-Snow	S308A	D18	26	0.47	0.26	0.05	0.31	0.03
Codd's	S340	N/A	50	0.88	N/A	0.04	0.04	0.04
Codd's	S231	N/A	100	0.62	N/A	0.07	0.07	0.04
Hemlock	S205C	N/A	37	0.48	N/A	0.05	0.05	0.02
Hemlock	S207	N/A	61	0.55	N/A	0.06	0.06	0.03

(1) Overflow from DDSWMM output 118863-3CHI100.out
(2) Velocity from SWMHYMO output 118863VD.out
(3) Depth of the cascading overflow was determined from the Calculation Sheet: Overflow From Typical Road Ponding Area provided in the February 2014 Technical Bulletin ISDTB-2014-01. For those areas which have a continuous road grade (or no dummy segment), the depth was taken from SWMHYMO VxD simulation.

Table 2.5 Summary of Cascading Flow during the 100 year 3 hour Chicago storm + 20%

Street	Drainage Area ID	Dummy Segment ID	Overflow (l/s)[1]	Velocity (m/s)[2]	Max. Static Ponding Depth (m)	Depth of Dynamic Flow (m)[3]	Max. Depth (Static + Dynamic) (m)	Velocity x Depth (m^2/s)
Michael Stoqua	S311A	N/A	66	0.79	N/A	0.05	0.05	0.04
Michael Stoqua	S310A	D14	33	0.61	0.29	0.06	0.35	0.04
Bareille-Snow	S309	N/A	71	0.57	N/A	0.06	0.06	0.03
Bareille-Snow	S308	N/A	216	1.15	N/A	0.08	0.08	0.09
Bareille-Snow	S308A	D18	268	1.29	0.26	0.13	**0.39**	0.17
Codd's	S340	N/A	98	1.04	N/A	0.05	0.05	0.06
Codd's	S231	N/A	165	0.71	N/A	0.08	0.08	0.06
Hemlock	S205C	N/A	46	0.51	N/A	0.05	0.05	0.03

Street	Drainage Area ID	Dummy Segment ID	Overflow (l/s)[1]	Velocity (m/s)[2]	Max. Static Ponding Depth (m)	Depth of Dynamic Flow (m)[3]	Max. Depth (Static + Dynamic) (m)	Velocity x Depth (m^2/s)
Hemlock	S207	N/A	89	0.60	N/A	0.07	0.07	0.04

(1) Overflow from DDSWMM output 118863-3CHI120.out
(2) Velocity from SWMHYMO output 118863VD.out
(3) Depth of the cascading overflow was determined from the Calculation Sheet: Overflow From Typical Road Ponding Area provided in the February 2014 Technical Bulletin ISDTB-2014-01. For those areas which have a continuous road grade (or no dummy segment), the depth was taken from SWMHYMO VxD simulation.

During the 100 year 3 hour Chicago storm, the summation of depth of ponding and depth of cascading flow for all street segments is less than the City guideline of 0.35 m. The product of depth and velocity is also less than the City guideline of 0.6 m^2/s.

During the sensitivity analysis applying the 100 year 3 hour Chicago storm increased by 20%, the summation of depth of ponding and depth of cascading flow for all street segments is less than the City guideline of 0.35 m, with the exception of S308A, noted in the above table in bold red type. At all locations, the product of depth and velocity is less than the City guideline of 0.6 m^2/s.

These results are consistent with those of the Phase 2B detailed design. It should be noted that major flow from the above-noted affected areas is at or below that accounted for in the Phase 2B model.

The area at which total depth of ponding and cascading flow exceeds 0.35 m during the stress test is noted in the below table with the critical adjacent property elevation.

Table 2.6 Critical Ponding Locations during the Stress Test and Adjacent Property Elevations

Drainage Area ID	Low Point Elevation (m)	Max. Depth (Static + Dynamic) (m)	(1) Corresponding Elevation (m)	(2) Adjacent Property Line (m)	Difference (2) – (1)
S308A	88.74	0.39	89.13	89.01	-0.12

The corresponding stress test ponding elevation is greater than the adjacent block grading at the boulevard. At the detailed design stage of the blocks, house openings must be greater than the ponding elevation.

2.5 Storm Hydraulic Grade Line Analysis

The hydraulic grade line (HGL) was evaluated using the XPSWMM hydraulic model. The existing overall model for the Wateridge site, most recently revised as part of the Phase 4 submission (December 2021), was revised to include the revised servicing of Parcels 1-5.

XPSWMM simulations were conducted for the 100 year 3 hour Chicago storm to ensure that the HGL is at least 0.3 m below the underside of footing elevations. A sensitivity analysis was also performed using the 100 year Chicago storm with a 20% increase in intensity to ensure that there is no severe flooding to properties. Hydraulic grade line elevations along the existing downstream Phase 1A trunk storm sewer and relevant Phase 2B storm sewers are presented in the below table for these storms, along with a comparison of underside of footing (USF) elevations. Results for the overall development area are presented in the enclosed **Appendix A**, including for the three historical storms per OSDG. Refer to **Figure 1** for the location of storm maintenance holes.

Table 2.7 Storm Hydraulic Grade Line – Phase 1A Trunk and Relevant Phase 2B Storm Sewers

MH ID	Street	Proposed Ground Elev. (m)	USF (m)	100 year 3 hour Chicago		100 year 3 hour Chicago + 20%	
				HGL (m)	USF – HGL (m)	HGL (m)	USF – HGL (m)
MH194	*Top of the escarpment*	82.05	N/A	80.47	N/A	80.55	N/A
MH193	OSHEDINAA	84.68	82.68	81.12	1.56	81.28	1.40
MH192	OSHEDINAA	84.99	82.99	81.46	1.53	81.64	1.35
MH191	OSHEDINAA	85.76	83.76	81.72	2.04	81.93	1.83
MH190	OSHEDINAA	86.36	84.36	81.96	2.40	82.19	2.17
MH180	OSHEDINAA	86.96	84.96	82.27	2.69	82.77	2.19
MH178	HEMLOCK	89.00	86.60	83.41	3.19	83.47	3.13
MH176	HEMLOCK	88.03	85.63	83.77	1.86	83.85	1.78
MH231	CODD'S	89.81	87.41	85.61	1.79	85.64	1.77
MH305	CODD'S	91.00	88.60	86.54	2.06	86.56	2.04
MH207	HEMLOCK	88.53	86.13	84.65	1.48	84.65	1.48
MH206	HEMLOCK	89.10	86.70	85.65	1.05	85.65	1.05
MH308	BAREILLE-SNOW	89.68	87.28	86.88	0.40	86.69	0.59
MH309	BAREILLE-SNOW	90.15	87.75	87.44	0.31	87.08	0.67
MH205	HEMLOCK	89.35	86.95	85.86	1.09	85.88	1.07
MH310	MICHAEL STOCQUA	90.04	87.64	87.28	0.36	87.42	0.22
MH311	MICHAEL STOCQUA	90.69	88.29	87.44	0.85	87.56	0.73

Along the Phase 1A trunk and Phase 2B storm sewers presented above, a minimum 0.3 m clearance between the USF and HGL is maintained during the 100 year 3 hour Chicago storm and the HGL elevations remain below USF elevations during the sensitivity analysis. This is also true for the results for the remainder of the development area for additional storm simulations (enclosed in **Appendix A**).

2.6 Conclusion

The storm servicing of Blocks 11 and 12 was addressed during the detailed design of Phase 2B. The purpose of this evaluation is to assess the impact on the dual drainage system of discretizing Blocks 11 and 12 into Parcels 1-5 and the associated revisions to the storm servicing. The proposed minor and major connectivity of the five parcels is presented on **Figure 3** and minor system capture and required on-site storage is summarized in **Table 2.2**.

In terms of major flow, the depth and velocity of flow on streets adjacent to the five parcels was evaluated. City guidelines with respect to ponding during the minor system design storm, as well as maximum depth and velocity of flow are maintained. Major flow from the adjacent street segments is at or below that accounted for in the Phase 2B model.

With respect to minor flow, the hydraulic grade line evaluation was updated with the revised inflow hydrographs from the five parcels. Results indicate that a minimum 0.3 m clearance between the USF and HGL is maintained during the 100 year 3 hour Chicago storm and the HGL elevations remain below USF elevations during the sensitivity analysis.

It is therefore concluded that the proposed storm servicing to support Parcels 1-5 can be accommodated by the existing storm infrastructure.

3. Wastewater Outlet

3.1 Objective

The objective of this evaluation is to assess the impact on the existing wastewater system by the sub-division of Blocks 11 and 12 into five parcels. **Figure 4** shows the location of the subject site and the existing sanitary sewers which will be impacted by this change.

3.2 Existing Conditions

Development of Phase 2B included the construction of sanitary sewers in Codd's Road from MH231A to the MH340A and Bareille-Snow Street from BLK308A to MH304A. The sanitary sewer on Codd's Road was designed to capture wastewater flows from Block 12 and the sanitary sewer on Bareille-Snow Street was designed to capture wastewater flows from Block 11. The Bareille-Snow sewer outlets to a sanitary sewer in Hemlock Road. The latter sewer was designed in 2017, using the City's wastewater flow criteria in effect at that time and predicted a flow of 28.49 l/s tributary from the Bareille-Snow sewer. The Bareille-Snow sanitary sewer was designed in 2019 based on flow calculation criteria in effect at that time and predicted a slightly less flow of 25.17 l/s. A highlighted copy of the Phase 2B sanitary sewer design sheet is included in **Appendix B**. The spreadsheet has been highlighted to indicate the immediate downstream sewers on Codd's Road and Bareille-Snow Street. The flow calculations in the Phase 2B spreadsheet were based on the City of Ottawa's wastewater criteria in effect of that time (2019) and the block population densities noted in the Master Servicing Study.

3.3 Proposed Condition

Because of the sub-division of Blocks 11 and 12 into five parcels, less wastewater flow is now proposed to outlet to the Codd's Road sanitary sewer. The Phase 2B sewer designed assumed all Block 12 would outlet to that sewer but now only parcel 5 is proposed to outlet in that direction. No further analysis is therefore needed for the Codd's Road sewer.

Parcels 3 and 4, which represent the balance of Block 12, are now proposed to outlet to the existing sanitary sewer in Bareille-Snow Street and not the Codd's Road sewer. There is no proposed change to the wastewater outlet for parcels 1 and 2. The Phase 2B design assumed all Block 11 would outlet to the Bareille-Snow sewer. Consequently, the expected wastewater flows to the latter pipe will likely increase.

An analysis of the ability of the existing sanitary sewer system in Bareille-Snow Street to accommodate the flows from both Block 11 and 12 was completed. This analysis is included on the updated sanitary sewer spreadsheet included in **Appendix B**. The updated spreadsheet was based not only on the current City of Ottawa wastewater criteria, which came into effect in 2018 but also on the most current concept plans for the various parcels which are also included in **Appendix B**. The updated analysis includes the existing sewer system highlighted on the Phase 2B design sheet.

Based on the updated analysis, the calculated wastewater flows tributary to the Hemlock Road sewer from Bareille-Snow Street is 30.31 l/s. This shows a wastewater flow increase of 1.82 l/s as a result of re-directing wastewater flows from parcels 3 and 4 in Block 12. The capacity of that sewer is 88.83 l/s. The Phase 1B design of the sanitary sewer in Hemlock Road between Bareille-Snow Street and Codd's Road indicated a spare capacity in that sewer of about 58 l/s. For reference, a highlighted copy of the Phase 1B sanitary sewer design sheet is included in **Appendix B**.

3.4 Conclusion

The impact of re-directing wastewater flows from Block 12 to the Bareille-Snow Street sanitary sewer has been completed. Based on the analysis noted above, the existing wastewater system in Wateridge Village Phase 1B and 2B has sufficient available capacity to carry the re-directed flows from Block 12. It is therefore concluded that the existing sanitary sewers in Bareille-Snow Street, Codd's Road and Hemlock Road adjacent to the subject property can accommodate the re-direction of flows from Block 12.

Scale

N.T.S.

Project Title

STORM AND SANITARY SERVICING
ASSESSMENT OF BLOCK 11 AND 12
WATERIDGE VILLAGE PHASE 2B

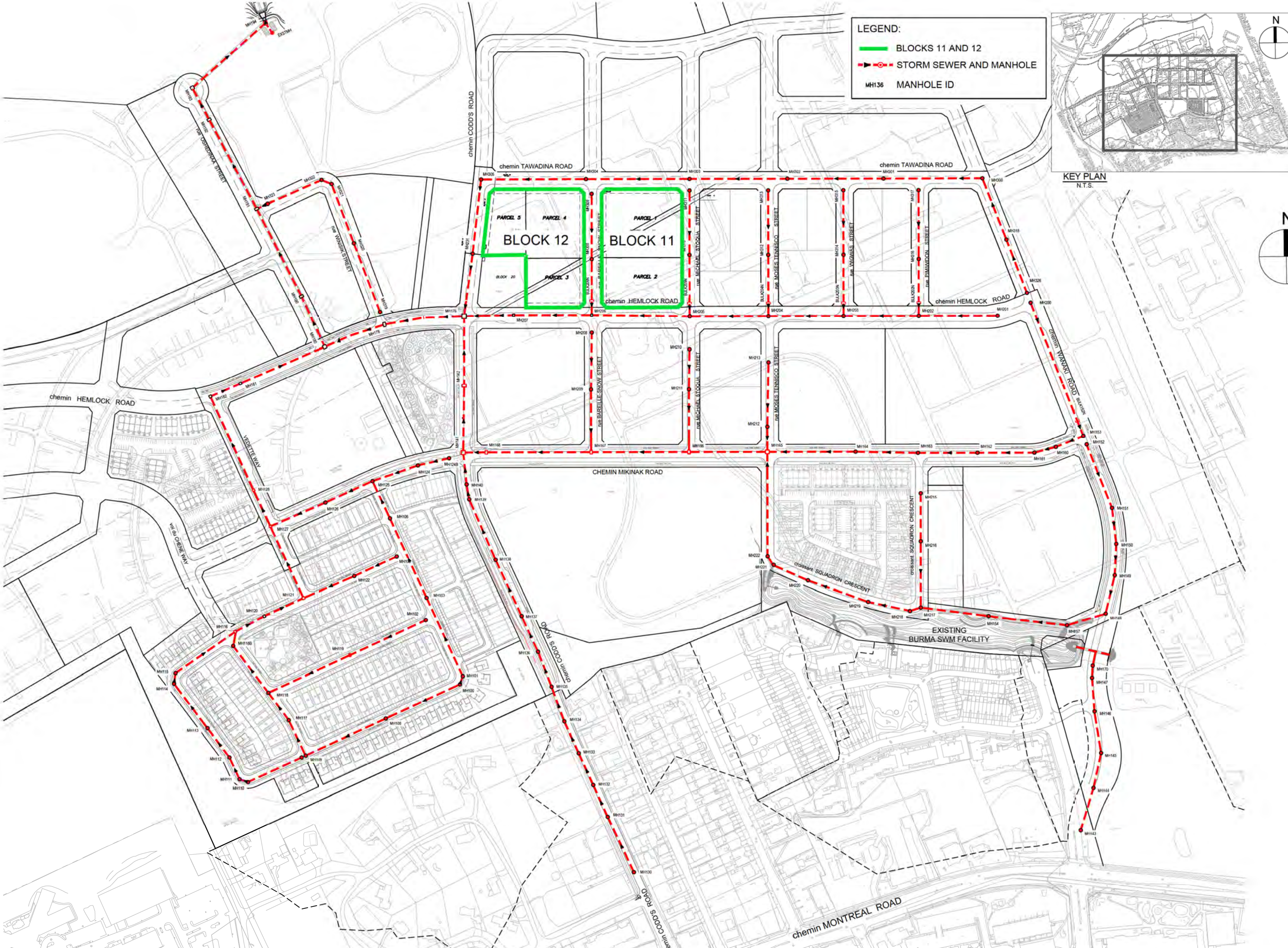
Drawing Title

LOCATION PLAN

Sheet No.

FIGURE 1

J:\38298—CFBRockcliffe\5.9 Drawings\59civil\SWM\FIGURES\BLOCK 11,12\FIGURE 1.dwg Layout Name: FIG1 Plot Style: AIA STANDARD COLOR-HALF.CTB Plotted At: 4/25/2022 5:40 PM Last Saved By: swakic, Apr. 25, 22



Project Title

STORM AND SANITARY SERVICING ASSESSMENT OF BLOCK 11 AND 12 WATERIDGE VILLAGE PHASE 2B

Drawing Title

LOCATION PLAN AND STORM SEWER NETWORK

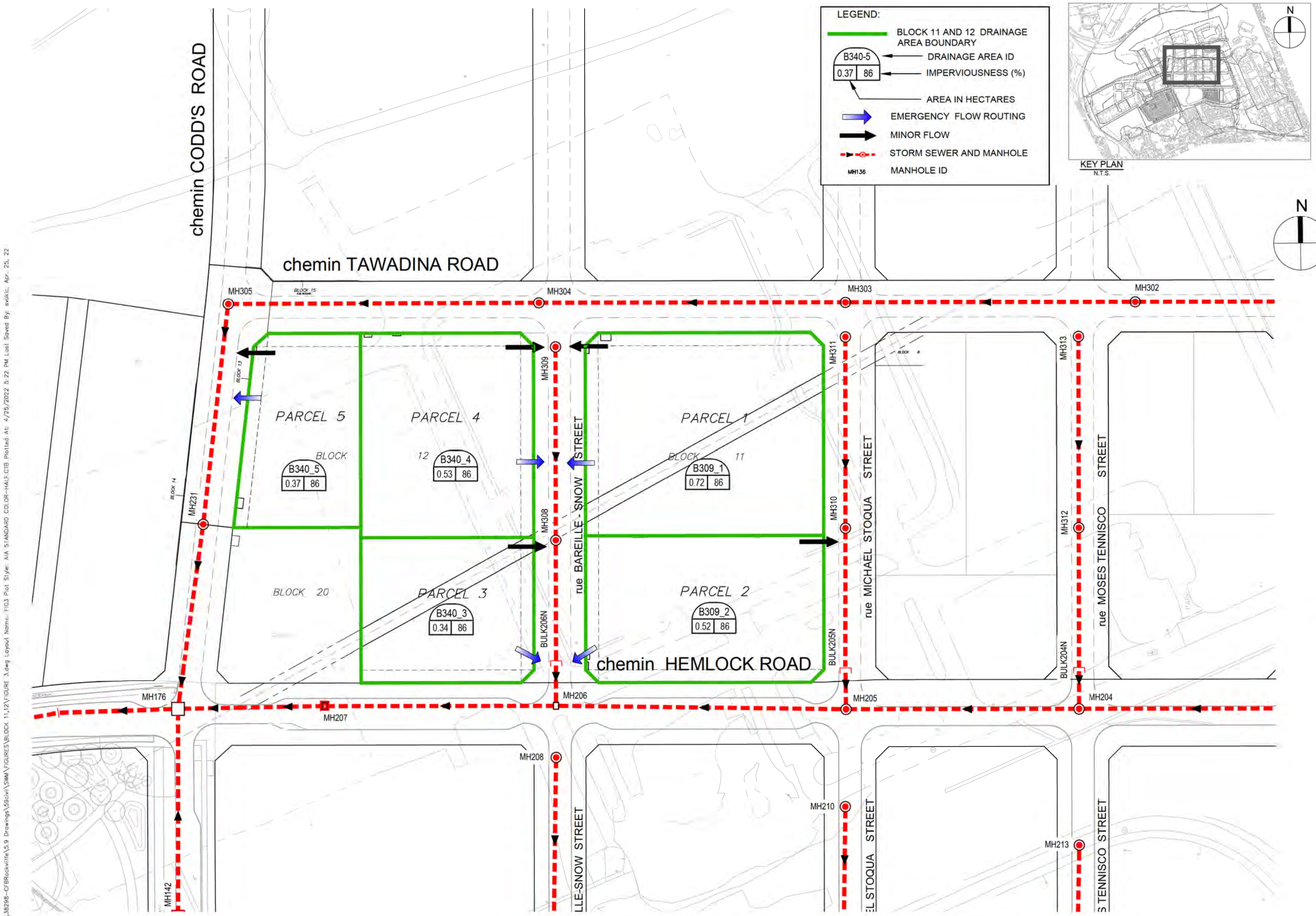
Sheet No.

FIGURE 2

Scale

N.T.S.

J:\38298-CFBRockcliffe\5.9 Drawings\59civil\SWM\FIGURES\BLOCK 11,12\FIGURE 2.dwg Layout Name: FIG2 Plot Style: AIA STANDARD COLOR-HALF.CTB Plotted At: 4/25/2022 5:45 PM Last Saved By: skukic, Apr. 25, 22



Project Title

STORM AND SANITARY SERVICING ASSESSMENT OF BLOCK 11 AND 12 WATERIDGE VILLAGE PHASE 2B

Drawing Title

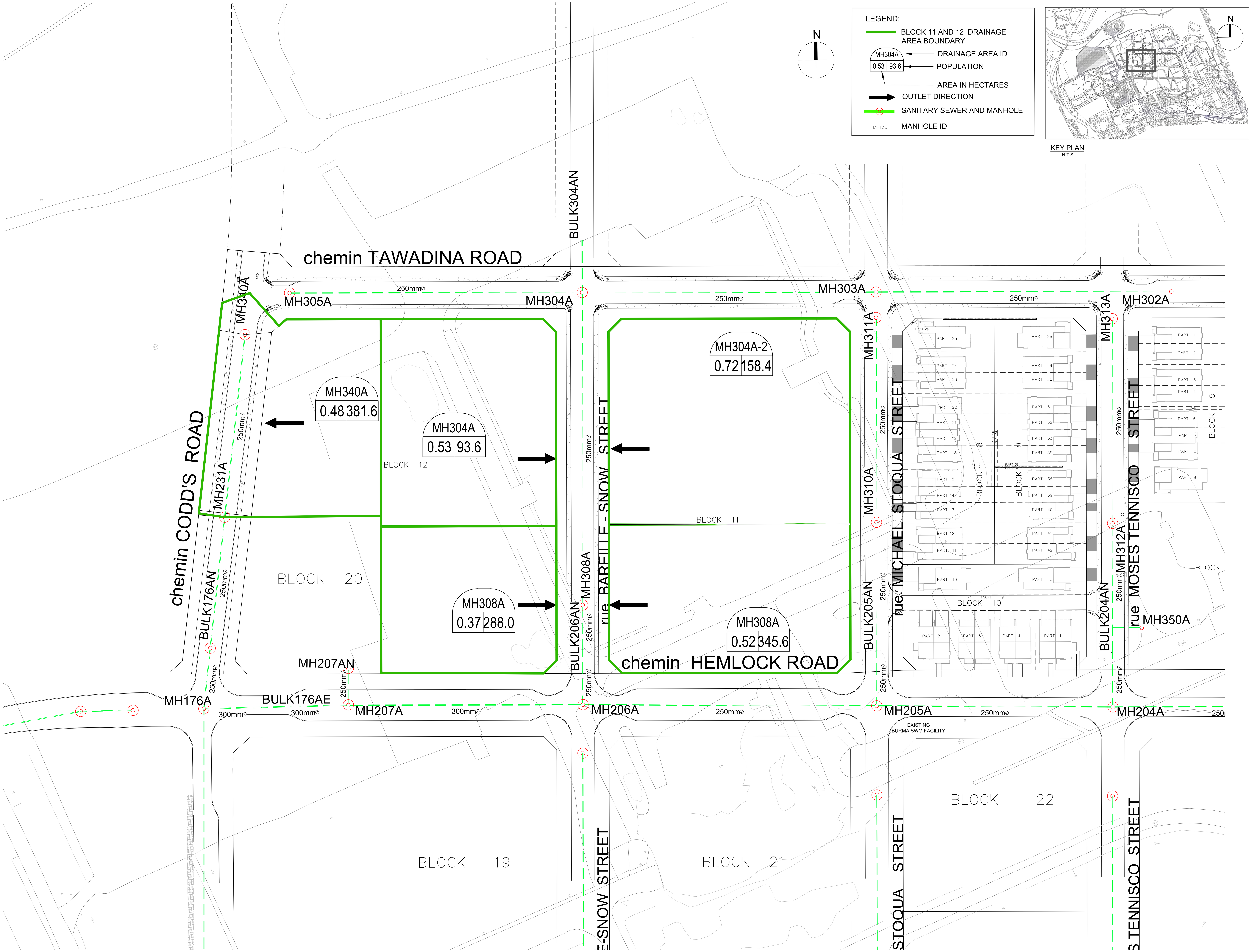
MINOR AND MAJOR SYSTEM CONNECTIVITY

Scale

N.T.S.

Sheet No.

FIGURE 3



Scale
N.T.S.

Project Title
STORM AND SANITARY SERVICING ASSESSMENT OF BLOCK 11 AND 12 WATERIDGE VILLAGE PHASE 2B

Drawing Title
LOCATION PLAN AND SANITARY SEWER NETWORK

Sheet No.
FIGURE 4

Appendix A

Supporting Storm Information

Summary of Model Files

DDSWMM:

5 year 3 hour Chicago: 118863-3CHI5.DAT
100 year 3 hour Chicago: 118863-3CHI100.DAT
100 year 3 hour Chicago + 20%: 118863-3CHI120.DAT

100 year 24 hour SCS Type II: 118863-24SCS100.DAT
100 year 24 hour SCS Type II + 20%: 118863-24SCS120.DAT

July 1979: 118863-JUL79.DAT
August 1988: 118863-AUG88.DAT
August 1996: 118863-Aug96.DAT

SWMHYMO VxD:

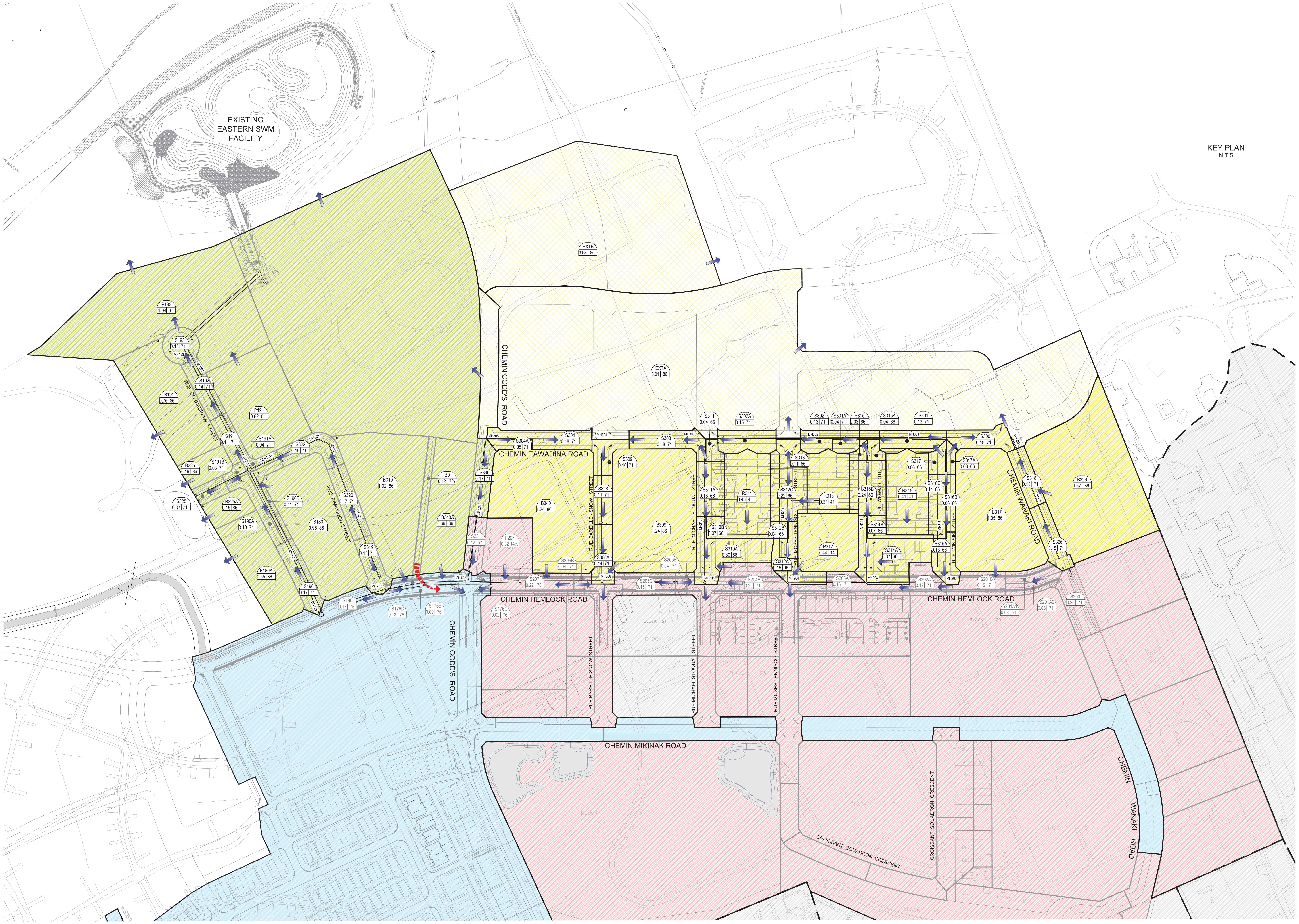
118863VD.dat

XPSWMM:

5 year 3 hour Chicago: 118863-3CHI5_BLK1112_V08_2022-03-15.XP
100 year 3 hour Chicago: 118863-3CHI100_BLK1112_V08_2022-02-28.XP
100 year 3 hour Chicago + 20%: 118863-3CHI120_BLK1112_V08_2022-02-28.XP

100 year 24 hour SCS Type II: 118863-24SCS100_BLK1112_V08_2022-03-15.XP
100 year 24 hour SCS Type II + 20%: 118863-24SCS120_BLK1112_V08_2022-03-15.XP

July 1979: 118863-JUL1979_BLK1112_V08_2022-03-15.XP
August 1988: 118863-AUG1988_BLK1112_V08_2022-03-15.XP
August 1996: 118863-AUG1996_BLK1112_V08_2022-03-15.XP



LEGEND:

- PHASE 2B DRAINAGE AREA
- PHASE 2A DRAINAGE AREA (FUTURE)
- PHASE 2C 2D DRAINAGE AREA (FUTURE)
- PHASE 1B DRAINAGE AREA (EXISTING)
- PHASE 1A DRAINAGE AREA (EXISTING)
- EXTERNAL DRAINAGE AREA

S318 — AREA ID
0.13 — AREA (ha)
71 — Imp.(%)

- MAJOR FLOW
- TOTAL FLOW
- MH136 MANHOLE ID

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1	SUBMISSION No.1 FOR CITY REVIEW	P.S.	2018:12:20

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Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE

PHASE 2B

M.S.BLACK
100101736
2019/04/17

Drawing Title

DDSWMM MODEL SCHEMATIC

Scale	1:2000
Design: M.B	Date: DEC. 2018
Drawn: S.V.	Checked: P.S.
Project No.: 118863	Drawing No.: 750

D07-16-15-0003

#17063

Velocity x Depth Calculation

Iteration equation:

Velocity:

$$v_x = v_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (v_{\max} - v_{\min})$$

Depth:

$$d_x = d_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (d_{\max} - d_{\min})$$

100 Year 3 Hour Chicago Storm																				
					SWMHYMO (118863VD.OUT)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (118863VD.OUT)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Static + Dynamic)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Depth (m)			Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S311A	20	1.52	**49**	0.049	0.039	0.084	0.699	0.847	**0.73**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.044**	**0.03**	0.00	0.04
S310A	20	1.22	**0**	0.000	0.000	0.002	0.000	0.301	**0.00**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.00**	0.29	0.29
S309	20	0.60	**43**	0.043	0.024	0.053	0.439	0.532	**0.50**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.050**	**0.03**	0.00	0.05
S308	20	1.84	**65**	0.065	0.043	0.092	0.769	0.932	**0.84**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.047**	**0.04**	0.00	0.05
S308A	20	0.71	**26**	0.026	0.009	0.027	0.365	0.478	**0.47**	0.021	0.027	0.050	0.055	**0.054**	N/A	N/A	**N/A**	**0.03**	0.26	0.31
S340	20	2.40	**50**	0.050	0.049	0.105	0.878	1.064	**0.88**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.041**	**0.04**	0.00	0.04
S205C	24	0.71	**37**	0.037	0.024	0.053	0.439	0.532	**0.48**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.047**	**0.02**	0.00	0.05
S231	20	0.53	**100**	0.100	0.096	0.155	0.617	0.697	**0.62**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.069**	**0.04**	0.00	0.07
S207	24	0.51	**61**	0.061	0.053	0.096	0.532	0.617	**0.55**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.057**	**0.03**	0.00	0.06

Velocity x Depth Calculation

Iteration equation:

Velocity:

$$v_x = v_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (v_{\max} - v_{\min})$$

Depth:

$$d_x = d_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (d_{\max} - d_{\min})$$

100 Year 3 Hour Chicago Storm + 20%																				
					SWMHYMO (118863VD.OUT)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (118863VD.OUT)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Static + Dynamic)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Depth (m)			Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S311A	20	1.52	**66**	0.066	0.039	0.084	0.699	0.847	**0.79**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.049**	**0.04**	0.00	0.05
S310A	20	1.22	**33**	0.033	0.012	0.035	0.478	0.626	**0.61**	0.028	0.035	0.055	0.060	**0.059**	N/A	N/A	**N/A**	**0.04**	0.29	0.35
S309	20	0.60	**71**	0.071	0.053	0.096	0.532	0.617	**0.57**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.060**	**0.03**	0.00	0.06
S308	20	1.84	**216**	0.216	0.167	0.272	1.081	1.221	**1.15**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.075**	**0.09**	0.00	0.07
S308A	20	0.71	**268**	0.268	0.255	0.364	0.841	0.919	**1.29**	0.240	0.269	0.125	0.130	**0.130**	N/A	N/A	**N/A**	**0.17**	0.26	0.39
S340	20	2.40	**98**	0.098	0.049	0.105	0.878	1.064	**1.04**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.053**	**0.06**	0.00	0.05
S205C	24	0.71	**46**	0.046	0.024	0.053	0.439	0.532	**0.51**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.052**	**0.03**	0.00	0.05
S231	20	0.53	**165**	0.165	0.155	0.234	0.697	0.773	**0.71**	N/A	N/A	N/A	N/A	**N/A**	0.082	0.095	**0.084**	**0.06**	0.00	0.08
S207	24	0.51	**89**	0.089	0.053	0.096	0.532	0.617	**0.60**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.066**	**0.04**	0.00	0.07

Storm Hydraulic Grade Line Elevations

XPSWMM NODE ID	MH NO.	PROPOSED GROUND ELEVATION (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO INCREASED BY 20%		100 YEAR 24 HOUR SCS TYPE II		100 YEAR 24 HOUR SCS TYPE II + 20%		JULY 1 1979		AUGUST 1988		AUGUST 1996	
				HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)
Phase 1B																	
S143	143	102.40	100.00	98.16	1.84	98.16	1.84	98.16	1.84	98.16	1.84	98.16	1.84	98.16	1.84	98.16	1.84
S144	144	99.41	97.01	95.79	1.22	95.79	1.22	95.78	1.23	95.79	1.22	95.78	1.23	95.79	1.22	95.78	1.23
S145	145	97.64	95.24	93.01	2.23	93.01	2.23	93.01	2.23	93.01	2.23	93.00	2.24	93.01	2.23	93.00	2.24
S146	146	95.28	92.88	90.96	1.92	91.82	1.06	90.77	2.11	91.26	1.62	90.91	1.97	91.01	1.87	90.63	2.25
S147	147	93.27	N/A	90.93	N/A	91.78	N/A	90.72	N/A	91.23	N/A	90.88	N/A	90.98	N/A	90.60	N/A
USBRM	N/A	N/A	N/A	90.88	N/A	91.72	N/A	90.67	N/A	91.17	N/A	90.83	N/A	90.93	N/A	90.56	N/A
BURMA	N/A	N/A	N/A	89.41	N/A	89.87	N/A	89.24	N/A	89.53	N/A	89.43	N/A	89.31	N/A	89.04	N/A
OUTLET	N/A	N/A	N/A	89.26	N/A	89.75	N/A	89.07	N/A	89.39	N/A	89.29	N/A	89.15	N/A	88.65	N/A
S152	152	92.73	90.33	89.71	0.62	89.71	0.62	89.71	0.62	89.71	0.62	89.71	0.62	89.71	0.62	89.71	0.62
S151	151	92.50	90.10	89.58	0.52	89.57	0.53	89.58	0.52	89.58	0.52	89.58	0.52	89.58	0.52	89.57	0.53
S150	150	92.32	89.92	89.49	0.43	89.48	0.44	89.49	0.43	89.49	0.43	89.49	0.43	89.49	0.43	89.49	0.43
S149	149	92.34	89.94	89.42	0.52	89.42	0.52	89.42	0.52	89.42	0.52	89.42	0.52	89.42	0.52	89.42	0.52
S148	148	92.14	89.74	89.30	0.44	89.29	0.45	89.30	0.44	89.30	0.44	89.30	0.44	89.30	0.44	89.30	0.44
S157	157	91.24	N/A	89.21	N/A	89.20	N/A	89.21	N/A	89.21	N/A	89.21	N/A	89.21	N/A	89.21	N/A
S154	154	91.02	N/A	87.68	N/A	87.68	N/A	87.68	N/A	87.68	N/A	87.68	N/A	87.68	N/A	87.68	N/A
S215	215	90.77	88.37	87.58	0.79	87.58	0.79	87.58	0.79	87.58	0.79	87.58	0.79	87.58	0.79	87.58	0.79
S216	216	90.85	88.45	87.30	1.15	87.30	1.15	87.30	1.15	87.30	1.15	87.30	1.15	87.31	1.14	87.30	1.15
S217	217	90.66	88.26	87.13	1.13	87.18	1.08	87.12	1.14	87.15	1.11	87.14	1.12	87.13	1.13	87.12	1.14
S218	218	90.40	88.00	87.04	0.96	87.10	0.90	87.02	0.98	87.06	0.94	87.05	0.95	87.04	0.96	87.02	0.98
S219	219	90.08	87.68	86.85	0.83	86.94	0.74	86.82	0.86	86.88	0.80	86.86	0.82	86.84	0.84	86.81	0.87
S220	220	89.86	87.46	86.74	0.72	86.84	0.62	86.70	0.76	86.78	0.68	86.75	0.71	86.72	0.74	86.68	0.78
S221	221	89.88	87.48	86.57	0.91	86.72	0.76	86.51	0.97	86.63	0.85	86.59	0.89	86.54	0.94	86.36	1.12
S222	222	89.86	87.46	86.38	1.08	86.51	0.95	86.32	1.14	86.43	1.03	86.39	1.07	86.35	1.11	86.19	1.27
S200	200	94.71	92.31	90.73	1.58	90.74	1.57	90.73	1.58	90.72	1.59	90.73	1.58	90.72	1.59	90.73	1.58
S214	214	93.52	91.12	90.26	0.86	90.28	0.84	90.26	0.86	90.27	0.85	90.26	0.86	90.26	0.86	90.26	0.86
MH201	201	94.29	91.89	90.72	1.17	90.73	1.16	90.72	1.17	90.72	1.17	90.72	1.17	90.72	1.17	90.71	1.18
MH202	202	93.91	91.51	90.42	1.09	90.43	1.08	90.41	1.10	90.42	1.09	90.41	1.10	90.41	1.10	90.40	1.11
MH203	203	92.38	89.98	88.66	1.32	88.68	1.30	88.63	1.35	88.66	1.32	88.63	1.35	88.64	1.34	88.61	1.37
MH204	204	90.40	88.00	87.08	0.92	87.10	0.90	87.06	0.94	87.08	0.92	87.06	0.94	87.07	0.93	87.02	0.98
MH205	205	89.35	86.95	85.86	1.09	85.88	1.07	85.83	1.12	85.86	1.09	85.84	1.11	85.84	1.11	85.77	1.18
MH206	206	89.10	86.70	85.65	1.05	85.65	1.05	85.62	1.08	85.65	1.05	85.63	1.07	85.63	1.07	85.57	1.13
MH207	207	88.53	86.13	84.65	1.48	84.65	1.48	84.62	1.51	84.65	1.48	84.63	1.50	84.64	1.49	84.58	1.55
S212	212	90.25	87.85	86.86	0.99	86.87	0.98	86.83	1.02	86.85	1.00	86.83	1.02	86.84	1.01	86.82	1.03
S213	213	89.74	87.34	86.45	0.89	86.45	0.89	86.43	0.91	86.45	0.89	86.44	0.90	86.44	0.90	86.42	0.92
S210	210	89.14	86.74	86.43	0.31	86.43	0.31	86.42	0.32	86.43	0.31	86.42	0.32	86.43	0.31	86.41	0.33
S211	211	89.15	86.75	85.94	0.81	85.93	0.82	85.93	0.82	85.94	0.81	85.93	0.82	85.93	0.82	85.92	0.83
S208	208	88.77	86.37	85.92	0.45	85.91	0.46	85.78	0.59	85.91	0.46	85.81	0.56	85.88	0.49	85.70	0.67
S209	209	88.75	86.35	85.46	0.89	85.45	0.90	85.41	0.94	85.46	0.89	85.42	0.93	85.45	0.90	85.38	0.97
MH231	231	89.81	87.41	85.61	1.79	85.64	1.77	85.73	1.67	85.78	1.63	85.84	1.57	85.77	1.63	85.71	1.69

Storm Hydraulic Grade Line Elevations

XPSWMM NODE ID	MH NO.	PROPOSED GROUND ELEVATION (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO INCREASED BY 20%		100 YEAR 24 HOUR SCS TYPE II		100 YEAR 24 HOUR SCS TYPE II + 20%		JULY 1 1979		AUGUST 1988		AUGUST 1996	
				HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)
Wateridge Village Phase 1A																	
S153	153	92.78	90.38	89.45	0.93	89.46	0.92	89.44	0.94	89.45	0.93	89.44	0.94	89.45	0.93	89.44	0.94
S160	160	92.27	89.87	89.01	0.86	89.02	0.85	89.01	0.86	89.01	0.86	89.01	0.86	89.01	0.86	89.00	0.87
S161	161	91.94	89.54	88.57	0.97	88.58	0.96	88.57	0.97	88.57	0.97	88.57	0.97	88.57	0.97	88.57	0.97
S162	162	91.34	88.94	88.26	0.68	88.26	0.68	88.25	0.69	88.26	0.68	88.25	0.69	88.26	0.68	88.25	0.69
S163	163	90.94	88.54	87.68	0.86	87.68	0.86	87.68	0.86	87.68	0.86	87.68	0.86	87.68	0.86	87.68	0.86
S164	164	90.22	87.82	87.00	0.82	87.01	0.81	86.99	0.83	87.00	0.82	87.00	0.82	87.00	0.82	86.99	0.83
S165B	165	89.61	87.21	86.45	0.76	86.45	0.76	86.44	0.77	86.44	0.77	86.44	0.77	86.44	0.77	86.44	0.77
S165	165	89.30	86.90	85.98	0.92	86.05	0.85	85.93	0.97	86.01	0.89	85.99	0.91	85.96	0.94	85.83	1.07
S166	166	88.90	86.50	84.88	1.62	85.03	1.47	84.78	1.72	84.93	1.57	84.88	1.62	84.85	1.65	84.59	1.91
S167	167	88.40	86.00	84.71	1.29	84.86	1.14	84.60	1.40	84.76	1.24	84.71	1.29	84.67	1.33	84.39	1.61
S168	168	87.70	85.30	84.54	0.76	84.66	0.64	84.43	0.87	84.58	0.72	84.54	0.76	84.50	0.80	84.22	1.08
S141	141	87.32	84.92	84.28	0.64	84.39	0.53	84.18	0.74	84.32	0.60	84.28	0.64	84.25	0.67	83.97	0.95
S142	142	87.52	85.12	84.02	1.10	84.12	1.00	83.94	1.18	84.06	1.06	84.03	1.09	84.00	1.12	83.74	1.38
MH176	176	88.03	85.63	83.77	1.86	83.85	1.78	83.69	1.94	83.80	1.83	83.77	1.86	83.75	1.88	83.49	2.14
MH178	178	89.00	86.60	83.41	3.19	83.47	3.13	83.34	3.26	83.44	3.16	83.41	3.19	83.39	3.21	83.18	3.42
MH180	180	88.23	85.83	82.20	3.62	82.44	3.38	81.98	3.84	82.27	3.56	82.21	3.62	82.10	3.73	81.49	4.34
MH190	190	88.10	85.70	81.90	3.80	82.12	3.58	81.65	4.05	81.97	3.73	81.91	3.79	81.80	3.90	81.23	4.47
MH191	191	86.36	83.96	81.66	2.30	81.86	2.10	81.44	2.52	81.73	2.23	81.67	2.29	81.56	2.40	81.06	2.91
MH192	192	85.92	83.52	81.41	2.11	81.59	1.93	81.21	2.31	81.47	2.05	81.41	2.11	81.31	2.21	80.89	2.63
MH193	193	84.85	82.45	81.09	1.36	81.24	1.21	80.92	1.53	81.14	1.31	81.09	1.36	81.00	1.45	80.60	1.85
MH194	194	82.44	N/A	80.45	N/A	80.53	N/A	80.35	N/A	80.48	N/A	80.46	N/A	80.40	N/A	80.13	N/A
S130	130		N/A	101.25	N/A	101.25	N/A	101.24	N/A	101.25	N/A	101.24	N/A	101.24	N/A	101.23	N/A
S131	131		N/A	101.05	N/A	101.05	N/A	101.04	N/A	101.05	N/A	101.04	N/A	101.04	N/A	101.03	N/A
S132	132		N/A	99.64	N/A	99.64	N/A	99.64	N/A	99.64	N/A	99.64	N/A	99.64	N/A	99.63	N/A
S133	133		N/A	96.52	N/A	96.52	N/A	96.51	N/A	96.52	N/A	96.51	N/A	96.51	N/A	96.50	N/A
S134	134		N/A	93.01	N/A	93.01	N/A	93.00	N/A	93.01	N/A	93.00	N/A	93.00	N/A	92.99	N/A
S135	135		N/A	90.11	N/A	90.11	N/A	90.10	N/A	90.11	N/A	90.10	N/A	90.10	N/A	90.09	N/A
S136	136		N/A	87.38	N/A	87.38	N/A	87.37	N/A	87.38	N/A	87.37	N/A	87.37	N/A	87.37	N/A
S137	137		86.91	85.77	1.14	85.77	1.14	85.76	1.15	85.77	1.14	85.76	1.15	85.77	1.14	85.76	1.15
S138	138		86.31	84.96	1.35	84.96	1.35	84.95	1.36	84.96	1.35	84.95	1.36	84.95	1.36	84.94	1.37
S139	139		85.66	84.46	1.20	84.48	1.18	84.46	1.20	84.46	1.20	84.46	1.20	84.46	1.20	84.45	1.21
S140	140		N/A	84.35	N/A	84.42	N/A	84.34	N/A	84.37	N/A	84.35	N/A	84.34	N/A	84.34	N/A
S100	100		87.16	85.70	1.46	85.69	1.47	85.70	1.46	85.70	1.46	85.70	1.46	85.70	1.46	85.70	1.46
S108	108		86.66	85.24	1.43	85.23	1.43	85.23	1.43	85.24	1.42	85.23	1.43	85.23	1.43	85.23	1.43
S109	109		85.36	84.05	1.31	84.05	1.31	84.05	1.31	84.05	1.31	84.05	1.31	84.05	1.31	84.05	1.31
S117	117		85.06	83.54	1.52	83.58	1.48	83.53	1.53	83.54	1.52	83.53	1.53	83.54	1.52	83.53	1.53
S118	118		84.71	83.21	1.50	83.48	1.23	83.20	1.51	83.25	1.46	83.22	1.49	83.21	1.50	83.20	1.51
S101	101		87.16	85.55	1.61	85.55	1.61	85.54	1.62	85.55	1.61	85.54	1.62	85.54	1.62	85.54	1.62
S102	102		86.46	84.72	1.74	84.72	1.74	84.71	1.75	84.72	1.74	84.71	1.75	84.71	1.75	84.70	1.76
S119	119		85.46	83.95	1.51	83.95	1.51	83.95	1.51	83.95	1.51	83.94	1.52	83.95	1.51	83.95	1.51
S104	104		N/A	85.90	N/A	85.89	N/A	85.89	N/A	85.90	N/A	85.89	N/A	85.89	N/A	85.88	N/A

Storm Hydraulic Grade Line Elevations

XPSWMM NODE ID	MH NO.	PROPOSED GROUND ELEVATION (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO INCREASED BY 20%		100 YEAR 24 HOUR SCS TYPE II		100 YEAR 24 HOUR SCS TYPE II + 20%		JULY 1 1979		AUGUST 1988		AUGUST 1996	
				HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)
S103	103		86.46	84.36	2.10	84.36	2.10	84.34	2.12	84.36	2.10	84.35	2.11	84.35	2.11	84.34	2.12
S105	105		85.71	83.90	1.81	83.91	1.80	83.89	1.82	83.90	1.81	83.89	1.82	83.90	1.81	83.89	1.82
S122	122		84.86	83.53	1.33	83.53	1.33	83.53	1.33	83.53	1.33	83.53	1.33	83.53	1.33	83.53	1.33
S121	121		84.26	82.80	1.46	83.03	1.23	82.43	1.83	82.82	1.44	82.77	1.49	82.61	1.65	81.98	2.28
S127	127		84.36	82.67	1.69	82.92	1.44	82.34	2.02	82.71	1.65	82.66	1.70	82.51	1.85	81.85	2.51
S128	128		N/A	82.61	N/A	82.86	N/A	82.30	N/A	82.67	N/A	82.61	N/A	82.47	N/A	81.81	N/A
S107	107		N/A	85.29	N/A	85.29	N/A	85.28	N/A	85.29	N/A	85.28	N/A	85.28	N/A	85.27	N/A
S106	106		85.61	83.76	1.85	83.75	1.86	83.73	1.88	83.76	1.85	83.74	1.87	83.75	1.86	83.73	1.88
S124	124		85.69	83.94	1.75	83.94	1.75	83.93	1.76	83.94	1.75	83.93	1.76	83.93	1.76	83.92	1.77
S125	125		85.34	83.37	1.97	83.38	1.96	83.35	1.99	83.37	1.97	83.36	1.98	83.36	1.98	83.35	1.99
S126	126		84.96	82.87	2.09	83.14	1.82	82.85	2.11	82.89	2.07	82.85	2.11	82.86	2.10	82.84	2.12
S182	182		N/A	82.46	N/A	82.70	N/A	82.18	N/A	82.52	N/A	82.46	N/A	82.32	N/A	81.68	N/A
S181	181		N/A	82.36	N/A	82.61	N/A	82.11	N/A	82.43	N/A	82.37	N/A	82.24	N/A	81.61	N/A
S110	110		85.56	83.59	1.97	83.80	1.76	83.59	1.97	83.59	1.97	83.59	1.97	83.59	1.97	83.59	1.97
S111	111		84.96	83.59	1.37	83.80	1.16	83.58	1.38	83.59	1.37	83.58	1.38	83.59	1.37	83.58	1.38
S112	112		84.91	83.40	1.52	83.77	1.14	83.18	1.73	83.50	1.41	83.42	1.49	83.22	1.69	83.22	1.69
S113	113		84.51	83.41	1.10	83.74	0.77	83.06	1.45	83.48	1.03	83.40	1.11	83.08	1.43	83.05	1.46
S114	114		83.91	83.06	0.85	83.31	0.60	82.66	1.25	83.11	0.80	83.04	0.87	82.85	1.06	82.49	1.42
S115	115		83.56	83.04	0.52	83.33	0.23	82.64	0.92	83.13	0.43	83.01	0.55	82.83	0.73	82.45	1.11
S116	116		83.71	82.88	0.83	83.16	0.55	82.51	1.20	82.92	0.79	82.85	0.86	82.70	1.01	82.10	1.61
S120	120		83.96	82.86	1.10	83.08	0.88	82.48	1.48	82.88	1.08	82.83	1.13	82.67	1.29	82.06	1.90

Storm Hydraulic Grade Line Elevations

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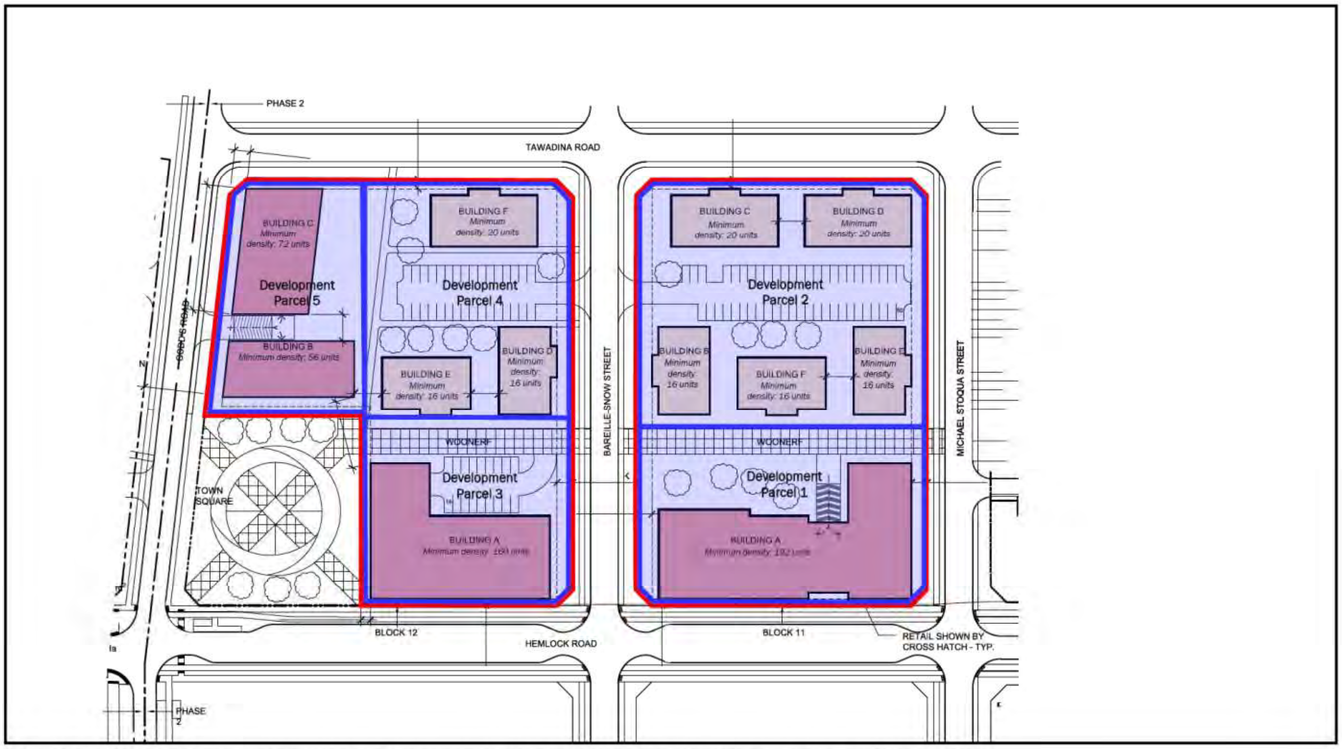
				HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)
Phase 2B, 4																	
MH317	317	94.08	91.68	91.17	0.51	91.18	0.50	91.14	0.54	91.15	0.53	91.15	0.53	91.14	0.54	91.11	0.57
MH316	316	94.09	91.69	90.96	0.73	90.96	0.73	90.95	0.74	90.95	0.74	90.95	0.74	90.95	0.74	90.92	0.77
MH315	315	93.39	91.36	90.28	1.08	90.29	1.07	90.25	1.11	90.26	1.10	90.27	1.09	90.27	1.09	90.26	1.10
MH314	314	93.00	91.16	89.91	1.25	89.91	1.25	89.91	1.25	89.91	1.25	89.91	1.25	89.91	1.25	89.89	1.27
MH313	313	92.62	90.71	89.35	1.36	89.34	1.37	89.35	1.36	89.35	1.36	89.35	1.36	89.35	1.36	89.34	1.37
MH312	312	91.36	89.68	88.42	1.26	88.42	1.26	88.41	1.27	88.42	1.26	88.42	1.26	88.42	1.26	88.38	1.30
MH311	311	90.69	88.29	87.44	0.85	87.56	0.73	87.40	0.89	87.48	0.81	87.45	0.84	87.47	0.82	87.38	0.91
MH310	310	90.04	87.64	87.28	0.36	87.42	0.22	87.25	0.39	87.35	0.29	87.30	0.34	87.33	0.31	87.06	0.58
MH309	309	90.15	87.75	87.44	0.31	87.08	0.67	87.33	0.42	87.44	0.31	87.41	0.34	87.43	0.32	87.22	0.53
MH308	308	89.68	87.28	86.88	0.40	86.69	0.59	86.81	0.47	86.88	0.40	86.87	0.41	86.88	0.40	86.76	0.52
MH326	326	94.76	92.36	91.33	1.03	91.33	1.03	91.32	1.04	91.32	1.04	91.32	1.04	91.32	1.04	91.33	1.03
MH318	318	94.40	92.00	91.03	0.97	91.03	0.97	91.00	1.00	91.03	0.97	91.00	1.00	91.00	1.00	91.00	1.00
MH300	300	94.00	91.60	90.71	0.89	90.70	0.90	90.67	0.93	90.70	0.90	90.68	0.92	90.68	0.92	90.68	0.92
MH301	301	93.73	91.33	90.21	1.12	90.21	1.12	90.20	1.13	90.20	1.13	90.21	1.12	90.20	1.13	90.20	1.13
MH302	302	92.80	90.40	88.64	1.76	88.64	1.76	88.63	1.77	88.63	1.77	88.64	1.76	88.63	1.77	88.63	1.77
MH303	303	90.67	88.27	87.80	0.47	87.81	0.46	87.63	0.64	87.65	0.62	87.79	0.48	87.72	0.55	87.64	0.63
MH304	304	90.30	87.90	87.39	0.51	87.38	0.52	87.30	0.60	87.31	0.59	87.38	0.52	87.34	0.56	87.30	0.60
MH305	305	91.00	88.60	86.54	2.06	86.56	2.04	86.61	1.99	86.64	1.96	86.69	1.91	86.65	1.95	86.60	2.00
MH319	319	88.81	86.61	86.13	0.48	86.12	0.49	86.12	0.49	86.13	0.48	86.12	0.49	86.12	0.49	86.12	0.49
MH320	320	89.12	86.92	85.49	1.43	85.49	1.43	85.49	1.43	85.49	1.43	85.49	1.43	85.49	1.43	85.49	1.43
MH321	321	87.67	85.47	84.18	1.29	84.39	1.08	84.10	1.37	84.15	1.32	84.11	1.36	84.13	1.34	84.09	1.38
MH322	322	87.50	85.30	84.18	1.12	84.39	0.91	84.10	1.20	84.15	1.15	84.10	1.20	84.12	1.18	84.09	1.21
MH323	323	86.57	84.37	83.40	0.97	83.48	0.89	83.31	1.06	83.37	1.00	83.32	1.05	83.34	1.03	83.30	1.07

Appendix B

Supporting Sanitary Information

SCHEDULE "A"

PARCEL IDENTIFICATION, DESCRIPTION, AND MINIMUM DENSITY[1]



**Boundaries of the development parcels are estimated. Purchasers to provide dimensioned sketch or electronic survey to confirm these boundaries

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[1] This image if provided for demonstration purposes only

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LEGEND
Block 11&12 Proposed Conditions
Old Criteria being used

AS-BUILT SANITARY SEWER DESIGN SHEET

Former CFB Rockcliffe
City of Ottawa
Canada Lands Company

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED	TOTAL	PROPOSED SEWER DESIGN						
STREET	AREA ID	FROM MH	TO MH	AREA Phase 1B (Ha)	UNIT TYPES SF	SD	TH	APT	AREA EXTERNAL (Ha)	POPULATION IND	CUM	PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha) INSTITUTIONAL IND	CUM	COMMERCIAL IND	CUM	INDUSTRIAL IND	CUM	PEAK FLOW (L/s)	AREA (Ha) IND	CUM	FLOW (L/s)	FLOW (L/s)	FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	(%)
Phase 1B																																
rue Michael Stoqua Street	EX205A	BULK205AN	MH205A						0.66	33.1	33.1	4.00	0.54		0.00		0.00		0.00	0.00	0.66	0.66	0.18	0.00	0.72	66.24	21.00	250	1.14	1.307	65.52	98.91%
Hemlock Road	205A	MH205A	MH206A	0.25						0.0	186.6	4.00	3.02		0.00		0.00		0.00	0.00	0.25	2.51	0.70	0.00	3.73	31.02	111.90	250	0.25	0.612	27.29	87.99%
rue Bareille-Snow Street	EX206A-B	BULK206AN	MH206A						9.79	2598.3	2598.3	3.49	36.78		0.00		0.00		0.00	0.00	9.79	9.79	2.74	0.00	39.52	88.83	21.00	250	2.05	1.753	49.30	55.50%
Hemlock Road	206A	MH206A	MH207A	0.20						0.0	2784.9	3.47	39.14		0.00		0.00		0.00	0.00	0.20	12.50	3.50	0.00	42.64	100.88	89.30	300	1.00	1.383	58.24	57.73%
Block 20	PARK1	MH207AN	MH207A	0.32						0.0	0.0	4.00	0.00		0.00		0.00		0.00	0.00	0.32	0.32	0.09	0.00	0.09	50.02	13.80	250	0.65	0.987	49.93	99.82%
Hemlock Road	PARK1, 207A	MH207A	*BULK176AE*	0.12						0.0	2784.9	3.47	39.14		0.00		0.00		0.00	0.00	0.12	12.94	3.62	0.00	42.77	134.59	33.10	300	1.78	1.845	91.83	68.23%
Phase 1A																																
Hemlock Road		*BULK176AE*	*MH176A*							0.0	2784.9	3.47	39.14		0.00		0.00		0.00	0.00	0.00	12.94	3.62	0.00	42.77	65.38	*21.97*	*300*	*0.42*	0.896	22.61	34.59%
Phase 1B																																
chemin Wanaki Road	200A, COM1	MH200A	MH214A	0.25						0.0	0.0	4.00	0.00		0.00	0.90	0.90		0.00	0.78	1.15	1.15	0.32	0.00	1.10	71.01	98.50	250	1.31	1.401	69.90	98.45%
chemin Wanaki Road	214A, COM2	MH214A	*BULK153AN*	0.16						0.0	0.0	4.00	0.00		0.00	0.65	1.55		0.00	1.35	0.81	1.96	0.55	0.00	1.89	57.20	44.60	250	0.85	1.129	55.30	96.69%
Phase 1A																																
chemin Wanaki Road	COM2	*BULK153AN*	*MH153A*							0.0	0.0	4.00	0.00		0.00		1.55		0.00	1.35	0.00	1.96	0.55	0.00	1.89	51.91	*20.13*	*250*	*0.70*	1.024	50.01	96.35%
chemin Wanaki Road	153A, COM3	*MH153A*	*MH151A*	0.21						0.0	0.0	4.00	0.00		0.00	0.88	2.43		0.00	2.11	1.09	3.05	0.85	0.00	2.96	36.70	*85.04*	*250*	*0.35*	0.724	33.74	91.93%
chemin Wanaki Road	151A, COM4	*MH151A*	*MH150A*	0.11						0.0	0.0	4.00	0.00		0.00	0.45	2.88		0.00	2.50	0.56	3.61	1.01	0.00	3.51	36.70	*40.97*	*250*	*0.35*	0.724	33.19	90.43%
chemin Wanaki Road	150A, COM5	*MH150A*	*MH149A*	0.11						0.0	0.0	4.00	0.00		0.00	0.95	3.83		0.00	3.32	1.06	4.67	1.31	0.00	4.63	36.70	*41.34*	*250*	*0.35*	0.724	32.07	87.38%
chemin Wanaki Road	149A	*MH149A*	*MH148A*	0.10						0.0	0.0	4.00	0.00		0.00		3.83		0.00	3.32	0.10	4.77	1.34	0.00	4.66	36.70	*40.04*	*250*	*0.35*	0.724	32.04	87.30%
chemin Wanaki Road	148A	*MH148A*	*MH157A*	0.04						0.0	0.0	4.00	0.00		0.00		3.83		0.00	3.32	0.04	4.81	1.35	0.00	4.67	36.70	*20.58*	*250*	*0.35*	0.724	32.03	87.27%
Phase 1B																																
chemin Wanaki Road	143B	BULK143AE	MH143A	0.31						104.0	104.0	4.00	1.69		0.00		0.00		0.00	0.00	0.31	0.31	0.09	0.00	1.77	43.87	21.50	250	0.50	0.866	42.10	95.96%
chemin Wanaki Road	143A	MH143A	MH144A	0.27						0.0	104.0	4.00	1.69		0.00		0.00		0.00	0.00	0.27	0.58	0.16	0.00	1.85	83.69	34.70	250	1.82	1.652	81.85	97.79%
chemin Wanaki Road	144A, 144B	MH144A	MH145A	0.72						0.0	104.0	4.00	1.69		0.00		0.00		0.00	0.00	0.72	1.30	0.36	0.00	2.05	88.61	41.10	250	2.04	1.749	86.56	97.69%
chemin Wanaki Road	145A, 145B, 145C	MH145A	MH146A	2.77						835.6	939.6	3.82	14.53		0.00		0.00		0.00	0.00	2.77	4.07	1.14	0.00	15.67	105.83	53.30	250	2.91	2.089	90.16	85.19%
chemin Wanaki Road	146A	MH146A	MH147A	0.14						0.0	939.6	3.82	14.53		0.00		0.00		0.00	0.00	0.14	4.21	1.18	0.00	15.71	43.54	37.30	250	0.97	1.206	27.83	63.92%
chemin Wanaki Road	PARK2	BLK147AE	MH147A	0.55						0.0	0.0	4.00	0.00		0.00		0.00		0.00	0.00	0.55	0.55	0.15	0.00	0.15	39.24	17.70	250	0.40	0.774	39.08	99.61%
chemin Wanaki Road	147C	BLK147AW	MH147A	0.10						33.6	33.6	4.00	0.54		0.00		0.00		0.00	0.00	0.10	0.10	0.03	0.00	0.57	41.62	17.70	250	0.45	0.821	41.04	98.62%
chemin Wanaki Road	147A	MH147A	MH170A	0.03						0.0	973.2	3.81	15.01		0.00		0.00		0.00	0.00	0.03	4.89	1.37	0.00	16.38	38.74	10.30	250	0.39	0.765	22.36	57.72%
chemin Wanaki Road	147B	MH170A	MH147C	0.16						0.0	973.2	3.81	15.01		0.00		0.00		0.00	0.00	0.16	5.05	1.41	0.00	16.42	31.63	38.20	250	0.26	0.624	15.21	48.08%
chemin Wanaki Road		MH147C	*BLK148AW*							0.0	973.2	3.81	15.01		0.00		0.00		0.00	0.00	0.00	5.05	1.41	0.00	16.42	46.01	11.80	250	0.55	0.908	29.58	64.30%
Phase 1A																																
chemin Wanaki Road		*BULK148AW*	*MH157A*							0.0	973.2	3.81	15.01		0.00		0.00		0.00	0.00	0.00	5.05	1.41	0.00	16.42	62.04	*8.00*	*250*	*1.00*	1.224	45.61	73.52%
chemin Wanaki Road	157A	*MH157A*	*MH158A*	0.05						0.0	973.2	3.81	15.01		0.00		3.83		0.00	3.32	0.05	9.91	2.77	0.00	21.11	31.02	*25.68*	*250*	*0.25*	0.612	9.91	31.94%
Street No. 2	INST1	*BULK158AN*	*MH158A*							0.0	0.0	4.00	0.00	2.62	2.62		0.00		0.00	2.27	2.62	2.62	0.73	0.00	3.01	39.24	*15.10*	*250*	*0.40*	0.774	36.23	92.33%
chemin Wanaki Road	158A	*MH158A*	*MH154A*	0.22						0.0	973.2	3.81	15.01		2.62		3.83		0.00	5.60	0.22	12.75	3.57	0.00	24.18	31.02	*68.91*	*250*	*0.25*	0.612	6.84	22.05%

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Block 11&12 Proposed Conditions
Old Criteria being used

AS-BUILT SANITARY SEWER DESIGN SHEET

Former CFB Rockcliffe
City of Ottawa
Canada Lands Company

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED	TOTAL	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW	FLOW	FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL														
STREET	AREA ID	FROM MH	TO MH	Phase 1B (Ha)	SF	SD	TH	APT	EXTERNAL (Ha)	IND	CUM	FACTOR	FLOW (L/s)	IND	CUM	IND	CUM	IND	CUM	FLOW (L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
Phase 1B																																
Block 9	154A	*Ex. BULK*	MH217Aa	0.19						0.0	973.2	3.81	15.01		2.62		3.83		0.00	5.60	0.19	12.94	3.62	0.00	24.23	104.37	*24.40*	250	*2.83*	2.060	80.13	76.78%
Block 9		MH217Aa	MH217A							0.0	973.2	3.81	15.01		2.62		3.83		0.00	5.60	0.00	12.94	3.62	0.00	24.23	62.66	*78.50*	250	*1.02*	1.237	38.42	61.32%
croissant Squadron Crescent	215Aa-b	MH215A	MH216A	0.79	3	4				117.8	117.8	4.00	1.91		0.00		0.00		0.00	0.00	0.79	0.79	0.22	0.00	2.13	55.49	*56.10*	250	*0.80*	1.095	53.36	96.16%
croissant Squadron Crescent	216Aa-b	MH216A	MH217A	0.67	2	6				94.5	212.3	4.00	3.44		0.00		0.00		0.00	0.00	0.67	1.46	0.41	0.00	3.85	46.01	*70.80*	250	*0.55*	0.908	42.16	91.63%
croissant Squadron Crescent	217A	MH217A	MH218A	0.02						0.0	1185.5	3.75	18.01		2.62		3.83		0.00	5.60	0.02	14.42	4.04	0.00	27.65	39.72	*9.70*	250	*0.41*	0.784	12.07	30.39%
croissant Squadron Crescent	218A	MH218A	MH218B	0.02						0.0	1185.5	3.75	18.01		2.62		3.83		0.00	5.60	0.02	14.44	4.04	0.00	27.66	39.24	*9.90*	250	*0.40*	0.774	11.58	29.51%
Thorncliffe Village	THORN1	MH600A	MH601A						5.55	1574.0	1574.0	3.66	23.36		0.00		0.00		0.00	0.00	5.55	19.99	5.60	0.00	28.96	69.16	*21.40*	300	*0.47*	0.948	40.20	58.12%
Thorncliffe Village		MH601A	MH218B							0.0	1574.0	3.66	23.36		0.00		0.00		0.00	0.00	0.00	19.99	5.60	0.00	28.96	108.18	*46.90*	300	*1.15*	1.483	79.22	73.23%
croissant Squadron Crescent	218B	MH218B	MH219A	0.07						0.0	2759.5	3.47	38.82		2.62		3.83		0.00	5.60	0.07	34.50	9.66	0.00	54.08	96.76	*40.20*	300	*0.92*	1.326	42.68	44.11%
croissant Squadron Crescent	219A	MH219A	MH220A	0.15						0.0	2759.5	3.47	38.82		2.62		3.83		0.00	5.60	0.15	34.65	9.70	0.00	54.12	66.92	*72.40*	300	*0.44*	0.917	12.79	19.12%
croissant Squadron Crescent	220A, 220B	MH220A	MH221A	1.46						319.0	3078.5	3.43	42.81		2.62		3.83		0.00	5.60	1.46	36.11	10.11	0.00	58.52	74.82	*43.30*	300	*0.55*	1.025	16.30	21.78%
croissant Squadron Crescent	221A	MH221A	MH222A	0.02						0.0	3078.5	3.43	42.81		2.62		3.83		0.00	5.60	0.02	36.13	10.12	0.00	58.53	64.60	*7.40*	300	*0.41*	0.885	6.07	9.40%
croissant Squadron Crescent		MH222A	MH223A							0.0	3078.5	3.43	42.81		2.62		3.83		0.00	5.60	0.00	36.13	10.12	0.00	58.53	58.82	*81.60*	300	*0.34*	0.806	0.30	0.51%
croissant Squadron Crescent	BLOCK 15	BLK223AE	MH223A	Design by Others																						109.23	*10.00*	250	*3.10*	2.156	109.23	100.00%
croissant Squadron Crescent	222A	MH223A	*MH165A*	0.22						0.0	3078.5	3.43	42.81		2.62		3.83		0.00	5.60	0.22	36.35	10.18	0.00	58.59	96.24	*36.10*	300	*0.91*	1.319	37.65	39.12%

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.4	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.7	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day 300 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: WY

Checked: JIM

Dwg. Reference: 38298-501

No.	Revision	Date
1.	City submission No. 1	2016-07-08
2.	City submission No. 2	2016-11-04
3.	City submission No. 3	2017-01-25
4.	Revised as per Mattamy's Design	2017-12-08
5.	As-Built Submission	2018-01-29
6.	Block 11 & 12 Study	2022-03-15

File Reference:	Date:	Sheet No:
38298.5.7.1	2016-07-08	1 of 2

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LEGEND
MH231A Existing infrastructure (shown for information only)
(yellow) Block 11, 12 Existing Conditions

SANITARY SEWER DESIGN SHEET

Wateridge at Rockcliffe - Phase 2B
City of Ottawa
Canada Lands Company

LOCATION STREET	LOCATION AREA ID	FROM MH	TO MH	RESIDENTIAL AREA w/ Units (Ha)	UNIT TYPES SF	UNIT TYPES SD / TH/F	UNIT TYPES TH/S	UNIT TYPES APT	AREA w/o Units (Ha)	POPULATION IND	POPULATION CUM	RES PEAK FACTOR	PEAK FLOW (L/s)	ICI AREAS AREA (Ha) INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	ICI PEAK FACTOR	PEAK FLOW (L/s)	INFILTRATION ALLOWANCE AREA (Ha) IND	AREA (Ha) CUM	FLOW (L/s)	FIXED FLOW (L/s) IND	FIXED FLOW (L/s) CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	AVAILABLE CAPACITY (%)
Pimiwidon Street	MH317-1, MH317-2	MH317A	MH316A	1.50	1	104				284.2	284.2	3.47	3.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.50	1.50	0.50	0.00	0.00	3.69	40.68	83.00	250	0.43	0.803	36.99	90.93%
Pimiwidon Street	MH316A	MH316A	BULK202AN	0.16		1				2.7	286.9	3.47	3.23	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.16	1.66	0.55	0.00	0.00	3.77	37.74	43.10	250	0.37	0.745	33.96	90.00%
Pimiwidon Street	-	*BULK202AN*	*MH202A*							*0.0*	*286.9*	*3.47*	*3.23*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*1.66*	*0.55*	*0.00*	*0.00*	*3.77*	*40.68*	*21.00*	*250*	*0.43*	*0.803*	*36.91*	*90.72%*
Wigwas Street	MH315A	MH315A	MH314A	0.79	2	18				55.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.79	0.79	0.26	0.00	0.00	0.92	49.63	111.64	250	0.64	0.979	48.72	98.16%
Wigwas Street	MH314A	MH314A	BULK203AN	0.06						0.0	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.06	0.85	0.28	0.00	0.00	0.93	83.46	14.37	250	1.81	1.647	82.53	98.88%
Wigwas Street	-	*BULK203AN*	*MH203A*							*0.0*	*55.4*	*3.64*	*0.65*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.85*	*0.28*	*0.00*	*0.00*	*0.93*	*80.17*	*21.00*	*250*	*1.67*	*1.582*	*79.24*	*98.83%*
Moses Tennisco Street	MH313A	MH313A	MH312A	0.66	2	16				50.0	50.0	3.65	0.59	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.66	0.66	0.22	0.00	0.00	0.81	75.73	77.20	250	1.49	1.495	74.92	98.93%
Moses Tennisco Street	MH312A, PARK	MH312A	BULK204AN	0.21		2				5.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.87	0.29	0.00	0.00	0.94	94.29	49.70	250	2.31	1.861	93.35	99.00%
Park	PARK	MH350A	pipe	0.42						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.42	0.42	0.14	0.00	0.00	0.14	48.39	11.00	200	2.00	1.492	48.25	99.71%
Moses Tennisco Street	-	*BULK204AN*	*MH204A*							*0.0*	*55.4*	*3.64*	*0.65*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.87*	*0.29*	*0.00*	*0.00*	*0.94*	*89.90*	*21.00*	*250*	*2.10*	*1.774*	*88.96*	*98.95%*
Michael Stoqua Street	MH311A	MH311A	MH310A	0.44	1	9				27.7	27.7	3.69	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.44	0.44	0.15	0.00	0.00	0.48	72.35	77.82	250	1.36	1.428	71.87	99.34%
Michael Stoqua Street	MH310A	MH310A	BULK205AN	0.21		2				5.4	33.1	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.65	0.21	0.00	0.00	0.61	65.66	49.19	250	1.12	1.296	65.05	99.07%
Michael Stoqua Street	-	*BULK205AN*	*MH205A*							*0.0*	*33.1*	*3.68*	*0.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.65*	*0.21*	*0.00*	*0.00*	*0.61*	*66.24*	*21.00*	*250*	*1.14*	*1.307*	*65.63*	*99.08%*
Wanaki Road	MH200A	MH200A	MH318A							0.0	0.0	3.80	0.00	0.00	0.00	1.01	1.01	0.00	0.00	1.50	0.49	1.01	1.01	0.33	0.00	0.00	0.82	42.53	63.35	250	0.47	0.839	41.71	98.06%
Wanaki Road	MH318A	MH318A	MH300A							0.0	0.0	3.80	0.00	0.00	0.00	0.95	1.96	0.00	0.00	1.50	0.95	0.95	1.96	0.65	0.00	0.00	1.60	42.53	77.11	250	0.47	0.839	40.93	96.24%
Tawadina Road	MH300A	MH300A	MH301A	0.47		15				40.5	40.5	3.67	0.48	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.47	2.43	0.80	0.00	0.00	2.24	31.02	109.85	250	0.25	0.612	28.78	92.79%
Tawadina Road	MH301A	MH301A	MH302A	0.54		14				37.8	78.3	3.62	0.92	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.54	2.97	0.98	0.00	0.00	2.85	59.18	110.39	250	0.91	1.168	56.33	95.18%
Tawadina Road	MH302A	MH302A	MH303A	0.26		2				5.4	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.26	3.23	1.07	0.00	0.00	3.00	72.61	111.69	250	1.37	1.433	69.62	95.87%
Tawadina Road	MH303A	MH303A	MH304A	0.21						0.0	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.21	3.44	1.14	0.00	0.00	3.07	31.02	112.10	250	0.25	0.612	27.95	90.11%
Tawadina Road	MH305A	MH305A	MH304A	0.24						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.24	0.24	0.08	0.00	0.00	0.08	49.63	111.61	250	0.64	0.979	49.55	99.84%
																					0.00													
Bareille-Snow Street	EXT-1	BULK304AN	MH304A	7.35				905		1629.0	1629.0	3.12	16.49	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	7.35	7.35	2.43	0.00	0.00	18.91	31.02	20.00	250	0.25	0.612	12.11	39.04%
Bareille-Snow Street	MH304A-1, MH304A-2	MH304A	MH308A	1.47				190		342.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	1.47	12.50	4.13	0.00	0.00	25.14	39.72	119.21	250	0.41	0.784	14.58	36.70%
Bareille-Snow Street	MH308A	MH308A	BULK206AN	0.07						0.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.07	12.57	4.15	0.00	0.00	25.17	84.15	16.82	250	1.84	1.661	58.99	70.09%
Bareille-Snow Street		BULK206AN	MH206A							0.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.00	12.57	4.15	0.00	0.00	25.17	88.83	21.00	250	2.05	1.753	63.66	71.67%
Codd's Road	MH340A	MH340A	BLK231AN	1.78				278		500.4	500.4	3.38	5.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.78	1.78	0.59	0.00	0.00	6.07	75.98	70.00	250	1.50	1.500	69.91	92.01%
Codd's Road		*MH231A*	*BULK176AN*							*0.0*	*500.4*	*3.38*	*5.48*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*1.78*	*0.59*	*0.00*	*0.00*	*6.07*	*83.92*	*50.22*	*250*	*1.83*	*1.656*	*77.86*	*92.77%*

Design Parameters:

Residential			ICI Areas			
SF	3.4	p/p/u				
TH/F/SD	2.7	p/p/u	INST	28,000	L/Ha/day	
TH/S	2.3	p/p/u	COM	28,000	L/Ha/day	
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area, 1.5 if greater than 20%, otherwise 1.0

Designed: KH
Checked: JIM
Dwg. Reference: 118863-400

No.	Revision	Date
1	Submission No. 1 for City Review	2018-12-20
2	Submission No. 2 for City Review	2019-03-15
3	MECP Submission	2019-04-17
4	Record information Added (No.1)	2020-10-08
5	Record information Added (No.2)	2021-03-23
6	Block 11 & 12 Study	2022-03-15

File Reference: 118863.5.7.1 **Date:** 2021-03-31 **Sheet No:** 1 of 1

IBI GROUP
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LEGEND
MH231A Existing infrastructure (shown for information only)
Block 11&12 Proposed Conditions

SANITARY SEWER DESIGN SHEET

Wateridge at Rockcliffe - Phase 2B
City of Ottawa
Canada Lands Company

LOCATION: STREET	LOCATION: AREA ID	LOCATION: FROM MH	LOCATION: TO MH	RESIDENTIAL: AREA w/ Units (Ha)	UNIT TYPES: SF	UNIT TYPES: SD / TH/F	UNIT TYPES: TH/S	UNIT TYPES: APT	AREA w/o Units (Ha)	POPULATION: IND	POPULATION: CUM	RES PEAK FACTOR	PEAK FLOW (L/s)	ICI AREAS: AREA (Ha) INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	ICI PEAK FACTOR	PEAK FLOW (L/s)	INFILTRATION ALLOWANCE: AREA (Ha) IND	AREA (Ha) CUM	FLOW (L/s)	FIXED FLOW (L/s): IND	FIXED FLOW (L/s): CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN: CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	AVAILABLE CAPACITY (%)
Pimiwidon Street	MH317-1, MH317-2	MH317A	MH316A	1.50	1	104				284.2	284.2	3.47	3.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.50	1.50	0.50	0.00	0.00	3.69	40.68	*83.00*	*250*	*0.43*	0.803	36.99	90.93%
Pimiwidon Street	MH316A	MH316A	BULK202AN	0.16		1				2.7	286.9	3.47	3.23	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.16	1.66	0.55	0.00	0.00	3.77	37.74	*43.10*	*250*	*0.37*	0.745	33.96	90.00%
Pimiwidon Street	-	*BULK202AN*	*MH202A*							*0.0*	*286.9*	*3.47*	*3.23*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*1.66*	*0.55*	*0.00*	*0.00*	*3.77*	*40.68*	*21.00*	*250*	*0.43*	*0.803*	*36.91*	*90.72%*
Wigwas Street	MH315A	MH315A	MH314A	0.79	2	18				55.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.79	0.79	0.26	0.00	0.00	0.92	49.63	*111.64*	*250*	*0.64*	0.979	48.72	98.16%
Wigwas Street	MH314A	MH314A	BULK203AN	0.06						0.0	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.06	0.85	0.28	0.00	0.00	0.93	83.46	*14.37*	*250*	*1.81*	1.647	82.53	98.88%
Wigwas Street	-	*BULK203AN*	*MH203A*							*0.0*	*55.4*	*3.64*	*0.65*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.85*	*0.28*	*0.00*	*0.00*	*0.93*	*80.17*	*21.00*	*250*	*1.67*	*1.582*	*79.24*	*98.83%*
Moses Tennisco Street	MH313A	MH313A	MH312A	0.66	2	16				50.0	50.0	3.65	0.59	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.66	0.66	0.22	0.00	0.00	0.81	75.73	*77.20*	*250*	*1.49*	1.495	74.92	98.93%
Moses Tennisco Street	MH312A, PARK	MH312A	BULK204AN	0.21		2				5.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.87	0.29	0.00	0.00	0.94	94.29	*49.70*	*250*	*2.31*	1.861	93.35	99.00%
Park	PARK	MH350A	pipe	0.42						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.42	0.42	0.14	0.00	0.00	0.14	48.39	*11.00*	*200*	*2.00*	1.492	48.25	99.71%
Moses Tennisco Street	-	*BULK204AN*	*MH204A*							*0.0*	*55.4*	*3.64*	*0.65*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.87*	*0.29*	*0.00*	*0.00*	*0.94*	*89.90*	*21.00*	*250*	*2.10*	*1.774*	*88.96*	*98.95%*
Michael Stoqua Street	MH311A	MH311A	MH310A	0.44	1	9				27.7	27.7	3.69	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.44	0.44	0.15	0.00	0.00	0.48	72.35	77.82	250	1.36	1.428	71.87	99.34%
Michael Stoqua Street	MH310A	MH310A	BULK205AN	0.21		2				5.4	33.1	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.65	0.21	0.00	0.00	0.61	65.66	49.19	250	1.12	1.296	65.05	99.07%
Michael Stoqua Street	-	*BULK205AN*	*MH205A*							*0.0*	*33.1*	*3.68*	*0.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.65*	*0.21*	*0.00*	*0.00*	*0.61*	*66.24*	*21.00*	*250*	*1.14*	*1.307*	*65.63*	*99.08%*
Wanaki Road	MH200A	MH200A	MH318A							0.0	0.0	3.80	0.00	0.00	0.00	1.01	1.01	0.00	0.00	1.50	0.49	1.01	1.01	0.33	0.00	0.00	0.82	42.53	*63.35*	*250*	*0.47*	0.839	41.71	98.06%
Tawadina Road	MH300A	MH300A	MH301A	0.47		15				40.5	40.5	3.67	0.48	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.47	2.43	0.80	0.00	0.00	2.24	*31.02*	*109.85*	*250*	*0.25*	0.612	28.78	92.79%
Tawadina Road	MH301A	MH301A	MH302A	0.54		14				37.8	78.3	3.62	0.92	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.54	2.97	0.98	0.00	0.00	2.85	*59.18*	*110.39*	*250*	*0.91*	1.168	56.33	95.18%
Tawadina Road	MH302A	MH302A	MH303A	0.26		2				5.4	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.26	3.23	1.07	0.00	0.00	3.00	72.61	*111.69*	*250*	*1.37*	1.433	69.62	95.87%
Tawadina Road	MH303A	MH303A	MH304A	0.21						0.0	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.21	3.44	1.14	0.00	0.00	3.07	31.02	112.10	250	0.25	0.612	27.95	90.11%
Tawadina Road	MH305A	MH305A	MH304A	0.24						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.24	0.24	0.08	0.00	0.00	0.08	49.63	111.61	250	0.64	0.979	49.55	99.84%
																					0.00													
Bareille-Snow Street	EXT-1	BULK304AN	MH304A	7.35				905		1629.0	1629.0	3.12	16.49	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	7.35	7.35	2.43	0.00	0.00	18.91	31.02	20.00	250	0.25	0.612	12.11	39.04%
Bareille-Snow Street	MH304A-1, MH304A-2	MH304A	MH308A	1.48				140		252.0	1964.7	3.07	19.57	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	1.48	12.51	4.13	0.00	0.00	24.33	39.72	119.21	250	0.41	0.784	15.39	38.75%
Bareille-Snow Street	MH308A	MH308A	BULK206AN	0.96				352		633.6	2598.3	3.00	25.23	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.96	13.47	4.45	0.00	0.00	30.31	84.15	16.82	250	1.84	1.661	53.85	63.99%
Bareille-Snow Street		BULK206AN	MH206A							0.0	2598.3	3.00	25.23	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.00	13.47	4.45	0.00	0.00	30.31	88.83	21.00	250	2.05	1.753	58.52	65.88%
Codd's Road	MH340A	MH340A	BLK231AN	0.88				212		381.6	381.6	3.43	4.24	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.88	0.88	0.29	0.00	0.00	4.53	75.98	70.00	250	1.50	1.500	71.46	94.04%
Codd's Road		*MH231A*	*BULK176AN*							*0.0*	*381.6*	*3.43*	*4.24*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.88*	*0.29*	*0.00*	*0.00*	*4.53*	*83.92*	*50.22*	*250*	*1.83*	*1.656*	*79.40*	*94.61%*

Design Parameters:

Residential			ICI Areas		
SF	3.4	p/p/u	INST	28,000 L/Ha/day	
TH/F/SD	2.7	p/p/u	COM	28,000 L/Ha/day	
TH/S	2.3	p/p/u	IND	35,000 L/Ha/day	MOE Chart
APT	1.8	p/p/u			
Other	60	p/p/Ha		17000 L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

Designed: KH

Checked: JIM

Dwg. Reference: 118863-400

No.	Revision	Date
1	Submission No. 1 for City Review	2018-12-20
2	Submission No. 2 for City Review	2019-03-15
3	MECP Submission	2019-04-17
4	Record information Added (No.1)	2020-10-08
5	Record information Added (No.2)	2021-03-23
6	Block 11 & 12 Study	2022-03-15

File Reference: 118863.5.7.1 **Date:** 2021-03-31 **Sheet No:** 1 of 1

CANADA LANDS COMPANY
SOCIÉTÉ IMMOBILIÈRE DU CANADA

REPORT
Project: 118863-5.2.2

DESIGN BRIEF
WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B

IBI

Prepared for CANADA LANDS COMPANY
by IBI GROUP
APRIL 2019

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1 Introduction

1.1 Scope

The purpose of this Design Brief is to provide stakeholder regulators with the project background together with the design philosophy and criteria incorporated in the sub-division design. This report will provide a logical framework to assist reviewers with evaluation of the design of the development.

1.2 Background

1.2.1 General

In 2011, Canada Lands Company (CLC), bought and took ownership of about 125 ha of the former CFB Rockcliffe air base site. The acquisition of the decommissioned base by CLC offers the opportunity today to reconnect this site back into the urban fabric of the City and create a highly desirable mixed-use community for approximately 10,000 residents. The long-term development period to full build out is estimated to be 15-20 years. There is also the opportunity to provide space for a variety of employment uses providing up to 2,600 permanent jobs.

Due to the proximity to the downtown, the new community will allow for more intensive development than in the outer suburbs, yet at a lower scale than one would see closer to the core.

A variety of housing types will be built to provide a range of choices for people with different housing needs. A community core will have the greatest mix of land uses to provide amenities to the new neighbourhoods, and it will also have the most active and vibrant streets in the community.

1.2.2 Previous Studies

In anticipation of development of the subject site, numerous reports and studies have been completed over the last five years. The most significant of these is the Community Design Plan (CDP) for which a Master Servicing Study was also prepared as a supporting document. Those documents were approved by City Council on October 14, 2015.

The “Former CFB Rockcliffe Community Design Plan, August 14, 2015”, includes a Draft Preferred Plan – Land Use which is shown in **Figure 1.1**. That figure illustrates the overall land use, road and block pattern for the community. That land use plan provides guidance and information upon which the balance of the development will be based.

In support of the CDP, there were numerous supporting documents including the “Former CFB Rockcliffe Master Servicing Study” (MSS), August 2015, prepared by IBI Group. That report provided a plan for provision of major infrastructure needed to support the proposed development of the subject site. The first two developments were Wateridge Village by Rockcliffe Phases 1A and 1B. Those phases are currently under construction. The Phase 1 designs built upon the infrastructure recommendations of the earlier MSS document including the Eastern Stormwater Management Facility with an outlet to the Ottawa River; major trunk sewer outlets and most of the backbone watermain designs. The current Phase 2B will connect to the major infrastructure designed in Phase 1A and 1B.

1.2.3 Municipal Infrastructure

The former site was serviced with central municipal services including a potable water supply and combined sewers. The water distribution system that previously serviced the property has been decommissioned and is no longer in service. The combined sewers discharged to the Ottawa Interceptor Sewer (IOS) which is a large diameter trunk combined sewer servicing a large portion of the City of Ottawa and a portion of which is located about 40 m below the Wateridge Village at Rockcliffe site. Combined sewage from the west portion of the site previously discharged to the Alvin Heights Pullback Sewer and combined flows from the eastern portion of the site discharged to the RCAF Pullback Sewer. Both these connections are fitted with overflow mechanisms which divert some flow away from the IOS sewer towards the Ottawa River during infrequent storm events.

There were two active storm sewers on the Rockcliffe site that discharged from the Burma Stormwater Management Facility. One storm sewer routed westward and flows eventually surfaced near the west portion of the site and flowed in open ditches off the site and eventually reached the Ottawa River through the Western Ditch. The second storm sewer routed towards the northeast and emptied over the escarpment and flowed to the Ottawa River through the Eastern Ditch.

The Phase 1 development also included decommissioning of the upper reaches of the two former "Burma Pond" storm sewers. Only the downstream portions of the sewers remain in operation. Most of the drainage area of the "northeast" storm sewer has been removed as part of the new development, but the lower portions of the sewer near the escarpment still collects some runoff before discharging into the Eastern Ditch. The Phase 2B design will include the removal of an additional 200 m of that pipe.

The same however, is not true of the remaining "western" storm sewer. Although most of its former drainage area has been replaced by the Phase 1 storm sewers, runoff from the new "southwest" ditch is temporarily connected to the remaining sections of the "western" sewer.

As development advances, the existing sewer system will be replaced with a separated system consisting of new sanitary sewers and minor storm sewers. The existing water system is also planned to be replaced with new watermains.

1.3 Subject Property

CLC plans to develop the Wateridge Village property in several phases. Phases 1A and 1B, which cover about 35 ha, are currently under development. The current location now planned for development is Phase 2B. The draft M-Plan for that location is shown in **Figure 1.2**. This phase covers about 10 ha and includes 12 blocks which include a small parkette and low to mid rise mixed use and residential opportunities.

1.4 Watercourses

There are two significant watercourses downstream of the Rockcliffe property. Please refer to **Figure 1.3**, Existing Water Courses. These are the Western Creek located west of the Aviation Parkway and the Eastern Creek located east of the Aviation Museum. Runoff from the former site not yet re-developed presently drains to both those watercourses. However, runoff from Phases 1 and 2 will be directed away from those two creeks and routed to the Eastern Stormwater Facility which was constructed and put into service in 2017 and discharges directly to the Ottawa River.

There is an existing shallow ditch that runs along the southern and western edges of Phase 1A of Wateridge Village site. That ditch collects runoff from adjacent upstream developments, including Codd's Road, the Fairhaven Community and the Montfort Woods. The upper reaches of that swale were improved as part of the Phase 1A sub-division and runoff from the ditch which is known as the Southwest Swale, is temporarily routed to the local storm sewer system and outlets to an existing ditch upstream of Hemlock Road. That runoff eventually discharges to the Western Creek.

The second remaining storm sewer on the property empties over the northeast escarpment and directs its runoff to the Eastern Ditch. As with the storm sewer on the western side of the site, the "eastern" storm sewer was once the outlet from the original Burma Storm Pond. As development advances towards the northeast of the property the “eastern” storm sewer is removed. A portion of this sewer will be removed as part of the Phase 2B development.

1.5 Limits of Existing Infrastructure

Figures 1.4 to Figure 1.6 indicate the limits of the existing municipal infrastructure which was constructed to provide the servicing requirements of the former CFB Rockcliffe airbase and subsequently revised as per the previous development Phases. **Figure 1.4** indicates the limits of existing water plant infrastructure and **Figure 1.5** and **Figure 1.6** respectively show the locations of existing sanitary and storm sewers. Both the Brittany Drive Pump Station and Montreal Road Pump Station provide water to both the Zone 1E and Zone Mont. The subject site is located in Zone Mont. The Ottawa Interceptor Sewer (IOS) is a 2400 mm diameter combined sewer to which wastewater and some storm runoff presently outlets. Codd’s Road was the approximate drainage divide for the former development and combined site sewers to the west of Codd’s Road discharged to the existing 300 mm diameter Airbase Pullback sewer which empties into the Alvin Heights Pullback Sewer which discharges to the IOS at the Peach Tree Road Shaft located west of the CLC property. Wastewater flows from the east portion of the site previously outletted to the existing 300 mm diameter RCAP Pullback sewer which connects to the IOS via the NRC shaft.

Sanitary flows from the Thorncliffe Village Community were previously routed through the subject site and connected to the IOS at the Codd’s Road Shaft which is located in the center of the site. Development of Phase 1A and 1B included a permanent interception of the sanitary sewer from the Thorncliffe Village development and an improved connection at the Codd’s Road Shaft.

All existing site sewers are proposed to be eventually removed in favour of new sewers. There were no existing stormwater management facilities servicing the former development.

1.6 Pre-Consultation

1.6.1 City of Ottawa

A pre-consultation meeting with the City of Ottawa was held on November 20, 2018. Attached and included in **Appendix A** is a November 29, 2018 summary e-mail from the City. While the usual host of requirements needed at registration were reviewed, some of the highlights included discussions about the Low Impact Development (LID) features and related modelling approach and the situation concerning development of a Composite Utility Plan.

1.6.2 Conservation Authority

The Rideau Valley Conservation Authority (RVCA) was contacted and asked if any permits for the proposed Phase 2A and 2B construction would be required. None are. Please refer to a December 5, 2018 e-mail response in **Appendix A** from the RVCA confirming same.

1.6.3 MECP

The local MECP office was contacted to initiate the pre-consultation process with the province. IBI has reached out to the local MECP office for a pre-consultation for Phases 2A and 2B. Attached is a copy of a December 19, 2018 e-mail from the MECP in Ottawa that recommends that the LID features, as well as services, can be approved under the transfer of review program. Please refer to a December 6, 2018 e-mail response from the local MECP located in **Appendix A**.

1.7 Geotechnical Considerations

Alston Associates, the geotechnical division of Terrapex, was retained to prepare a geotechnical investigation report for Phase 2B in the Wateridge Village by Rockcliffe Development. The objectives of the investigation are to prepare a report to:

- Determine the subsoil and groundwater conditions at the site by means of test pits and boreholes and
- To provide geotechnical recommendations pertaining to design of the proposed development including construction considerations.

The report No. CO682.00 was prepared by Alston Associates in February 2019. The report recommendations were based on the findings and observations from several boreholes and test pits. Among other items, the report recommendations deal with:

- Site grading;
- Foundation Design;
- Pavement Structure;
- Sewer and Watermain Construction;
- Groundwater Control;
- Grade raises

1.8 Existing Private Services

There are existing private services within the Fairhaven Community located south of and adjacent to Phase 1A and at the Aviation Museum. None of the private services will be impacted by Phase 2 construction.

1.9 Phasing

The development of the Wateridge Village at Rockcliffe site will be completed in multiple phases. **Figure 1.7** shows the limits of the proposed phase. Phases 1A and 1B are currently under construction. The timing of development of future phases after Phase 2B will be confirmed by CLC. The current vision is that full build out will take 15 to 20 years. Based on that schedule, the property may not be fully developed until the early 2030's.

2 Water Supply

2.1 Existing Conditions

Phase 2B of Wateridge Village at Rockcliffe will be serviced with potable water from the City of Ottawa's Montreal Road Pressure Zone (Zone MONT). The water distribution system that previously serviced the property has been decommissioned. An existing 406 mm diameter watermain on Montreal road will supply the site with connections at Codd's Road and Burma Road.

As part of the Phase 1 water plan, two 400 mm mains were extended northward along Codd's Road and Wanaki Road. Existing watermains in the Wateridge Village development are shown on **Figure 1.4**.

2.2 Master Servicing Study

A recommended water distribution plan was included in the former CFB Rockcliffe Master Servicing Study, August 2015 by IBI Group. A copy of Figure 4.4 Proposed Pipe Alignment and Diameters from the Master Servicing Study is included in **Appendix B**. The recommended plan for the previous Phases 1A and 1B was implemented as discussed in Section 2.1. Phase 2B will include completion of a 400 mm "backbone" watermain along Wanaki Road with connections at Codd's Road and Wanaki Road. Connections to these two pipes are proposed for the Phase 2B design. The water plan for Phase 2B also includes a series of 200 mm and 300 mm diameter mains along the five streets connecting to and north of Hemlock Road. All other mains in Phase 2B will be 200 mm or 300 mm diameter.

2.3 Design Criteria

2.3.1 Water Demands

Water demands for Phase 2B are based on **Table 4.2** – Consumption Rates for Subdivisions of 501 to 3,000 Persons of the Ottawa Design Guidelines – Water Distribution. In the preferred Concept Plan from the Master Servicing Study land use in Phase 2B consists of low rise residential, mid-rise mixed use. As there are no details for the residential development, population projections are derived from the projected population densities for the blocks. A watermain demand calculation sheet is included in **Appendix B** and the total water demands for Phase 2B are summarized as follows:

- Average Day 13.0 l/s
- Maximum Day 32.5 l/s
- Peak Hour 71.4 l/s

2.3.2 System Pressure

The 2010 City of Ottawa Water Distribution Guidelines state that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Maximum Pressure	Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls may be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.3.3 Fire Flow Rate

In the recent Technical Bulletin 'ISDTB-2014-02, Revisions to Ottawa Design Guidelines – Water', the fire flow requirements for single detached dwellings and traditional town and row houses can be capped at 10,000 l/min providing that there is a minimum separation of 10 meters between the backs of adjacent units and that the town and row house blocks are limited to 600 square meters of building areas and seven dwelling units.

As there are no specific details for the residential development in Phase 2B the Technical Bulletin IDSTD-2014-02 may not be applicable. A fire flow rate of 13,000 l/main will be used to evaluate fire flows for all of Phase 2B; that is consistent with the Master Servicing Study.

2.3.4 Boundary Conditions

The City of Ottawa has provided two hydraulic boundary conditions on Montreal Road at Codd's Road and at Burma Road. The boundary conditions are at the two connection locations for Phase 1. The boundary conditions are for existing conditions.

A copy of the boundary conditions is included in **Appendix B** and summarized as follows:

	Codd's Road	Burma Road
Max HGL (Basic Day)	147.0 m	147.0 m
Peak Hour	142.5 m	143.0 m
Max Day + Fire (13,000 l/min Fire Flow)	135.0 m	137.0 m

The City is planning upgrades to the Montreal Road Pump Station and the Brittany Drive Pump Station. The plan is to use a different pumping strategy to maintain a constant hydraulic grade line of 143.0 meters even during peak hour and/or fire flow conditions. As the existing boundary conditions have lower peak hour and fire flow hydraulic grade lines and higher maximum hydraulic grade line valves, they are used in the hydraulic analysis.

2.3.5 Hydraulic Model

A computer model for the Phase 2B site has been developed using the H20 MAP version 6.0 program produced by MWH Soft Inc. The model is an extension of the hydraulic model used for Phase 1A and 1B. The model incorporates the boundary conditions at Codd's Road and Burma Road. Current and future basic day (max HGL) and peak hour scenarios were run using the HGLs discussed in **Section 2.3.4**.

2.4 Proposed Water Plan

The hydraulic model has a 400 mm diameter watermain extending on Wanaki Road and connecting to an existing 400 mm watermain on Codd's Road. A 300 mm watermain is extended on Moses Tennisco Street from the existing 300 mm watermain on Hemlock Road to connect to the proposed 400 mm watermain on Wanaki Road. All other mains are 200 mm diameter in accordance with the Master Servicing Study.

Results of the hydraulic model for both the current and future conditions are included in **Appendix B** and summarized as follows:

Scenario	**Results**
Basic Day (Max HGL)	515.9 to 607.9
Peak Hour	464.0 to 508.1
Max Day + Fire Flow (l/s)	432.7 to 850.5

A comparison of the results and design criteria is summarized as follows:

Maximum Pressure	Under current conditions, the basic day (Max HGL) scenario yields the majority of the nodes above 552 kPa (80 psi) require pressure reducing control except for the north east corner of the site. There are no areas where the pressure exceeds 689 kPa (100 psi).
Minimum Pressure	The minimum peak hour pressures at all nodes exceed the minimum requirement of 276 kPa (40 psi).
Fire Flow	All nodes have design fire flows above the target rate of 216.7 l/s.

3 Wastewater Disposal

3.1 Existing Conditions

The existing wastewater collection system for the Wateridge Village at Rockcliffe property consists of the new Phase 1A and 1B sanitary sewers together with the remaining older combined sewers not already impacted by the re-development of the property. All wastewater flow from the former air base development was directed to the Ottawa Interceptor Sewer (IOS). That sewer is a 2.4 mm diameter trunk facility which bisects the Rockcliffe site about 40 meters below ground. The IOS is a large combined sewer which services a large portion of the City of Ottawa.

Combined wastewater flow from the former development was directed to the IOS via one of two existing connections. **Figure 1.5** shows the existing wastewater network in and around the subject site. Prior to the re-development of the Rockcliffe Base site, generally wastewater flow from lands located west of Codd's Road was directed to the IOS sewer via the Air Base and Alvin Heights pull-back sewers. Wastewater flows east of Codd's Road were routed and connected to the IOS via the RCAF pull back sewer.

There are also three external areas which pass wastewater flows through the CLC lands and also outlet to the IOS. The Montfort Hospital is located adjacent to and immediately southwest of the CLC property. Sanitary wastewater flow from the hospital outlets to an existing combined sewer located near the west portion of the CLC lands which in turn outlets to the Air Base Pull back sewer and the Alvin Heights sewer. That pull back sewer system will remain in service and will not be impacted by the early phases of development of Wateridge Village, including Phases 2A and 2B.

The National Research Council (NRC) campus abuts the CLC property to the east. Combined wastewater from the NRC campus was previously collected in a 750 mm diameter combined sewer and routed through the CLC property to the NRC Shaft at the IOS. In 2017, the NRC completed a sewer separation plan and the 750 mm diameter sewer is no longer in service. Therefore, the development of Phases 2A and 2B will not impact the NRC outlet sewer.

The Thorncliffe Community is located south of the Wateridge Village at Rockcliffe site. Wastewater from the community was originally routed in a dedicated sanitary sewer through the CLC property and connected to the IOS combined sewer at the Codd's Road Shaft which is located near the middle of the property. The Thorncliffe Village Sanitary sewer was intercepted by Phase 1 development and the wastewater flows from the Thorncliffe Village as well as Phases 1A and 1B are re-routed to the IOS sewer via the Codd's Road Shaft. The Codd's Road Shaft location is indicated on **Figure 1.5**. This connection to the Interceptor Outfall Sewer was added in 1991 as part of the development of the Thorncliffe Village community and subsequently upgraded as part of Phase 1A.

3.2 Master Servicing Study

Canada Lands Company completed a Community Design Plan (CDP) in 2015. To support that plan, a number of technical reports were prepared including the 'Former CFB Rockcliffe Master Servicing Study, August, 2015' (MSS). That report recommended that the existing combined sewers on the subject site be abandoned in favour of dedicated sanitary and storm sewer systems.

In particular, the MSS recommended that future wastewater flow from Phase 2B be directed to the Codd's Road Shaft. Accordingly, wastewater flows from the subject site will be designed to outlet to that location. The previous Phase 1A design included the new connection to that shaft and the proposed Phase 2B sanitary sewers will connect to the Phase 1B system. For reference, a copy of Figure 5.1, Recommended Wastewater Plan, from the MSS document is included in **Appendix C**.

The current Phase 2B design along Tawadina Road includes one minor change to the wastewater plan shown on **Figure 5.1**. The Phase 2B wastewater plan includes a local sewer in Tawadina Road between nodes 314A and 201A where there were no sanitary sewers identified in that location in the MSS report. The reason for the change is that there is now a possibility that an on-street housing product, which would require a nearby local sewer, may be included in the development proposals in this location.

3.3 Design Criteria

The City of Ottawa recently revised its wastewater design criteria in 2018. The MSS Report, which was completed in 2015, recommended that the wastewater system proposed for the re-development of the Rockcliffe Airbase site be designed with the City's criteria in effect in 2015. However, because of the recent changes, the Phase 2B sanitary sewers are proposed to be designed with the current criteria. Table 3.1 shows a comparison of the two criteria. Because the new criteria predicts less wastewater flows, the existing downstream sewers will have sufficient capacity for predicted flows from Phase 2B.

Table 3.1 – Comparison of City of Ottawa Wastewater Criteria

	CITY OF OTTAWA DESIGN CRITERIA	
	PRE 2018	2018
Minimum Velocity	0.60 m/s	0.60 m/s
Maximum Velocity	3.00 m/s	3.00 m/s
Roughness Coefficient	0.013	0.013
Average Residential Flow	350 l/c/r	280 l/c/d
Residential Peaking Factor	Harmon (2.00 – 4.00)	Harmon (0.60)
Commercial Flow	50,000 l/ha/d	27,000 l/ha/d
Institutional Flow	50,000 l/ha/d	23,000 l/ha/d
Commercial/Institutional Peaking Factor	1.5	1.5
Infiltration Rate	0.28 l/s/ha	0.33 l/s/ha

Minimum allowable slopes as listed below remain unchanged:

DIAMETER (mm)	SLOPE (%)
250	0.240
300	0.186
375	0.140
450	0.111
525 and larger	0.100

Where practical and where there are less than 10 residential connections, the first lengths of sanitary sewers are designed as 250 mm diameter pipes with a minimum slope of 0.65%.

The population densities identified in the CFB Rockcliffe MSS are:

- Single Family Units 3.4 ppu

- Semi Detached Units 2.7 ppu
- Freehold Townhouses 2.7 ppu
- Apartments 1.8 ppu

3.4 Proposed Wastewater Plan

The recommended wastewater plan for Phase 2B is shown on **Figure 3.1** which is included in **Appendix C**. All wastewater flows will be directed and connected to the Phase 1B sewers. In accordance with the MSS report, the Phase 2B sanitary sewer will be oversized to provide capacity for future developments within the CLC property including Phase 2C and part of Phase 2D. All sanitary sewers proposed for the current phases will be 250 mm diameter.

3.5 Local Extraneous Flows

Ground water levels are expected to be in a clay or rock stratum. All new sanitary sewers will be tested to the City of Ottawa standards prior to being put into service. For the subject site, there are no unusual local conditions that are expected to contribute to extraneous flows that are higher than those noted in the City's guidelines.

3.6 Wastewater Outlet

As stated above, the wastewater outlet for the subject site will be the Ottawa Interceptor Sewer. That sewer bisects the CLC property and previously accepted combined flows from the site and wastewater from the Thorncliffe Village Community. The Phase 1A and 1B wastewater plan included new local sewers that were routed to the reconstructed Codd's Road Shaft. Wastewater flows from Phase 2B are proposed to connect to the upper reaches of the Phase 1B sewer system.

3.7 Sewer Calculations

Detailed sewer design spreadsheets, using MOE and City design criteria, together with Sanitary Drainage Area Plan Drawing 118863-400 are included in **Appendix C**. In accordance with the recommendations of the MSS document, wastewater flows from the Phase 2B site will be routed to the IOS trunk sewer via the Phase 1B sewers. The Phase 2B sanitary sewers will also provide capacity for future phases of development including 2C and a part of Phase 2D. Those external areas are identified on the Drainage Area Plans, and relevant design elements for these external areas, such as areas and population estimates, were interpreted from the MSS document.

3.8 Environmental Constraints

There are limited environmental constraints for the development of Phase 2B. Any SAR vegetation will be protected on defined park blocks such as Block 4 and 9. Other than scattered road side ditches remaining from the former airbase development, there are no significant water courses on the subject site which will be impacted by the development of Phase 2B.

3.9 Emergency Overflow

All wastewater flows from the Wateridge Village at Rockcliffe site, including Phase 2B, are proposed to be directed to their outlets by gravity. Therefore, no pumping stations and related emergency overflows are needed for this development.

4 Minor Storm System

4.1 Existing Conditions

Figure 1.6 shows the existing storm sewers in and around the Wateridge Village at Rockcliffe site. Prior to the re-development of the property, most of the existing site sewers were combined sewers. Ultimately the existing combined sewers are proposed to be abandoned in favour of separated sanitary and storm sewers. Accordingly Phase 2B will include both dedicated storm and sanitary sewers.

Previously, the only dedicated storm sewers on the CLC property include two 1050 mm diameter sewer outlet pipes from the existing Burma Road SWM Facility. The Phase 1 minor storm sewer plan included interception and de-commissioning of the two existing storm sewers that were impacted by the Phase 1 limits. Flows from the Burma Pond are now directed to the Eastern SWM facility before release to the Ottawa River.

4.2 Master Servicing Study

CLC completed the servicing report, "Former CFB Rockcliffe Master Servicing Study" in 2015. That report recommended a preferred Stormwater Management Plan for the Wateridge Village at Rockcliffe site. The report recommended construction of two stormwater ponds and related appurtenances to service the CLC property; the Western Stormwater Management Facility and the Eastern Stormwater Management Facility.

The Eastern Pond is proposed to provide management of flows from most of Phase 1 and 2 of the CLC property. Therefore, the Eastern pond construction was included as part of the development of Phase 1A and the facility was put into service in 2017.

The MSS Report also recommends a series of local and trunk storm sewers to collect runoff from Phases 1 and 2 and route those flows to the Eastern Facility. The Phase 1 design followed the recommendations of the MSS report, including construction of the large diameter sewers, which outlet to the Eastern Stormwater Management Facility; the Eastern Stormwater Management Facility and outlet to the Ottawa River. The proposed Phase 2B storm sewers will connect to the downstream Phase 1 sewer system. For reference, a copy of Figure 6.7, Recommended Storm Sewer System from the MSS Report, is included in **Appendix D**.

The Phase 2B storm sewer design will follow the MSS plan with one minor exception. Figure 6.7, Recommended Storm Sewer System, from the MSS Report shows a series of storm sewers on Tawadina Road, between nodes 300 and 201. The MSS Report recommends that those sewers flow northward at the earliest opportunity and eventually outlet to the 1650 mm diameter sewer proposed to be located in the North Community Park. Because the series of roads north of Tawadina Road are not part of Phase 2B, the current plan is to extend the storm sewer on Tawadina Road from node 300 to node 201 and then southward along Codd's Road. The existing 600 mm diamater pipe that was installed in Codd's Road as part of Phase 1B is proposed to be removed and replaced with a 750 mm diameter sewer to accommodate this modification and construction of future storm sewers in Codd's Road north of Tawadina will be deferred to future phases. Because the XPSWMM model has confirmed that, even with the increased flows in the Phase 1 storm sewers, there is no negative impact to the Phase 1 sewer system, we accordingly recommend that the proposed re-design of the Codd's Road sewer system be permanent. The hydraulic model is discussed in further detail in **Section 5** of this report. Based on this change to the MSS report, the future storm sewers in Phase 2C and 2D to be constructed through the North Community Park, will have a reduced drainage area.

4.3 Minor Storm Sewer Design Criteria

In keeping with guidelines published by the City of Ottawa for storm sewers, the storm drainage system proposed for the Wateridge Village at Rockcliffe Phase 2B lands will follow the principles of dual drainage.

The minor storm flow estimates were calculated by the Rational Method. Some of the significant criteria used in the minor storm sewer design are:

- Initial Time of Concentration — 10 min
- Runoff Coefficients — 0.66 front yards
  0.49 rear yards
  0.70 roadways without units
  0.80 ICI lands
  0.30 parks
- Velocities — 0.80 m/s to 3.0 m/s
- Manning roughness coefficients — 0.013 (smooth wall pipes)
- Minimal allowable slopes

DIAMETER (MM)	SLOPE (%)
250	0.43
300	0.34
375	0.25
450	0.20
525	0.16
600	0.13
675	0.11

- Minimum depth of cover of 2.0 m
- Inlet-control rate to capture 5 year peak flows
- 100 year Hydraulic Grade Line (HGL) separation to be greater than 0.30 m from the underside of footings
- HGL analysis calculated with XPSWMM

Runoff coefficients for the proposed single, semi and townhouse units are included in **Appendix D**.

4.4 Proposed Minor Storm Sewer Plan

Figure 4.1, which is also included in **Appendix D**, shows the recommended minor storm plan. All Phase 2A and 2B sewers will connect to the Phase 1A and 1B sewers at numerous locations as indicated on **Figure 4.1**. The new sewers will range in size from 375 mm diameter to 750 mm diameter. The minor storm sewer design sheets together with the Storm Drainage Area Plan Drawing 118863-500 are included in **Appendix D**.

The development of Phase 2B will also impact existing surface runoff patterns. A series of temporary drainage ditches is recommended to ensure existing undeveloped areas do not flood. These temporary ditches are included in **Figure 4.3**, Temporary Ditch Inlet Drainage Areas and Time of Concentration Plan. Capacity calculations and proposed temporary ditch inlets complete with ICD's are included in **Appendix D**. When appropriate, each of the proposed temporary drainage ditches will be removed.

4.5 Erosion and Sedimentation Control

Development of a subdivision such as Phase 2B of the Wateridge Village at Rockcliffe site can potentially create deleterious material which can enter the natural environment and gain access to fish habitat. In order to prevent site generated sediments from entering the environment, an Erosion and Sedimentation Control Plan will be implemented prior to development.

The erosion and sedimentation strategy for the subject site will include erection of silt fences around most of the site perimeter. The silt fences will ensure protection of both adjacent developments and the natural environment including the Western and Eastern Creeks and the Ottawa River.

It is expected that installation of municipal infrastructure on the subject site will include some dewatering. Accordingly, the Erosion and Sedimentation Control Plan also includes the installation of dewatering traps (OPSD 219-240). The final Erosion and Sedimentation Plan will be designed by the site's civil contractor.

A copy of the Erosion and Sedimentation Control Plan, Drawing 118863-900, is included in **Appendix E**.

4.6 Miscellaneous Elements

The following section includes brief comments for items indicated in the current Servicing Study Guidelines for which the proposed development will have little or no impact.

These include:

- Setbacks
- Drainage catchment diversions
- Municipal drains
- 100 year flood lands
- Floodplains

The geotechnical report completed as part of the supporting documents for the CDP included recommended setbacks along the northern escarpment of the CLC lands. **Figure 4.2** shows the proposed development setbacks along the northern escarpment. Other than potential structures within the North Community Park, these setbacks are not impacted by the proposed Phase 2B development.

Any runoff from the site, as with all future developments in Wateridge Village at Rockcliffe, will have end of pipe quality treatment. Any impacts to receiving watercourses will therefore be mitigated.

There are no municipal drains in the vicinity of the subject development and there are no drainage catchment diversions proposed by the current development.

Because the site is located well above the receiving waters of the Ottawa River, there will be no 1:100 yr water levels in that watercourse that will impact the site development.

5 Stormwater Management

5.1 Background

Wateridge Phase 2B is part of the larger development referred to as the Former CFB Rockcliffe. The stormwater management strategy was outlined in the "Former CFB Rockcliffe Master Servicing Study" (MSS) (IBI Group, August 2015). Phase 2B is located between Hemlock Road and Tawadina Road (refer to **Figure 1.7**). As part of the Phase 2B development, the design of downstream Phase 2A has been completed.

The subject site is part of the drainage area that ultimately discharges to the Eastern SWM Facility. The trunk storm sewer to the pond and the pond itself were constructed as part of Wateridge Phase 1A.

5.2 Objective

The purpose of this evaluation is to prepare the dual drainage design, including the minor and major system, of Phase 2A and 2B.

The dual drainage evaluation includes assessment of the on-site detention versus cascading major flow, maximum depth and velocity of flow on the street segments, sizing of inlet control devices and hydraulic grade line analysis.

The design takes into consideration the August 2015 MSS, the "Design Brief Wateridge Village at Rockcliffe Phase 1B" (IBI Group, June 2017), the "Design Brief Wateridge Village at Rockcliffe Phase 1A" (IBI Group, April 2016), the City of Ottawa Sewer Design Guidelines (OSDG) (October 2012), and the February 2014 Technical Bulletin ISDTB-2014-01.

5.3 Stormwater Management Design

The site was designed with dual drainage features, accommodating minor and major system flow. Minor flow will be conveyed through storm sewer connections to the existing trunk storm sewer to the Eastern SWM Facility. There are multiple major flow outlets, outlined in detail this section.

5.3.1 Dual Drainage System

Due to the flat topography of the majority of street segments within the site, on-site detention is available to facilitate ponding in street sags (see **Drawings 600** and **601**). Inlet control devices (ICDs) are proposed to minimize the surcharge in the minor system during infrequent storm events and maximize use of available on-site storage. The minor system capture of ICDs is generally based on the 5 year simulated flow for individual catchments, consistent with the MSS. The balance of the surface flow not captured by the minor system will be conveyed via the major system.

The dual drainage system has been evaluated using the DDSWMM hydrological model, while the minor system hydraulic grade line analysis has been evaluated using the XPSWMM dynamic model and is discussed in **Section 5.5**.

<u>Street segments</u>

As noted, the site includes a combination of continuous and saw-tooth road grade pattern. The saw-tooth road grade pattern is based on maximum 350 mm separation between the low point at the catchbasin and the high overflow point at the downstream end of the segment. Inflow into the minor system will be controlled by ICDs to meet the flow allowance of the downstream system. **Table 5-3** indicates whether a street segment is continuous or sawtoothed.

Further details regarding the street segment minor and major system design are presented in **Section 5.4.2**.

Rear yards

Rear yards have minor system inflow restriction with major flow cascading to a street segment. ICDs will control the inflow into the minor system from rear yards. Further discussion regarding the rear yard minor and major system design is presented in **Section 5.4.2**.

Development Blocks

Development blocks have minor system inflow restriction with major flow cascading to a street segment. At the time of detailed design of each block, the developer's engineering consultant will be required to limit the minor system inflow in accordance with **Table 5-2**.

External Areas

Areas external to Phase 2B considered in this design submission are downstream Phase 2A. Phase 2A has been modeled at a detailed level,

Phases 2C and 2D have been included at a semi-lumped level, with minor system inflow taken as the 5 year simulated flow and an on-site storage unit rate comparable to that of Phase 2B. Minor flow will be conveyed to the Eastern SWM Facility via a future storm sewer. Major flow from the majority of the area is tributary to the future park dry pond in Phase 2D (identified as the Eastern Dry Pond in the MSS). Major flow from the remainder area will cascade north.

Summary of dual drainage design

The sewer design and rational method spreadsheet for the subject site for the 5 year storm event is enclosed in **Appendix D** (and corresponding drainage areas indicated on **Drawing 500**). The rational method design indicates that the 5 year rational flow for local roads is conveyed to the storm sewer under free flow conditions. For the subject site, ICD sizing has been based on a 5 year level of service for all local streets and development blocks, consistent with the MSS.

With respect to the minor system, runoff from Phase 2B is conveyed to the pond via the existing storm sewer on Hemlock Road (itself tributary to the trunk storm sewer on Ooshedinaw Street). Runoff from Phase 2A is conveyed to the Eastern SWM Facility via the existing trunk storm sewer on Ooshedinaw Street.

The minor system inflow was increased above the 5 year in some locations to satisfy downstream major system constraints, as summarized in **Table 5-3**.

Major flow from the majority of Phase 2B is tributary to Phase 1B. The exception is the eastern half of Tawadina Street, which cascades overland to the future park dry pond in Phase 2D (identified as the Eastern Dry Pond in the MSS). Major flow from the majority of Phase 2A is conveyed north on Ooshedinaw Street towards Kishkabika Park. Major flow from the blocks west of Ooshedinaw Street drains west.

As part of the stormwater evaluation, where major flow from Phases 2A and 2B enters existing development, the surface conveyance of flow was evaluated and is reported in **Tables 5.6 and 5.7**.

5.4 Hydrological Analysis

Hydrological analysis of the proposed dual drainage system of the subject site was conducted using DDSWMM. This technique offers a single storm event flow generation and routing. Land use, selected modeling routines, and input parameters are discussed in the following sections. A drainage area plan is presented in **Drawing 750** and the model files are included in **Appendix F**.

The model was based on the existing detailed Phases 1A and 1B modeling of the Rockcliffe development, updated to account for detailed design of Phase 2B. Phase 2A is included, as are relevant drainage areas from Phases 1A and 1B, and semi-lumped drainage areas in Phases 2C and 2D. For Phases 1A and 1B drainage areas, design parameters were adopted from the respective 1A and 1B design briefs. Some minor adjustments to drainage areas on Hemlock Road were made at the interface of Phase 2B.

The primary focus of the hydrological analysis was to generate minor flow hydrographs for the hydraulic analysis, and to evaluate surface flow and ponding conditions during the 100 year storm event in order to satisfy City of Ottawa Sewer Design Guidelines with respect to velocity and depth. The parameters used to model the subject site are presented in **Table 5-2**.

5.4.1 Summary of Model Files

For ease of review, the following is a reference list of the model files including file names and storm events evaluated. The files are included on the CD enclosed in **Appendix F**.

DDSWMM:

- 5 year 3 hour Chicago: 118863-3CHI5.DAT
- 100 year 3 hour Chicago: 118863-3CHI100.DAT
- 100 year 3 hour Chicago + 20%: 118863-3CHI120.DAT
- 100 year 24 hour SCS Type II (103.2 mm): 118863-24SCS100.DAT
- July 1979: 118863-JUL79.DAT
- August 1988: 118863-AUG88.DAT
- August 1996: 118863-Aug96.DAT

SWMHYMO – Velocity x Depth:

- 118863VD.DAT

XPSWMM:

- 100 year 3 hour Chicago: 118863-3CHI100_SUB2_2019-03-12.xp
- 100 year 3 hour Chicago + 20%: 118863-3CHI120_SUB2_2019-03-12.xp
- 100 year 24 hour SCS Type II: 118863-24SCS100_SUB2_2019-03-12.xp
- July 1979: 118863-JUL79_SUB2_2019-03-12.xp
- August 1988: 118863-AUG88_SUB2_2019-03-12.xp
- August 1996: 118863-AUG96_SUB2_2019-03-12.xp

5.4.2 Storm and Design Parameters

The following storms and design parameters have been used in the evaluation of the stormwater management system for the subject site.

Land Use

Phase 2A and 2B will be developed as mix of low- to mid-rise residential, low- to mid-rise mixed-use, mid-rise mixed-use, and parks.

Storms and Drainage Area Parameters

The main hydrological parameters are outlined below and summarized in **Table 5-2**.

- **Design Storms:** The subject site was evaluated with the following storms:
  - 5 and 100 year 3 hour Chicago storm events (10 minute time step), as per the OSDG;
  - 100 year 24 hour SCS Type II storm event (103.2 mm), the design storm for the pond;
  - July 1979, August 1988, August 1996 historical storms per the OSDG;
  - 100 year 3 hour Chicago storm event (10 minute time step) with 20% increase for Climate Change consideration, as per OSDG.

- **Area and Imperviousness:** Catchment areas are based on the rational method spreadsheet. See **Drawing 750** for the catchment areas used in the DDSWMM modeling for the subject site.

  Imperviousness values are based on runoff coefficients used in the rational method. Park areas were assigned an imperviousness of 14%.

- **Infiltration:** Infiltration losses were selected to be consistent with the OSDG. The Horton values are as follows: f_o = 76.2 mm/h, f_c = 13.2 mm/h, k = 0.00115 s^{-1}.

- **Subcatchment Width:** The catchment width was based on the conveyance route length of the drainage area and multiplied by two. The multiplier of two was only used if the drainage area had runoff contribution from both sides of the drainage area. For the future external areas the subcatchment width of 225 m/ha was used.

- **Slope:** The ground slope was based upon the average slope for both impervious and pervious area. Generally, the slope is approximately 2% (0.02 m/m). This assumes a slope of approximately 1% for impervious or road surfaces and 3% for pervious surfaces (lot grading).

- **Initial Abstraction (Detention Storage):** Detention storage depths of 1.5 mm and 4.67 mm were used for impervious and pervious areas, respectively. These values are consistent with the OSDG.

- **Manning's roughness:** Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.

- **Baseflow:** No baseflow components were assumed for any of the areas contributing runoff to the minor system within the DDSWMM model.

- **Minor System Capture:** The minor system from the subject site is tributary to the Eastern SWM Facility. Phase 2B storm sewers will connect to the downstream Phase 1B storm sewers which outlet to the Eastern SWM Facility. Runoff from Phase 2A is conveyed via the existing trunk storm sewer to the Eastern SWM Facility.

  Inlet control devices (ICDs) are proposed to limit the flow into the minor system during the 100 year event. The ICD sizes for street and rear yard segments were selected from the standard orifice sizes summarized in the City of Ottawa Standard Tender Documents MS-18.4 (March 2017).

Table 5-1 Standard ICD Sizes per City of Ottawa Standard Tender Documents MS-18.4

ICD DIAMETER (MM)	ORIFICE AREA (M2)
83	0.0054
94	0.0069
102	0.0082
108	0.0092
127	0.0127
152	0.0181
178	0.0249

Standard head values were applied in the calculation of flow rates. A head of 1.65 m was used for street segments and 1.3 m for rear yards. In addition to the above, the Vortex ICD was considered for street segments. The minor system inflow rate was optimized to minimize ponding at street segments during the 5 year storm event. Further information on the ICDs can be found in the catchbasin table in **Appendix F**.

Minor system inflow has been increased above the 5 year as noted in **Table 5-3** due to downstream major system constraints.

Park areas are assumed to be restricted to the 5 year modeled flow.

- **Major System Storage and Routing:** The subject site contains street segments with a saw-tooth design grade pattern with catchbasins installed with inlet control devices (ICDs) at the low points. The flow is attenuated within these localized low points with potential overflow cascading to the next segment downstream. The total volume at each low point, up to the overflow depth, is the maximum static storage.

  For street segments, the cascading overflow to the next segment or low point, utilizes the static storage available plus an additional amount of storage equivalent to the depth required for the flow to carry over the high point. The attenuation in street sags was evaluated to account for static storage and, if overflow occurs, dynamic storage. Within this report it is referred to as double routing.

  The DDSWMM model does not have a direct way of coding double routing since it does not allow the user to code dynamic storage over the high point. For this analysis, an alternative method was employed where the overflow from a street segment (regular static storage at a sag) is conveyed to a dummy segment. In other words, a regular low point segment was provided with a downstream dummy segment for further flow attenuation to account for the dynamic ponding during overflow.

  The dummy segment does not have any drainage area attributes associated with it since it is a segment for routing. In addition, there is no inflow to the minor system from these dummy segments. The overflow hydrograph from the upstream catchment is routed in the dummy segment to the next “real” downstream segment. The dummy segments have specific characteristics which are noted below:

  - Segment Length – equivalent to length of maximum static storage from the street segment contributing to it.
  - Road Type – equivalent to appropriate right-of-way characteristics from the segment contributing to it, but with a longitudinal slope is 0.01% (0.0001 m/m).

The double routing method noted above, and applied to DDSWMM, is a recommended double routing method presented within the February 2014 City of Ottawa Technical Bulletin.

The dummy segments for major system routing were applied to the analysis of the subject site. The segments are referenced as D1, D2, D3, etc. within the DDSWMM modelling file. The DDSWMM schematic presented in **Drawing 750** does not show the dummy segments, but DDSWMM computer output file shows the dummy segments immediately following the corresponding major segment which cascades into that dummy segment.

Street segments

Where surface storage is available, the storage-outflow characteristics for each low point were taken into consideration. The evaluation was undertaken assuming static conditions. The ponding plan for the subject site is presented on **Drawings 600** and **601**.

For continuous grade profiles, the computer simulations were based on the approach-capture characteristics of the catchbasin with the constraint that during the critical storms the maximum cascading flow would not exceed 350 mm.

Rear yards

Rear yards were considered independently of street segments. DDSWMM simulations were based on the total interception of runoff by the storm inlets. This was done by specifying a one-to-one relationship between approach flow and capture flow. No storage volume was accounted for in rear yards. Overflow from the rear yards cascades to a major system road segment via swales.

Development blocks

Development blocks were considered independently. As previously noted, DDSWMM simulations were generally based on a minor system capture between the 5 and 100 year, with major flow cascading to an adjacent street segment. No on-site storage has been assumed.

The below table summarizes the main hydrological parameters used in the DDSWMM model. The storm drainage area plan (**Drawing 750**) is provided in **Appendix F**, along with the model files.

Table 5-2 Hydrological Parameters

DRAINAGE AREA ID	AREA (HA)	D/S SEGMENT ID	XPSWMM NODE ID	IMP RATIO [TP (H)]	SEGMENT LENGTH (M)	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC PONDING (M^3)
Phase 2B							
B326	1.57	S318	MH326	0.86	181	363	0(1)
S326	0.152	S318	MH326	0.71	76	153	0
S318	0.132	EXTA	MH318	0.71	66	132	0
S317A	0.034	S300	MH317	0.66	38	38	0.02
S300	0.149	EXTA	MH300	0.71	71	141	6.41
S317	0.059	S301	MH317	0.66	38	38	0.02
S301	0.13	S302	MH301	0.71	73	145	0
S315A	0.038	S302	MH315	0.66	23	23	0.82
S315	0.028	S302	MH315	0.66	23	23	0.05
S302	0.13	EXTA	MH302	0.71	86	172	0
S313	0.107	EXTA	MH313	0.66	31	62	12.65

DRAINAGE AREA ID	AREA (HA)	D/S SEGMENT ID	XPSWMM NODE ID	IMP RATIO [TP (H)]	SEGMENT LENGTH (M)	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC PONDING (M^3)
B317	1.054	S201B	MH317	0.86	123	245	0(1)
S316B	0.063	S316A	MH316	0.66	63	63	0
S316A	0.132	S202A	MH316	0.66	57	114	4.61
R315	0.413	S314B	MH315	0.41	94	187	0
S315B	0.233	S314A	MH315	0.66	60	120	0
S314B	0.07	S314A	MH314	0.66	96	96	0
S314A	0.366	S203A	MH314	0.66	122	243	15.48
R313	0.289	S312C	MH313	0.41	66	133	0
P312	0.442	S312A	MH312	0.14	56	112	0
S312B	0.036	S312A	MH312	0.66	19	19	0
S312A	0.19	DS212(4)	MH312	0.66	102	204	29.27
R311	0.449	S310B	MH311	0.41	94	188	0
S311A	0.179	S310A	MH311	0.66	60	119	0
S310B	0.07	S310A	MH310	0.66	97	97	0
S310A	0.305	DS210(4)	MH310	0.66	115	230	61.39
S302A	0.151	S303	MH302	0.71	63	126	0
S311	0.039	S303	MH311	0.66	24	24	0.24
S303	0.179	S308	MH303	0.71	84	167	28.17
S304	0.18	S309	MH304	0.71	115	229	1.58
S309	0.1	S308	MH309	0.71	65	131	0
S308	0.106	S308A	MH308	0.71	53	106	0
S308A	0.139	DS208(4)	MH308	0.71	53	106	40.38
B309	1.238	S308A	MH309	0.86	135	270	0(1)
S312C	0.22	S312A	MH312	0.66	58	116	0
S316C	0.137	S316A	MH316	0.66	69	69	3.64
S300A	0.04	S301	MH300	0.71	37	37	0
S301A	0.04	S302	MH301	0.71	38	38	0
S304A	0.05	S304	MH304	0.71	49	49	0
Future Phase 2A							
S340	0.167	S231	MH305	0.71	86	171	0
B340	1.237	S207	MH305	0.86	173	346	0(1)
B340A	0.66	S176D	MH305	0.86	145	290	0(1)
S319	0.134	S176D	MH319	0.71	66	131	46.17
B319	1.024	S176D	MH319	0.86	152	304	0(1)
S320	0.166	S322	MH320	0.71	83	166	0
S322	0.164	S191A	MH322	0.71	85	171	0
B180	0.947	S190B	MH180	0.86	153	306	0(1)
S190	0.168	S190B	MH190	0.71	88	176	0
S190A	0.103	S191B	MH190	0.71	103	103	0
S190B	0.114	S191A	MH190	0.71	113	113	0.34
S191A	0.045	S191	MH191	0.71	38	38	0
S191B	0.032	S191	MH191	0.71	26	26	0
S191	0.11	S192	MH191	0.71	55	109	0
S192	0.137	S193	MH192	0.71	49	98	0
S193	0.125	P193	MH193	0.71	39	78	5.68
P191	0.816	P193	MH191	0.00	110	219	0
P193	1.941	DESWM2(5)	MH193	0.14	297	594	0
B180A	0.552	DNCC(6)	MH180	0.86	121	241	0(1)

DRAINAGE AREA ID	AREA (HA)	D/S SEGMENT ID	XPSWMM NODE ID	IMP RATIO [TP (H)]	SEGMENT LENGTH (M)	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC PONDING (M^3)
B325A	0.151	DNCC(6)	MH325	0.86	51	102	0(1)
S325	0.072	DNCC(6)	MH325	0.71	36	72	0
B325	0.16	DNCC(6)	MH325	0.86	54	107	0(1)
B191	0.761	DESWM2(5)	MH191	0.86	134	268	0(1)
P331	6.15	ESWM1(5)	EXSTMH	0.14	320	640	0
B9	0.12	S176D	MH305	0.07	151	302	0(1)
Future Phases 2C and 2D							
S305	0.3	P331	MH305	0.71	161	321	7.50(1)
EXTA	8.01	DEDP(2)	EXSTMH	0.86	901	1802	200.25(1)
EXTB	3.68	DEDP(2)	EXSTMH	0.86	414	828	0
Relevant Existing Phases 1A and 1B							
S201A1	0.08	S201B	MH201	0.71	63	63	0
S201A2	0.08	S201B	MH201	0.71	63	63	0
S201B	0.15	S202A	MH202	0.86	65	65	21.20
S202A	0.12	S203A	MH202	0.71	41	41	0
S203A	0.16	DS212	MH203	0.71	90	90	0
S204A	0.22	DS210(4)	MH204	0.71	58	115	0
S205B	0.0379	DS210(4)	MH205	0.71	13	26	0
S205C	0.148	DS208(4)	MH205	0.71	58	58	0
P207	0.32	S207	MH207	0.14	36	72	0
S231	0.22	DS142(4)	MH231	0.71	61	61	0
S207	0.22	DS142(4)	MH207	0.71	90	90	0
S176D	0.13	DS142(4)	MH176	0.76	95	95	2.60
S176E	0.09	DS142(4)	MH176	0.76	80	80	0
S206B	0.0382	DS208(4)	MH206	0.71	11	22	0
S176C	0.05	DS142(4)	MH176	0.76	40	40	1.14
S180	0.16	DNCC(6)	MH180	0.76	68	68	0

(1) Assumed ponding volume
(2) Future dry pond; major flow from a portion of EXTB will cascade north per MSS
(3) Adjustment to drainage area at interface of Phase 2B
(4) Existing Phase 1B
(5) North towards existing SWM facility
(6) West to external

Table 5-3 Minor Flow Capture

DRAINAGE AREA ID	CONTINUOUS/ SAG(1),(2)	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
Phase 2B						
B326	Block	N/A	5	318	318	Minor system restriction for future development block

DRAINAGE AREA ID	CONTINUOUS/ SAG[(1),(2)]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
S326	Continuous	20m Row, 8.5m asphalt	5	29	12	
S318	Continuous	20m Row, 8.5m asphalt	5	24	25	
S317A	Sag	20m Row, 8.5m asphalt	5	6	19	
S300	Sag	20m Row, 8.5m asphalt	5	29	38	
S317	Sag	20m Row, 8.5m asphalt	5	10	19	
S301	Continuous	20m Row, 8.5m asphalt	5	25	12	
S315A	Sag	20m Row, 8.5m asphalt	5	7	19	
S315	Sag	20m Row, 8.5m asphalt	5	5	6	
S302	Continuous	20m Row, 8.5m asphalt	5	24	12	
S313	Sag	20m Row, 8.5m asphalt	5	19	25	
B317	Block	N/A	5	214	310	Minor system restriction for future development block
S316B	Continuous	20m Row, 8.5m asphalt	5	11	6	
S316A	Sag	20m Row, 8.5m asphalt	5	24	38	
R315	Rear Yard	N/A	5	46	56	
S315B	Continuous	20m Row, 8.5m asphalt	5	40	12	
S314B	Sag	20m Row, 8.5m asphalt	5	12	44	
S314A	Sag	20m Row, 8.5m asphalt	5	65	107	
R313	Rear Yard	N/A	5	32	39	
P312	Park	N/A	5	19	24	
S312B	Sag	20m Row, 8.5m asphalt	5	6	44	
S312A	Sag	20m Row, 8.5m asphalt	5	35	172	
R311	Rear Yard	N/A	5	49	56	
S311A	Continuous	20m Row, 8.5m asphalt	5	32	12	
S310B	Sag	20m Row, 8.5m asphalt	5	12	86	

DRAINAGE AREA ID	CONTINUOUS/ SAG[(1),(2)]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
S310A	Sag	20m Row, 8.5m asphalt	5	54	107	
S302A	Continuous	20m Row, 8.5m asphalt	5	29	12	
S311	Sag	20m Row, 8.5m asphalt	5	7	19	
S303	Sag	20m Row, 8.5m asphalt	5	33	56	
S304	Sag	20m Row, 8.5m asphalt	5	35	48	
S309	Continuous	20m Row, 8.5m asphalt	5	20	12	
S308	Continuous	20m Row, 8.5m asphalt	5	19	12	
S308A	Sag	20m Row, 8.5m asphalt	5	24	52	
B309	Block	N/A	5	249	370	Minor system restriction for future development block
S312C	Continuous	20m Row, 8.5m asphalt	5	38	12	
S316C	Block	N/A	5	24	24	Minor system restriction for future development block
S300A	Block	N/A	5	8	6	Minor system restriction for future development block
S301A	Continuous	20m Row, 8.5m asphalt	5	8	6	
S304A	Block	N/A	5	10	6	Minor system restriction for future development block
Future Phase 2A						
S340	Continuous	20m Row, 8.5m asphalt	5	32	12	
B340	Rear Yard	N/A	5	257	366	
B340A	Block	N/A	5	144	204	Minor system restriction for future development block
S319	Sag	20m Row, 8.5m asphalt	5	26	38	
B319	Rear Yard	N/A	100	395	490	
S320	Continuous	20m Row, 8.5m asphalt	5	32	12	
S322	Continuous	20m Row, 8.5m asphalt	5	30	25	
B180	Block	N/A	5	200	200	Minor system restriction for future development block
S190	Continuous	20m Row, 8.5m asphalt	5	33	12	

DRAINAGE AREA ID	CONTINUOUS/ SAG[(1),(2)]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
S190A	Sag	20m Row, 8.5m asphalt	5	20	24	
S190B	Sag	20m Row, 8.5m asphalt	5	20	63	
S191A	Sag	20m Row, 8.5m asphalt	5	7	63	
S191B	Sag	20m Row, 8.5m asphalt	5	6	6	
S191	Continuous	20m Row, 8.5m asphalt	5	21	12	
S192	Continuous	20m Row, 8.5m asphalt	5	24	12	
S193	Sag	20m Row, 8.5m asphalt	5	22	52	
P191	Park	N/A	5	22	24	
P193	Park	N/A	5	88	109	CB lead as restriction; 1.65m head, 200mm dia lead
B180A	Block	N/A	5	120	120	Minor system restriction for future development block
B325A	Block	N/A	5	34	34	Minor system restriction for future development block
S325	Continuous	20m Row, 8.5m asphalt	5	14	12	
B325	Block	N/A	5	36	36	Minor system restriction for future phase
B191	Block	N/A	5	162	162	Minor system restriction for future phase
P331	Park	N/A	5	226	226	
B9	Block	N/A	5	12	0	No CBs located in this green space block
Future Phases 2C and 2D						
S305	Sag	20m Row, 8.5m asphalt	5	58	60	
EXTA	Fut. Dev.	N/A	5	1609	1681	Minor system restriction for future phase
EXTB	Fut. Dev.	N/A	5	744	744	Minor system restriction for future phase
Relevant Existing Phases 1A and 1B						
S201A1	Continuous	26m Row, 9.5m asphalt	5		15	ICD(s) installed
S201A2	Continuous	26m Row, 9.5m asphalt	5		6	ICD(s) installed
S201B	Sag	26m Row, 9.5m asphalt	5		88	ICD(s) installed

DRAINAGE AREA ID	CONTINUOUS/ SAG(1),(2)	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
S202A	Continuous	26m Row, 9.5m asphalt	5		30	ICD(s) installed
S203A	Continuous	26m Row, 9.5m asphalt	5		38	ICD(s) installed
S204A	Continuous	26m Row, 9.5m asphalt	5		48	ICD(s) installed
S205B	Continuous	24m Row, 12m asphalt	5		12	ICD(s) installed
S205C	Continuous	24m Row, 12m asphalt	5		38	ICD(s) installed
P207	Park	N/A	5		19	ICD(s) installed
S231	Continuous	20m Row, 8.5m asphalt	5		21	ICD(s) installed
S207	Continuous	24m Row, 12m asphalt	5		30	ICD(s) installed
S176D	Sag	26m Row, 9.5m asphalt	5		37	Replacing existing ICDs
S176E	Continuous	26m Row, 9.5m asphalt	5		11.4	ICD(s) installed
S206B	Continuous	24m Row, 12m asphalt	5		12	ICD(s) installed
S176C	Sag	24m Row, 12m asphalt	5		10	ICD(s) installed
S180	Continuous	26m Row, 9.5m asphalt	5		16.3	ICD(s) installed

(1) Capture on continuous grade is limited to capacity of grate
(2) The minor flow restriction has been increased in sags to allow full capture of overflow from upstream segments on continuous grade during the design storm event without ponding.

5.4.3 Results of Hydrological Modeling

5.4.3.1 Street Segment Storage

The storage available on-site storage and the results of the DDSWMM major system evaluation for the design storm are presented in **Table 5-4**. The ponding plan for the subject site is presented in **Appendix F** on **Drawings 600** and **601.** The DDSWMM output files are presented in **Appendix F**.

Table 5-4 Summary of On-site Storage during Target Minor System Design Storm

STREET SEGMENT ID	MINOR SYSTEM DESIGN STORM	AVAILABLE STATIC STORAGE (M^3)	TOTAL STORAGE USED DURING 5 YEAR STORM (DDSWMM SIMULATION) (M^3)	OVERFLOW (DDSWMM SIMULATION) (L/S)
Phase 2B				
S317A	5	0.02	0	0
S300	5	6.41	0	0
S317	5	0.02	0	0
S315A	5	0.82	0	0
S315	5	0.05	0	0
S313	5	12.65	0	0
S316A	5	4.61	0	0
S314A	5	15.48	0	0
S312A	5	29.27	0	0
S310A	5	61.39	0	0
S311	5	0.24	0	0
S303	5	28.17	0	0
S304	5	1.58	0	0
S308A	5	40.38	0	0
Future Phase 2A				
S319	5	46.17	0	0
S190A	5	0.45	0	0
S190B	5	0.34	0	0
S191A	5	0.07	0	0
S191B	5	0.07	0	0
S193	5	5.68	0	0

The results of the on-site detention analysis show that during the 5 year storm event there is no ponding on the street segments.

5.4.3.2 Velocity x Depth

According to the City of Ottawa Sewer Design Guidelines (October 2012), the maximum depth of flow should not exceed 350 mm and the product of velocity x depth on all the street segments should not exceed 0.6 m^2/s during the 100 year storm event.

The cascading overflow is the flow exiting a drainage area when maximum minor system inflow and maximum available ponding has been utilized. To determine velocity of the cascading overflow, a SWMHYMO file was created (118863VD.dat).

To determine velocity of the cascading overflow at critical locations, SWMHYMO was used. The ROW sections were entered into the model with the appropriate longitudinal slopes to obtain the maximum velocity of flow using the Route Channel routine. The output files are provided in **Appendix F**. The overflow is obtained from the respective DDSWMM output file and is noted in the title in the tables below.

To determine depth of the cascading overflow, the *Calculation Sheet: Overflow From Typical Road Ponding Area* provided at the February 2014 Technical Bulletin ISDTB-2014-01 was used. The exception to this is where the road is on grade in which case the depths were obtained from the SWMHYMO model.

The results are presented in **Table 5-5** and **Table 5-6** and the supporting calculations are included in **Appendix F**. The results of velocity by depth for the Phases 1A and 1B streets included in the DDSWMM model are also included in the below tables.

It should be noted that major flow from the majority of Phase 2B cascades to Hemlock Road, and continues south to streets within existing Phase 1B. The major flow hydrographs generated by the current modeling exercise were compared to those in the Phase 1B model to assure that there is no increase in major flow to the existing system. Major flow from Phase 2B has been kept at or below that accounted for in the Phase 1B model.

Table 5-5 Summary of Cascading Flow during the 100 year 3 hour Chicago storm

DRAINAGE AREA ID	DUMMY SEGEMENT ID	OVERFLOW (L/S)(1)	VELOCITY (M/S)(2)	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC PONDING DEPTH (WHERE APPLICABLE) (M)(3)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VELOCITY X DEPTH (M^2/S)
Phase 2B							
S326		0.044	0.47	0	N/A	0.05	0.02
S318		0.331	0.84	0	N/A	0.11	0.09
S317A	D1	0	0.35	0.02	0	0.02	0.00
S300	D2	0	0.00	0.13	0	0.13	0.00
S317	D3	0.001	0	0.02	0.02	0.04	0.01
S315A	D4	0	0	0.08	0	0.08	0
S315	D5	0.003	0.34	0.03	0.03	0.06	0.01
S302		0.098	0.72	0	N/A	0.06	0.05
S313	D6	0	0	0.13	0	0.13	0
S316B		0.019	0.46	0	N/A	0.05	0.02
S316A	D7	0.038	0.74	0.11	0.06	0.17	0.05
S315B		0.066	0.93	0	N/A	0.05	0.04
S314B	D9	0.027	1.06	0.07	0.07	0.14	0.07
S314A	D10	0.089	0.92	0.19	0.08	0.27	0.08
S312B	D11	0	0	0.02	0	0.02	0

DRAINAGE AREA ID	DUMMY SEGEMENT ID	OVERFLOW (L/S)(1)	VELOCITY (M/S)(2)	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC PONDING DEPTH (WHERE APPLICABLE) (M)(3)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VELOCITY X DEPTH (M^2/S)
S312A	D12	0	0	0.22	0	0.22	0
S311A		0.049	0.71	0	N/A	0.04	0.03
S310B	D13	0	0	0.07	0	0.07	0
S310A	D14	0	0	0.29	0	0.29	0
S302A		0.043	0.79	0	N/A	0.04	0.03
S311	D15	0	0.00	0.07	0	0.07	0
S303	D16	0.008	1.30	0.2	0.03	0.23	0.05
S304	D17	0.027	0.45	0.08	0.06	0.14	0.02
S309		0.046	0.51	0	N/A	0.05	0.03
S308		0.067	0.56	0	N/A	0.06	0.03
S308A	D18	0.095	1.06	0.26	0.09	0.35	0.09
S312C		0.093	0.84	0	N/A	0.06	0.05
S316C	D27	0.021	0.57	0.02	0.07	0.09	0.04
S300A		0.013	0.49	0	N/A	0.04	0.02
S301A		0.013	0.51	0	N/A	0.04	0.02
S304A		0.016	0.49	0	N/A	0.04	0.02
Future Phase 2A							
S340		0.050	0.52	0	N/A	0.05	0.03
S319	D20	0	0	0.24	0	0.24	0
S320		0.050	0.52	0	N/A	0.05	0.03
S322		0.083	0.37	0	N/A	0.06	0.02
S190		0.05	0.73	0	N/A	0.05	0.04
S190A	D21	0.012	0.76	0.05	0.05	0.10	0.04
S190B	D22	0.185	0.40	0.05	0.14	0.19	0.06
S191A	D23	0.210	0.89	0.06	0.15	0.21	0.13
S191B	D24	0.016	0.46	0.05	0.06	0.11	0.03
S191		0.245	0.78	0	N/A	0.10	0.08
S192		0.275	0.80	0	N/A	0.10	0.08
S193	D25	0.243	0.78	0.15	0.12	0.27	0.10
S325		0.019	0.41	0	N/A	0.04	0.01

DRAINAGE AREA ID	DUMMY SEGEMENT ID	OVERFLOW (L/S)(1)	VELOCITY (M/S)(2)	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC PONDING DEPTH (WHERE APPLICABLE) (M)(3)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VELOCITY X DEPTH (M^2/S)
Relevant Existing Phases 1A and 1B							
S201A1		0.021	0.42	0	N/A	0.04	0.02
S201A2		0.025	0.44	0	N/A	0.04	0.02
S201B	D8	0.054	0.80	0.19	0.09	0.28	0.07
S202A		0.099	0.62	0	N/A	0.07	0.04
S203A		0.195	0.74	0	N/A	0.09	0.07
S204A		0.056	0.54	0	N/A	0.06	0.03
S205B		0.01	0.348	0	N/A	0.03	0.01
S205C		0.037	0.48	0	N/A	0.05	0.02
S231		0.100	0.62	0	N/A	0.07	0.04
S207		0.162	0.70	0	N/A	0.08	0.06
S176D	D19	0.071	1.06	0.15	0.08	0.23	0.08
S176E		0.025	0.44	0	N/A	0.04	0.02
S206B		0.010	0.35	0	N/A	0.03	0.01

(1) Overflow from DDSWMM output 118863-3CHI100.out
(2) Velocity from SWMHYMO output 118863VD.out
(3) Depth of the cascading overflow was determined from the Calculation Sheet: Overflow From Typical Road Ponding Area provided in the February 2014 Technical Bulletin ISDTB-2014-01. For those areas which have a continuous road grade (or no dummy segment), the depth was taken from SWMHYMO VxD simulation.

Table 5-6 Summary of Cascading Flow during the 100 year 3 hour Chicago storm + 20% increase in intensity

DRAINAGE AREA ID	DUMMY SEGEMENT ID	OVERFLOW (L/S)(1)	VELOCITY (M/S)(2)	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC PONDING DEPTH (WHERE APPLICABLE) (M)(3)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VELOCITY X DEPTH (M^2/S)
Phase 2B							
S326		0.059	0.51	0	N/A	0.06	0.03
S318		0.498	0.94	0	N/A	0.13	0.12
S317A	D1	0	0.38	0.02	0	0.02	0
S300	D2	0.024	5.18	0.13	0.05	0.18	0.27
S317	D3	0.006	0.37	0.02	0.04	0.06	0.02
S301		0.069	0.66	0	N/A	0.06	0.04

DRAINAGE AREA ID	DUMMY SEGEMENT ID	OVERFLOW (L/S)[(1)]	VELOCITY (M/S)[(2)]	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC PONDING DEPTH (WHERE APPLICABLE) (M)[(3)]	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VELOCITY X DEPTH (M^2/S)
S315A	D4	0	0	0.08	0	0.08	0
S315	D5	0.006	0.42	0.03	0.04	0.07	0.02
S302		0.137	0.78	0	N/A	0.07	0.06
S313	D6	0.005	0.37	0.13	0.03	0.16	0.01
S316B		0.024	0.49	0	N/A	0.05	0.03
S316A	D7	0.065	0.84	0.11	0.07	0.18	0.06
S315B		0.087	1.00	0	N/A	0.05	0.05
S314B	D9	0.058	1.28	0.07	0.09	0.16	0.12
S314A	D10	0.166	1.42	0.19	0.11	0.30	0.15
S312B	D11	0	0	0.02	0	0.02	0
S312A	D12	0.051	0.68	0.22	0.07	0.29	0.05
S311A		0.066	0.77	0	N/A	0.05	0.04
S310B	D13	0.025	0.88	0.07	0.07	0.14	0.06
S310A	D14	0.033	0	0.29	0.06	0.35	0
S302A		0.058	0.84	0	N/A	0.04	0.04
S311	D15	0	0	0.07	0	0.07	0
S303	D16	0.044	0.50	0.20	0.07	0.27	0.03
S304	D17	0.047	0.51	0.08	0.07	0.15	0.03
S309		0.074	0.57	0	N/A	0.06	0.04
S308		0.137	0.67	0	N/A	0.08	0.05
S308A	D18	0.272	1.29	0.26	0.13	0.39	0.17
S312C		0.131	0.92	0	N/A	0.07	0.06
S316C	D27	0.033	0.64	0.02	0.08	0.10	0.05
S300A		0.016	0.52	0	N/A	0.04	0.02
S301A		0.016	0.54	0	N/A	0.04	0.02
S304A		0.020	0.52	0	N/A	0.05	0.02
Future Phase 2A							
S340		0.067	0.56	0	N/A	0.06	0.03
S319	D20	0	0	0.24	0	0.24	0
S320		0.066	0.56	0	N/A	0.06	0.03

DRAINAGE AREA ID	DUMMY SEGEMENT ID	OVERFLOW (L/S)(1)	VELOCITY (M/S)(2)	MAX. STATIC PONDING DEPTH (WHERE APPLICABLE) (M)	DYNAMIC PONDING DEPTH (WHERE APPLICABLE) (M)(3)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	VELOCITY X DEPTH (M^2/S)
S322		0.115	0.47	0	N/A	0.07	0.03
S190		0.067	0.82	0	N/A	0.06	0.05
S190A	D21	0.022	0.86	0.05	0.07	0.12	0.06
S190B	D22	0.297	0.46	0.05	0.17	0.22	0.08
S191A	D23	0.353	1.07	0.06	0.18	0.24	0.19
S191B	D24	0.028	0.54	0.05	0.07	0.12	0.04
S191		0.409	0.89	0	N/A	0.12	0.10
S192		0.449	0.91	0	N/A	0.12	0.11
S193	D25	0.419	0.89	0.15	0.15	0.30	0.13
S325		0.024	0.67	0	N/A	0.07	0.05
Relevant Existing Phases 1A and 1B							
S201A1		0.027	0.45	0	N/A	0.04	0.02
S201A2		0.032	0.46	0	N/A	0.04	0.02
S201B	D8	0.179	1.09	0.19	0.14	0.33	0.15
S202A		0.255	0.79	0	N/A	0.10	0.08
S203A		0.438	0.90	0	N/A	0.12	0.11
S204A		0.071	0.57	0	N/A	0.06	0.03
S205B		0.013	0.3675	0	N/A	0.03	0.01
S205C		0.046	0.51	0	N/A	0.05	0.03
S231		0.135	0.67	0	N/A	0.08	0.05
S207		0.308	0.83	0	N/A	0.11	0.09
S176D	D19	0.150	1.29	0.15	0.10	0.25	0.13
S176E		0.032	0.46	0	N/A	0.04	0.02
S206B		0.012	0.36	0	N/A	0.03	0.01

(1) Overflow from DDSWMM output 118863-3CHI120.out
(2) Velocity from SWMHYMO output 118863VD.out
(3) Depth of the cascading overflow was determined from the Calculation Sheet: Overflow From Typical Road Ponding Area provided in the February 2014 Technical Bulletin ISDTB-2014-01. For those areas which have a continuous road grade (or no dummy segment), the depth was taken from SWMHYMO VxD simulation.

During the 100 year 3 hour Chicago storm, the summation of depth of ponding and depth of cascading flow for all street segments is less than the City guideline of 0.35 m. The product of depth and velocity is also less than the City guideline of 0.6 m^2/s.

During the sensitivity analysis applying the 100 year 3 hour Chicago storm increased by 20%, the summation of depth of ponding and depth of cascading flow for all street segments is less than the City guideline of 0.35 m, with the exception of two locations, both within Phase 2B. The street segments are S310 and S308A, noted in the above table in bold red type. At all locations, the product of depth and velocity is less than the City guideline of 0.6 m^2/s.

The two areas at which total depth of ponding and cascading flow exceeds 0.35 m during the stress test are noted in the below table with critical adjacent property elevations.

Table 5-7 Critical Ponding Locations during the Stress Test and Adjacent Property Elevations

DRAINAGE AREA ID	LOW POINT ELEVATION (M)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	(1) CORRESPONDING ELEVATION (M)	(2) ADJACENT PROPERTY LINE ELEVATION (M)	DIFFERENCE (2) – (1)
S308A	88.74	0.39	89.13	89.01	-0.12

In both instances, the corresponding ponding elevation is greater than the adjacent block grading at the boulevard. At the detailed design stage of the blocks, house openings must be greater than the ponding elevation.

5.5 Storm Hydraulic Grade Line Analysis

The hydraulic grade line (HGL) was evaluated using the XPSWMM hydraulic model. The existing overall model for the Wateridge site was expanded to include the detailed design of the storm sewer laterals within the subject site.

The minor system hydrographs for Phases 2A and 2B were obtained from the DDSWMM evaluation undertaken as outlined in **Section 5.4**. Minor system losses along the storm sewer pipes were accounted for in accordance with Appendix 6-B of the City of Ottawa Sewer Design Guidelines.

XPSWMM simulations were conducted for the 100 year 3 hour Chicago storm to ensure that the HGL is at least 0.3 m below the underside of footing elevations. For locations at which under-side of footing (USF) elevations are not available, it was assumed that the USF elevations are 2.2 m below ground elevation. A sensitivity analysis was also performed using the 100 year Chicago storm with a 20% increase in intensity and the July 1 1979 historical storm to ensure that there would be no severe flooding to properties. Hydraulic grade line values for the various storms are presented in the below table, along with a comparison of USF elevations.

The XPSWMM model schematic and files are provided within **Appendix F**.

Table 5-8 Storm Hydraulic Grade Line

XPSWMM NODE	PROPOSED GROUND ELEV. (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%		100 YEAR 24 HOUR SCS TYPE II		JULY 1 1979	
			HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)
Phase 2B										
MH317	94.08	91.88	91.16	0.72	91.18	0.70	91.14	0.74	91.15	0.73

XPSWMM NODE	PROPOSED GROUND ELEV. (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%		100 YEAR 24 HOUR SCS TYPE II		JULY 1 1979	
			HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)
MH316	94.09	91.89	90.96	0.93	90.96	0.93	90.94	0.95	90.95	0.94
MH315	93.39	91.36	90.27	1.09	90.29	1.07	90.24	1.12	90.24	1.12
MH314	93.00	91.16	89.90	1.26	89.91	1.25	89.90	1.26	89.91	1.25
MH313	92.62	90.71	89.34	1.37	89.35	1.36	89.34	1.37	89.34	1.37
MH312	91.36	89.68	88.41	1.27	88.42	1.26	88.41	1.27	88.41	1.27
MH311	90.69	88.49	87.38	1.11	87.44	1.05	87.33	1.16	87.34	1.15
MH310	90.04	87.84	86.94	0.90	87.25	0.59	86.83	1.01	86.84	1.00
MH309	90.15	87.95	87.29	0.66	87.32	0.63	87.18	0.77	87.19	0.76
MH308	89.68	87.48	86.65	0.83	86.65	0.83	86.59	0.89	86.61	0.87
MH326	94.76	92.56	91.33	1.23	91.33	1.23	91.32	1.24	91.32	1.24
MH318	94.40	92.20	91.03	1.17	91.03	1.17	91.00	1.20	91.00	1.20
MH300	94.00	91.80	90.71	1.09	90.70	1.10	90.67	1.13	90.68	1.12
MH301	93.73	91.53	90.20	1.33	90.21	1.32	90.20	1.33	90.20	1.33
MH302	92.80	90.60	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97
MH303	90.67	88.47	87.69	0.78	87.85	0.62	87.59	0.88	87.68	0.79
MH304	90.30	88.10	87.32	0.78	87.44	0.66	87.27	0.83	87.32	0.78
MH305	91.00	88.80	86.81	1.99	86.91	1.89	86.70	2.10	86.79	2.01
Phase 2A										
MH319	88.81	86.61	86.21	0.40	86.58	0.03	85.82	0.79	85.83	0.78
MH320	88.77	86.57	85.16	1.41	85.23	1.34	85.09	1.48	85.09	1.48
MH321	87.67	85.47	84.46	1.01	84.51	0.96	84.40	1.07	84.40	1.07
MH322	87.50	85.30	84.15	1.15	84.19	1.11	84.11	1.19	84.11	1.19
MH323	86.57	84.37	83.19	1.18	83.28	1.09	83.11	1.26	83.11	1.26
MH325	86.19	83.99	83.14	0.85	83.14	0.85	83.13	0.86	83.13	0.86
Existing Phase 1B Trunk										
MH201	94.29	91.89	90.72	1.17	90.73	1.16	90.72	1.17	90.72	1.17
MH202	93.91	91.51	90.42	1.09	90.43	1.08	90.41	1.10	90.41	1.10
MH203	92.38	89.98	88.65	1.33	88.68	1.30	88.63	1.35	88.63	1.35
MH204	90.40	88.00	87.07	0.93	87.10	0.90	87.05	0.95	87.06	0.94
MH205	89.35	86.95	85.80	1.15	85.85	1.10	85.77	1.18	85.78	1.17

XPSWMM NODE	PROPOSED GROUND ELEV. (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%		100 YEAR 24 HOUR SCS TYPE II		JULY 1 1979	
			HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)	HGL (M)	USF – HGL (M)
MH206	89.10	86.70	85.59	1.11	85.62	1.08	85.56	1.14	85.57	1.13
MH207	88.53	86.13	84.60	1.53	84.63	1.50	84.58	1.55	84.58	1.55
MH231	89.81	87.41	85.81	1.59	85.83	1.58	85.70	1.70	85.80	1.61
Existing Phase 1A Trunk										
MH176	88.03	85.63	83.77	1.86	83.86	1.77	83.67	1.96	83.75	1.88
MH178	89.00	86.60	83.41	3.19	83.48	3.12	83.32	3.28	83.40	3.20
MH180	88.23	N/A	82.21	N/A	82.69	N/A	81.93	N/A	82.20	N/A
MH190	86.96	N/A	81.91	N/A	82.16	N/A	81.65	N/A	81.90	N/A
MH191	86.36	N/A	81.68	N/A	81.88	N/A	81.43	N/A	81.67	N/A
MH192	85.76	N/A	81.41	N/A	81.60	N/A	81.21	N/A	81.41	N/A
MH193	84.99	N/A	81.09	N/A	81.24	N/A	80.91	N/A	81.08	N/A
MH194	82.05	N/A	80.44	N/A	80.53	N/A	80.34	N/A	80.45	N/A

The results indicate that the minimum 0.3 m clearance between the USF and HGL is maintained across Phase 2B, Phase 2A, as well as in the downstream existing Phases 1A and 1B trunk sewers, during the 100 year 3 hour Chicago storm, sensitivity analysis and historical storms.

6 Approvals and Permit Requirements

6.1 City of Ottawa

The City of Ottawa reviews all development documents including this report and working drawings. Upon completion, the City will approve the local watermains under Permit NO. 008-202, submit the sewer ECA application to the province, and eventually issue a Commence Work Notification.

6.2 Province of Ontario

The Ministry of Environment, Conservation and Parks (MECP) will approve the local sewers under Section 53 of the Ontario Water Resources Act and issue an Environmental Compliance Approval. A Permit To Take Water for the subject site has been provided by the MECP. The permit, number 0565-A5AMP8, expires on December 31, 2025.

6.3 Conservation Authority

Since no watercourses are impacted by the proposed development, no permits will be required from the local Conservation Authority (Rideau Valley Conservation Authority).

6.4 Federal Government

There are no federal permits, authorizations or approvals needed for this development.

7 Conclusions and Recommendations

7.1 Conclusions

This report and the accompanying working drawings clearly indicate that the proposed development meets the requirements of the stakeholder regulators, including the City of Ottawa, provincial MECP, RVCA and NCC. The proposed development is in general conformance with the 'Former CFB Rockcliffe Master Servicing Study, August 2015', including provision of major municipal infrastructure such as water supply, wastewater collection and disposal, and management of stormwater runoff.

7.2 Recommendations

It is recommended that the regulators review this submission with an aim of providing the requisite approvals to permit the owners to proceed to the development stage of the subject site.

Report Prepared by:

IBI Group

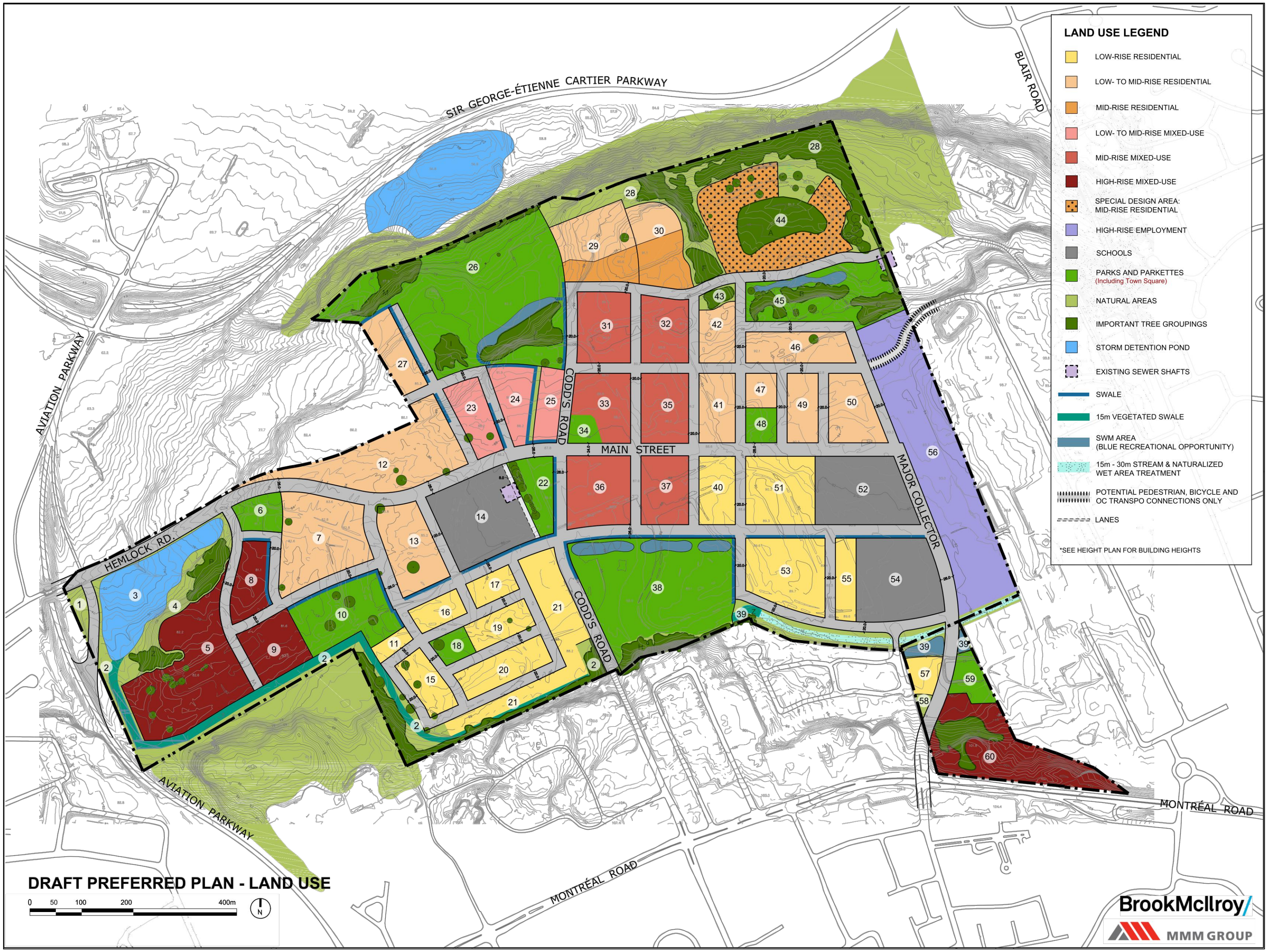
LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
Apr 17/19
PROVINCE OF ONTARIO

James Moffatt, P. Eng.
Associate

LICENSED PROFESSIONAL ENGINEER
M. S. BLACK
100101736
2019-04-17
PROVINCE OF ONTARIO

Meghan Black, P. Eng.
Associate

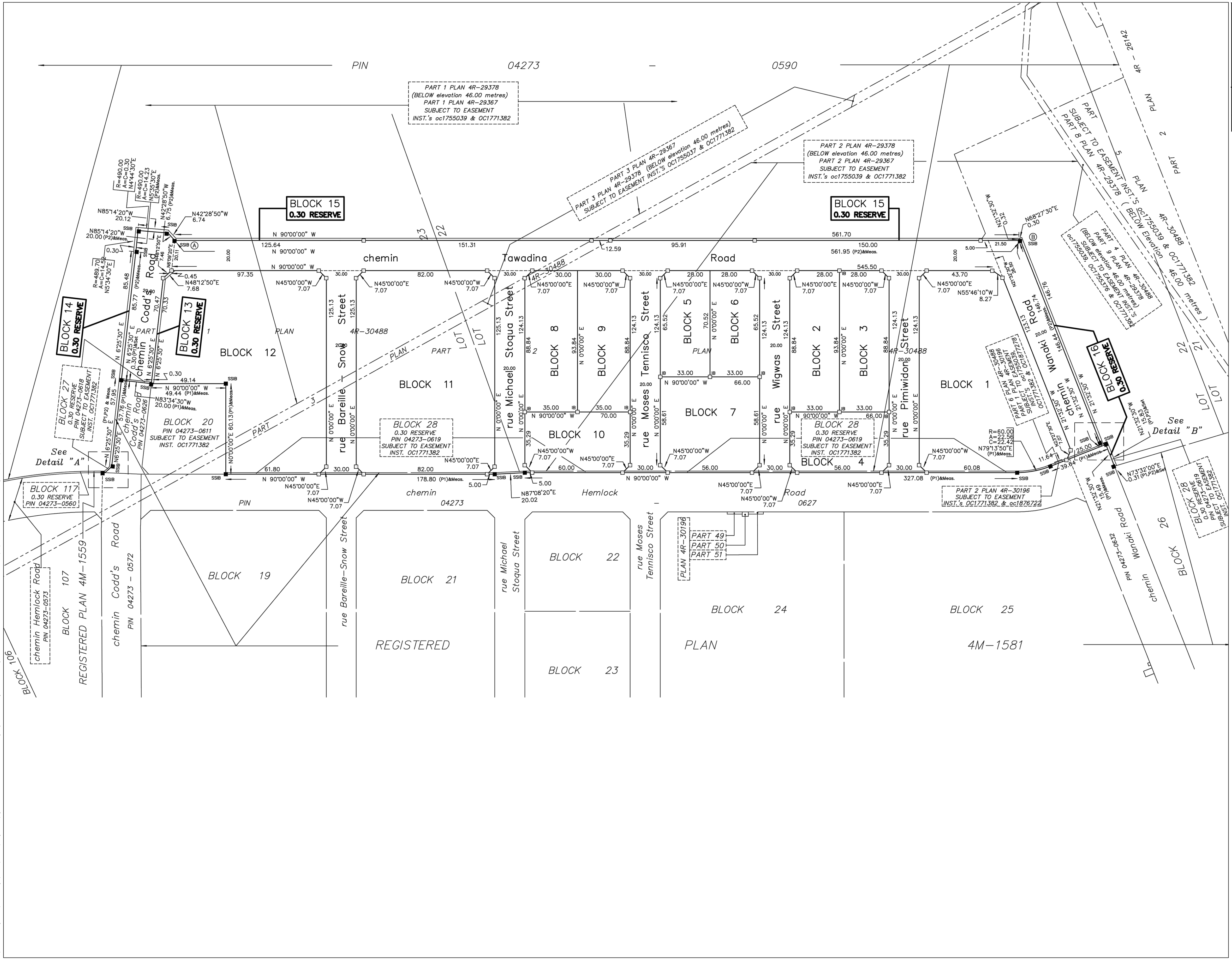
J:\118863_Wtridge2A2B\5.2 Reports\5.2.2 Civil\5.2.2.1 Sewers\2019-04 Design Brief Submission 3\CTR_Design Brief Phase 2B_2019-04-17.docx\



J:\118863_wtridge2a2b\5.9 drawings\59civil\current\Design Brief\Figure 1.1–Preferred Concept Plan.dwg Layout Name: Model

IBI

Scale	Project Title	Drawing Title	Sheet No.
NTS	DESIGN BRIEF WATERIDGE VILLAGE AT ROCKCLIFFE PHASE 2B	PREFERRED CONCEPT PLAN	FIGURE 1.1



PLAN 4M-

I CERTIFY THAT THIS PLAN
IS REGISTERED IN THE LAND REGISTRY OFFICE
FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4
AT _____ O'CLOCK ON THE ____ DAY OF _________, ____
AND ENTERED IN THE PARCEL REGISTER FOR
PROPERTY IDENTIFIERS 04273-0590, 04273-0618 AND 04273-0619

AND THE REQUIRED CONSENTS ARE REGISTERED AS
PLAN DOCUMENT NO.___________

REPRESENTATIVE FOR LAND REGISTRAR

This plan comprises all of PIN 04273-0618 and 04273-0619 and part of PIN 04273-0590.

PLAN OF SUBDIVISION OF
PART OF LOTS 22 And 23
CONCESSION 1 (OTTAWA FRONT)
Geographic Township of Gloucester
And
BLOCKS 27 And 28
REGISTERED PLAN 4M-1581
CITY OF OTTAWA
Surveyed by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1250
50 37.5 25 12.5 0 25 50 Metres

Metric
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

Surveyor's Certificate

I CERTIFY THAT :

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Land Titles Act and the regulations made under them.
2. The survey was completed on the th day of March, 2019.

Date
E. H. Herweyer
Ontario Land Surveyor

OWNER'S CERTIFICATE

THIS IS TO CERTIFY THAT :

1. Blocks 1 to 12, both inclusive, and the Streets, namely, rue Bareille-Snow Street, chemin Codd's Road, rue Michael Stoqua Street, rue Moses Tennisco Street, rue Pimiwidon Street, chemin Tawadina Road, chemin Wanaki Road and rue Wigwas Street and the Reserves, namely, Blocks 13, 14, 15 and 16 have been laid out in accordance with our instructions.
2. The Streets are dedicated to City of Ottawa as public highways.

Dated the _____ day of _________, 2019

Rodger Martin, Vice President,
Real Estate Ontario & Atlantic
Canada Lands Company CLC Limited
I have the authority to bind the corporation.

Dated the _____ day of _________, 2019

Jean Lachance, Senior Director
Real Estate (Ottawa)
Canada Lands Company CLC Limited
I have the authority to bind the corporation.

NOTES AND LEGEND

—□—	denotes	Survey Monument Planted.
—■—	"	Survey Monument Found
SIB	"	Standard Iron Bar.
SSIB	"	Short Standard Iron Bar.
CC	"	Cut Cross.
IB	"	Iron Bar.
CLF	"	Chain Link Fence
BF	"	Board Fence
(AOG)	"	Annis, O'Sullivan, Vollebekk Ltd.
(P1)	"	Registered Plan 4M-1581
(P2)	"	(AOG) Plan, December 11, 2017

All found survey monuments are (AOG), unless otherwise noted.

All planted survey monuments are SSIB's unless otherwise noted.

Distances shown on curved limits are Arc distances unless otherwise noted.

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.999947.

Bearings are grid, derived from Can-Net 2016 Real Time Network GPS observations on reference points A and B, shown hereon, having a bearing of N 90°00'00" W and are referenced to Specified Control Points 01919680105 and 019198434761, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinates are derived from Can-Net 2016 Real Time Network GPS observations referenced to Specified Control Points 01919680105 and 0198434761, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinate values are to urban accuracy in accordance with O. Reg. 216/10.

. 01919680105	Northing	5024915.16	Easting	373971.65
. 019198434761	Northing	5036178.12	Easting	372436.11
. Point A	Northing	5035324.64	Easting	372560.98
. Point B	Northing	5035324.64	Easting	373122.90

Caution: Coordinates cannot, in themselves, be used to re-establish corners or boundaries shown on this plan.

ELEVATION NOTES

1. Elevations are geodetic, referred to City of Ottawa Vertical Bench Mark No. 396 (01919680138), having an elevation of 95.06 metres.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No.18904–18 CLC Pt Lts 22 23 C1 OF GL SUB 2B D4 | N

Scale: NTS

Project Title: DESIGN BRIEF WATERIDGE VILLAGE AT ROCKCLIFFE PHASE 2B

Drawing Title: DRAFT M-PLAN

Sheet No. FIGURE 1.2

Scale

Project Title

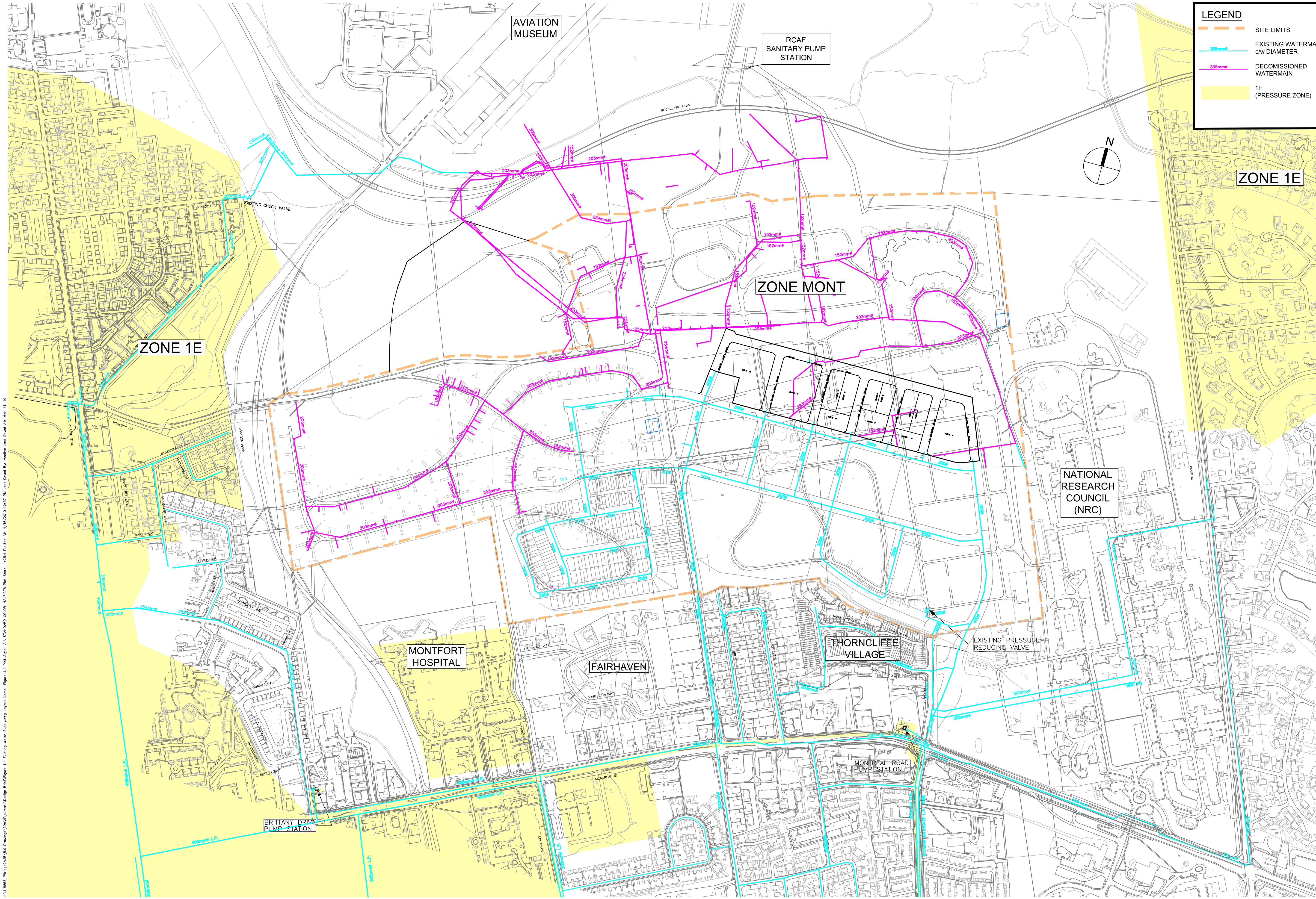
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title

EXISTING
WATER COURSES

Sheet No.

FIGURE 1.3



Project Title

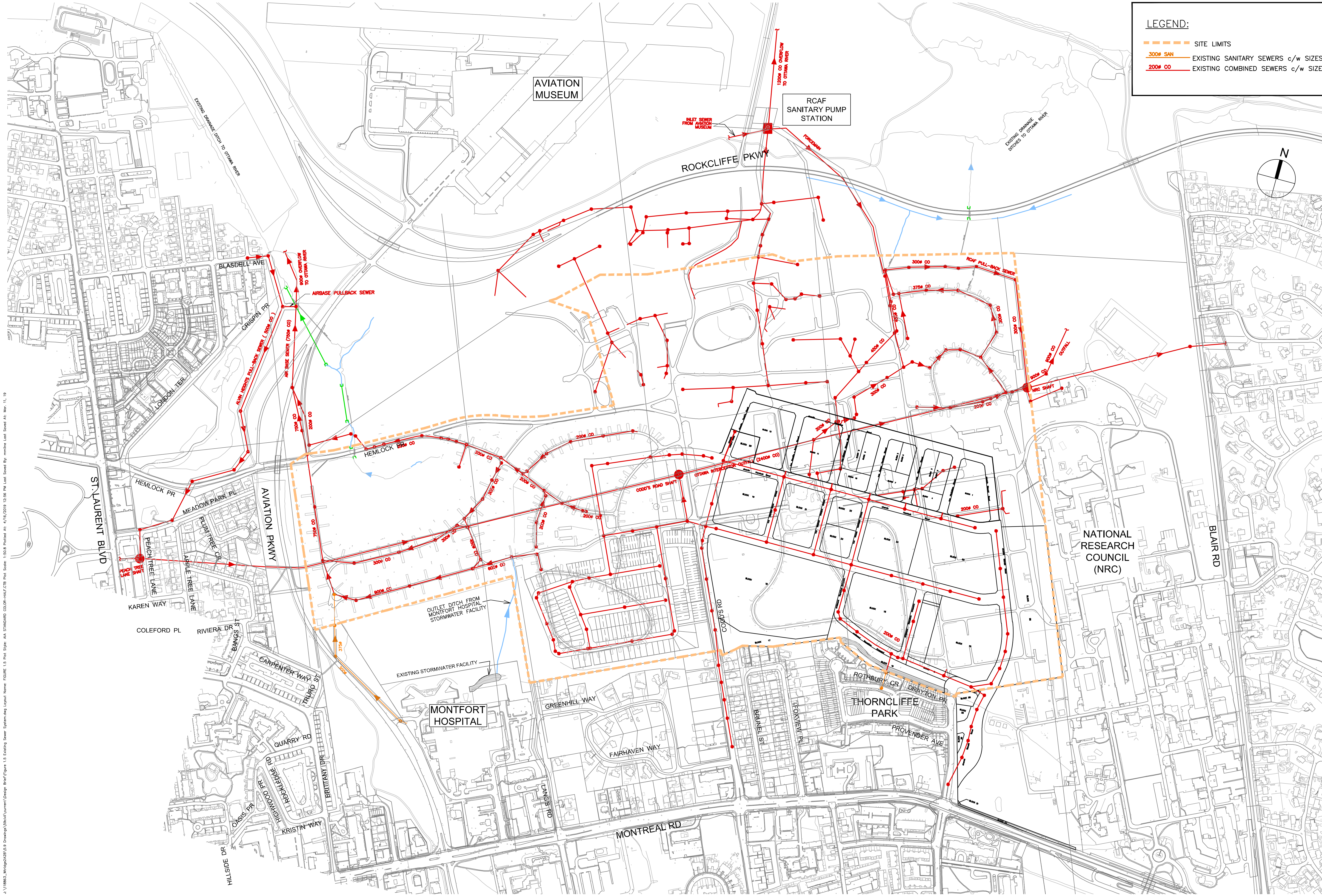
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title

EXISTING WATER SUPPLY
AND DISTRIBUTION

Sheet No.

FIGURE 1.4

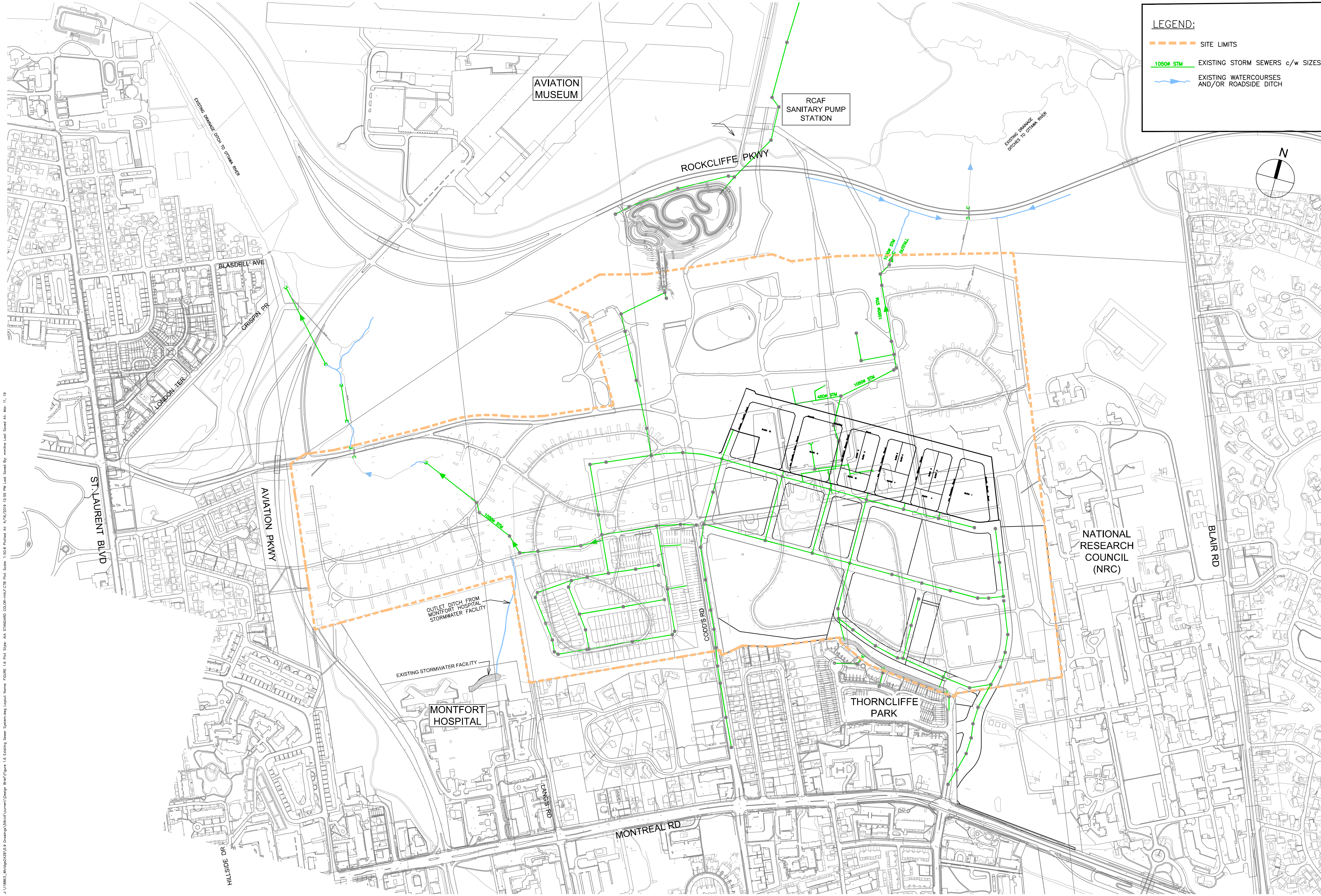


Scale

Project Title
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title
EXISTING SANITARY
COLLECTION SYSTEM

Sheet No.
FIGURE 1.5



Scale

Project Title

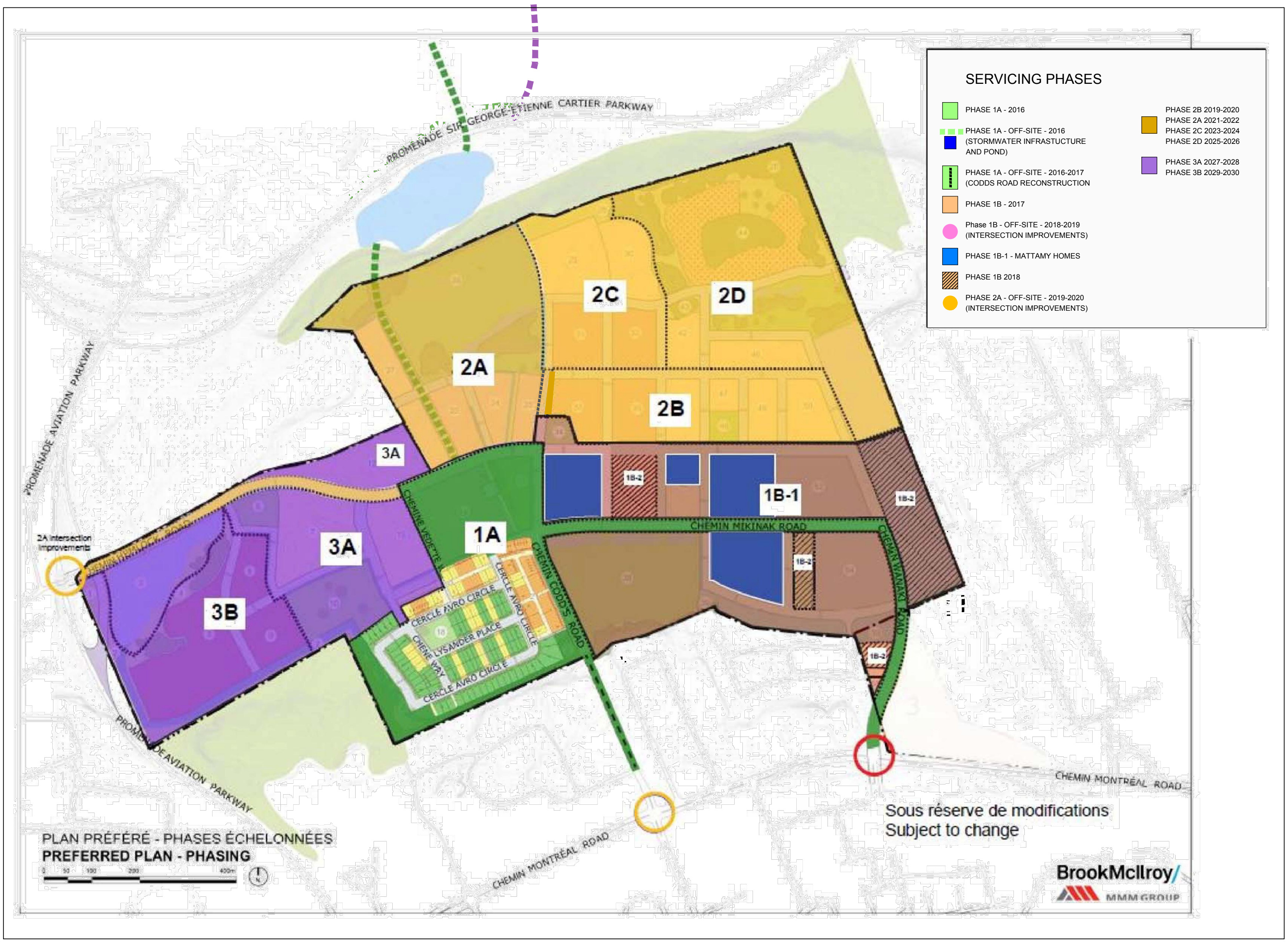
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title

EXISTING STORM
COLLECTION SYSTEM

Sheet No.

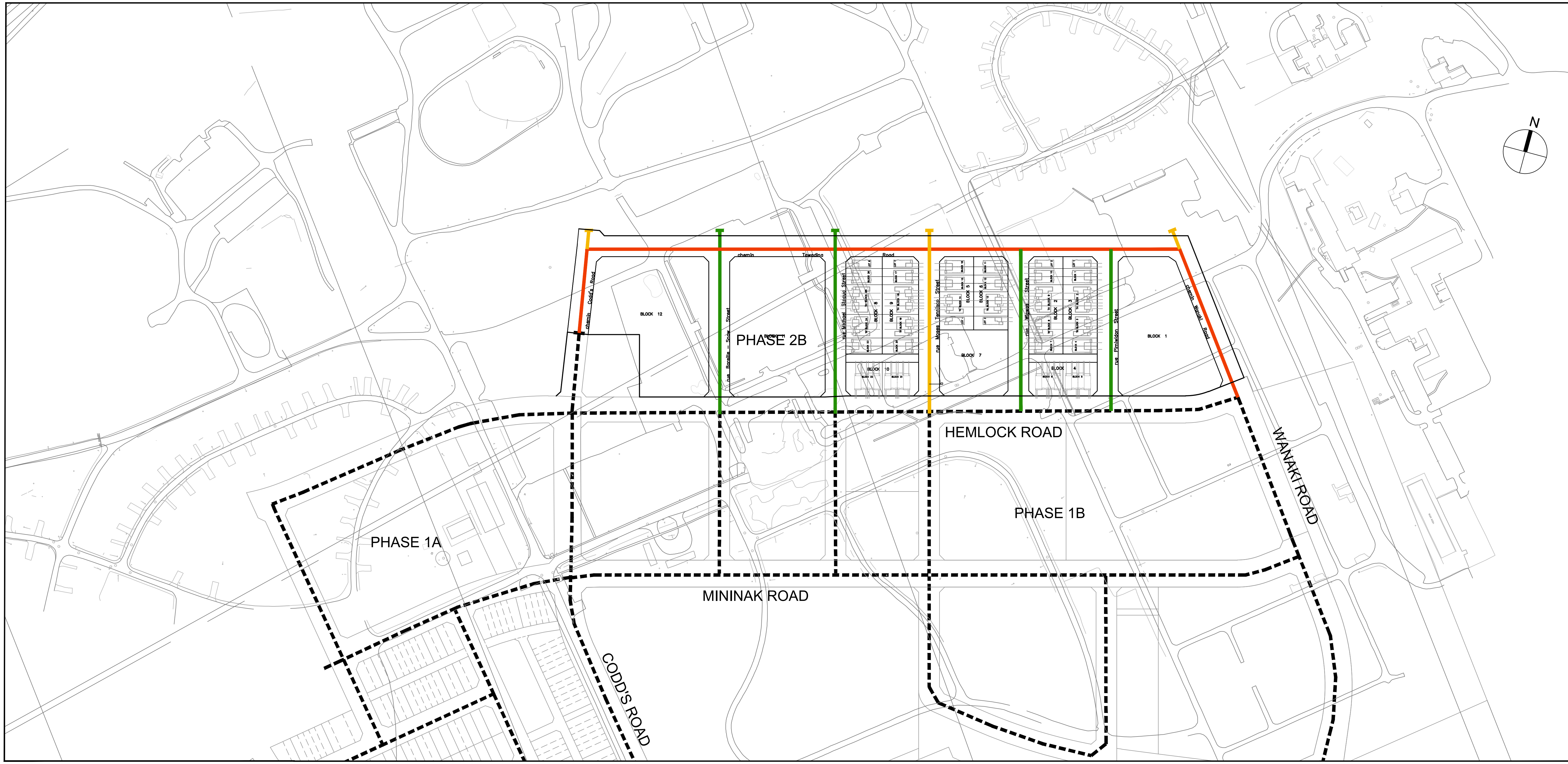
FIGURE 1.6



J:\118863_wtridge2a2b\5.9 drawings\59civil\current\Design Brief\Figure 1.7–Development Phasing.dwg Layout Name: Figure 1.7

IBI

Scale	Project Title	Drawing Title	Sheet No.
NTS	DESIGN BRIEF WATERIDGE VILLAGE AT ROCKCLIFFE PHASE 2B	DEVELOPMENT PHASING PLAN	FIGURE 1.7



LEGEND:

EXISTING WATERMAINS

PROPOSED PIPING DIAMETER:

152mmØ

203mmØ

305mmØ

406mmØ

Scale

Project Title

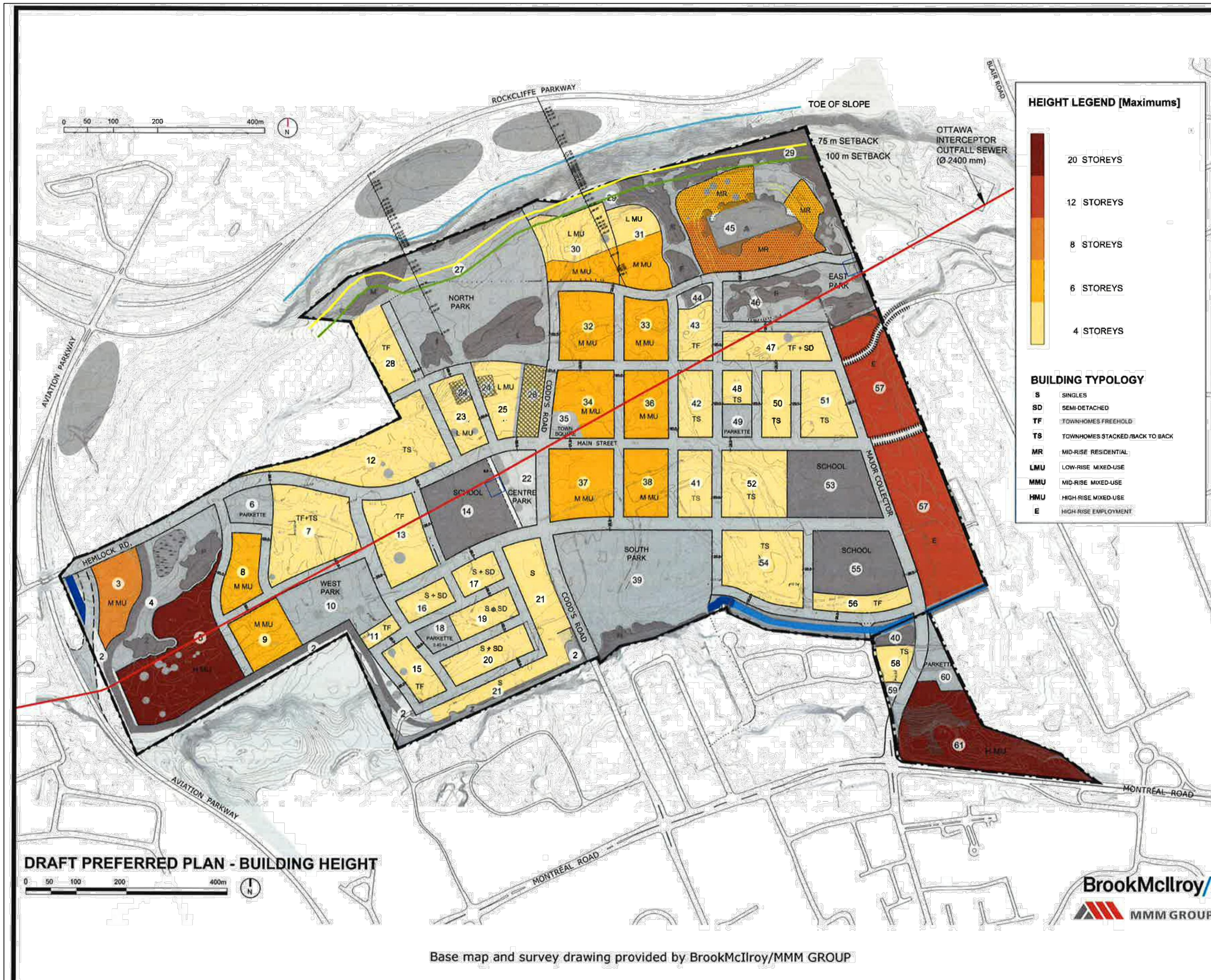
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title

RECOMMENDED
WATER PLAN

Sheet No.

FIGURE 2.1



DST consulting engineers
2150 THURSTON DRIVE, SUITE 203
OTTAWA, ONTARIO, K1G 5T9
TEL (613) 748-1415 FAX (613) 748-1356
www.dstgroup.com

NOTES:
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE ASSOCIATED TECHNICAL REPORT.
2. DO NOT SCALE DRAWING.

LEGEND:
- Toe of Slope
- 75 m Setback
- 100 m Setback

REV	DATE	ISSUE	APPROVAL
0	MAR. 27, 2014	Original	M.W.B.

PROJECT TITLE
Geotechnical Investigation
Former CFB Rockcliffe
Ottawa, Ontario

DRAWING TITLE
SETBACK DISTANCES
NORTH ESCARPMENT

DESIGNED BY	SCALE
B.V.	As Shown
DRAWN BY	DATE
M.L.	MARCH 2014
APPROVED BY	PROJECT NO.:
M.W.B	OE-OT-015358

Figure 10

J:\118863_wtridge2a2b\5.9 drawings\59civil\current\Design Brief\Figure 4.2-Development Setback Limits.dwg Layout Name: Model

IBI

Scale	Project Title	Drawing Title	Sheet No.
NTS	DESIGN BRIEF WATERIDGE VILLAGE AT ROCKCLIFFE PHASE 2B	DEVELOPMENT SETBACK LIMITS	FIGURE 4.2

APPENDIX A

- **November 29, 2018 e-mail from City of Ottawa**
- **December 5, 2018 e-mail from RVCA**
- **December 19, 2018 e-mail from MECP Ottawa Office**

Jim Moffatt

From: O'Connell, Erin <Erin.O'Connell@Ottawa.ca>
Sent: Thursday, November 29, 2018 12:01 PM
To: Jean Lachance; 'Mary Jarvis'; 'Coffey, Matt'; 'Whyte, Pamela'; Buchanan, Richard; Dubyk, Wally; Franklin, Carol; Jim Moffatt; Conway, Darlene; Jolliet, Laurent; Meghan Black; 'Chris Denich'
Subject: Phase 2 Wateridge Follow up from November 20th meeting
Attachments: Proposed Land Use Summary Table-subdivisions.docx; Wateridge Village_Subdivision Conditions_Registration of Phases 2A and 2....pdf

Good morning all,

As a follow up from the Wateridge Phase 2 meeting on November 20th, here are some notes and plan for next steps:

- In order to officially start the process for Phase 2 registration, I will require from CLC a draft 4M plan, five paper copies and a filled out land use table (attached)
- Once the above is received, I will contact legal to start drafting the agreement
- The target date for registration is the end of March 2019 and this Phase will contain approximately 1100 units
- The attached table will be used to track conditions and requirements prior to registration moving forward
- On the attached table, it looks like from the draft conditions, 38 (traffic calming measures), 79 (EIS) and 118 (Conservation Handbook) could be added to ensure they are tracked
- We spoke at the meeting on some of the conditions that could be removed from the table that are not relevant such as the gateway ones
- The street naming process should commence as street names need to be included on plan for registration and addresses should be assigned to blocks
- There will likely be an additional transportation condition for a pavement markings and signage plan prior to registration
- CLC requested that parks timing be extended until 2024, I will follow up with parks staff regarding this possibility
- The intended approach for LID measures is to submit one set of drawings for review, but consolidated modelling will not be used until likely Phase 3A/3B
- It is likely that there will be LID measures in Phase 2A, but not 2B
- I will provide Chris with the storm brief and servicing plans approved as part of Phase 1B
- Following that, Chris will provide a memo indicating tracking targets, how they have been met, and send the tracking tool. This will be provided to all on this email
- A tracking tool is required prior to registration to ensure targets are met
- Prior to registration, we need the monitoring plan for LID measures for previous phases
- CLC requested we investigate whether slope stability studies can be delayed until the site plan stage for Block 78 on the draft plan
- IBI indicated they are running into difficulty in designing the CUP at the plan of subdivision stage as the utilities are not cooperating until the stage when specifics are better known (site plan control)
- IBI requested confirmation on turning radii for intersections, as other groups are modifying them from approved 9 m to 5 m now

- CLC indicated for Phase 2A soil has been remediated, but there is an issue with groundwater. City suggested that a proposal for addressing this be provided and the city will review accordingly
- CLC requested confirmation if an IERS is required prior to registration
- Prior to registration, all relevant clearances are required
- The plans and studies required prior to registration are as follows:
    - Surveyor certificate
    - 4M plan for registration
    - Transportation Impact Study
    - Construction traffic management plan
    - Traffic calming measures/memo
    - Pavement markings and signage plan
    - Conservation Authority handbook
    - Environmental Impact Study
    - Geotechnical study and slope stability study
    - Tree Conservation Report
    - Landscape plan
    - Stormwater management plan
    - LID measures
    - Waste collection plan
    - Servicing study/plan
    - Grading and drainage plan
    - Erosion and sediment control plan
    - Noise study
    - Confirmation of RSCs
    - CUP (to be discussed further)

Please feel free to amend the above based on your own notes or understanding.

Sincerely,

Erin O'Connell, MCIP, RPP
Planner III
Development Review (Urban Services)
Urbaniste III
Examen des projects d'amenagement (Services urbains)

Planning, Infrastructure and Economic Development Department
City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27967
ottawa.ca/planning / ottawa.ca/urbanisme

Jim Moffatt

From:	Hal Stimson <hal.stimson@rvca.ca>
Sent:	Wednesday, December 5, 2018 3:22 PM
To:	Ed Ireland
Cc:	Jim Moffatt; Jamie Batchelor
Subject:	RE: RVCA Consultation for Standard Sewage Works - Transfer of Review at Wateridge Phase 2 in the City of Ottawa
Attachments:	wateridge.pdf

Hi Ed,

I don't believe there are any other issues for RVCA from a permit perspective.

I've attached a map showing the two water courses at Hemlock Private and Burma.

These would be the only areas of concern for RVCA if anything is proposed that impacts these watercourses (Hemlock intersection improvements?).

I know all the work at the river is complete per previous permits.

Unless there are Planning issues for the development agreement to be resolved I don't think there is any further RVCA involvement.

Regards,

Hal Stimson
Inspector, RVCA
hal.stimson@rvca.ca ext. 1127

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

From: Ed Ireland <ed.ireland@IBIGroup.com>
Sent: Wednesday, December 05, 2018 1:50 PM
To: Hal Stimson <hal.stimson@rvca.ca>
Cc: Jim Moffatt <jmoffatt@IBIGroup.com>
Subject: RVCA Consultation for Standard Sewage Works - Transfer of Review at Wateridge Phase 2 in the City of Ottawa

Good afternoon Hal,

IBI is preparing a servicing report and drawings for phase 2 at Wateridge Village in the City of Ottawa. The storm and sanitary sewers are all in public right of ways and will discharge into existing previously ECA approved storm and sanitary sewers with Phase 1. The project is located off Montreal Road and access to the site is from Codd's Road and Burma (now Wanaki) Road.

Does IBI need to do any further consultation with RVCA or do we just continue working with the City of Ottawa on this project?

I can speak with you about this project if you want more information.

Thank you.

Ed

Ed Ireland

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 64033 fax +1 613 225 9868

Wateridge Development

RIDEAU VALLEY CONSERVATION AUTHORITY

1,297.2 0 648.58 1,297.2

Meters

© Rideau Valley Conservation Authority

Map created: 12/5/2018

Map produced by RVCA, under License with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2016. This map is the property of the RVCA, and the RVCA holds a copyright on them. These maps may be copied or reproduced, provided that the RVCA is properly acknowledged as the original source of the information and provided that no fee is charged (other than to cover handling charges). The RVCA cannot guarantee the accuracy of the mapping for all possible uses. End-users of the information contained herein must therefore determine if the information is of suitable accuracy for their purposes

Legend

- Lot
- RVCA Admin Boundary
- Regulation Limit
- 100yr Floodline
  - Floodplain
  - Area of Reduced Flood Risk
  - Area of Shallow Flooding
- Reg Limit Dominant Hazard
  - Floodplain
  - Geo-technical Hazard Limit
  - Meander Belt
  - Spill Line
  - Stable-Toe Slope
  - Top of Slope
  - Unstable-Toe Slope
  - Wetland
- Regulated Wetlands
- OMAFRA Constructed Drains
  - <all other values>
  - Award Drain
  - Municipal Drain
  - Natural
  - Private Drain
- Municipal Drains
- RVCA Sub-Watersheds
- RVCA Catchments
- Water Control Structures
  - Lock-Gate
  - Dam

Notes

1: 25,534.73

N

Map Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Ed Ireland

From: Des Rochers, Christina (MECP) <Christina.Desrochers@ontario.ca>
Sent: Wednesday, December 19, 2018 11:02 AM
To: Ed Ireland
Cc: Jim Moffatt
Subject: RE: MOE Consultation for Sewage Works - Wateridge Phase 2 in the City of Ottawa

Good morning Ed,

I recommend reviewing the proposed LID in phase 2A against the ToR agreement. Specifically, Schedule A, 2.0 Additional Works Allowed, c. Lot Level and Conveyance Control (Low Impact Development) Measures permits:

"installing new LID measures, including storm water outfalls, provided that:

- if the proposed works are required to provide quality control, the LID measures are designed to achieve Enhanced Level water quality control and erosion protection (i.e. 80% TSS removal);
- any attenuation design requirements are satisfied; and
- the design considers corrective and remediation measure in the event of lack of performance of the LID measures:"

If the project complies with the provisions and the City agrees, a single application can be submitted under the ToR-Additional Works process for all of Phase 2.

Thanks and Happy New Year!

Christina
Christina Des Rochers
Water Inspector | Inspectrice de l'eau
Safe Drinking Water Branch | Direction du contrôle de la qualité de l'eau potable
Ministry of the Environment, Conservation and Parks | Ministère de l'Environnement, de la Protection de la nature et des Parcs
Tel. 613-521-3450 ex. 231
Fax. 613-521-5437
Spills Action Centre | Centre d'intervention en cas de déversement 1-800-268-6060

From: Ed Ireland [mailto:ed.ireland@IBIGroup.com]
Sent: December-13-18 5:02 PM
To: Des Rochers, Christina (MECP)
Cc: Jim Moffatt
Subject: MOE Consultation for Sewage Works - Wateridge Phase 2 in the City of Ottawa

Good afternoon Christina,

IBI coordinated with the City and they asked us to confirm the following with your office.

Phase 2 has a couple of sub-phases – 2A and 2B

2A has Lids (bioswales) and storm and sanitary sewers

2B no Lids – just storm and sanitary sewers

IBI proposes to prepare 2 separate applications:

1. A Transfer of Review Application that includes all of Phase 2A and 2B storm and sanitary sewers
2. A Direct Submission Application for the Phase 2A Lids

Is this how we should proceed? I believe this is what was done on a previous phase of the project. IBI prepared a transfer of review application for sewage works – storm and sanitary pipes - while another consultant prepared a direct submission application for LIDs.

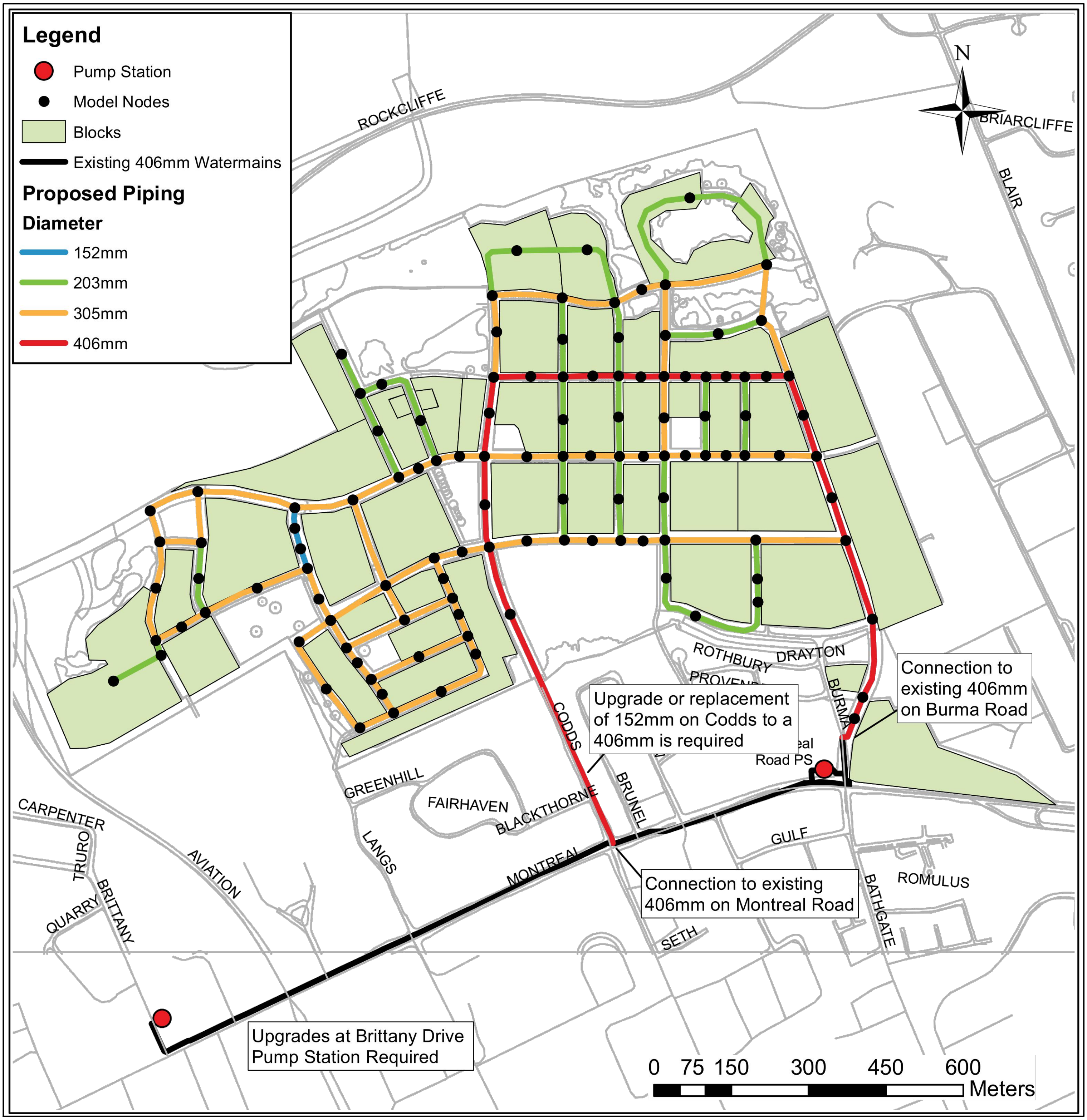
Ed

Ed Ireland

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 64033 fax +1 613 225 9868

APPENDIX B

- Figure 4.4 Proposed Pipe alignment and Diameters
- Watermain Demand Calculation Sheet
- Boundary Conditions
- Hydraulic Modeling Results



J:\32952-RockcliffeRedev\5.9 Drawings\59civil\current\Report Figures\MSS 2015\Section 4\FIGURE4.4 Proposed Pipe alignment and Diameters-REV.dwg Layout Name: FIGURE4.4

Stantec

IBI

Project Title	Drawing Title	Sheet No.
FORMER CFB ROCKCLIFFE MASTER SERVICING STUDY	PROPOSED PIPE ALIGNMENT AND DIAMETERS	FIGURE 4.4

IBI GROUP
IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : FORMER CFB ROCKCLIFFE - PHASE 2B
LOCATION : CITY OF OTTAWA

FILE: 118863.5.7
DATE PRINTED: 15-Mar-19
DESIGN: LE

NODE	RESIDENTIAL UNITS TH/SD	RESIDENTIAL UNITS TH/S	RESIDENTIAL UNITS APT	RESIDENTIAL POP'N	NON-RESIDENTIAL INDTRL (ha.)	NON-RESIDENTIAL COMM. (ha.)	NON-RESIDENTIAL INST. (ha.)	AVERAGE DAILY DEMAND (l/s) Res.	AVERAGE DAILY DEMAND (l/s) Non-res.	AVERAGE DAILY DEMAND (l/s) Total	MAXIMUM DAILY DEMAND (l/s) Res.	MAXIMUM DAILY DEMAND (l/s) Non-res.	MAXIMUM DAILY DEMAND (l/s) Total	MAXIMUM HOURLY DEMAND (l/s) Res.	MAXIMUM HOURLY DEMAND (l/s) Non-res.	MAXIMUM HOURLY DEMAND (l/s) Total	FIRE DEMAND (l/min)
PHASE 2B																	
I12			298	536.4				2.17	0.00	2.17	5.43	0.00	5.43	11.95	0.00	11.95	13,000
I14			300	540.0				2.19	0.00	2.19	5.47	0.00	5.47	12.03	0.00	12.03	13,000
I16			100	180.0				0.73	0.00	0.73	1.82	0.00	1.82	4.01	0.00	4.01	13,000
I18			100	180.0				0.73	0.00	0.73	1.82	0.00	1.82	4.01	0.00	4.01	13,000
I20			300	540.0				2.19	0.00	2.19	5.47	0.00	5.47	12.03	0.00	12.03	13,000
I22		60	300	678.0				2.75	0.00	2.75	6.87	0.00	6.87	15.11	0.00	15.11	13,000
I24		60		138.0				0.56	0.00	0.56	1.40	0.00	1.40	3.07	0.00	3.07	13,000
I26		35		80.5				0.33	0.00	0.33	0.82	0.00	0.82	1.79	0.00	1.79	13,000
I28		35		80.5				0.33	0.00	0.33	0.82	0.00	0.82	1.79	0.00	1.79	13,000
I30		30		69.0				0.28	0.00	0.28	0.70	0.00	0.70	1.54	0.00	1.54	13,000
I32		25		57.5				0.23	0.00	0.23	0.58	0.00	0.58	1.28	0.00	1.28	13,000
I34		25		57.5				0.23	0.00	0.23	0.58	0.00	0.58	1.28	0.00	1.28	13,000
I36		30		69.0				0.28	0.00	0.28	0.70	0.00	0.70	1.54	0.00	1.54	13,000
TOTALS		**300**	**1398**	**3206**						**13.00**			**32.48**			**71.43**	

ASSUMPTIONS

RESIDENTIAL DENSITIES
- Townhouse/Semi Detached (TH/SD) 2.7 p / p / u
- Townhouse Stacked (TH/S) 2.3 p / p / u
- Apartment (APT) 1.8 p / p / u

AVG. DAILY DEMAND
- Residential 350 l / cap / day
- ICI 50,000 l / ha / day

MAX. DAILY DEMAND
- Residential 875 l / cap / day
- ICI 75,000 l / ha / day

MAX. HOURLY DEMAND
- Residential 1,925 l / cap / day
- ICI 135,000 l / ha / day

FIRE FLOW
- SF, SD & TH 13,000 l / min
- ICI 13,000 l / min

Lance Erion

From: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Sent: Friday, November 23, 2018 10:23 AM
To: Lance Erion
Subject: Wateridge Village Phase 2 - Request for Water Boundary Conditions
Attachments: Wateridge Village (rockcliffe) Nov 2018.pdf

Good Morning Lance;

The following are boundary conditions, HGL, for hydraulic analysis at Wateridge Village (zone MONT) assumed to be connected to the 406mm on Montreal (see attached PDF for locations). Total demands of Phase 1 and Phase 2 were used to provide the boundary conditions.

Existing Conditions based on current pump operations:

Codd's Road
MAX HGL = 147.0m
PKHR = 142.5m
MXDY+Fire (217 L/s) = 135.0m

Burma Road
MAX HGL = 147.0m
PKHR = 143.0m
MXDY+Fire (217 L/s) = 137.0m

Please note the following:

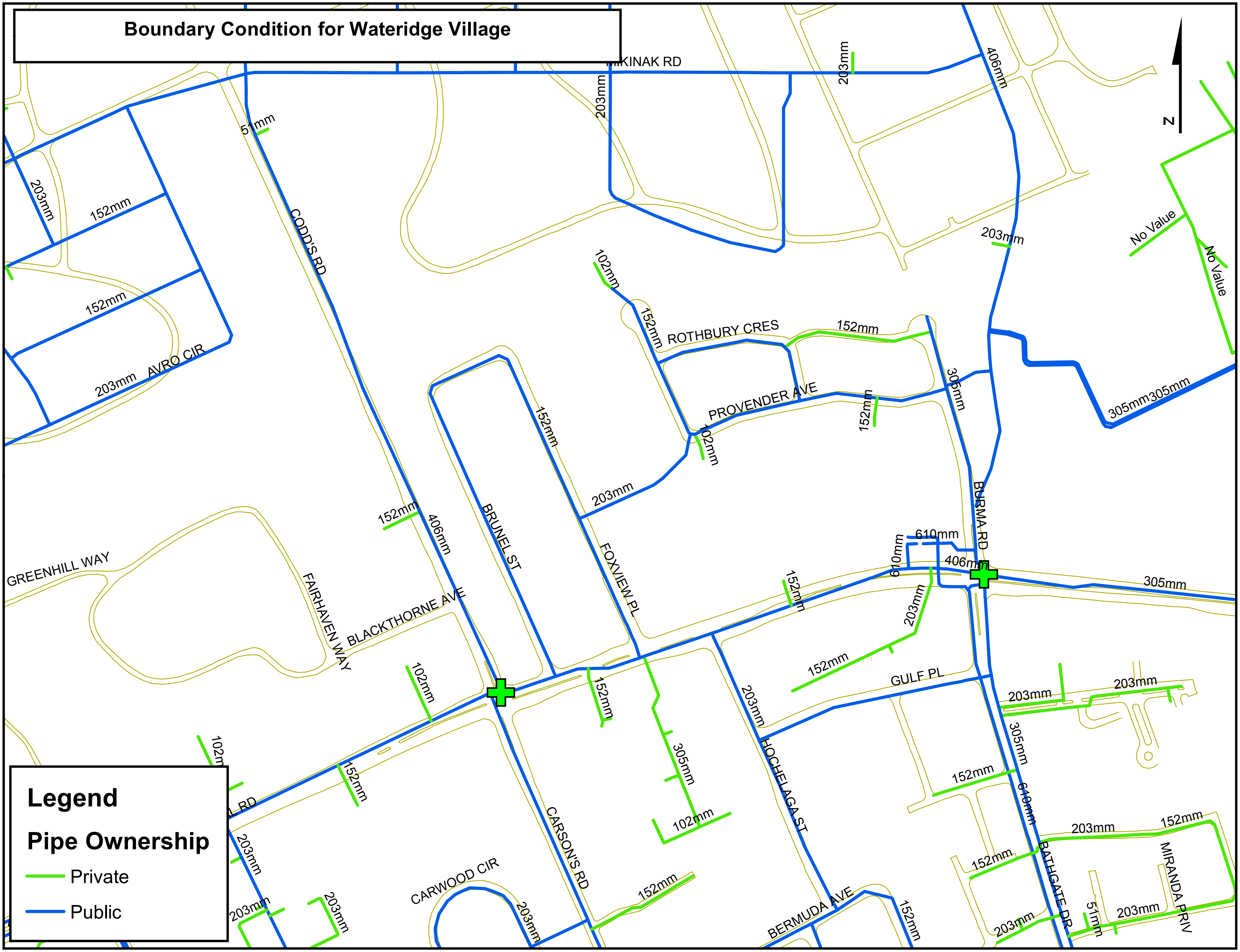
- *Boundary conditions provided above are for existing conditions. Upgrades to the Montreal and Brittany pump stations are currently being planned to support the CFB Rockcliffe development. The City plans to control the discharge HGL to 143.0m. Furthermore, the current plan is to use a different pumping strategy that will try to maintain a constant HGL of 143.0m even during peak hour and/or fire flow conditions.*

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Richard Buchanan, CET

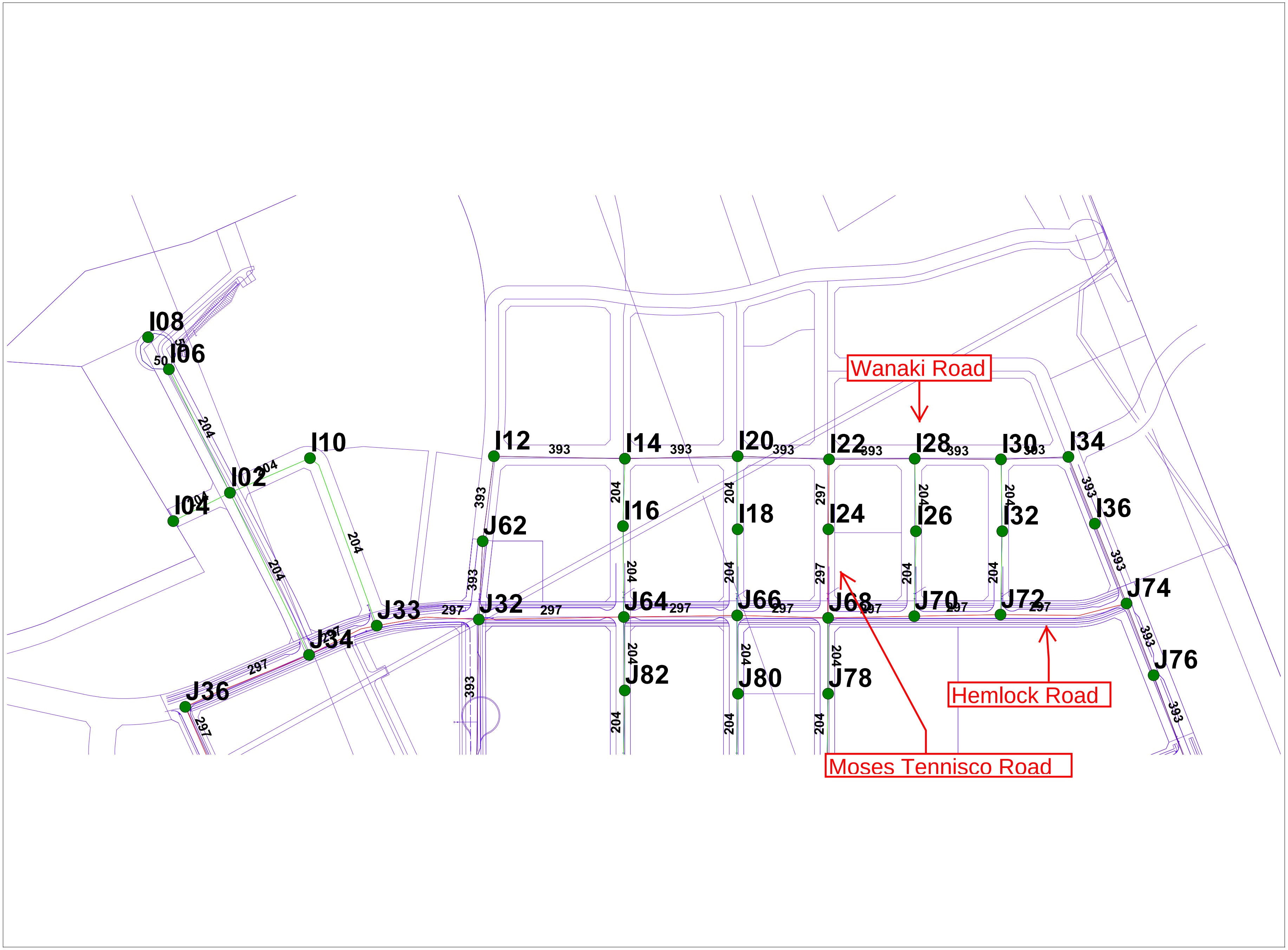
Project Manager, Development Approvals
Planning, Infrastructure and Economic Development Department
Planning & Growth Management Branch
City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27801
ottawa.ca/planning / ottawa.ca/urbanisme


Boundary Condition for Wateridge Village
N
Legend
Pipe Ownership
Private
Public
CODD'S RD
BRUNEL ST
FOXVIEW PL
CARSON'S RD
HOCHELAGA ST
BURMA RD
BATHGATE DR
MIRANDA PRIV
BERMUDA AVE
CARWOOD CIR
GULF PL
PROVENDER AVE
ROTHBURY CRES
AVRO CIR
GREENHILL WAY
FAIRHAVEN WAY
BLACKTHORNE AVE
KINAK RD
406mm
610mm
305mm
203mm
152mm
102mm
51mm
No Value

Wateridge Overall Model

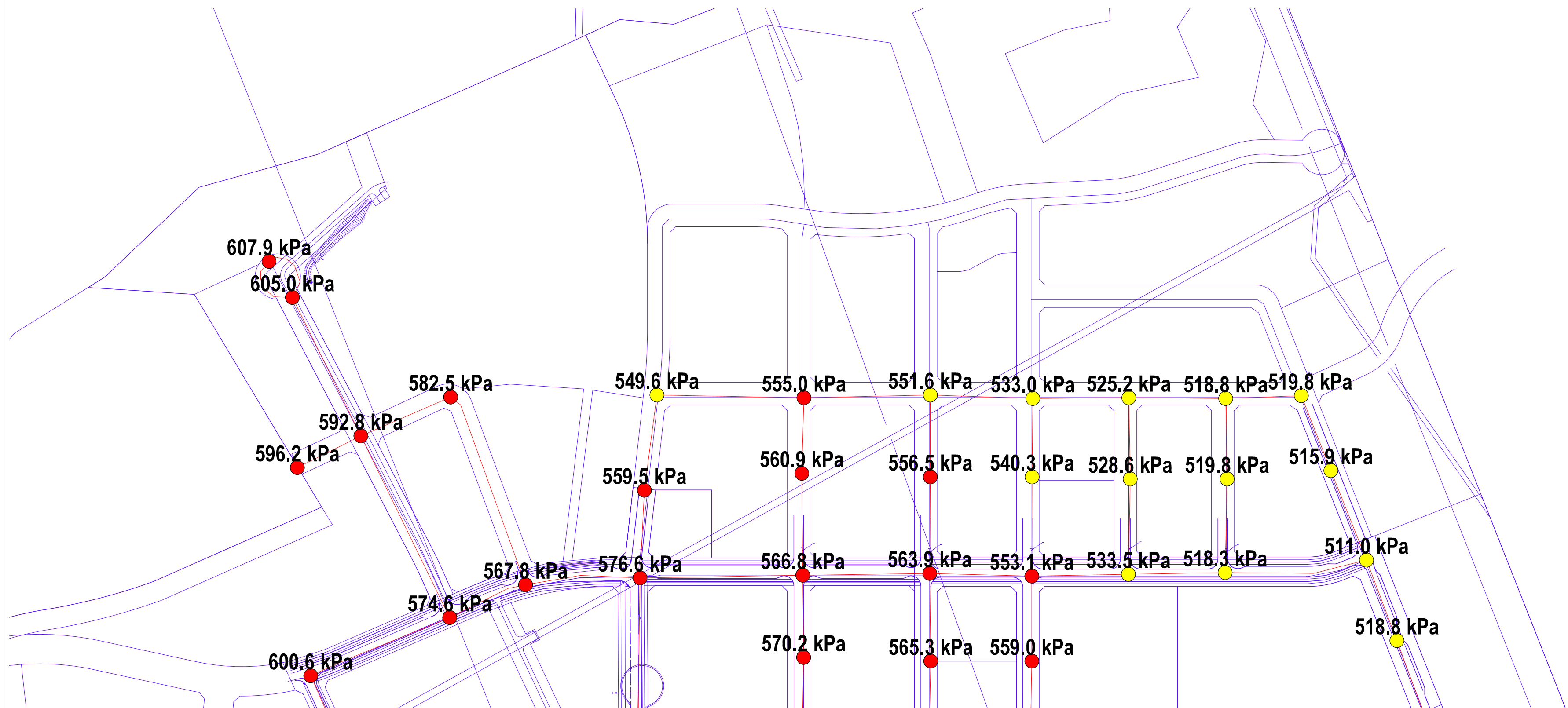
Date: Thursday, December 06, 2018

Phase 2 Node ID's and Pipe Sizes



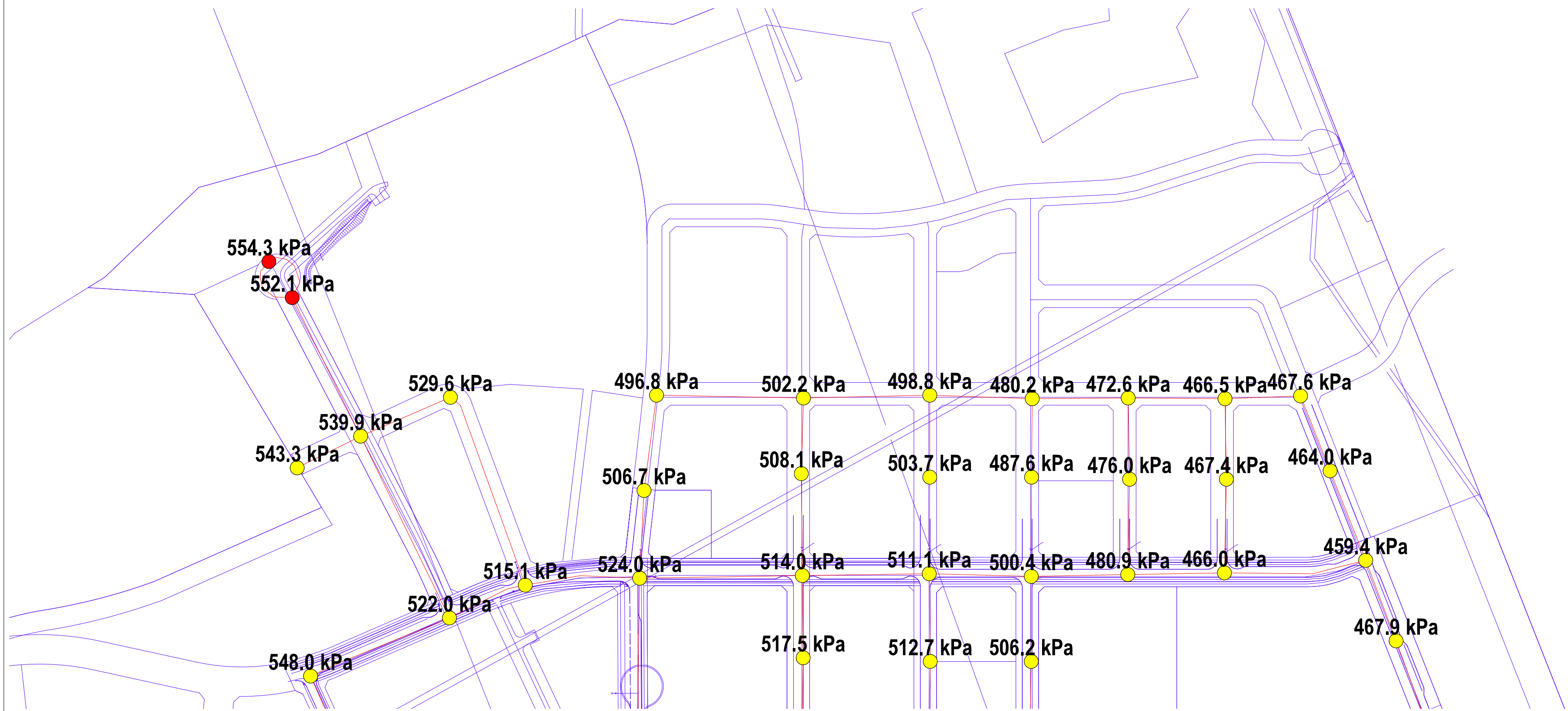
Date: Thursday, December 06, 2018

Phase 2 Basic Day (Max HGL) Pressures



Date: Thursday, December 06, 2018

Phase 2 Peak Hour Pressures



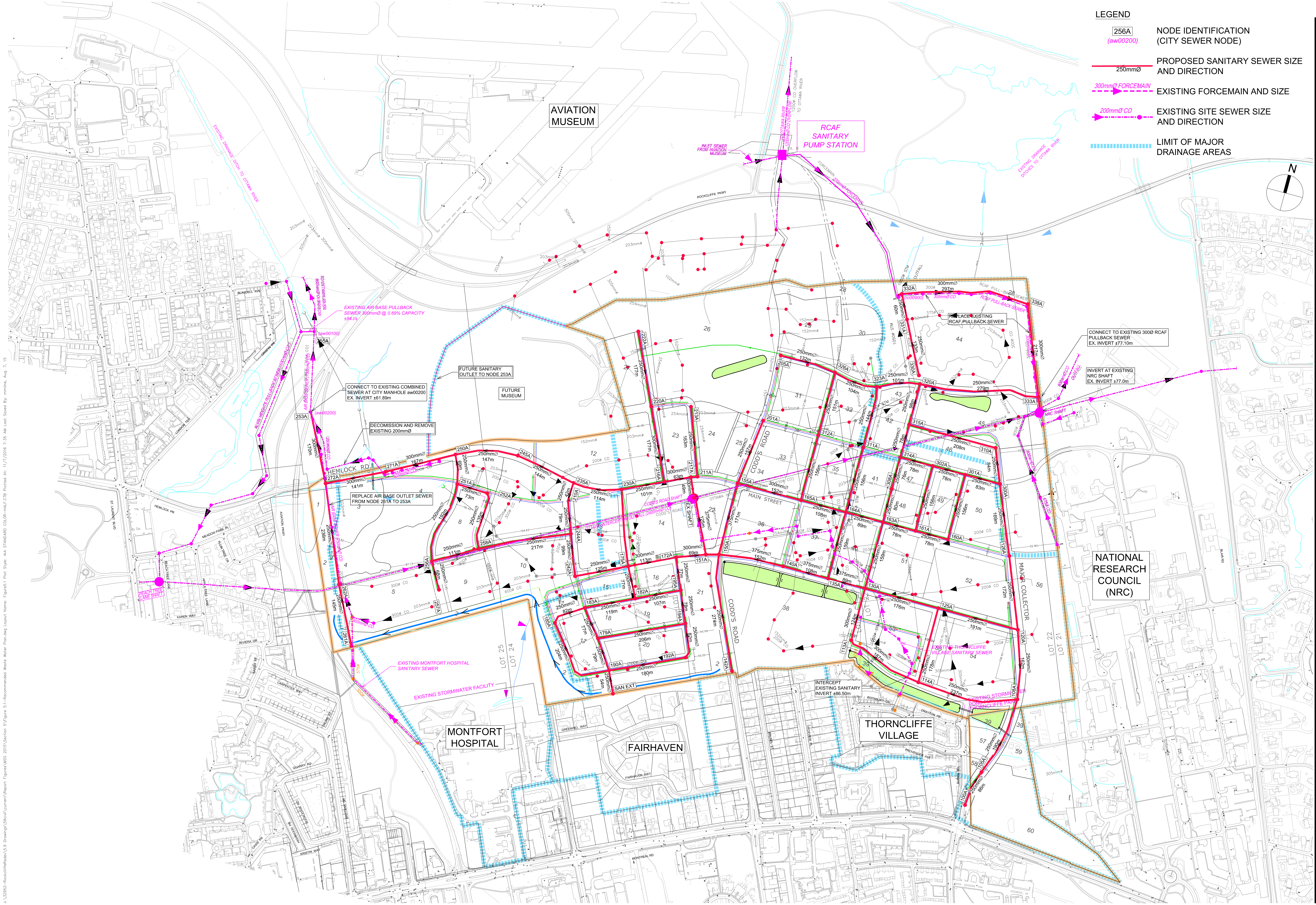
Date: Thursday, December 06, 2018

Phase 2 Max Day + Fire Design Fireflows

Date: Thursday, December 06, 2018

APPENDIX C

- **Figure 5.1 – Recommended Wastewater Plan (MSS)**
- **Figure 3.1 – Recommended Wastewater Plan**
- **Sanitary Sewer Design Sheets**
- **Sanitary Drainage Area Plans - Drawings 118863-400**



Scale

Project Title

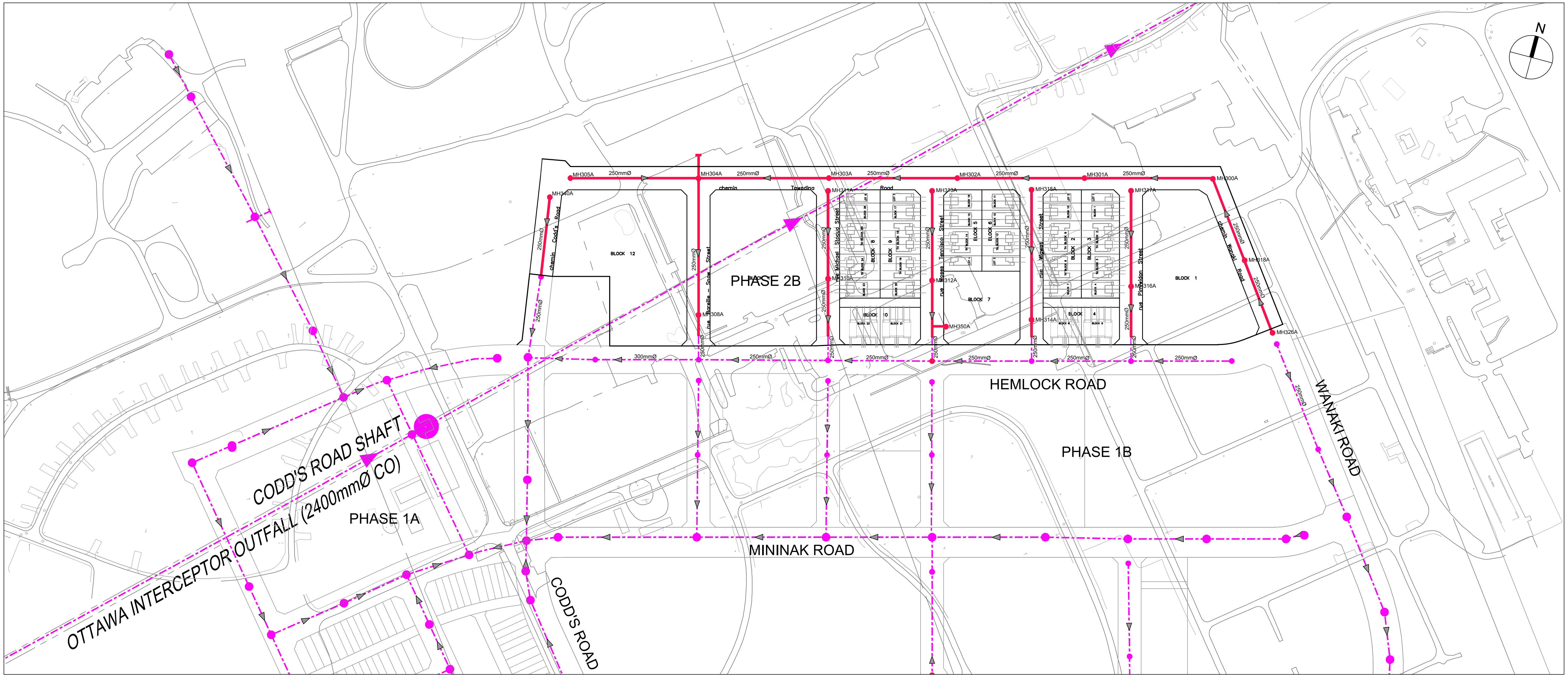
FORMER CFB ROCKCLIFFE MASTER SERVICING STUDY

Drawing Title

RECOMMENDED WASTEWATER PLAN

Sheet No.

FIGURE 5.1



LEGEND

250mmØ PROPOSED SANITARY SEWER SIZE AND DIRECTION

EXISTING SEWER AND DIRECTION

[B]

Scale

Project Title

DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title

RECOMMENDED
WASTEWATER PLAN

Sheet No.

FIGURE 3.1

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

LEGEND
MH231A Existing infrastructure (shown for information only)

SANITARY SEWER DESIGN SHEET

Wateridge at Rockcliffe - Phase 2B
City of Ottawa
Canada Lands Company

LOCATION: STREET	LOCATION: AREA ID	LOCATION: FROM MH	LOCATION: TO MH	RESIDENTIAL: AREA w/ Units (Ha)	RESIDENTIAL: UNIT TYPES SF	RESIDENTIAL: UNIT TYPES SD / TH/F	RESIDENTIAL: UNIT TYPES TH/S	RESIDENTIAL: UNIT TYPES APT	RESIDENTIAL: AREA w/o Units (Ha)	RESIDENTIAL: POPULATION IND	RESIDENTIAL: POPULATION CUM	RESIDENTIAL: RES PEAK FACTOR	RESIDENTIAL: PEAK FLOW (L/s)	ICI AREAS: AREA (Ha) INSTITUTIONAL IND	ICI AREAS: AREA (Ha) INSTITUTIONAL CUM	ICI AREAS: AREA (Ha) COMMERCIAL IND	ICI AREAS: AREA (Ha) COMMERCIAL CUM	ICI AREAS: AREA (Ha) INDUSTRIAL IND	ICI AREAS: AREA (Ha) INDUSTRIAL CUM	ICI AREAS: ICI PEAK FACTOR	ICI AREAS: PEAK FLOW (L/s)	INFILTRATION ALLOWANCE: AREA (Ha) IND	INFILTRATION ALLOWANCE: AREA (Ha) CUM	INFILTRATION ALLOWANCE: FLOW (L/s)	FIXED FLOW (L/s): IND	FIXED FLOW (L/s): CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN: CAPACITY (L/s)	PROPOSED SEWER DESIGN: LENGTH (m)	PROPOSED SEWER DESIGN: DIA (mm)	PROPOSED SEWER DESIGN: SLOPE (%)	PROPOSED SEWER DESIGN: VELOCITY (full) (m/s)	PROPOSED SEWER DESIGN: AVAILABLE CAPACITY L/s	PROPOSED SEWER DESIGN: AVAILABLE CAPACITY (%)
Pimiwidon Street	MH317-1, MH317-2	MH317A	MH316A	1.50	1	104				284.2	284.2	3.47	3.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.50	1.50	0.50	0.00	0.00	3.69	41.62	83.50	250	0.45	0.821	37.93	91.13%
Pimiwidon Street	MH316A	MH316A	BULK202AN	0.16		1				2.7	286.9	3.47	3.23	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.16	1.66	0.55	0.00	0.00	3.77	41.62	43.56	250	0.45	0.821	37.84	90.93%
Pimiwidon Street	-	*BULK202AN*	*MH202A*							0.0	286.9	3.47	3.23	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.66	0.55	0.00	0.00	3.77	40.68	21.00	250	0.43	0.803	36.91	90.72%
Wigwas Street	MH315A	MH315A	MH314A	0.79	2	18				55.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.79	0.79	0.26	0.00	0.00	0.92	50.02	113.00	250	0.65	0.987	49.10	98.17%
Wigwas Street	MH314A	MH314A	BULK203AN	0.06						0.0	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.06	0.85	0.28	0.00	0.00	0.93	80.17	15.00	250	1.67	1.582	79.24	98.83%
Wigwas Street	-	*BULK203AN*	*MH203A*							0.0	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.85	0.28	0.00	0.00	0.93	80.17	21.00	250	1.67	1.582	79.24	98.83%
Moses Tennisco Street	MH313A	MH313A	MH312A	0.66	2	16				50.0	50.0	3.65	0.59	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.66	0.66	0.22	0.00	0.00	0.81	75.98	78.00	250	1.50	1.500	75.17	98.93%
Moses Tennisco Street	MH312A, PARK	MH312A	BULK204AN	0.21		2				5.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.87	0.29	0.00	0.00	0.94	89.90	48.98	250	2.10	1.774	88.96	98.95%
Park	PARK	MH350A	pipe	0.42						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.42	0.42	0.14	0.00	0.00	0.14	48.39	11.00	200	2.00	1.492	48.25	99.71%
Moses Tennisco Street	-	*BULK204AN*	*MH204A*							0.0	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.87	0.29	0.00	0.00	0.94	89.90	21.00	250	2.10	1.774	88.96	98.95%
Michael Stoqua Street	MH311A	MH311A	MH310A	0.44	1	9				27.7	27.7	3.69	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.44	0.44	0.15	0.00	0.00	0.48	70.74	78.00	250	1.30	1.396	70.26	99.33%
Michael Stoqua Street	MH310A	MH310A	BULK205AN	0.21		2				5.4	33.1	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.65	0.21	0.00	0.00	0.61	66.24	48.95	250	1.14	1.307	65.63	99.08%
Michael Stoqua Street	-	*BULK205AN*	*MH205A*							0.0	33.1	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.65	0.21	0.00	0.00	0.61	66.24	21.00	250	1.14	1.307	65.63	99.08%
Wanaki Road	MH200A	MH200A	MH318A							0.0	0.0	3.80	0.00	0.00	0.00	1.01	1.01	0.00	0.00	1.50	0.49	1.01	1.01	0.33	0.00	0.00	0.82	43.91	68.65	250	0.50	0.867	43.09	98.12%
Wanaki Road	MH318A	MH318A	MH300A							0.0	0.0	3.80	0.00	0.00	0.00	0.95	1.96	0.00	0.00	1.50	0.95	0.95	1.96	0.65	0.00	0.00	1.60	43.87	76.95	250	0.50	0.866	42.27	96.35%
Tawadina Road	MH300A	MH300A	MH301A	0.47		15				40.5	40.5	3.67	0.48	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.47	2.43	0.80	0.00	0.00	2.24	31.02	110.00	250	0.25	0.612	28.78	92.79%
Tawadina Road	MH301A	MH301A	MH302A	0.54		14				37.8	78.3	3.62	0.92	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.54	2.97	0.98	0.00	0.00	2.85	58.86	110.00	250	0.90	1.162	56.00	95.16%
Tawadina Road	MH302A	MH302A	MH303A	0.26		2				5.4	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.26	3.23	1.07	0.00	0.00	3.00	73.41	112.50	250	1.40	1.449	70.41	95.92%
Tawadina Road	MH303A	MH303A	MH304A	0.21						0.0	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.21	3.44	1.14	0.00	0.00	3.07	31.02	111.99	250	0.25	0.612	27.95	90.11%
Tawadina Road	MH305A	MH305A	MH304A	0.24						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.24	0.24	0.08	0.00	0.00	0.08	50.02	111.50	250	0.65	0.987	49.94	99.84%
																					0.00													
Bareille-Snow Street	EXT-1	BULK304AN	MH304A	7.35				905		1629.0	1629.0	3.12	16.49	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	7.35	7.35	2.43	0.00	0.00	18.91	31.02	20.00	250	0.25	0.612	12.11	39.04%
Bareille-Snow Street	MH304A-1, MH304A-2	MH304A	MH308A	1.47				190		342.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	1.47	12.50	4.13	0.00	0.00	25.14	31.02	119.13	250	0.25	0.612	5.87	18.94%
Bareille-Snow Street	MH308A	MH308A	BULK206AN	0.07						0.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.07	12.57	4.15	0.00	0.00	25.17	88.83	17.00	250	2.05	1.753	63.66	71.67%
Bareille-Snow Street		BULK206AN	MH206A							0.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.00	12.57	4.15	0.00	0.00	25.17	88.83	21.00	250	2.05	1.753	63.66	71.67%
Codd's Road	MH340A	MH340A	BLK231AN	1.78				278		500.4	500.4	3.38	5.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.78	1.78	0.59	0.00	0.00	6.07	75.98	70.00	250	1.50	1.500	69.91	92.01%
Codd's Road		*MH231A*	*BULK176AN*							0.0	500.4	3.38	5.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.78	0.59	0.00	0.00	6.07	83.92	50.22	250	1.83	1.656	77.86	92.77%

Design Parameters:

Residential			ICI Areas		
SF	3.4	p/p/u			
TH/F/SD	2.7	p/p/u	INST	28,000 L/Ha/day	
TH/S	2.3	p/p/u	COM	28,000 L/Ha/day	
APT	1.8	p/p/u	IND	35,000 L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000 L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

Designed: KH

Checked: JIM

Dwg. Reference: 118863-400

No.	Revision	Date
1	Submission No. 1 for City Review	2018-12-20
2	Submission No. 2 for City Review	2019-03-15
3	MECP Submission	2019-04-17

File Reference:	Date:	Sheet No:
118863.5.7.1	2019-04-17	1 of 1

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	MECP SUBMISSION	J.I.M.	2019:04:17
2	SUBMISSION NO. 2 FOR CITY REVIEW	J.I.M.	2019:03:15
1	SUBMISSION NO. 1 FOR CITY REVIEW	J.I.M.	2018:12:20

CANADA LANDS COMPANY
SOCIÉTÉ IMMOBILIÈRE DU CANADA
30 Metcalfe Street Suite 601
Ottawa, On K1P 5L4
613 998 7777

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2019/04/17
PROVINCE OF ONTARIO

N

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale: 1:1500

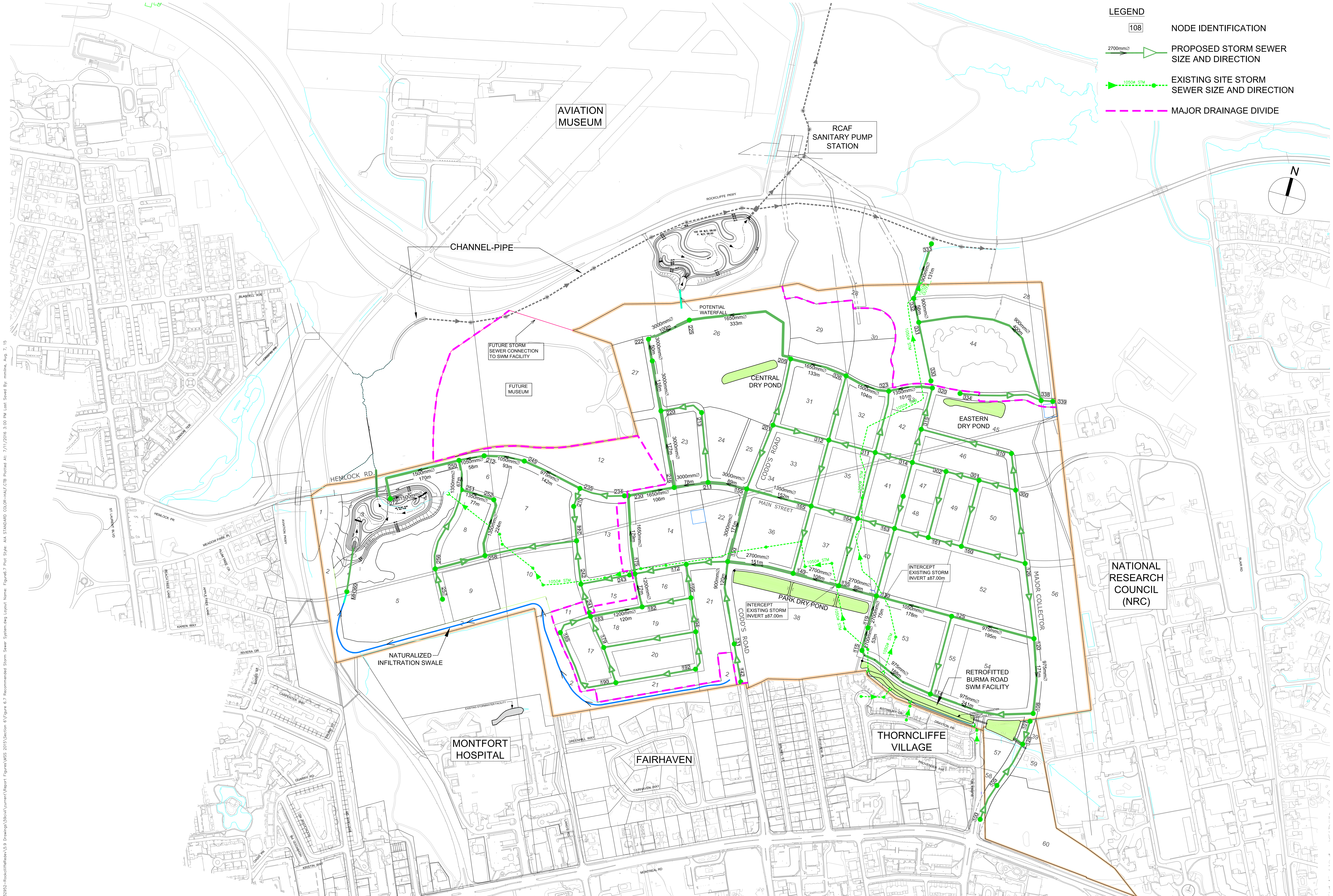
Design: K.H./S.T.	Date: DECEMBER 2018
Drawn: M.M.	Checked: J.I.M.
Project No.: 118863	Drawing No.: 400

D07-16-15-0003

#17063

APPENDIX D

- Figure 6.7 – Recommended Storm Sewer System (MSS)
- Runoff Coefficient Calculations
- Figure 4.1 – Proposed Minor Storm Plan
- Storm Sewer Design Sheets
- Storm Drainage Area Plans - Drawings 118863-500
- Figure 4.3 – Temporary Ditch Inlet Drainage Areas and Time of Concentration Calculations
- Temporary Ditch Inlet Time of Concentration Calculations
- Temporary Ditch Inlet ICD Calculations

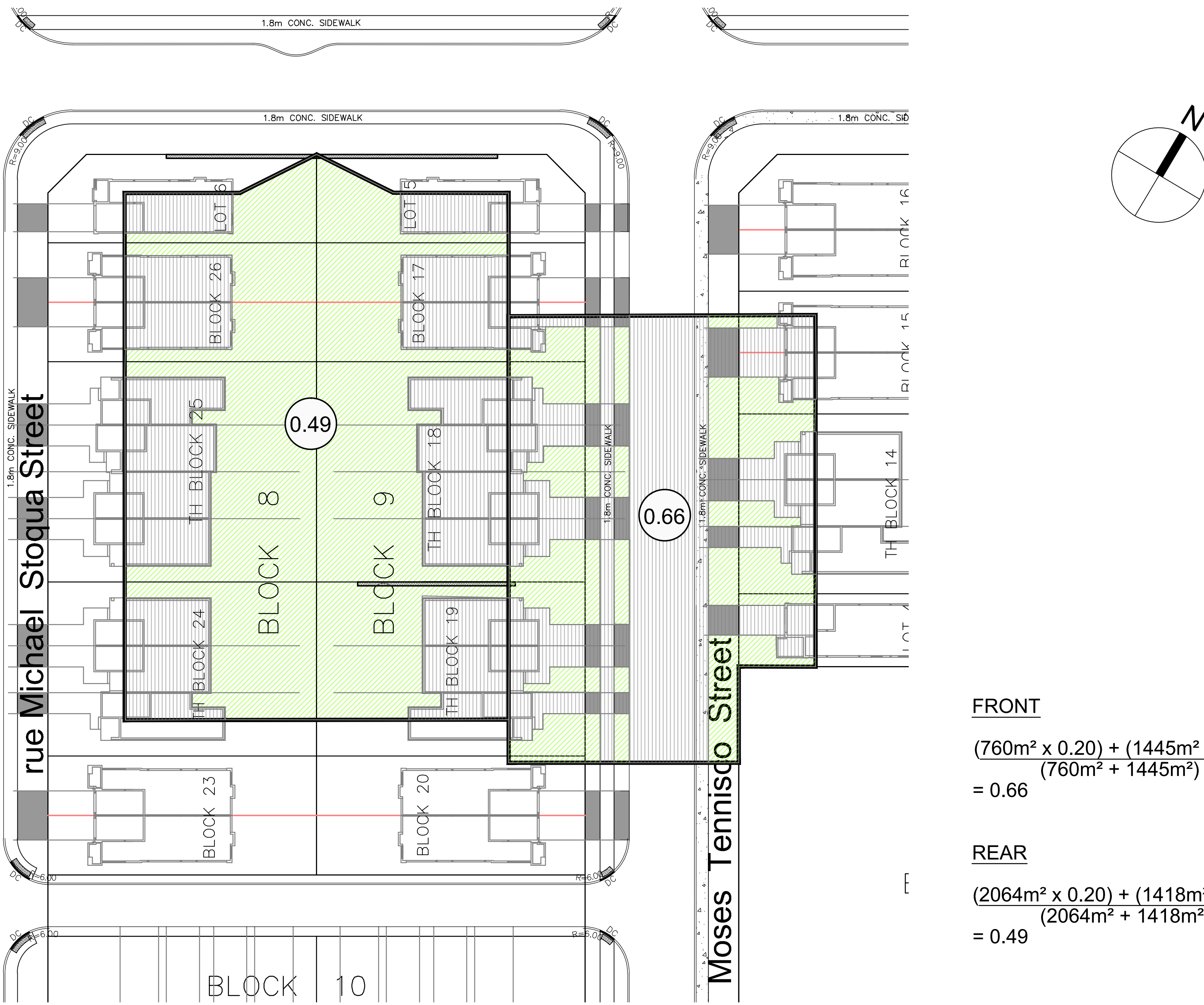


Scale

Project Title
FORMER CFB ROCKCLIFFE MASTER SERVICING STUDY

Drawing Title
RECOMMENDED STORM SEWER SYSTEM

Sheet No.
FIGURE 6.7



FRONT

$$\frac{(760m^2 \times 0.20) + (1445m^2 \times 0.90)}{(760m^2 + 1445m^2)}$$
= 0.66

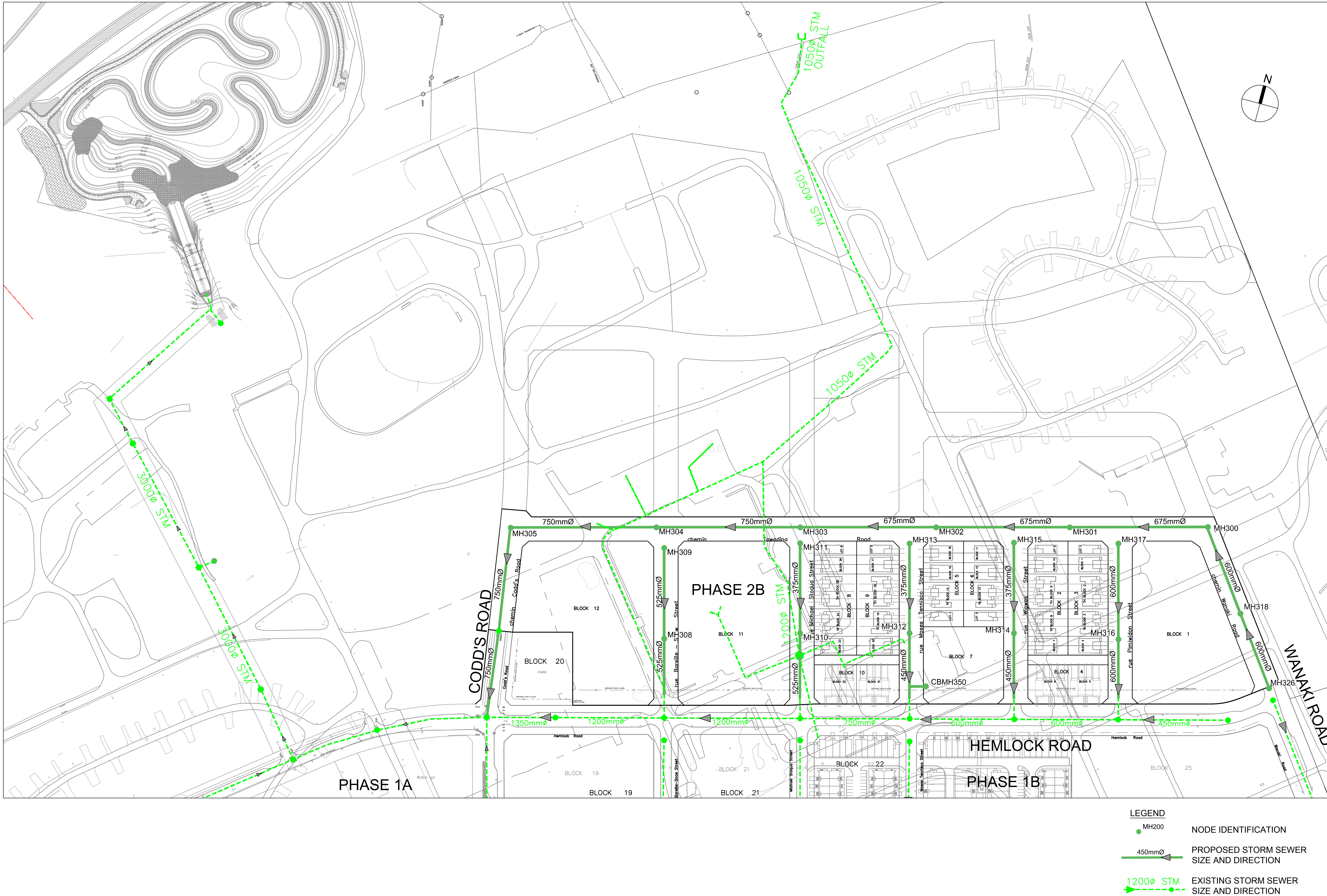
REAR

$$\frac{(2064m^2 \times 0.20) + (1418m^2 \times 0.90)}{(2064m^2 + 1418m^2)}$$
= 0.49

J:\118863_wtridge2a2b\5.9 drawings\59civil\current\Design Brief\Figure_Stmcoefficients.dwg Layout Name: Figure StmCoeff

IBI

Scale	Project Title	Drawing Title	Sheet No.
NTS	WATERIDGE VILLAGE AT ROCKCLIFFE PHASE 2B	AVERAGE DRAINAGE COEFFICIENT CALCULATION	



[B]

Scale

Project Title
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title
RECOMMENDED MINOR
STORM PLAN

Sheet No.
FIGURE 4.1

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

LEGEND
Black text 5 year event curve design
Blue text 100 year event curve design
MH206 Existing infrastructure (shown for information only)

STORM SEWER DESIGN SHEET

Wateridge at Rockcliffe - Phase 2B
City of Ottawa
Canada Lands Company

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW															SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.30	C= 0.40	C= 0.49	C= 0.57	C= 0.65	C= 0.66	C= 0.70	C= 0.73	C= 0.80	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	(%)
Pimiwidon Street	S317A, B317	MH317	MH316							0.09			1.05	2.50	2.50	10.00	0.85	10.85	76.81	104.19	122.14	178.56		260.52				260.52	452.94	78.86	600			0.50	1.552	192.43	42.48%
Pimiwidon Street	S316A-B	MH316	BLK202N							0.33				0.61	3.11	10.85	0.74	11.59	73.70	99.92	117.11	171.17		310.34				310.34	320.28	49.00	600			0.25	1.097	9.94	3.10%
Pimiwidon Street		*BULK202N*	*MH202*											0.00	3.11	11.59	0.24	11.83	71.19	96.48	113.06	165.21		299.64				299.64	320.28	*16.00*	*600*			*0.25*	1.097	20.64	6.44%
Wigwas Street	S315, S315A-B, R315	MH315	MH314				0.41			0.31				1.13	1.13	10.00	0.99	10.99	76.81	104.19	122.14	178.56		117.46				117.46	141.68	73.88	375			0.60	1.243	24.23	17.10%
Wigwas Street	S314A-B	MH314	BULK203N							0.44				0.81	1.93	10.99	0.48	11.47	73.20	99.24	116.30	169.98		191.98				191.98	310.53	54.00	450			1.09	1.891	118.55	38.18%
Wigwas Street		*BULK203N*	*MH203*											0.00	1.93	11.47	0.18	11.64	71.60	97.04	113.71	166.18		187.73				187.73	247.07	*16.00*	*450*			*0.69*	1.505	59.34	24.02%
Moses Tennisco St	S313, R313	MH313	MH312				0.31			0.11				0.62	0.62	10.00	0.80	10.80	76.81	104.19	122.14	178.56		65.03				65.03	112.79	73.88	300			1.25	1.546	47.76	42.35%
Moses Tennisco St	S312A-C	MH312	BULK204N							0.45				0.83	1.45	10.80	0.37	11.17	73.88	100.17	117.40	171.59		145.22				145.22	400.16	54.00	450			1.81	2.437	254.94	63.71%
Park Block 7	P312	CBMH350	pipe	0.42										0.23	0.23	10.00	0.13	10.13	76.81	104.19	122.14	178.56		24.33				24.33	87.74	13.50	250			2.00	1.731	63.40	72.27%
Moses Tennisco St		*BULK204N*	*MH204*											0.00	1.68	11.17	0.11	11.28	72.60	98.41	115.33	168.56		165.66				165.66	400.16	*16.00*	*450*			*1.81*	2.437	234.50	58.60%
Michael Stoqua St	S311, S311A, R311	MH311	MH310				0.45			0.22				1.02	1.02	10.00	0.81	10.81	76.81	104.19	122.14	178.56		105.93				105.93	173.52	73.88	375			0.90	1.522	67.60	38.96%
Michael Stoqua St	S310A-B	MH310	BLK205N							0.37				0.68	1.70	10.81	0.53	11.34	73.83	100.11	117.33	171.49		169.73				169.73	279.02	53.99	450			0.88	1.700	109.29	39.17%
Michael Stoqua St		*BLK205N*	*MH205*											0.00	1.70	11.34	0.16	11.50	72.02	97.62	114.40	167.18		165.51				165.51	279.02	*16.00*	*450*			*0.88*	*1.700*	*113.50*	*40.68%*
Bareille-Snow St	S309, B309	MH309	MH308								0.10		1.24	2.95	2.95	10.00	0.74	10.74	76.81	104.19	122.14	178.56		307.62				307.62	375.37	74.73	525			0.70	1.680	67.76	18.05%
Bareille-Snow St	S308, S308A	MH308	BULK206N								0.25			0.49	3.44	10.74	0.32	11.06	74.07	100.43	117.71	172.05		345.38				345.38	536.52	46.47	525			1.43	2.401	191.14	35.63%
Bareille-Snow St		*BULK206N*	*MH206*											0.00	3.44	11.06	0.12	11.19	72.95	98.89	115.90	169.38		340.07				340.07	536.52	*17.50*	*525*			*1.43*	2.401	196.45	36.62%
Wanaki Road	B200, S200A	MH326	MH318								0.15		1.57	3.78	3.78	10.00	0.71	10.71	76.81	104.19	122.14	178.56		394.22				394.22	452.94	65.85	600			0.50	1.552	58.72	12.96%
Wanaki Road	S318	MH318	MH300								0.13			0.25	4.04	10.71	0.82	11.53	74.19	100.60	117.91	172.34		406.08				406.08	452.94	76.32	600			0.50	1.552	46.87	10.35%
Tawadina Road	S300, S300A	MH300	MH301								0.19			0.37	4.41	11.53	1.59	13.11	71.40	96.77	113.39	165.71		426.38				426.38	438.47	113.03	675			0.25	1.187	12.09	2.76%
Tawadina Road	S301, S301A	MH301	MH302								0.17			0.33	4.74	13.11	0.86	13.97	66.61	90.19	105.66	154.35		427.25				427.25	788.75	110.00	675			0.81	2.135	361.51	45.83%
Tawadina Road	S302, S302A	MH302	MH303								0.28			0.54	5.28	13.97	0.69	14.66	64.30	87.03	101.94	148.89		459.70				459.70	1,004.08	111.92	675			1.31	2.718	544.38	54.22%
Tawadina Road	S303	MH303	MH304								0.18			0.35	5.63	14.66	1.55	16.21	62.58	84.68	99.17	144.83		476.92				476.92	580.71	118.37	750			0.25	1.273	103.79	17.87%
Tawadina Road	S304, S304A	MH304	MH305								0.23			0.45	6.08	16.21	1.57	17.78	59.06	79.85	93.49	136.49		485.46				485.46	580.71	120.00	750			0.25	1.273	95.25	16.40%
Codd's Road	S340, B340, B340A	MH305	MH231								0.17		2.02	4.82	10.90	17.78	0.49	18.27	55.90	75.54	88.42	129.06		823.59				823.59	1,324.21	85.55	750			1.30	2.904	500.62	37.81%
Codd's Road	S231	MH231	*MH176*								0.12			0.23	11.14	18.27	0.45	18.72	54.99	74.29	86.96	126.92		827.38				827.38	1,218.10	71.97	750			1.10	2.671	390.72	32.08%
Block 1	-	DICB1	Pipe	1.05										0.58	0.58	61.68	0.20	61.88	24.06	32.28	37.67	54.75				31.97		31.97	62.04	14.59	250			1.00	1.224	30.07	48.47%
Block 11	-	DICB3	Pipe	1.24										0.69	0.69	81.62	0.19	81.81	19.53	26.16	30.52	44.31				30.55		30.55	62.04	13.63	250			1.00	1.224	31.49	50.76%
Block 12	-	DICB4	Pipe	1.24										0.69	0.69	80.96	0.23	81.19	19.65	26.32	30.70	44.58				30.74		30.74	60.47	16.78	250			0.95	1.193	29.73	49.17%
Block 8	-	DICB5	Pipe	0.66										0.37	0.37	28.47	0.15	28.62	41.47	55.87	65.32	95.20				34.93		34.93	62.04	11.20	250			1.00	1.224	27.11	43.69%

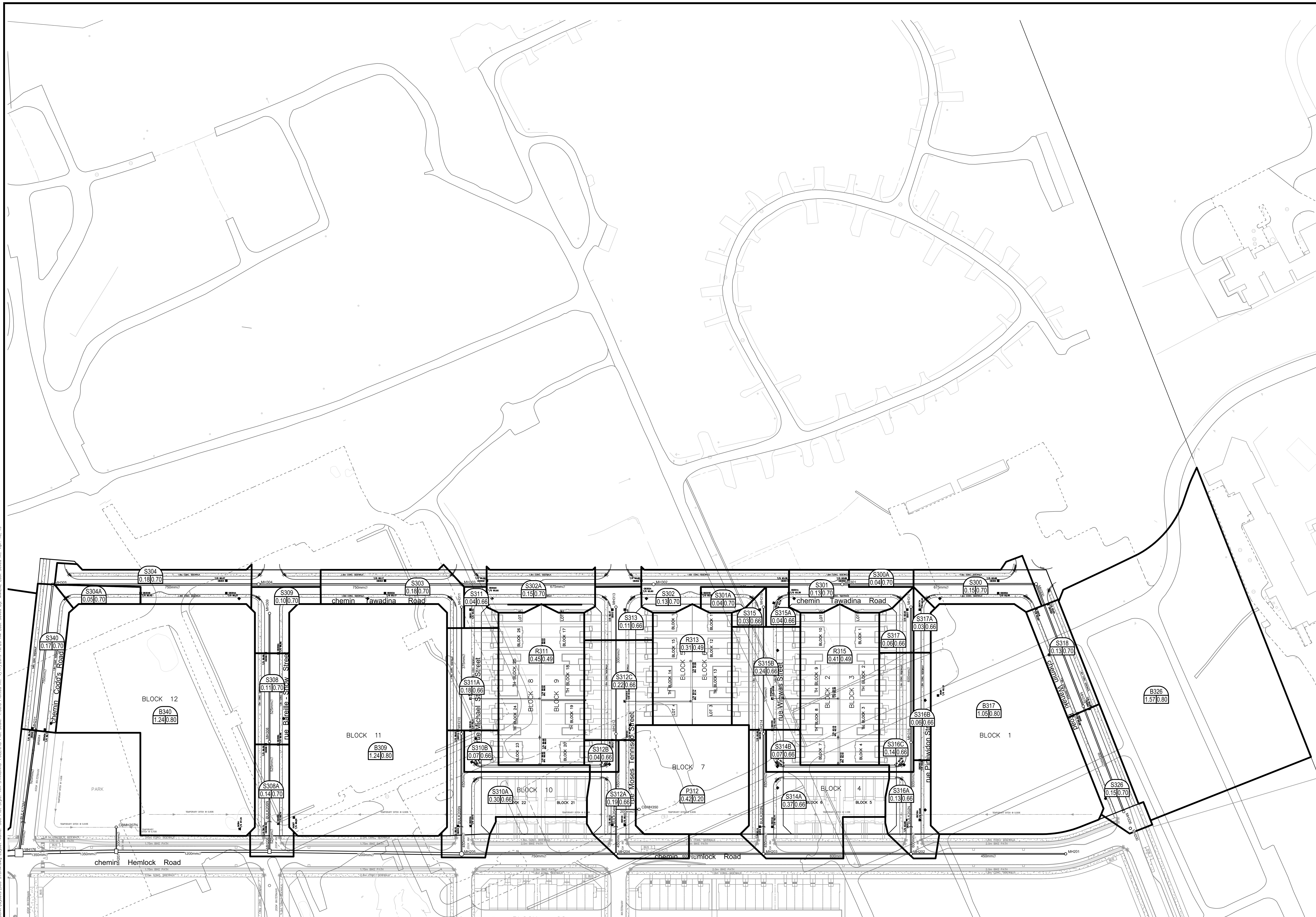
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

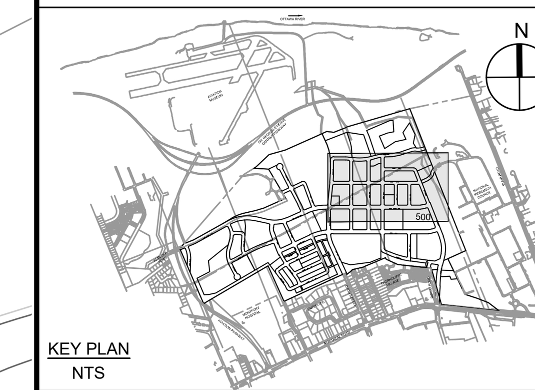
Designed: KH
Checked: JIM
Dwg. Reference: 118863-500

No.	Revision	Date
1	Submission No. 1 for City Review	2018-12-20
2	Submission No. 2 for City Review	2019-03-15
3	MECP Submission	2019-04-17

File Reference:	Date:	Sheet No:
118863.5.7.1	2019-04-17	1 of 1



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
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No.	REVISIONS	By	Date
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3	MECP SUBMISSION	J.I.M.	2019:04:17
2	SUBMISSION NO. 2 FOR CITY REVIEW	J.I.M.	2019:03:15
1	SUBMISSION NO. 1 FOR CITY REVIEW	J.I.M.	2018:12:20

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IBI GROUP
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ibigroup.com

Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE

PHASE 2B

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2019/04/17
PROVINCE OF ONTARIO

N

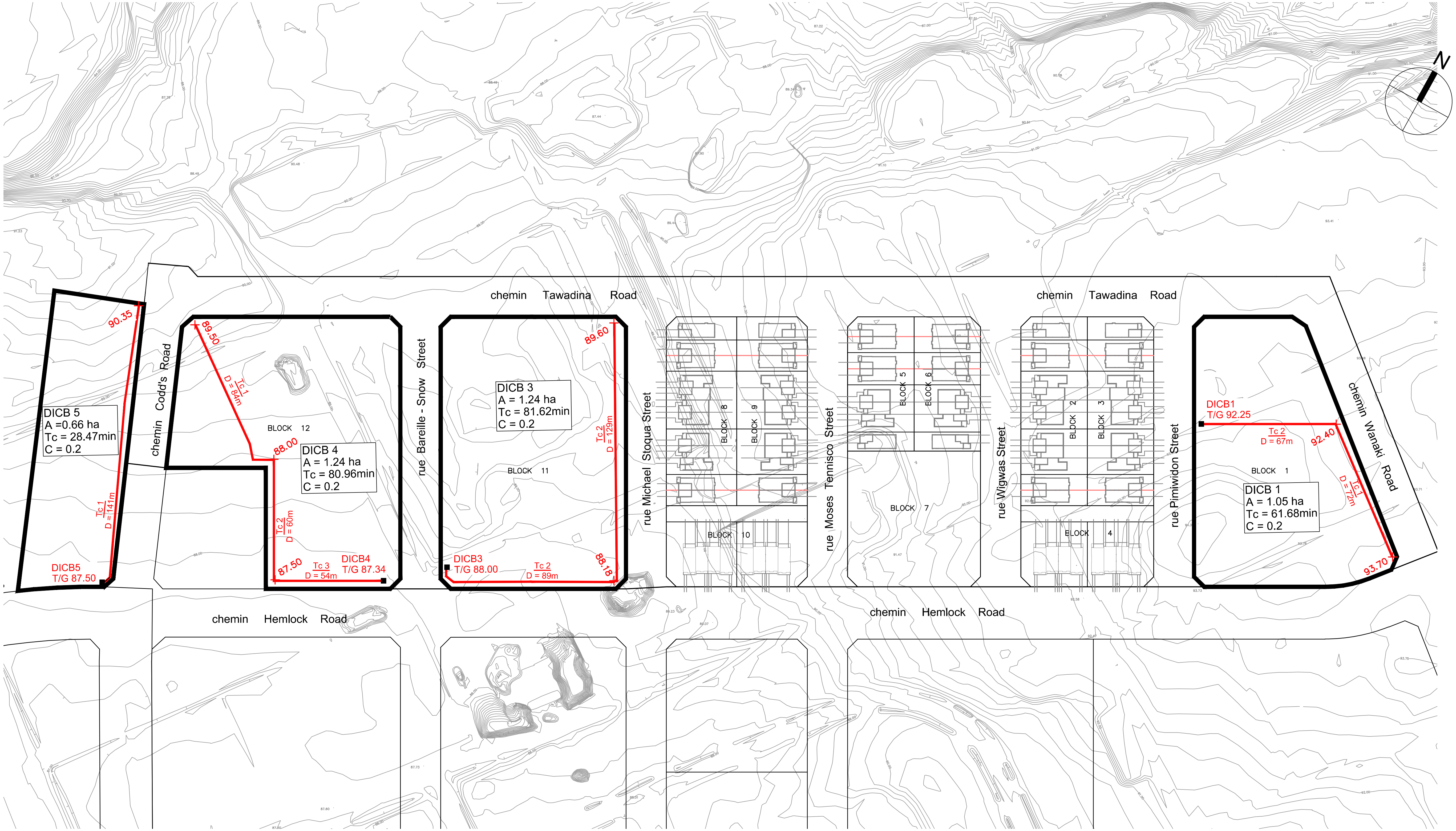
Drawing Title

STORM DRAINAGE AREA PLAN

Scale: 1:1000	
Design: K.H./S.T.	Date: DECEMBER 2018
Drawn: M.M.	Checked: J.I.M.
Project No.: 118863	Drawing No.: 500

D07-16-15-0003

#17063



LEGEND :

(thick black line)	EXTERNAL DRAINAGE AREAS
(red line)	TEMPORARY DRAINAGE DITCH DESIGN
×97.00	ELEVATION

B

Scale
N.T.S.

Project Title
DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Drawing Title
TEMPORARY DITCH INLET
DRAINAGE AREAS AND
TIME OF CONCENTRATION
PLAN

Sheet No.
FIGURE 4.3

J:\118863_wtridge2a2b\5.9 drawings\59civil\current\Design Brief\FIGURE 4.4 TEMPORARY DITCHES AND T OF C CALC.dwg Layout Name: FIG 4.4 Plot Style: ---- Plot Scale: 1:2.5849 Plotted At: 3/14/2019 2:08 PM Last Saved By: mmilne Last Saved At: Mar. 14, 19

Wateridge Phase 2B
Internal Interim Block Drainage

Time Of Concentration Calculations

DICB 1

Section	Area (ha)			Airport Formula (min)
TC1	1.05	**High Point**	93.70	$= \frac{3.36\,(1.1 - C_{factor})\,distance^{0.5}}{slope^{0.33}}$
		Low Point	92.40	
		Distance	72.00	= 21.11
		Slope	1.81%	
		C_{factor}	0.20	
TC2		**High Point**	92.40	$= \frac{3.36\,(1.1 - C_{factor})\,distance^{0.5}}{slope^{0.33}}$
		Low Point	92.25	
		Distance	67.00	= 40.56
		Slope	0.22%	
		C_{factor}	0.20	
			TC1 + TC2 =	**61.68 min**

DICB 3

Section	Area (ha)			Airport Formula (min)
TC1	1.24	**High Point**	89.60	$= \frac{3.36\,(1.1 - C_{factor})\,distance^{0.5}}{slope^{0.33}}$
		Low Point	88.18	
		Distance	129.00	= 33.27
		Slope	1.10%	
		C_{factor}	0.20	
TC2		**High Point**	88.18	$= \frac{3.36\,(1.1 - C_{factor})\,distance^{0.5}}{slope^{0.33}}$
		Low Point	88.00	
		Distance	89.00	= 48.34
		Slope	0.20%	
		C_{factor}	0.20	
			TC1 + TC2 =	**81.62 min**

DICB 4

Section	Area (ha)			Airport Formula (min)
TC1	1.24	**High Point**	89.50	$= \frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
		Low Point	88.00	
		Distance	84.00	= 22.89
		Slope	1.79%	
		C_{factor}	0.20	
TC2		**High Point**	88.00	$= \frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
		Low Point	87.50	
		Distance	60.00	= 24.88
		Slope	0.83%	
		C_{factor}	0.20	
TC3		**High Point**	87.50	$= \frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
		Low Point	87.34	
		Distance	54.00	= 33.20
		Slope	0.30%	
		C_{factor}	0.20	
TC1 + TC2 + TC3 = 80.96 min				

DICB 5

Section	Area (ha)			Airport Formula (min)
TC1	0.66	**High Point**	90.35	$= \frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
		Low Point	87.50	
		Distance	141.00	= 28.47
		Slope	2.02%	
		C_{factor}	0.20	
TC1 = 28.47 min				

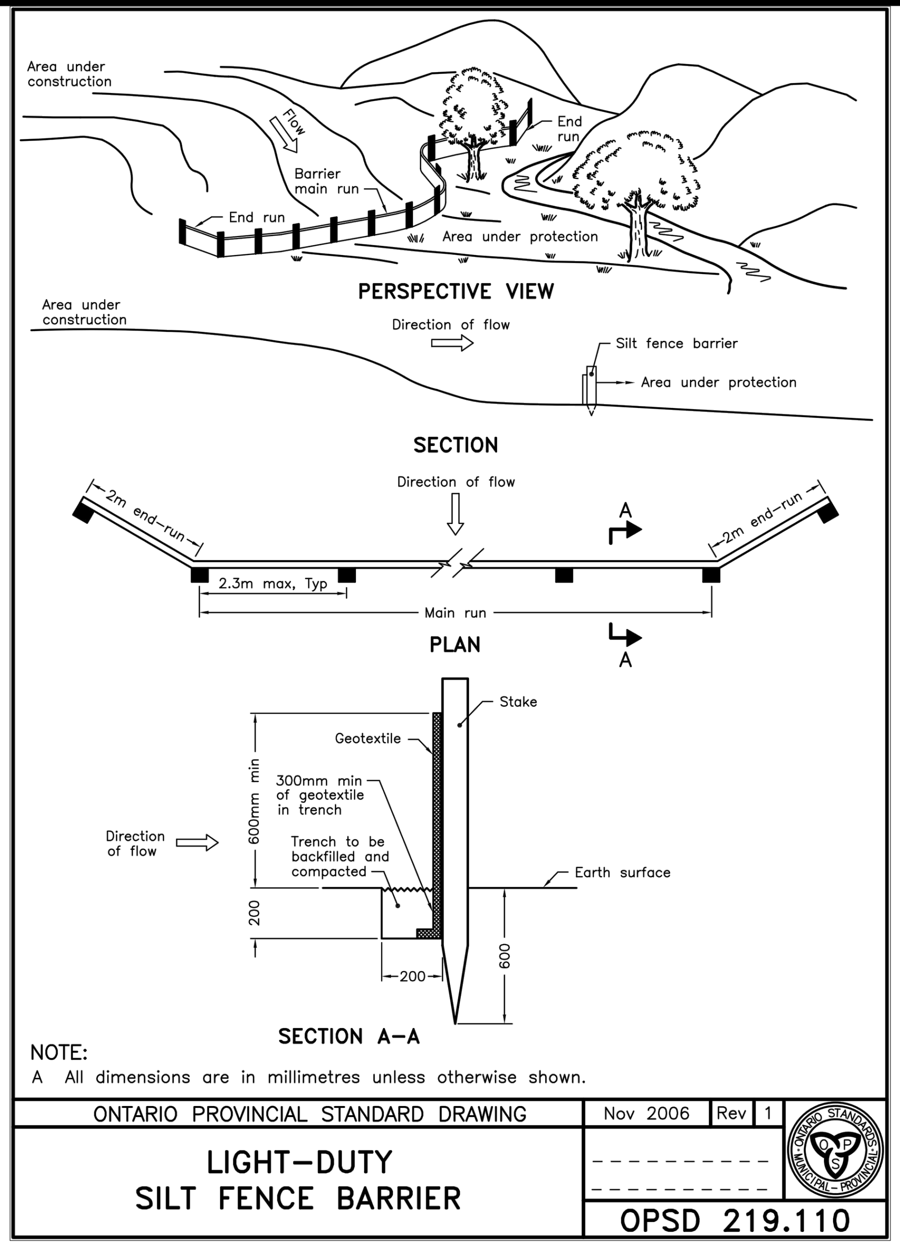
Wateridge Phase 2B
Ditch Inlet ICD Calculations

Structure	Flow (l/s)	Grade Elev. (m)	Pipe Invert (m)	Pipe Size (m)	Height (m)	Area (Sq m)	Orifice Size	
							Sq. mm	mm dia.
DICB 1	31.97	92.25	90.85	0.250	1.28	0.010	102	116
DICB 3	30.55	88.00	86.60	0.250	1.28	0.010	100	113
DICB 4	30.74	87.34	86.39	0.250	0.83	0.013	112	126
DICB 5	34.93	87.50	86.10	0.250	1.28	0.011	107	121

Based On Equation: Where: A=(Q/(C*(2*g*h)^.5)
C= 0.61
g= 9.81

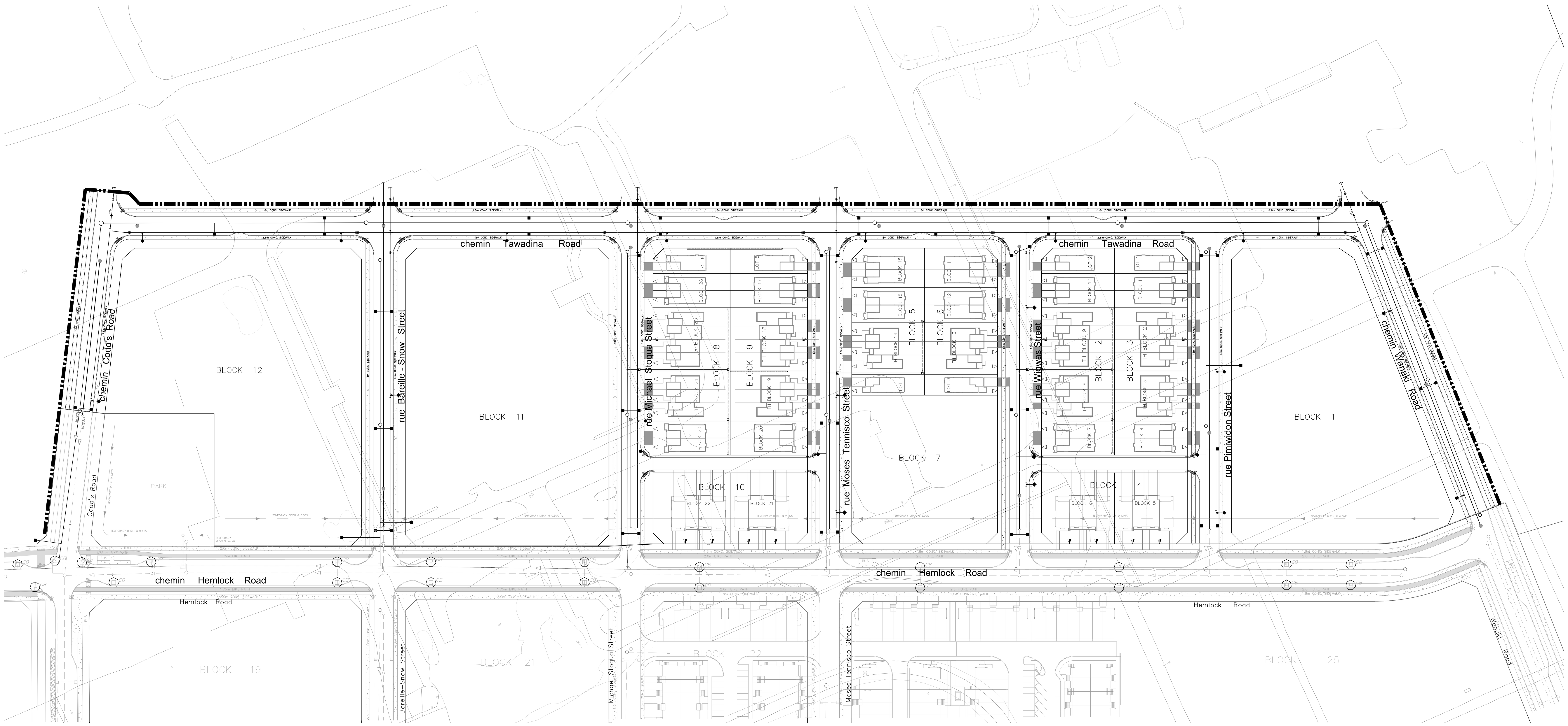
APPENDIX E

- **Drawing 118863-900 - Erosion and Sedimentation Control Plan**



NOTES:

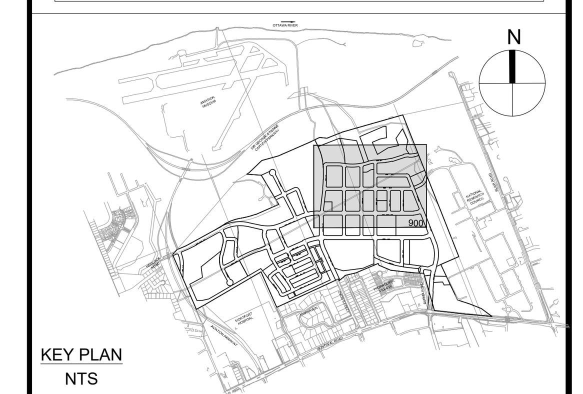
1. SILT FENCE TO BE ERECTED PRIOR TO EARTH WORKS BEING COMMENCED. SILT FENCE TO BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED OR UNTIL START OF SUBSEQUENT PHASE.
2. SILT SACK TO BE PLACED AND MAINTAINED UNDER COVER OF ALL CATCHBASINS. GEOTEXTILE SILT SACK IN STREET CBs TO REMAIN UNTIL ALL CURBS ARE CONSTRUCTED. GEOTEXTILE FABRIC IN RYCBs TO REMAIN UNTIL VEGETATION IS ESTABLISHED. ALL CATCHBASINS TO BE REGULARLY INSPECTED AND CLEANED, AS NECESSARY, UNTIL SOD AND CURBS ARE CONSTRUCTED.
3. CONTRACTOR TO PROTECT EXISTING CATCHBASINS WITH FILTER CLOTH UNDER THE COVERS TO TRAP SEDIMENTATION. REFER TO IDENTIFIED STRUCTURES.
4. IF DEEMED NECESSARY BY CITY INSPECTOR, LOCATION OF MUD MATS TO BE DETERMINED IN THE FIELD.



LEGEND :

(heavy dash-dot line)	LIGHT DUTY SILT FENCE AS PER OPSD-219.110
(circle)	SILT SACK PLACED UNDER EXISTING CB COVER
(hatched box)	TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOTH

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
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2	SUBMISSION NO. 2 FOR CITY REVIEW	J.I.M.	2019:03:15
1	SUBMISSION NO. 1 FOR CITY REVIEW	J.I.M.	2018:12:20

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IBI GROUP
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tel 613 225 1311 fax 613 225 9868
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Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2019/03/15
PROVINCE OF ONTARIO

N

Drawing Title

EROSION AND SEDIMENTATION CONTROL PLAN

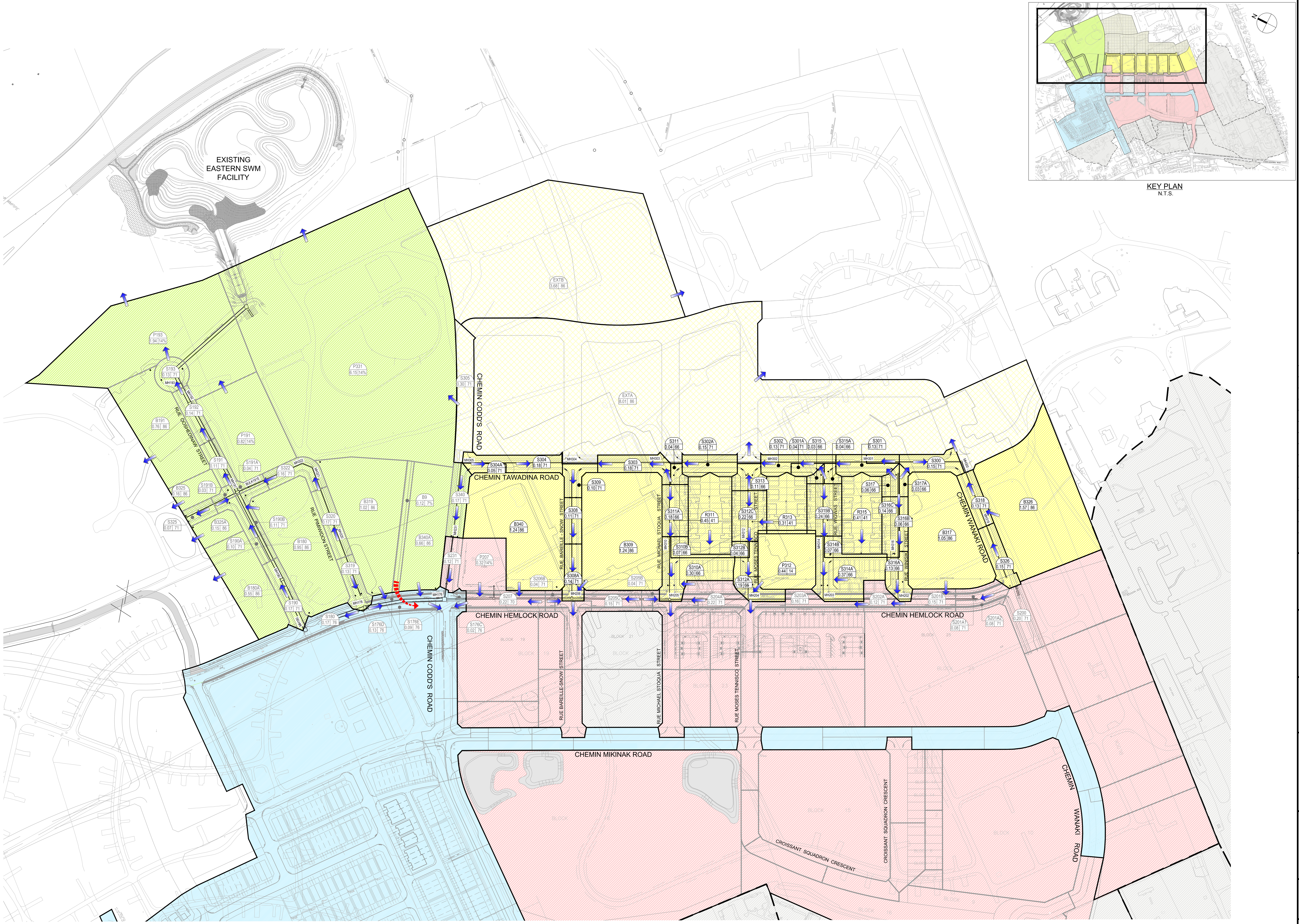
Scale 1:1000	
Design K.H./S.T.	Date DECEMBER 2018
Drawn M.M.	Checked J.I.M.
Project No. 118863	Drawing No. 900

D07-16-15-0003

#17063

APPENDIX F

- Drawing 750, DDSWMM Model Schematic
- Drawing 600
- Velocity x Depth Calculation Sheet
- XPSWMM Schematic
- HGL Results
- CD with Model Files



KEY PLAN
N.T.S.

LEGEND:

- PHASE 2B DRAINAGE AREA
- PHASE 2A DRAINAGE AREA (FUTURE)
- PHASE 2C 2D DRAINAGE AREA (FUTURE)
- PHASE 1B DRAINAGE AREA (EXISTING)
- PHASE 1A DRAINAGE AREA (EXISTING)
- EXTERNAL DRAINAGE AREA

S318 — AREA ID
0.13 | 71 — Imp.(%) / AREA (ha)

- MAJOR FLOW
- TOTAL FLOW
- MH136 MANHOLE ID

No.	REVISIONS	By	Date
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3	MECP SUBMISSION	P.S.	2019:04:17
2	SUBMISSION No.2 FOR CITY REVIEW	P.S.	2019:03:15
1	SUBMISSION No.1 FOR CITY REVIEW	P.S.	2018:12:20

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tel 613 225 1311 fax 613 225 9868
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Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B

M.S. BLACK
2019/04/17

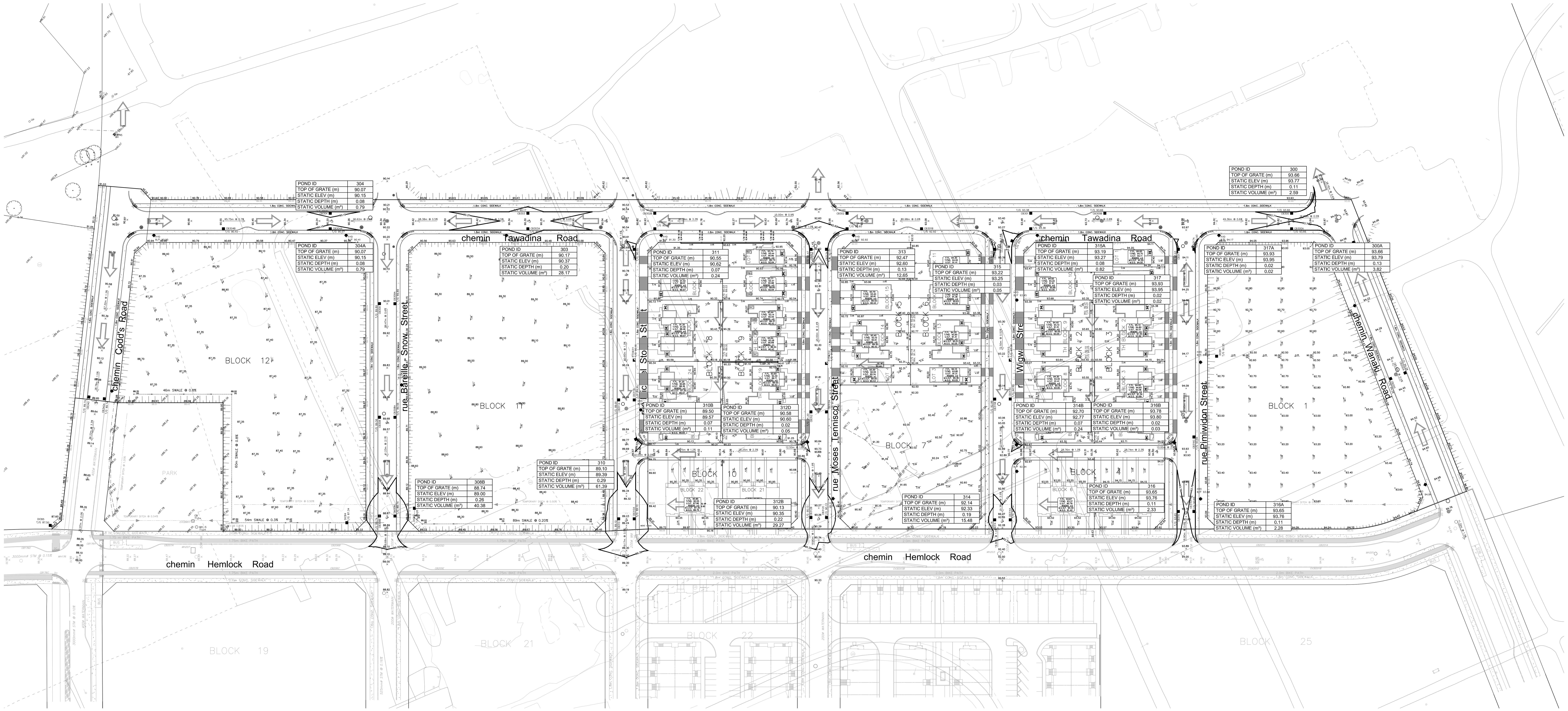
Drawing Title

DDSWMM MODEL SCHEMATIC

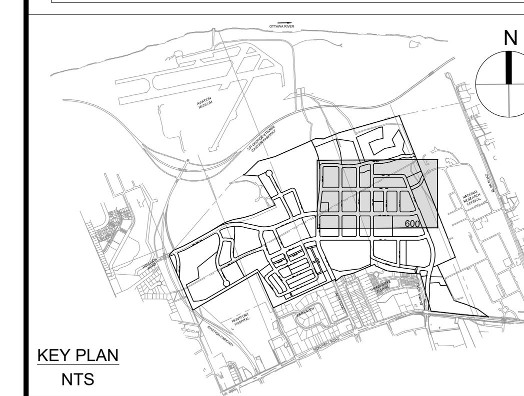
Scale	1:2000
Design: M.B	Date: DEC. 2018
Drawn: S.V.	Checked: P.S.
Project No.: 118863	Drawing No.: 750

D07-16-15-0003

#17063



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
NTS

No.	REVISIONS	By	Date
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3			
2	SUBMISSION NO. 2 FOR CITY REVIEW	J.I.M.	2019:03:15
1	SUBMISSION NO. 1 FOR CITY REVIEW	J.I.M.	2018:12:20

CANADA LANDS COMPANY
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Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2019/03/15
PROVINCE OF ONTARIO

N

Drawing Title

PONDING PLAN

Scale: 1:1000

Design	Date
K.H./S.T.	DECEMBER 2018
Drawn	**Checked**
M.M.	J.I.M.
Project No.	**Drawing No.**
118863	600

D07-16-15-0003

#17063

Velocity x Depth Calculation

Iteration equation:

Velocity:

$$v_x = v_{min} + \frac{Q_x - Q_{min}}{Q_{max} - Q_{min}} (v_{max} - v_{min})$$

Depth:

$$d_x = d_{min} + \frac{Q_x - Q_{min}}{Q_{max} - Q_{min}} (d_{max} - d_{min})$$

100 Year 3 Hour Chicago Storm

					SWMHYMO (118863VD.OUT)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (118863VD.OUT)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Static + Dynamic)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Depth (m)			Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S326	20	0.50	**44**	0.044	0.022	0.048	0.401	0.486	**0.473**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.053**	**0.025**	0.00	0.053
S318	20	0.60	**331**	0.331	0.234	0.334	0.773	0.845	**0.843**	N/A	N/A	N/A	N/A	**N/A**	0.095	0.109	**0.109**	**0.092**	0.00	0.109
S317A	20	0.63	**0**	0	0.000	0.001	0.000	0.216	**0.355**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.02	0.020
S300	20	0.60	**0**	0	0.000	0.001	0.000	0.211	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.13	0.130
S317	20	0.80	**2**	0.002	0.001	0.004	0.216	0.343	**0.258**	0.002	0.003	0.020	0.025	**0.020**	N/A	N/A	**N/A**	**0.005**	0.02	0.040
S301	20	0.90	**48**	0.048	0.030	0.065	0.538	0.652	**0.597**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.048**	**0.029**	0.00	0.048
S315A	20	0.90	**0**	0	0.000	0.001	0.000	0.259	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.08	0.080
S315	20	0.90	**6**	0.006	0.005	0.015	0.411	0.538	**0.335**	0.006	0.008	0.030	0.035	**0.031**	N/A	N/A	**N/A**	**0.010**	0.03	0.061
S302	20	0.90	**98**	0.098	0.065	0.117	0.652	0.756	**0.718**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.063**	**0.045**	0.00	0.063
S313	20	0.90	**0**	0	0.000	0.002	0.000	0.323	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.13	0.130
S316B	20	0.53	**19**	0.019	0.011	0.025	0.413	0.500	**0.463**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.049**	**0.023**	0.00	0.049
S316A	20	1.81	**38**	0.038	0.014	0.042	0.582	0.763	**0.737**	0.036	0.045	0.060	0.065	**0.061**	N/A	N/A	**N/A**	**0.045**	0.11	0.171
S315B	20	2.37	**66**	0.066	0.049	0.105	0.873	1.057	**0.929**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.045**	**0.042**	0.00	0.045
S201B	26	1.81	**108**	0.108	0.091	0.166	0.924	1.072	**0.802**	0.106	0.123	0.090	0.095	**0.091**	N/A	N/A	**N/A**	**0.073**	0.19	0.281
S314B	20	2.37	**54**	0.054	0.052	0.095	1.057	1.227	**1.065**	0.045	0.054	0.065	0.070	**0.070**	N/A	N/A	**N/A**	**0.074**	0.07	0.140
S314A	20	1.81	**89**	0.089	0.042	0.091	0.763	0.924	**0.917**	0.078	0.091	0.080	0.085	**0.084**	N/A	N/A	**N/A**	**0.077**	0.19	0.274
S312B	20	1.41	**0**	0	0.000	0.001	0.000	0.324	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.02	0.020
S312A	20	1.22	**0**	0	0.000	0.002	0.000	0.301	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.22	0.220
S310B	20	1.52	**0**	0	0.000	0.001	0.000	0.336	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.07	0.070
S311A	20	1.52	**49**	0.049	0.038	0.081	0.676	0.819	**0.713**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.045**	**0.032**	0.00	0.045
S310A	20	1.22	**0**	0	0.000	0.002	0.000	0.301	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.29	0.290
S302A	20	1.99	**43**	0.043	0.015	0.045	0.610	0.800	**0.787**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.040**	**0.032**	0.00	0.040
S311	20	1.99	**0**	0	0.000	0.002	0.000	0.325	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.07	0.070
S303	20	0.60	**8**	0.008	0.000	0.002	0.000	0.325	**1.300**	0.005	0.008	0.030	0.035	**0.035**	N/A	N/A	**N/A**	**0.045**	0.20	0.235
S304	20	0.60	**27**	0.027	0.024	0.053	0.439	0.532	**0.449**	0.027	0.034	0.055	0.060	**0.055**	N/A	N/A	**N/A**	**0.025**	0.08	0.135
S309	20	0.60	**46**	0.046	0.024	0.053	0.439	0.532	**0.510**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.052**	**0.026**	0.00	0.052
S308	20	1.84	**67**	0.067	0.053	0.096	0.532	0.617	**0.560**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.059**	**0.033**	0.00	0.059
S308A	20	0.71	**95**	0.095	0.053	0.096	0.532	0.617	**1.060**	0.086	0.100	0.085	0.090	**0.088**	N/A	N/A	**N/A**	**0.094**	0.26	0.348
S340	20	2.40	**50**	0.05	0.024	0.053	0.439	0.532	**0.522**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.054**	**0.028**	0.00	0.054
S176D	26	0.55	**71**	0.071	0.048	0.087	0.969	1.124	**1.060**	0.061	0.073	0.075	0.080	**0.079**	N/A	N/A	**N/A**	**0.084**	0.15	0.229
S319	20	1.25	**0**	0	0.000	0.001	0.000	0.211	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.24	0.240
S320	20	1.47	**50**	0.05	0.024	0.053	0.439	0.532	**0.522**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.054**	**0.028**	0.00	0.054
S322	20	1.11	**83**	0.083	0.053	0.096	0.532	0.617	**0.374**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.064**	**0.024**	0.00	0.064
S190	20	1.06	**50**	0.05	0.024	0.053	0.439	0.532	**0.731**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.054**	**0.039**	0.00	0.054
S190A	20	0.81	**24**	0.024	0.024	0.053	0.439	0.532	**0.760**	0.021	0.028	0.050	0.055	**0.052**	N/A	N/A	**N/A**	**0.040**	0.05	0.102
S190B	20	1.11	**370**	0.37	0.334	0.458	0.845	0.914	**0.400**	0.351	0.390	0.140	0.145	**0.142**	N/A	N/A	**N/A**	**0.057**	0.05	0.192
S191A	20	0.50	**420**	0.42	0.334	0.458	0.845	0.914	**0.893**	0.417	0.458	0.150	0.155	**0.150**	N/A	N/A	**N/A**	**0.134**	0.06	0.210
S191B	20	0.50	**32**	0.032	0.024	0.053	0.439	0.532	**0.465**	0.027	0.034	0.055	0.060	**0.059**	N/A	N/A	**N/A**	**0.027**	0.05	0.109
S191	20	2.00	**245**	0.245	0.234	0.334	0.773	0.845	**0.781**	N/A	N/A	N/A	N/A	**N/A**	0.095	0.109	**0.097**	**0.075**	0.00	0.097
S192	20	0.85	**275**	0.275	0.234	0.334	0.773	0.845	**0.803**	N/A	N/A	N/A	N/A	**N/A**	0.095	0.109	**0.101**	**0.081**	0.00	0.101
S193	20	2.00	**243**	0.243	0.234	0.334	0.773	0.845	**0.779**	0.229	0.255	0.120	0.125	**0.123**	N/A	N/A	**N/A**	**0.096**	0.15	0.273
S325	20	1.20	**19**	0.019	0.008	0.024	0.335	0.439	**0.407**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.037**	**0.015**	0.00	0.037

100 Year 3 Hour Chicago Storm

					SWMHYMO (118863VD.OUT)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (118863VD.OUT)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Static + Dynamic)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Depth (m)			Depth (m)					
			Qx (l/s)	**Qx (cms)**	**Qmin**	**Qmax**	**vmin**	**vmax**	**vx**	**Qmin**	**Qmax**	**dmin**	**dmax**	**dx**	**dmin**	**dmax**	**dx**	**(m^2/s)**	**(m)**	(m)
S206B	24	1.34	**10**	0.01	0.008	0.024	0.335	0.439	**0.348**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.029**	**0.010**	0.00	0.029
S201A1	26	1.01	**21**	0.021	0.008	0.024	0.335	0.439	**0.420**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.038**	**0.016**	0.00	0.038
S201A2	26	1.01	**25**	0.025	0.024	0.053	0.439	0.532	**0.442**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.041**	**0.018**	0.00	0.041
S202A	26	1.81	**99**	0.099	0.096	0.155	0.617	0.697	**0.621**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.069**	**0.043**	0.00	0.069
S203A	26	1.22	**195**	0.195	0.155	0.234	0.697	0.773	**0.735**	N/A	N/A	N/A	N/A	**N/A**	0.082	0.095	**0.089**	**0.065**	0.00	0.089
S204A	26	1.22	**56**	0.056	0.053	0.096	0.532	0.617	**0.538**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.056**	**0.030**	0.00	0.056
S205B	24	0.71	**10**	0.01	0.008	0.024	0.335	0.439	**0.348**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.029**	**0.010**	0.00	0.029
S205C	24	0.71	**37**	0.037	0.024	0.053	0.439	0.532	**0.481**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.047**	**0.023**	0.00	0.047
S231	20	0.53	**100**	0.1	0.096	0.155	0.617	0.697	**0.622**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.069**	**0.043**	0.00	0.069
S207	24	0.51	**162**	0.162	0.155	0.234	0.697	0.773	**0.704**	N/A	N/A	N/A	N/A	**N/A**	0.082	0.095	**0.083**	**0.059**	0.00	0.083
S176E	26	0.53	**25**	0.025	0.024	0.053	0.439	0.532	**0.442**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.041**	**0.018**	0.00	0.041
S312C	20	1.41	**93**	0.093	0.081	0.146	0.816	0.946	**0.840**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.057**	**0.048**	0.00	0.057
S316C	20	0.53	**42**	0.042	0.025	0.045	0.500	0.580	**0.568**	0.042	0.051	0.065	0.070	**0.065**	N/A	N/A	**N/A**	**0.037**	0.02	0.085
S300A	20	0.80	**13**	0.013	0.005	0.014	0.387	0.507	**0.494**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.039**	**0.019**	0.00	0.039
S301A	20	0.90	**13**	0.013	0.005	0.015	0.411	0.538	**0.513**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.038**	**0.020**	0.00	0.038
S304A	20	0.70	**16**	0.016	0.013	0.028	0.474	0.575	**0.494**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.044**	**0.022**	0.00	0.044

(shaded cell) For drainage areas with a sag that are defined by 1/2 of a ROW, flow has been multiplied by two for flow depth calculation

Velocity x Depth Calculation

Iteration equation:

Velocity:

$$v_x = v_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (v_{\max} - v_{\min})$$

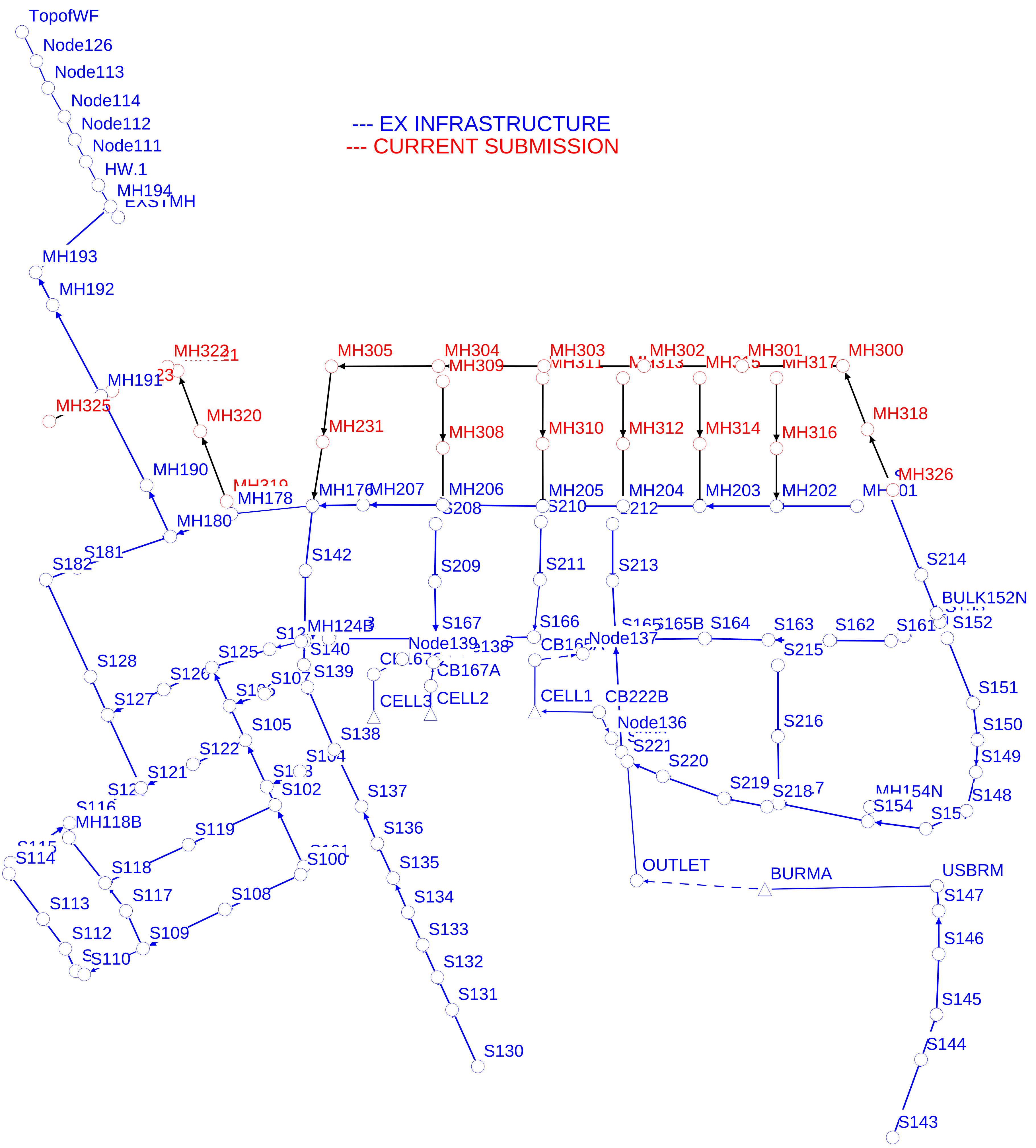
Depth:

$$d_x = d_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (d_{\max} - d_{\min})$$

100 Year 3 Hour Chicago Storm + 20%																				
					SWMHYMO (118863VD.OUT)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (118863VD.OUT)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Static + Dynamic)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Depth (m)			Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S326	20	0.50	**59**	0.059	0.048	0.087	0.486	0.564	**0.508**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.059**	**0.030**	0.00	0.059
S318	20	0.60	**498**	0.498	0.458	0.629	0.914	1.021	**0.939**	N/A	N/A	N/A	N/A	**N/A**	0.123	0.136	**0.126**	**0.118**	0.00	0.126
S317A	20	0.63	**0**	0.000	0.000	0.001	0.000	0.216	**0.379**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.02	0.020
S300	20	0.60	**24**	0.024	0.000	0.001	0.000	0.216	**5.184**	0.021	0.027	0.050	0.055	**0.053**	N/A	N/A	**N/A**	**0.273**	0.13	0.183
S317	20	0.80	**12**	0.012	0.004	0.013	0.343	0.450	**0.375**	0.012	0.016	0.040	0.045	**0.040**	N/A	N/A	**N/A**	**0.015**	0.02	0.060
S301	20	0.90	**69**	0.069	0.065	0.117	0.652	0.756	**0.660**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.056**	**0.037**	0.00	0.056
S315A	20	0.90	**0**	0.000	0.000	0.001	0.000	0.259	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.08	0.080
S315	20	0.90	**12**	0.012	0.005	0.015	0.411	0.538	**0.424**	0.012	0.016	0.040	0.045	**0.040**	N/A	N/A	**N/A**	**0.017**	0.03	0.070
S302	20	0.90	**137**	0.137	0.117	0.190	0.756	0.854	**0.783**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.072**	**0.056**	0.00	0.072
S313	20	0.90	**5**	0.005	0.002	0.013	0.323	0.512	**0.375**	0.003	0.006	0.025	0.030	**0.029**	N/A	N/A	**N/A**	**0.011**	0.13	0.159
S316B	20	0.53	**24**	0.024	0.011	0.025	0.413	0.500	**0.494**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.054**	**0.027**	0.00	0.054
S316A	20	1.81	**65**	0.065	0.042	0.091	0.763	0.924	**0.839**	0.054	0.065	0.070	0.075	**0.075**	N/A	N/A	**N/A**	**0.063**	0.11	0.185
S315B	20	2.37	**87**	0.087	0.049	0.105	0.873	1.057	**0.998**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.051**	**0.050**	0.00	0.051
S201B	26	1.81	**358**	0.358	0.270	0.407	1.211	1.342	**1.089**	0.323	0.362	0.135	0.140	**0.140**	N/A	N/A	**N/A**	**0.152**	0.19	0.330
S314B	20	2.37	**116**	0.116	0.095	0.154	1.227	1.386	**1.284**	0.106	0.123	0.090	0.095	**0.093**	N/A	N/A	**N/A**	**0.119**	0.07	0.163
S314A	20	1.81	**166**	0.166	0.095	0.154	1.227	1.386	**1.418**	0.160	0.181	0.105	0.110	**0.106**	N/A	N/A	**N/A**	**0.151**	0.19	0.296
S312B	20	1.41	**0**	0.000	0.000	0.001	0.000	0.324	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.02	0.020
S312A	20	1.22	**51**	0.051	0.035	0.075	0.626	0.759	**0.679**	0.043	0.053	0.065	0.070	**0.069**	N/A	N/A	**N/A**	**0.047**	0.22	0.289
S310B	20	1.52	**50**	0.050	0.042	0.076	0.847	0.983	**0.879**	0.045	0.054	0.065	0.070	**0.068**	N/A	N/A	**N/A**	**0.060**	0.07	0.138
S311A	20	1.52	**66**	0.066	0.038	0.081	0.676	0.819	**0.769**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.050**	**0.039**	0.00	0.050
S310A	20	1.22	**33**	0.033	0.012	0.035	0.478	0.626	**0.000**	0.028	0.035	0.055	0.060	**0.059**	N/A	N/A	**N/A**	**0.000**	0.29	0.349
S302A	20	1.99	**58**	0.058	0.045	0.096	0.800	0.969	**0.843**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.045**	**0.038**	0.00	0.045
S311	20	1.99	**0**	0.000	0.000	0.002	0.000	0.325	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.07	0.070
S303	20	0.60	**44**	0.044	0.024	0.053	0.439	0.532	**0.503**	0.042	0.051	0.065	0.070	**0.066**	N/A	N/A	**N/A**	**0.033**	0.20	0.266
S304	20	0.60	**47**	0.047	0.024	0.053	0.439	0.532	**0.513**	0.042	0.051	0.065	0.070	**0.068**	N/A	N/A	**N/A**	**0.035**	0.08	0.148
S309	20	0.60	**74**	0.074	0.053	0.096	0.532	0.617	**0.574**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.061**	**0.035**	0.00	0.061
S308	20	1.84	**137**	0.137	0.096	0.155	0.617	0.697	**0.673**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.078**	**0.052**	0.00	0.078
S308A	20	0.71	**272**	0.272	0.234	0.334	0.773	0.845	**1.287**	0.269	0.304	0.130	0.135	**0.130**	N/A	N/A	**N/A**	**0.168**	0.26	0.390
S340	20	2.40	**67**	0.067	0.053	0.096	0.532	0.617	**0.560**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.059**	**0.033**	0.00	0.059
S176D	26	0.55	**150**	0.150	0.141	0.213	1.270	1.407	**1.287**	0.132	0.150	0.100	0.105	**0.105**	N/A	N/A	**N/A**	**0.135**	0.15	0.255
S319	20	1.25	**0**	0.000	0.000	0.001	0.000	0.211	**0.000**	0.000	0.001	0.000	0.001	**0.000**	N/A	N/A	**N/A**	**0.000**	0.24	0.240
S320	20	1.47	**66**	0.066	0.053	0.096	0.532	0.617	**0.558**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.059**	**0.033**	0.00	0.059
S322	20	1.11	**115**	0.115	0.096	0.155	0.617	0.697	**0.475**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.073**	**0.034**	0.00	0.073
S190	20	1.06	**67**	0.067	0.053	0.096	0.532	0.617	**0.822**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.059**	**0.049**	0.00	0.059
S190A	20	0.81	**44**	0.044	0.024	0.053	0.439	0.532	**0.862**	0.043	0.053	0.065	0.070	**0.065**	N/A	N/A	**N/A**	**0.056**	0.05	0.115
S190B	20	1.11	**594**	0.594	0.458	0.629	0.914	1.021	**0.458**	0.562	0.610	0.165	0.170	**0.168**	N/A	N/A	**N/A**	**0.077**	0.05	0.218
S191A	20	0.50	**706**	0.706	0.629	0.836	1.021	1.142	**1.066**	0.687	0.738	0.180	0.185	**0.182**	N/A	N/A	**N/A**	**0.194**	0.06	0.242
S191B	20	0.50	**56**	0.056	0.053	0.096	0.532	0.617	**0.538**	0.051	0.061	0.070	0.075	**0.072**	N/A	N/A	**N/A**	**0.039**	0.05	0.122
S191	20	2.00	**409**	0.409	0.334	0.458	0.845	0.914	**0.887**	N/A	N/A	N/A	N/A	**N/A**	0.109	0.123	**0.117**	**0.104**	0.00	0.117
S192	20	0.85	**449**	0.449	0.334	0.458	0.845	0.914	**0.909**	N/A	N/A	N/A	N/A	**N/A**	0.109	0.123	**0.122**	**0.111**	0.00	0.122
S193	20	2.00	**419**	0.419	0.334	0.458	0.845	0.914	**0.892**	0.402	0.443	0.145	0.150	**0.147**	N/A	N/A	**N/A**	**0.131**	0.15	0.297
S325	20	1.20	**24**	0.024	0.334	0.458	0.845	0.914	**0.673**	N/A	N/A	N/A	N/A	**N/A**	0.109	0.123	**0.074**	**0.050**	0.00	0.074
S206B	24	1.34	**12**	0.012	0.008	0.024	0.335	0.439	**0.361**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.031**	**0.011**	0.00	0.031
S201A1	26	1.01	**27**	0.027	0.024	0.053	0.439	0.532	**0.449**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.042**	**0.019**	0.00	0.042

S201A2	26	1.01	**32**	0.032	0.024	0.053	0.439	0.532	**0.465**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.045**	**0.021**	0.00	0.045
S202A	26	1.81	**255**	0.255	0.234	0.334	0.773	0.845	**0.788**	N/A	N/A	N/A	N/A	**N/A**	0.095	0.109	**0.098**	**0.077**	0.00	0.098
S203A	26	1.22	**438**	0.438	0.334	0.458	0.845	0.914	**0.903**	N/A	N/A	N/A	N/A	**N/A**	0.109	0.123	**0.121**	**0.109**	0.00	0.121
S204A	26	1.22	**71**	0.071	0.053	0.096	0.532	0.617	**0.568**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.060**	**0.034**	0.00	0.060
S205B	24	0.71	**13**	0.013	0.008	0.024	0.335	0.439	**0.368**	N/A	N/A	N/A	N/A	**N/A**	0.027	0.041	**0.031**	**0.012**	0.00	0.031
S205C	24	0.71	**46**	0.046	0.024	0.053	0.439	0.532	**0.510**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.052**	**0.026**	0.00	0.052
S231	20	0.53	**135**	0.135	0.096	0.155	0.617	0.697	**0.670**	N/A	N/A	N/A	N/A	**N/A**	0.068	0.082	**0.077**	**0.052**	0.00	0.077
S207	24	0.51	**308**	0.308	0.234	0.334	0.773	0.845	**0.826**	N/A	N/A	N/A	N/A	**N/A**	0.095	0.109	**0.105**	**0.087**	0.00	0.105
S176E	26	0.53	**32**	0.032	0.024	0.053	0.439	0.532	**0.465**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.045**	**0.021**	0.00	0.045
S312C	20	1.41	**131**	0.131	0.081	0.146	0.816	0.946	**0.916**	N/A	N/A	N/A	N/A	**N/A**	0.055	0.068	**0.065**	**0.060**	0.00	0.065
S316C	20	0.53	**66**	0.066	0.045	0.073	0.580	0.655	**0.636**	0.061	0.073	0.075	0.080	**0.077**	N/A	N/A	**N/A**	**0.049**	0.02	0.097
S300A	20	0.80	**16**	0.016	0.014	0.030	0.507	0.614	**0.520**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.043**	**0.022**	0.00	0.043
S301A	20	0.90	**16**	0.016	0.015	0.032	0.538	0.652	**0.545**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.042**	**0.023**	0.00	0.042
S304A	20	0.70	**20**	0.020	0.013	0.028	0.474	0.575	**0.521**	N/A	N/A	N/A	N/A	**N/A**	0.041	0.055	**0.048**	**0.025**	0.00	0.048

For drainage areas with a sag that are defined by 1/2 of a ROW, flow has been multiplied by two for flow depth calculation



SWMM

Version 9.12

Wateridge Village Phase 2A 2B

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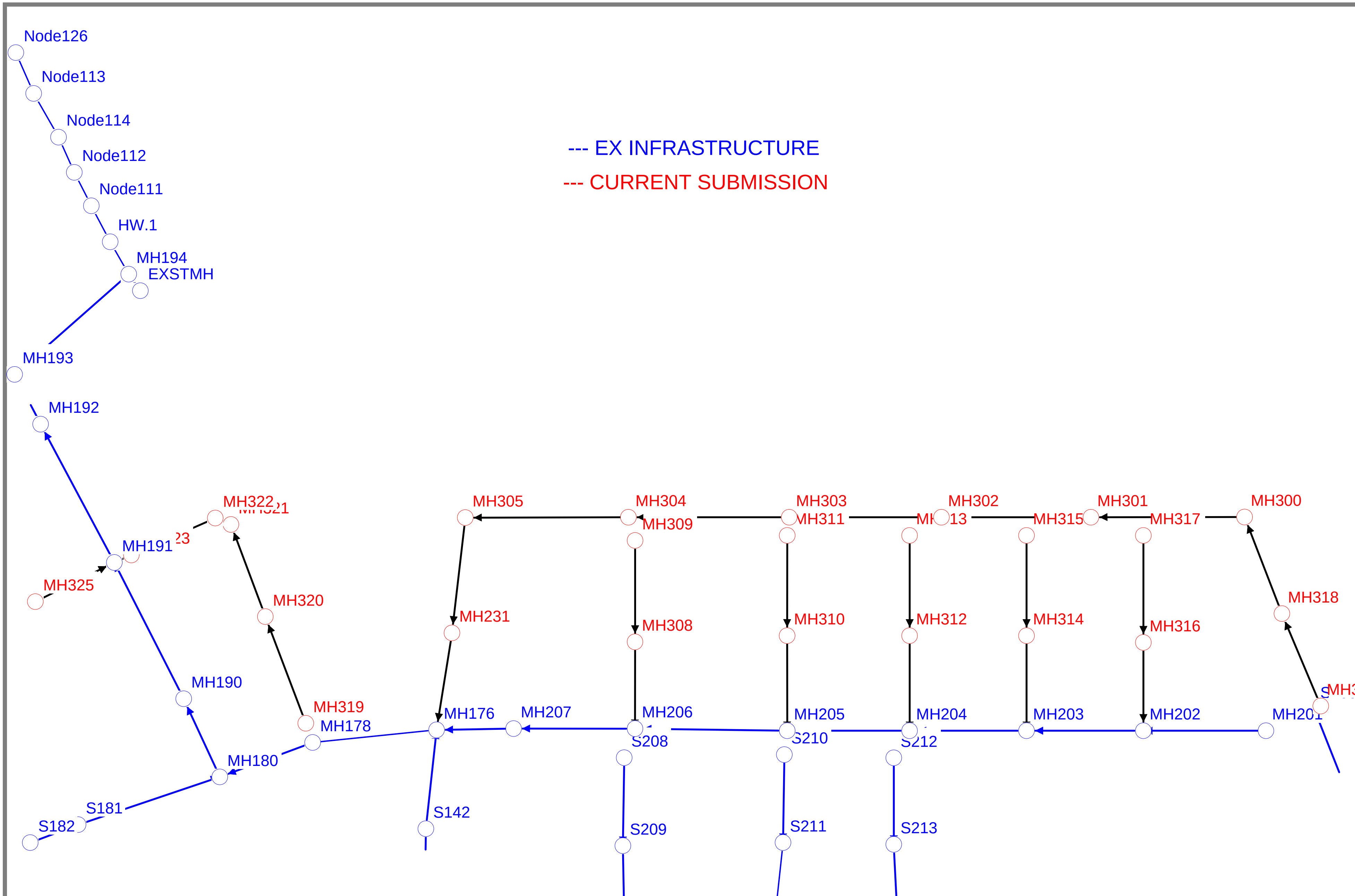
03/08/19



SWMM

Version 9.12

Wateridge Village Phase 2A 2B

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03/08/19

HGL

XPSWMM NODE ID	PROPOSED GROUND ELEVATION (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%		100 YEAR 24 HOUR SCS TYPE II		JULY 1 1979		AUGUST 1988		AUGUST 1996	
			HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)
Phase 2B														
MH317	94.08	91.88	91.16	0.72	91.18	0.70	91.14	0.74	91.15	0.73	91.14	0.74	91.11	0.77
MH316	94.09	91.89	90.96	0.93	90.96	0.93	90.94	0.95	90.95	0.94	90.94	0.95	90.92	0.97
MH315	93.39	91.36	90.27	1.09	90.29	1.07	90.24	1.12	90.24	1.12	90.28	1.08	90.22	1.14
MH314	93.00	91.16	89.90	1.26	89.91	1.25	89.90	1.26	89.91	1.25	89.91	1.25	89.89	1.27
MH313	92.62	90.71	89.34	1.37	89.35	1.36	89.34	1.37	89.34	1.37	89.34	1.37	89.33	1.38
MH312	91.36	89.68	88.41	1.27	88.42	1.26	88.41	1.27	88.41	1.27	88.42	1.26	88.38	1.30
MH311	90.69	88.49	87.38	1.11	87.44	1.05	87.33	1.16	87.34	1.15	87.39	1.10	87.34	1.15
MH310	90.04	87.84	86.94	0.90	87.25	0.59	86.83	1.01	86.84	1.00	86.85	0.99	86.80	1.04
MH309	90.15	87.95	87.29	0.66	87.32	0.63	87.18	0.77	87.19	0.76	87.19	0.76	87.11	0.84
MH308	89.68	87.48	86.65	0.83	86.65	0.83	86.59	0.89	86.61	0.87	86.61	0.87	86.56	0.92
MH326	94.76	92.56	91.33	1.23	91.33	1.23	91.32	1.24	91.32	1.24	91.32	1.24	91.33	1.24
MH318	94.40	92.20	91.03	1.17	91.03	1.17	91.00	1.20	91.00	1.20	91.00	1.20	91.00	1.20
MH300	94.00	91.80	90.71	1.09	90.70	1.10	90.67	1.13	90.68	1.12	90.68	1.12	90.68	1.12
MH301	93.73	91.53	90.20	1.33	90.21	1.32	90.20	1.33	90.20	1.33	90.20	1.33	90.20	1.33
MH302	92.80	90.60	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97
MH303	90.67	88.47	87.69	0.78	87.85	0.62	87.59	0.88	87.68	0.79	87.66	0.81	87.62	0.85
MH304	90.30	88.10	87.32	0.78	87.44	0.66	87.27	0.83	87.32	0.78	87.31	0.79	87.29	0.81
MH305	91.00	88.80	86.81	1.99	86.91	1.89	86.70	2.10	86.79	2.01	86.72	2.08	86.71	2.09
Phase 2A														
MH319	88.81	86.61	86.21	0.40	86.58	0.03	85.82	0.79	85.83	0.78	85.92	0.69	85.77	0.84
MH320	88.77	86.57	85.16	1.41	85.23	1.34	85.09	1.48	85.09	1.48	85.11	1.46	85.08	1.49
MH321	87.67	85.47	84.46	1.01	84.51	0.96	84.40	1.07	84.40	1.07	84.42	1.05	84.39	1.08
MH322	87.50	85.30	84.15	1.15	84.19	1.11	84.11	1.19	84.11	1.19	84.12	1.18	84.10	1.20
MH323	86.57	84.37	83.19	1.18	83.28	1.09	83.11	1.26	83.11	1.26	83.13	1.24	83.09	1.28
MH325	86.19	83.99	83.14	0.85	83.14	0.85	83.13	0.86	83.13	0.86	83.13	0.86	83.13	0.86
Existing Phase 1B Trunk														
MH201	94.29	91.89	90.72	1.17	90.73	1.16	90.72	1.17	90.72	1.17	90.72	1.17	90.71	1.18
MH202	93.91	91.51	90.42	1.09	90.43	1.08	90.41	1.10	90.41	1.10	90.41	1.10	90.39	1.12
MH203	92.38	89.98	88.65	1.33	88.68	1.30	88.63	1.35	88.63	1.35	88.64	1.34	88.60	1.38
MH204	90.40	88.00	87.07	0.93	87.10	0.90	87.05	0.95	87.06	0.94	87.06	0.94	87.02	0.98
MH205	89.35	86.95	85.80	1.15	85.85	1.10	85.77	1.18	85.78	1.17	85.79	1.16	85.72	1.23
MH206	89.10	86.70	85.59	1.11	85.62	1.08	85.56	1.14	85.57	1.13	85.57	1.13	85.52	1.18
MH207	88.53	86.13	84.60	1.53	84.63	1.50	84.58	1.55	84.58	1.55	84.59	1.54	84.54	1.59
MH231	89.81	87.41	85.81	1.59	85.83	1.58	85.70	1.70	85.80	1.61	85.74	1.67	85.70	1.70
Existing Phase 1A Trunk														
MH176	88.03	85.63	83.77	1.86	83.86	1.77	83.67	1.96	83.75	1.88	83.72	1.91	83.48	2.15
MH178	89.00	86.60	83.41	3.19	83.48	3.12	83.32	3.28	83.40	3.20	83.37	3.23	83.16	3.44
MH180	88.23	N/A	82.21	N/A	82.69	N/A	81.93	N/A	82.20	N/A	82.07	N/A	81.46	N/A
MH190	86.96	N/A	81.91	N/A	82.16	N/A	81.65	N/A	81.90	N/A	81.78	N/A	81.22	N/A
MH191	86.36	N/A	81.68	N/A	81.88	N/A	81.43	N/A	81.67	N/A	81.55	N/A	81.06	N/A
MH192	85.76	N/A	81.41	N/A	81.60	N/A	81.21	N/A	81.41	N/A	81.30	N/A	80.89	N/A
MH193	84.99	N/A	81.09	N/A	81.24	N/A	80.91	N/A	81.08	N/A	80.99	N/A	80.60	N/A
MH194	82.05	N/A	80.44	N/A	80.53	N/A	80.34	N/A	80.45	N/A	80.39	N/A	80.12	N/A

May 13th, 2018
Ref No. 65578.1

To:	**Jean Lachance, Canada Lands Company (CLC)**
From:	**Chris Denich, M.Sc., Aquafor Beech Ltd., Meaghan Dustin, E.I.T., Aquafor Beech Ltd.**
Re:	**Wateridge Phase 2B Developer's Checklist**

1.0 Phase 2B

Wateridge Village Phase 2B includes 12 development blocks located between Codd's Road and Wanaki Road to the west and east, and Tawadina Road and Hemlock Road to the north and south. The land-use within this block includes semi-detached singles, townhouse blocks, low-rise residential, mid-rise residential, mid-rise mixed-use, and parks.

As part of the Wateridge Village low impact development (LID) Demonstration project, this phase will include stormwater management treatment strategies that maximize pervious surfaces and increase infiltration and groundwater recharge through a combination of lot-level (source), conveyance and end-of-pipe stormwater management controls.

The following sections outline the stormwater criteria the developer is required to meet with the implementation of LID measures. The testing requirements necessary for design and implementation are also described. Finally, LIDs recommended to be incorporated within Phase 2B are summarized.

2.0 SWM Criteria

All LID measures implemented in Phase 2B of the Wateridge Village development shall be designed to achieve the infiltration, erosion, and water quality design targets summarized in **Table 2.1**. These targets represent minimum volumes to achieve water balance (infiltration), water quality, and erosion controls.

All landscaped areas (turf or garden) will require Topsoil Amendments per Option 1 or Option 2; these options are outlined in **Appendix B**.

Table 2.1 LID Design Targets

LID Design Targets		
Infiltration*	**Erosion***	**Water Quality†**
LID Infiltration target = 4mm Maintain groundwater recharge per the existing conditions water budget. Groundwater recharge includes hydrological connection and linkages to wetlands, woodlots, streams and other natural features. LID lot-level and conveyance controls shall infiltrate an equivalent volume a 4mm event applied to the full catchment area.	LID Erosion Control Target = 4mm LID lot-level and conveyance controls shall match the existing conditions water balance through the application of the infiltration targets in order to reduce or eliminate the effects of hydro-modification (magnitude, duration and frequency) form the contributing drainage area. As such the infiltration targets shall be considered the erosion control targets for LID controls.	Min. Target = 15mm The minimum water quality event for LID lot-level and conveyance controls for the Former CFB Rockcliffe shall be the 15mm event. LID controls shall treat the runoff from a 15mm event through filtration, detention, evapotranspiration, detention and release and infiltration. Drainage areas which achieve the minimum 15mm water quality target shall be required to discharge to another LID in the treatment train and or an end-of-pipe pond to achieve the full enhanced level of control per the MOE SWMPD. Enhanced Target = 25mm To achieve the enhanced level of control, per the MSS, the target water quality event for LID lot-level and conveyance controls shall be the 25mm event. LID controls shall treat the runoff from a 25mm event through filtration, detention, evapotranspiration, detention and release and infiltration. Drainage areas which achieve the enhanced water quality target do not require treatment in an end-of-pipe facility.
*Catchment Based Target – target applied over the full catchment area †Contributing Impervious Area Target – applied to the directly contributing impervious area to the LID control and should focus on the "treatment" of the required event through a combination of filtration, storage and release, evaporation and infiltration. Note: the water quality target shall include the required water balance (infiltration) targets i.e. water quality treatment = 15mm water quality event – 4mm infiltration/erosion target.		

3.0 Testing Requirements

The implementation of LIDs requires a geotechnical assessment (including groundwater monitoring) and infiltration tests to determine the in-situ conditions prior to design.

3.1 Geotechnical Assessment

A soils report will be required to accompany the design of all infiltration facilities to ensure adequate soil permeability and depth to the seasonally high water table. This report should include:

- Borehole information, including soil stratigraphy, composition, grain-size and chemical analysis (additional testing may be required for individual LID techniques per the requirement of the Low Impact Development Stormwater Management Planning and Design Guide, Version 1.0 (TRCA/CVC - 2010); number of boreholes can range from 2 to greater than 20 based on size of facility and site specific conditions. Boreholes should be extended a minimum of 1.5m below the proposed invert of the proposed LID facility.
- Geotechnical assessment will generally include:
  - particle size distribution (ASTM D422 and D2217),
  - Stratigraphy, Piezometer(s) and Standpipes –to determine seasonally high (March – April or Late fall before snowfall) groundwater elevation information per O.Reg 389/09 natural moisture content (ASTM D2216),
  - plasticity characteristics (ASTM D4318),
  - soil strength assessment (CBR and Soaked CBR) for permeable pavement designs.

The scope of the geotechnical assessment shall be determined based on the need to confirm that the following conditions are not present. The following conditions are considered unsuitable or may increase facility failure rate for infiltration based controls.

1. Slopes ≥20% and contributing catchment area slopes ≥15%;
2. Seasonally-high water table elevations that are within 1.0-0.60 metre of the bottom of proposed infiltration based facilities;
3. Bedrock within 1 metre of the bottom of the proposed infiltration facility;
4. Wetlands and associated hydric soils;
5. Proposed Land uses that are classified as potential "hot spots";
6. Drinking water wells within 30 metres; and
7. Karst topography.

It is not anticipated that conditions 1, 6 or 7 above will be of concern.

3.2 Infiltration Testing

For design purposes, the preferred approach to measure field saturated hydraulic conductivity (Kfs) at a subject site include:

- Guelph Permeameter
- Double Ring Infiltrometers (constant head)
- Single ring (constant head pressure)

At least one (1) test will be required at 2 soil depths for each 450m^2 footprint surface area at each location. **Note: Infiltration rates derived from borehole analysis, T-test, slug or other generalized test shall not be accepted for design purposes.** All infiltration testing should be completed per Appendix C of the TRCA/CVC LID Planning and Design Guide (2010). Based on in-situ soil testing of previous phases, it is anticipated that the soils tested in Phase 2B will have a field saturated hydraulic conductivity below 15mm/hr and therefore will require the installation of a underdrain per the TRCA/CVC LID Stormwater Planning and Design Guide (2010).

4.0 Recommended LID Types

The Draft Wateridge Village Phases 2B - Master Concept Plan (Appendix A) displays the proposed land-use in Phase 2B; including: low & medium rise residential and mixed-use, parks, and municipal ROW. Error! Reference source not found. summarizes suitable LID measures by each land use.

Table 4.1 Low Impact Development (LID) Suitability Matrix by Land-Use

		Phase 2B Proposed Land-Uses			
		Low & Medium Rise Residential	Low and Medium Rise Mixed-Use	Schools & Parks	Municipal ROW
	Assumed Lot Coverage	50-60%	80-100%	10-30%	n/a
LID Type					
Lot-Level Controls	Green Roofs	□	□	n/a	n/a
	Bioretention	□□	□□	□□□	□□□
	Rainwater Harvesting	□	□	n/a	n/a
	Soakaways, Trenches & Chambers	□□□	□□□	□□□	n/a
	Downspout Disconnection	□□□	□□□	n/a	n/a
	Soil Amendments	□□□	□□□	□□□	n/a
	Permeable Pavements	□□	□□	□□	See Conveyance Controls
	Infiltration Basins	n/a	n/a	□□□	n/a
Conveyance Controls	Vegetated/Grass Swales	n/a	n/a	□	□□
	Bioswales/Biofilters	n/a	n/a	□□	□□□
	Perforated Pipes	n/a	n/a	□	□□
	Permeable Pavements	n/a	n/a	□□	□□□

*Assumed lot coverage indicates percentage of development with hard surface land cover

□□□ **= Highly Suitable,** □□ **= Suitable,** □ **= Poor Suitability,** n/a **= Not Applicable**

In areas where infiltration is not possible, i.e. over underground parking structures, runoff can be collected using ditch inlets, catch basins, or eavestroughs for roof surfaces and conveyed via pipe to an infiltration system or end-of-pipe facility.

Based on the land-use proposed in the Master Concept Plan for Phase 2B, the following LIDs can be implemented in Phase 2B:

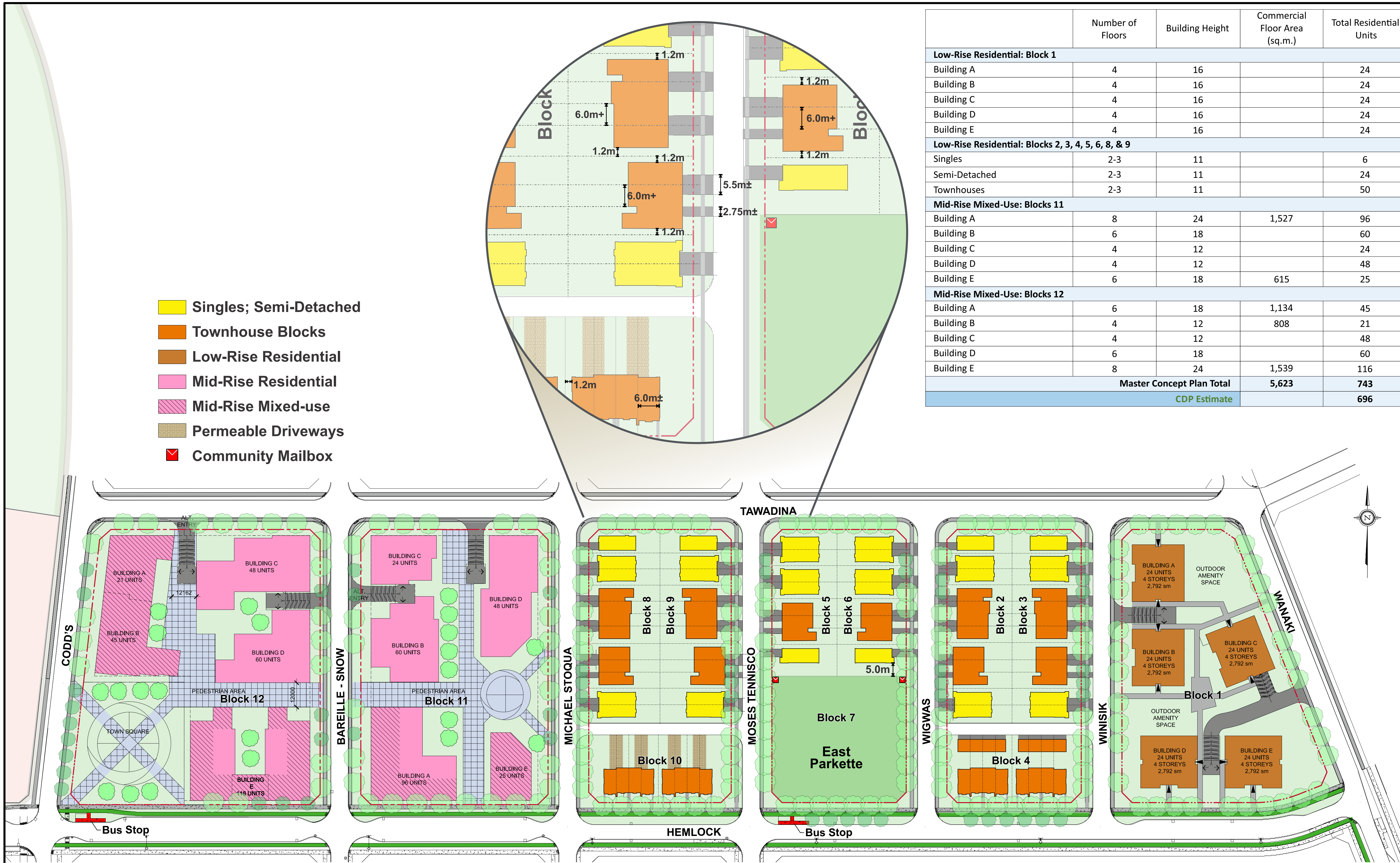
- Soakaways, Trenches & Chambers
- Downspout Disconnection
- Soil Amendments
- Bioretention

- Infiltration Basins
- Bioswales/Biofilters
- Permeable Pavements
- Vegetated/Grass Swales
- Perforated Pipe

Relevant resources detailing the constraints, implementation, construction, and monitoring of all suitable LID measures are included in **Appendix C**. These resources also include the Stormwater Management Planning and Design Manual, background groundwater information, permitting requirements, and monitoring and costing information.

Appendix A: Draft Wateridge Village Phases 2B - Master Concept Plan

	Number of Floors	Building Height	Commercial Floor Area (sq.m.)	Total Residential Units
Low-Rise Residential: Block 1				
Building A	4	16		24
Building B	4	16		24
Building C	4	16		24
Building D	4	16		24
Building E	4	16		24
Low-Rise Residential: Blocks 2, 3, 4, 5, 6, 8, & 9				
Singles	2-3	11		6
Semi-Detached	2-3	11		24
Townhouses	2-3	11		50
Mid-Rise Mixed-Use: Blocks 11				
Building A	8	24	1,527	96
Building B	6	18		60
Building C	4	12		24
Building D	4	12		48
Building E	6	18	615	25
Mid-Rise Mixed-Use: Blocks 12				
Building A	6	18	1,134	45
Building B	4	12	808	21
Building C	4	12		48
Building D	6	18		60
Building E	8	24	1,539	116
		Master Concept Plan Total	**5,623**	**743**
		CDP Estimate		696



PHASE 2B

Canada Lands Company
Société immobilière du Canada
PARSONS

Wateridge Village Phase 2B - Master Concept Plan

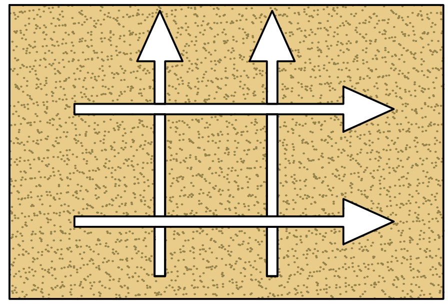
April, 2019

Appendix B: Topsoil Amendment Options

OPTION 1
On-Site Soil Amendment - Default Ratio 3:1
All Building Types

Materials

- Amend existing site topsoil using 3:1 ratio by volume (3 parts existing topsoil, 1 part amendment material)
- Amendment Material: organic matter primarily leaf, yard and bark waste compost of 20-30% by dry weight as determined by Loss-on-Ignition (LOI) and a pH of 6.0 to 8.0
- No uncomposted manure or other organic materials, sphagnum peat or organic amendments that contain sphagnum peat



Detail No.1 - Perpendicular Native Soil Ripping Pattern

Placement and Amendments

1. Remove existing topsoil and preserve on-site.
2. Rip native subsoil (decompaction) using the teeth of an excavator or bobcat bucket or equivalent to a depth of 100-200mm. Rip using a perpendicular pattern (See Detail No.1) ensuring full site coverage. No ripping within tree protection areas (See Detail No.2) or within 3m of building foundations (See Detail No.3).
3. Amend existing site topsoil to meet post construction soil amendment requirements using 3:1 ratio by volume (topsoil : amendment material).
4. Two (2) methods for amending the existing soils in place are acceptable:

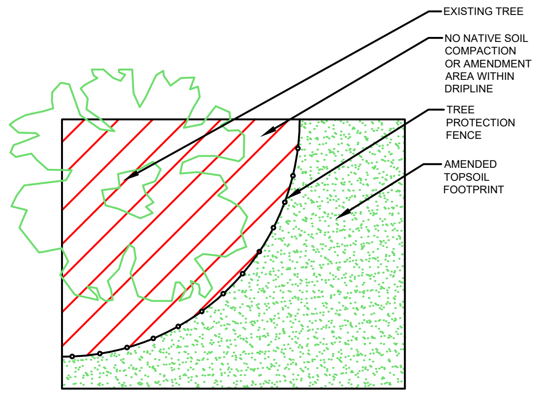
   Method No.1 - Layer and Incorporate (Detail No.4)

   i. Apply 100mm of existing site topsoil followed by 50mm of amendment material and incorporate/mix amended material.
   ii. Lightly roll or smooth using the back of the machinery bucket.
   iii. Repeat i. and ii.
   iv. Adjust layer quantities to ensure a settled amended topsoil depth of 300m and compliance with site grading. Placement should account for 10% settlement.

   Method No.2 - Mechanical or Bucket Mix

   i. Successively add, mix and pile one (1) unit of amendment material with three (3) units of existing site topsoil.
   ii. Thoroughly mix.
   iii. Repeat i. and ii to ensure thorough mixing until required volume is achieved.
   iv. Place 150mm of amended topsoil, lightly roll or smooth using the back of the machinery bucket.
   v. Repeat iv.
   vi. Adjust layer quantities to ensure a settled amended topsoil depth of 300m and compliance with site grading.

   Amended topsoil should be wetted after application, allowed to settle for a minimum of one (1) week and grades adjusted as required prior to installation of turf.

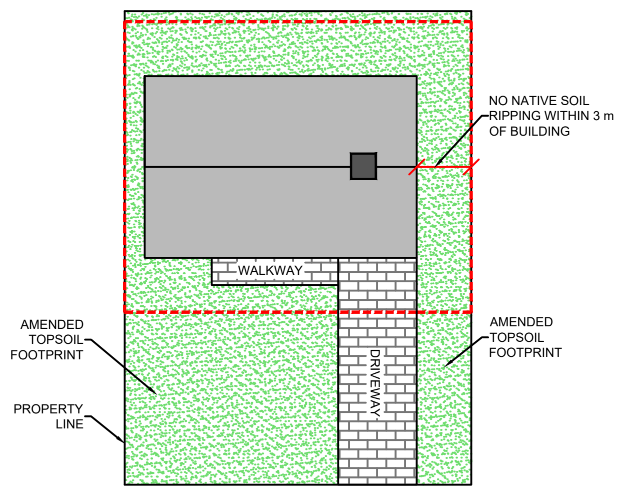


Detail No.2 - No Native Soil Ripping within Tree Protection Areas or Amendment

-IMPORTANT-

Documentation Requirements

As part of verification, the owners shall produce delivery tickets, receipts and specifications detailing the delivery address, quantities and product description and sources for verification by City inspectors. Delivery address is to be listed and must correspond to the property/site being inspected. Site without proper documentation may be subject to additional verification procedures including laboratory testing at the expense of the owner. The owner's engineer shall provide a duly notarized letter with all supporting documentation certifying the proper installation and placement of amended soil.



Detail No.3 - No native soil ripping within 3.0m of Building Foundation (Amendment Only)

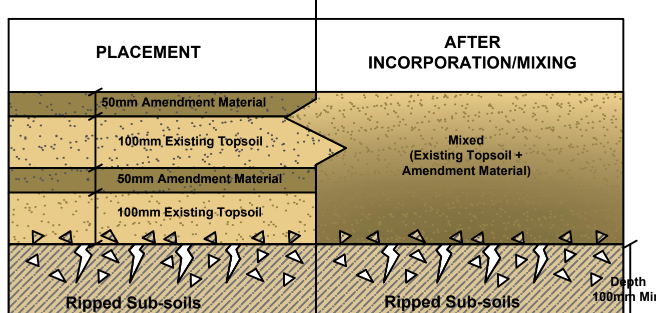
Consultant Verification/Inspection

Verification may occur after the minimum one (1) week settlement period. Verification is suggested prior to turf placement. Non-compliant sites shall be rectified at the expense of the owner.

At random, the Developer's consultant shall dig at least one (1) test hole to verify amended topsoil depth and uncompacted soil depths.

Requirements:

1. Amended topsoil layer shall be easily dug using only the inspector's weight or cored without other mechanical assistance.
2. The amended topsoil layer shall be darker in color than the unamended- ripped subsoil and particles of organic matter should be easily visible.
3. Measured amended topsoil depths shall be deemed to be in conformance based on the following:
   - Using a common garden spade, the measured depth of amended topsoil shall be equal to the required 300mm depth (±25mm)
   - Using a small diameter coring unit, the measured core depth of amended topsoil shall be equal to the required 300mm depth (±50mm)

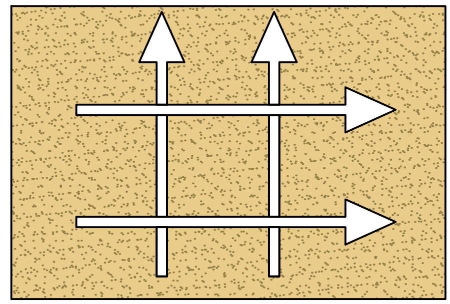


Detail No.4 Amendment Method No. 1

OPTION 2
On-Site Soil Amendment
Import and Replace Topsoil with Amendment Material
All Building Types and Parks

Materials

- Amendment material shall be obtained from a Compost Quality Assurance (CQA) licensed and OMOE/ CCME approved facility and shall comply with the Category "A" compost designation. The amendment material must contain:
  - Organic matter primarily leaf, yard and bark waste compost of 8-15% by dry weight as determined by Loss-on-Ignition (LOI) and a pH of 6.0 to 8.0.
  - No uncomposted manure or other organic materials, sphagnum peat or organic amendments that contain sphagnum peat.

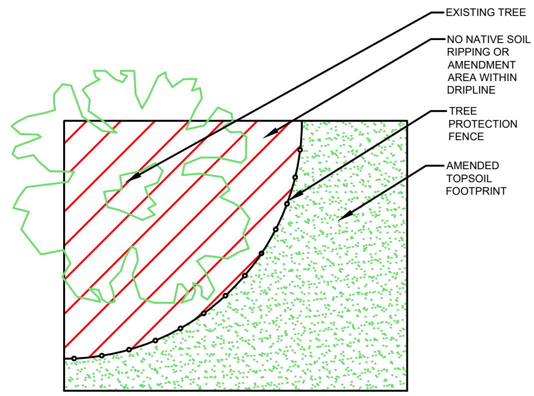


Detail No.1 - Perpendicular Native Soil Ripping Pattern

Placement and Amendments

1. Remove existing topsoil and dispose off-site in accordance with OPSS 206 and OPSS 180, O. Reg. 153/06, the Environmental Protection Act or municipal by-laws and policies, whichever supersedes.
2. Rip native subsoil (decompaction) using the teeth of an excavator or bobcat bucket or equivalent to a native subsoil at depth of 100-200mm. Rip using a perpendicular pattern (See Detail No.1) ensuring full site coverage. No ripping within tree protection areas (See Detail No.2) or within 3m of building foundations (See Detail No.3).
3. Import pre-mixed amended topsoil (300mm depth of coverage required).
4. Place imported pre-mixed amended topsoil in 150mm lifts, lightly roll or smooth using machinery bucket and repeat. Adjust layer quantities to ensure a settled amended topsoil depth of 300mm and compliance with site grading. (See Detail No.4).

Amended topsoil should be wetted after application, allowed to settle for a minimum of one (1) week and grades adjusted as required prior to installation of turf.



Detail No.2 - No Native Soil Ripping within Tree Protection Areas or Amendment

-IMPORTANT-

Documentation Requirements

As part of verification, the owners shall produce delivery tickets, receipts and specifications detailing the delivery address, quantities and product description and sources for verification by City inspectors. Delivery address is to be listed and must correspond to the property/site being inspected. Sites without proper documentation may be subject to additional verification procedures including laboratory testing at the expense of the owner. The owner's engineer shall provide a duly notarized letter with all supporting documentation certifying the proper installation and placement of amended soil.

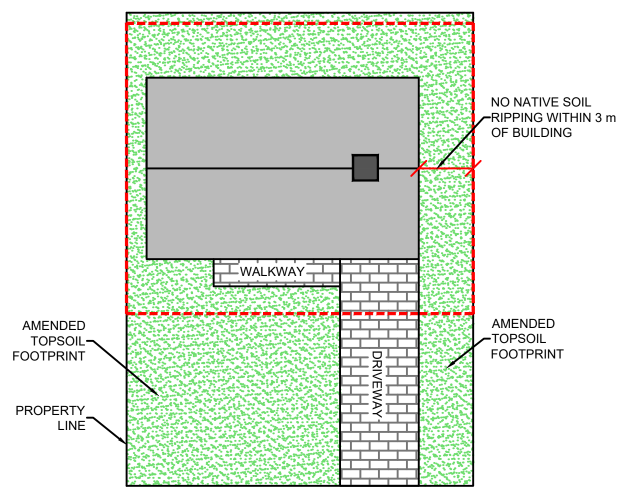
Consultant Verification/Inspection

Verification may occur after the minimum one (1) week settlement period. Verification is suggested prior to turf placement. Non-compliant sites shall be rectified at the expense of the owner

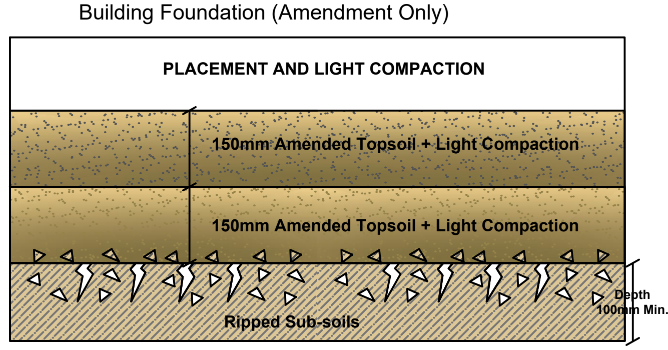
At random, the Developer's consultant shall dig at least one (1) test hole to verify amended topsoil depth and uncompacted soil depths.

Requirements:

1. Amended topsoil layer shall be easily dug using only the inspector's weight or cored without other mechanical assistance.
2. The amended topsoil layer shall be darker in color than the unamended- ripped subsoil and particles of organic matter should be easily visible.
3. Measured amended topsoil depths shall be deemed to be in conformance based on the following:
   - Using a common garden spade, the measured depth of amended topsoil shall be equal to the required 300mm depth (±25mm)
   - Using a small diameter coring unit, the measured core depth of amended topsoil shall be equal to the required 300mm depth (±50mm)



Detail No.3 - No Native Soil Ripping within 3.0m of Building Foundation (Amendment Only)

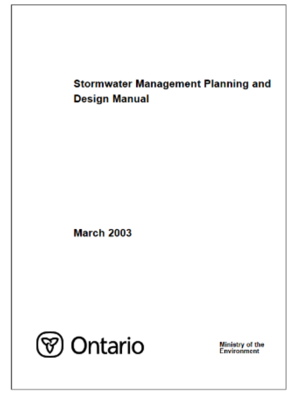
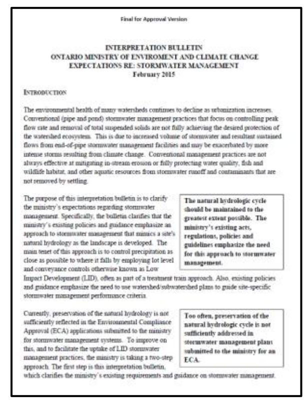
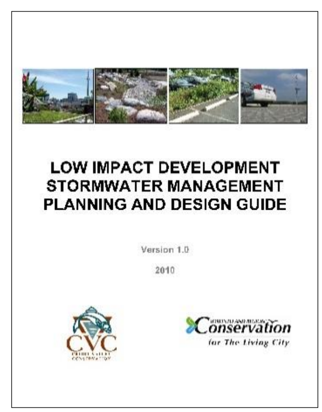


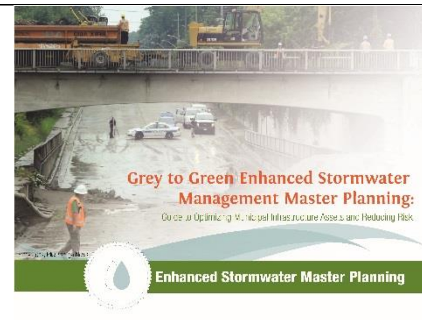
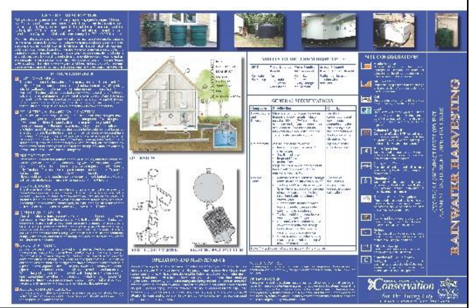
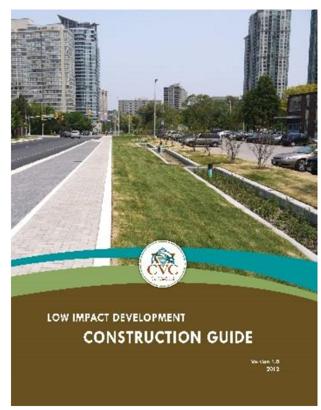
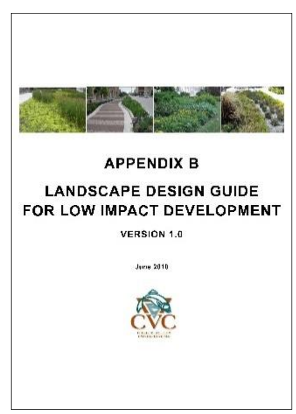
Detail No.4 Placement and Compaction Lifts for Amended Topsoil

Appendix C: Resource Directory

May 13th, 2018
Ref No. 65578.1

Resource Directory

Provincial Manual	**Stormwater Management Planning and Design Manual (MOE, 2003)** https://www.ontario.ca/document/stormwater-management-planning-and-design-manual-0	
Interpretation Bulletin	**Interpretation Bulletin Ontario Ministry of Environment and Climate Change Expectation Re: Stormwater Management (MOE, 2015)** http://www.raincommunitysolutions.ca/wp-content/uploads/2015/07/MOECC-interpretation-bulletin-re-stormwater-management.pdf	 Final for Approval Version INTERPRETATION BULLETIN ONTARIO MINISTRY OF ENVIROMENT AND CLIMATE CHANGE EXPECTATIONS RE: STORMWATER MANAGEMENT February 2015 INTRODUCTION The environmental health of many watersheds continues to decline as urbanization increases. Conventional (pipe and pond) stormwater management practices that focus on controlling peak flow rate and removal of total suspended solids are not fully achieving the desired protection of the watershed ecosystem. This is due to increased volume of stormwater and resultant sustained flows from end-of-pipe stormwater management facilities and may be exacerbated by more intense storms resulting from climate change. Conventional management practices are not always effective at mitigating in-stream erosion or fully protecting water quality, fish and wildlife habitat, and other aquatic resources from stormwater runoff and contaminants that are not removed by settling. The purpose of this interpretation bulletin is to clarify the ministry's expectations regarding stormwater management. Specifically, the bulletin clarifies that the ministry's existing policies and guidance emphasize an approach to stormwater management that mimics a site's natural hydrology as the landscape is developed. The main tenet of this approach is to control precipitation as close as possible to where it falls by employing lot level and conveyance controls otherwise known as Low Impact Development (LID), often as part of a treatment train approach. Also, existing policies and guidance emphasize the need to use watershed/subwatershed plans to guide site-specific stormwater management performance criteria. **The natural hydrologic cycle should be maintained to the greatest extent possible. The ministry's existing acts, regulations, policies and guidelines emphasize the need for this approach to stormwater management.** Currently, preservation of the natural hydrology is not sufficiently reflected in the Environmental Compliance Approval (ECA) applications submitted to the ministry for stormwater management systems. To improve on this, and to facilitate the uptake of LID stormwater management practices, the ministry is taking a two-step approach. The first step is this interpretation bulletin, which clarifies the ministry's existing requirements and guidance on stormwater management. **Too often, preservation of the natural hydrologic cycle is not sufficiently addressed in stormwater management plans submitted to the ministry for an ECA.**
Planning and Design Guide	**Low Impact Development Stormwater Management Planning and Design Guide (TRCA/CVC, 2101, Version 1.0)** http://sustainabletechnologies.ca/wp/wp-content/uploads/2013/01/LID-SWM-Guide-v1.0_2010_1_no-appendices.pdf	
Planning Guide	**Grey to Green Enhanced Stormwater Management Master Planning: Guide to Optimizing Municipal Infrastructure Assets and Reducing Risk (CVC)** http://www.creditvalleyca.ca/wp-content/uploads/2016/01/ORGuide.pdf	

		
Planning & Design Fact Sheets	**Low Impact Development Stormwater Management Planning and Design Guide, including Fact Sheets:** http://www.creditvalleyca.ca/low-impact-development/low-impact-development-support/stormwater-management-lid-guidance-documents/low-impact-development-stormwater-management-planning-and-design-guide/	
Construction Guide	**Construction Guide for Low Impact Development (CVC, 2012, Version 1.0)** http://www.creditvalleyca.ca/wp-content/uploads/2013/03/CVC-LID-Construction-Guide-Book.pdf	
Landscape Design Guide	**Landscape Design Guide for Low Impact Development (CVC – Version 1.0)** http://www.creditvalleyca.ca/low-impact-development/low-impact-development-support/stormwater-management-lid-guidance-documents/andscape-design-guide-for-low-impact-development-version-1-0-june-2010/	

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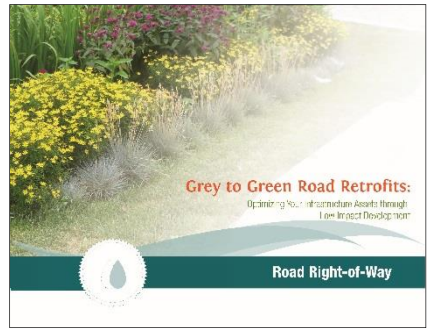
<td>Roads Retrofit Design Guide</td>
<td>Low Impact Development Road Retrofits: Optimizing Your Infrastructure through Low Impact Development (CVC)

http://www.creditvalleyca.ca/wp-content/uploads/2014/08/Grey-to-Green-Road-ROW-Retrofits-Complete_1.pdf</td>
<td>
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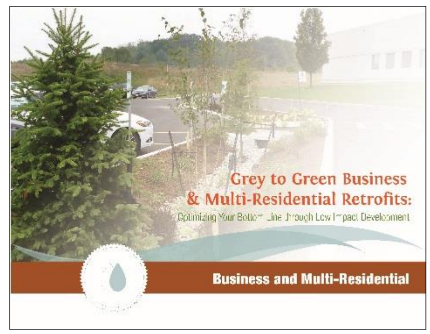
<td>Business & Multi- Res. Retrofit Design Guide</td>
<td>Grey to Green Business & Multi- Residential Retrofits: Optimizing Your Infrastructure through Low Impact Development (CVC)

http://www.creditvalleyca.ca/wp-content/uploads/2015/01/Grey-to-Green-Business-and-Multiresidential-Guide1.pdf</td>
<td>
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<td>Residential Retrofit Design Guide</td>
<td>Low Impact Development Residential Retrofits: Engaging Residents to Adopt Low Impact Development in their Properties (CVC)

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<td>Public Lands Retrofit Design Guide</td>
<td>Grey to Green Public Lands Retrofits: Optimizing Your Infrastructure through Low Impact Development (CVC)

http://www.creditvalleyca.ca/wp-content/uploads/2015/01/Grey-to-Green-Pulic-Lands-Guide.pdf</td>
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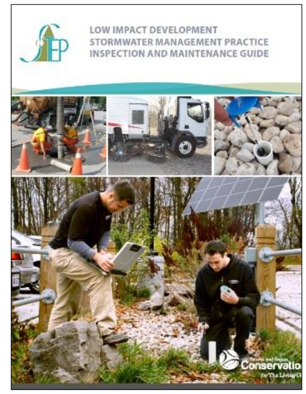
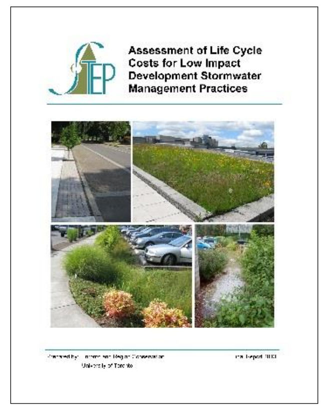
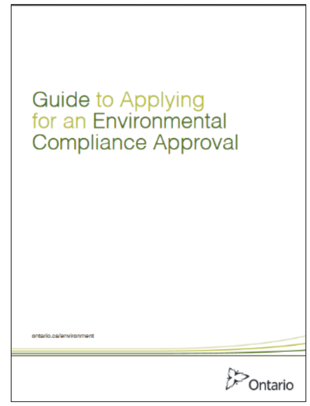
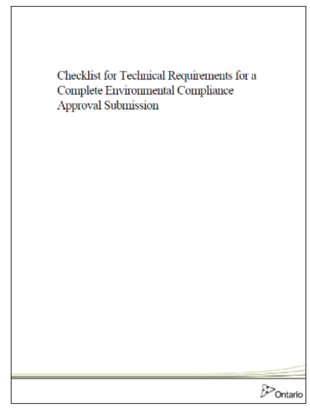
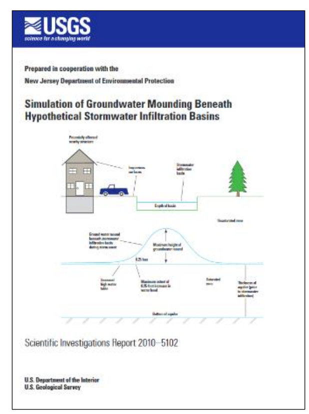
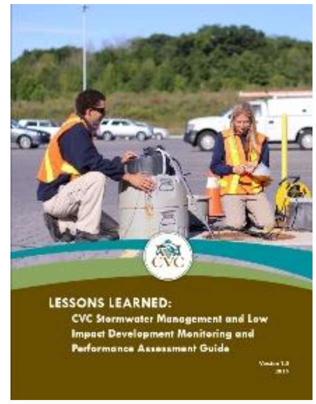
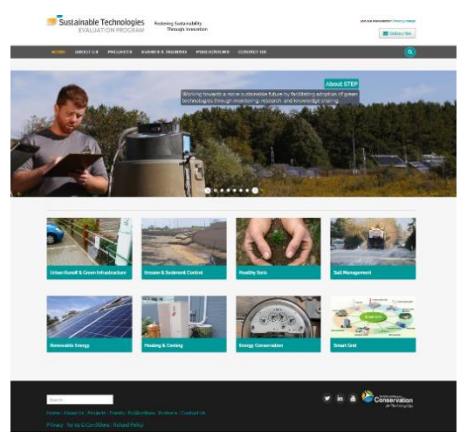
Maintenance Guide	**Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide (TRCA/ STEP, 2016, Version 1.0)** http://www.sustainabletechnologies.ca/wp/home/urban-runoff-green-infrastructure/low-impact-development/low-impact-development-stormwater-practice-inspection-and-maintenance-guide/	
Life Cycle Costs Report	**Assessment of Life Cycle Costs for Low Impact Development Stormwater Management Practices (TRCA, UofT, 2013)** http://www.sustainabletechnologies.ca/wp/wp-content/uploads/2013/06/LID-LCC-final-2013.pdf	
Costing Tool	**Low Impact Development Life Cycle Costing Tool (STEP)** http://www.sustainabletechnologies.ca/wp/home/urban-runoff-green-infrastructure/low-impact-development/low-impact-development-life-cycle-costs/	

Approval Guide	**Guide to Applying for an Environmental Compliance Approval** https://www.ontario.ca/document/guide-applying-environmental-compliance-approval	
ECA Submission Checklist	**Checklist for Technical Requirements for Complete Environmental Compliance Approval Submission** https://www.ontario.ca/document/checklist-technical-requirements-complete-environmental-compliance-approval-submission	
Groundwater Mounding Analysis	**Simulation of Groundwater Mounding Beneath Hypothetical Stormwater Infiltration Basins** **USGS** https://pubs.usgs.gov/sir/2010/5102/ Spreadsheet Hantush_USGS_SIR_2010-5102-1110.xlsm	

Monitoring Guide	**CVC Stormwater Management and Low Impact Development Monitoring and Performance Assessment Guide (2015, V1.0)** http://www.creditvalleyca.ca/wp-content/uploads/2016/06/Monitoring_Guide_Final.pdf	
Planning Level Modelling Tool (Class A)	**LID Treatment Train Tool (LID TTT)** http://www.sustainabletechnologies.ca/wp/low-impact-development-treatment-train-tool/	
LID Performance Resources	**Sustainable Technologies Evaluation Program available** https://wiki.sustainabletechnologies.ca/wiki/Main_Page **LID BMP monitoring plans, technical reports and case studies** http://www.creditvalleyca.ca/low-impact-development/lid-maintenance-monitoring/ **International Stormwater BMP Database** http://www.bmpdatabase.org/index.htm.	

Other Resources and Reports		
	Sustainable Technologies Evaluation Program (STEP): www.sustainabletechnologies.ca/ **Resources, Studies and Reports** 1. Green Infrastructure Map 2. Stormwater Infiltration in Cold Climates Review (2009) 3. Stormwater Management and Watercourse Impacts: The Need for a Water Balance Approach 4. Preserving and Restoring Healthy Soil: Best Practices for Urban Construction 5. LID Discussion Paper 6. Urban Water Balance 7. LID "Barrier Buster" fact sheet series **Features Studies and Resources:** 8. Bioretention and Rain Gardens 9. Green Roofs	

	10. Soakaways, Infiltration Trenches and Chambers 11. Permeable Pavement 12. Swales and Roadside Ditches 13. Perforated Pipe Systems 14. Rainwater Harvesting 15. Residential Stormwater Landscaping 16. Water Balance for the Protection of Natural Features	

4.4 Low Impact Development Feasibility

It is our understanding that the proposed buildings will incorporate infiltration chamber systems to be located west of Building D and south of Building C. It should be noted that based on reviewing the servicing plans, the invert level of the proposed infiltration systems was found to be 85.22 and 85.4 for the west and south systems, respectively. Therefore, Paterson conducted the supplemental investigation (TP1-20 through TP5-20) to assess the underlying soils by means of permeameter testing to confirm the infiltration rates of the underlying soils. The following summarizes the field observations during the supplemental investigation and the results of the testing:

In-Situ Testing

Permeameter testing was conducted using a Pask (Constant Head Well) Permeameter. At each location, an 83 mm hole was excavated using a Riverside/Bucket auger to a depth of 0.3 and 0.9 m below the base of the excavation at each location. All soil from the auger flights were visually inspected and initially classified on site. The permeameter reservoir was filled with water and inverted into the hole, ensuring it was relatively vertical and rests on the bottom of the hole. The water level of the reservoir was monitored at various time intervals until the rate of fall out of the permeameter reached equilibrium, known as *quasi "steady state'* flow rate. Quasi steady state flow can be considered to have been obtained after measuring 3 to 5 consecutive rate of fall readings with identical values. The values for the steady state rate of fall were recorded for each location.

Permeameter Testing Results

A total of 10 constant head Pask permeameter tests were conducted at 5 locations along the west property boundary as well as the western portion of the south property boundary to determine the design infiltration rates of the soils below the proposed infiltration system. The permeameter test locations were selected by Paterson in a manner to provide general coverage of the proposed infiltration system. Preparation and testing of this investigation are in accordance with the Canadian Standards Association (CSA) B65-12 - Annex E. The field saturated hydraulic conductivity (K_{fs}) values and design infiltration rates for each test hole location are presented in Table 2 below.

Field saturated hydraulic conductivity values were determined using Engineering Technologies Canada (ETC) Ltd. reference tables provided in the most recent ETC Pask Permeameter User Guide dated March 2016. The design infiltration rates were determined using Appendix C of the Low Impact Development Stormwater Management Planning and Design Guide (CVC, 2011). It should be noted that a safety correction factor was applied to the calculated design infiltration rates at each test hole location.

Table 2 - Field Saturated Hydraulic Conductivity and Design Infiltration Rates					
Test Hole ID	**Invert of Infiltration System (m)**	**Invert of Permeameter Testing (m)**	**K_{fs} (m/sec)**	**Infiltration Rate (mm/hr)**	**Design Infiltration Rate (mm/hr)**
TP1-20	85.22	85.2	$3.2x10^{-7}$	33	9.5
		84.6	$2.1x10^{-7}$	30	
TP2-20	85.22	85.2	$6.3x10^{-8}$	23	< 6.5
		84.6	$< 9.4x10^{-9}$	< 13	
TP3-20	85.22	85.2	$6.3x10^{-8}$	23	< 6.5
		84.6	$< 9.4x10^{-9}$	< 13	
TP4-20	85.4	85.4	$< 9.4x10^{-9}$	< 13	< 5
		84.8	$< 9.4x10^{-9}$	< 13	
TP5-20	85.4	85.4	$< 9.4x10^{-9}$	< 13	< 5
		84.8	$3.1x10^{-8}$	19	

Based on Paterson's field investigation, the field saturated hydraulic conductivity values and design infiltration rates measured at the base of the proposed infiltration system are consistent with similar material Paterson has encountered on other sites with similar subsoil structures and typical values for clayey glacial till and silty clay material. Field saturated hydraulic conductivity values for the clayey glacial till range from $2.1x10^{-7}$ to $3.2x10^{-7}$ m/sec, while the silty clay ranges from $<9.4x10^{-9}$ to $6.3x10^{-8}$ m/sec. The design infiltration rate for the proposed system locations should range between < 5 mm/hr within the silty clay to 9.5 mm/hr within the glacial till. Based on our review, the proposed systems are considered acceptable from a geotechnical and a hydrogeological perspective.

The invert levels of the proposed infiltration systems were also found to be well above the long-term groundwater table (greater than 1 m) which is considered acceptable from a geotechnical perspective.

APPENDIX

B CALCULATIONS

Project:	1000 - 1500 Tawdina Street	No.:	221-04473-00	
By:	KK	Date:	2023-01-12	Page:
Checked:	AJ	Checked:	2023-01-12	1

Subject: **Infiltration Calculations - Building 1**

Water Quality Target	15 mm	* Only applies to impervious areas connected to LID
Infiltration Target	4 mm	* Applies to entire site

	Area [m2]	Infiltration (mm)	ET (mm)	Evaporation (mm)	Re-Use (mm)	Total Abstraction [mm]	Total Abstraction Volume (m3)	Required Water Quality Volume (m3)	Required Infiltration Volume
Building 1 Site									
Impervious Areas	4360	0.0	0.0	1.0	0.0	1	4	61	13
Green Roof	332	0.0	5.0	0.0	0.0	5	2	3	0
Gardens/Landscaped Areas	501	5.0	5.0	0.0	0.0	10	5	N/A	-3
Total							**11**	**64**	**13**

$$d_r = i * \frac{t_s}{V_r}$$

Where i = soil infiltration rate (mm/hr), Vr = void ratio, ts = time to drain (hr), and dr = the maximum stone reservoir depth (m)

Void Ratio =	0.4
Design infiltration rate (mm/hr) =	6
Max depth clearstone below outlet (m) =	1.1
Base Area (m2) =	149
Depth of clearstone below unit (m) =	0.23
Depth of storage chamber below outlet (m) =	0.34
Outlet invert (m) =	86.36
Base of storage unit (m) =	86.02
Base of stone (m) =	85.79
Top of storage unit (m) =	87.45

Project:	1000 - 1500 Tawdina Street	No.:	221-04473-00	
By:	KK	Date:	2023-01-12	Page:
Checked:	AJ	Checked:	2023-01-12	1

Subject: **Infiltration Calculations - Building 2**

Water Quality Target	15	mm	* Only applies to impervious areas connected to LID
Infiltration Target	4	mm	* Applies to entire site

	Area [m2]	Infiltration (mm)	ET (mm)	Evaporation (mm)	Re-Use (mm)	Total Abstraction [mm]	Total Abstraction Volume (m3)	Required Water Quality Volume (m3)	Required Infiltration Volume
Building 2 Site									
Impervious Areas	2847	0.0	0.0	1.0	0.0	1	3	40	9
Green Roof	364	0.0	5.0	0.0	0.0	5	2	3.64	0
Gardens/Landscaped Areas	521	5.0	5.0	0.0	0.0	10	5	N/A	0
Total							**10**	**43**	**9**

$$d_r = i * \frac{t_s}{V_r}$$

Where i = soil infiltration rate (mm/hr), Vr = void ratio, ts = time to drain (hr), and dr = the maximum stone reservoir depth (m)

Void Ratio =	0.4
Design infiltration rate (mm/hr) =	6
Max depth clearstone below outlet (m) =	1.1
Base Area (m2) =	101
Depth of clearstone below unit (m) =	0.23
Depth of storage chamber below outlet (m) =	0.34
Outlet invert (m) =	86.47
Base of storage unit (m) =	86.13
Base of stone (m) =	85.90
Top of storage unit (m) =	87.56

Subject: **Infiltration Calculations - Building 3**

Water Quality Target	15 mm	* Only applies to impervious areas connected to LID
Infiltration Target	4 mm	* Applies to entire site

	Area [m2]	Infiltration (mm)	ET (mm)	Evaporation (mm)	Re-Use (mm)	Total Abstraction [mm]	Total Abstraction Volume (m3)	Required Water Quality Volume (m3)	Required Infiltration Volume
Building 3 Site									
Impervious Areas	2549	0.0	0.0	1.0	0.0	1	3	36	8
Green Roof	244	0.0	5.0	0.0	0.0	5	1	2	0
Gardens/Landscaped Areas	589	5.0	5.0	0.0	0.0	10	6	N/A	0
Total							**10**	**38**	**8**

$$d_r = i * \frac{t_s}{V_r}$$

Where i = soil infiltration rate (mm/hr), Vr = void ratio, ts = time to drain (hr), and dr = the maximum stone reservoir depth (m)

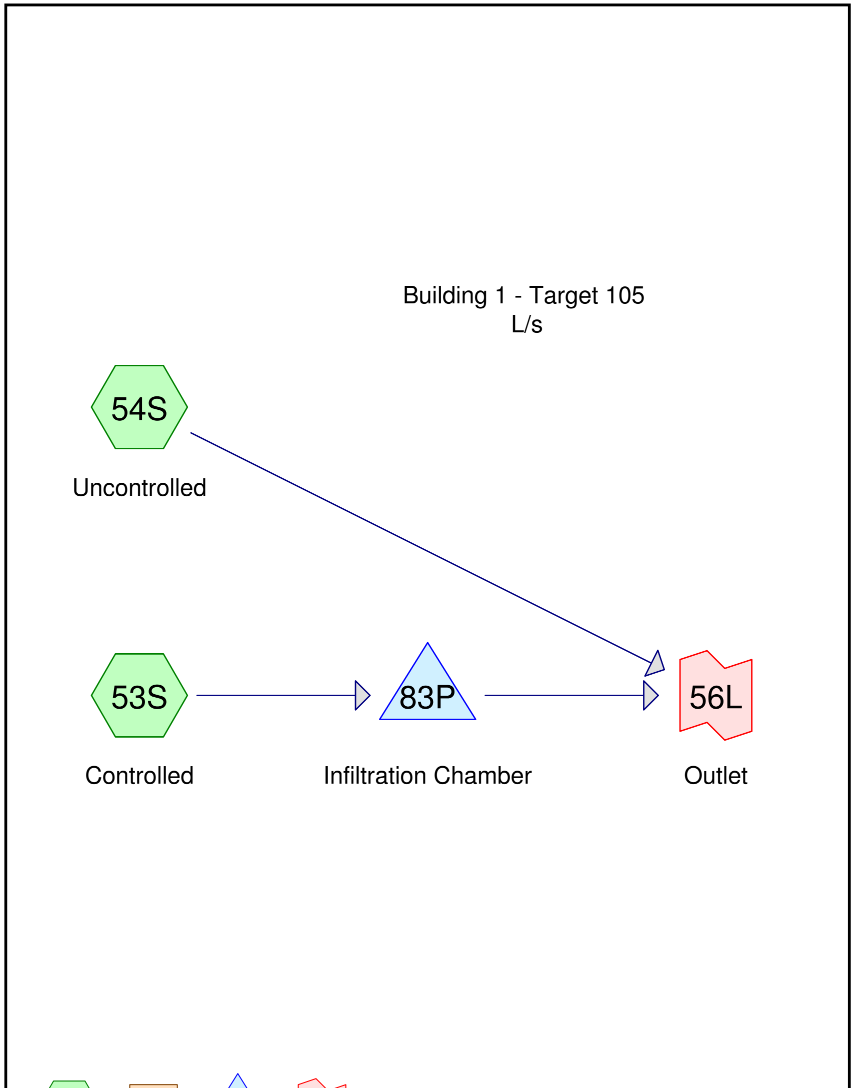
Void Ratio =	0.4
Design infiltration rate (mm/hr) =	6
Max depth clearstone below outlet (m) =	1.1
Base Area (m2) =	88
Depth of clearstone below unit (m) =	0.23
Depth of storage chamber below outlet (m) =	0.34
Outlet invert (m) =	86.44
Base of storage unit (m) =	86.10
Base of stone (m) =	85.87
Top of storage unit (m) =	87.53

APPENDIX

C HYDROCAD OUTPUT

APPENDIX

C-1 *BUILDING 1*



Routing Diagram for Tawdina_20230111
Prepared by WSP Canada inc., Printed 2023-01-12
HydroCAD® 10.00-22 s/n 10697 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,970.0	0.90	S-BLDG1 (53S)
1,590.0	0.80	S101 (53S)
840.0	0.68	S102 (53S)
790.0	0.58	S103 (54S)
5,190.0	**0.79**	**TOTAL AREA**

Time span=0.00-4.00 hrs, dt=0.01 hrs, 401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 53S: Controlled Runoff Area=0.4400 ha 0.00% Impervious Runoff Depth=18 mm
Tc=10.0 min C=0.82 Runoff=0.08064 m³/s 77.4 m³

Subcatchment 54S: Uncontrolled Runoff Area=0.0790 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.58 Runoff=0.01024 m³/s 9.8 m³

Pond 83P: Infiltration Chamber Peak Elev=86.586 m Storage=33.6 m³ Inflow=0.08064 m³/s 77.4 m³
Outflow=0.05291 m³/s 77.4 m³

Link 56L: Outlet Inflow=0.06065 m³/s 87.2 m³
Primary=0.06065 m³/s 87.2 m³

Total Runoff Area = 5,190.0 m² Runoff Volume = 87.2 m³ Average Runoff Depth = 17 mm
100.00% Pervious = 5,190.0 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 53S: Controlled

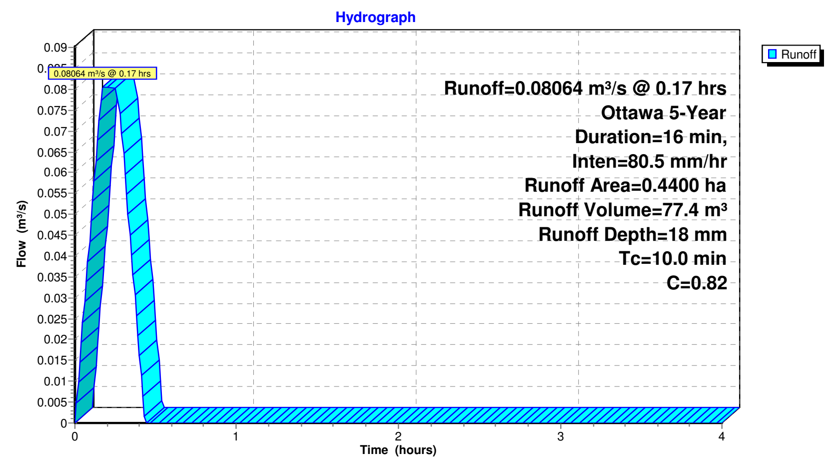
Runoff = 0.08064 m³/s @ 0.17 hrs, Volume= 77.4 m³, Depth= 18 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=16 min, Inten=80.5 mm/hr

Area (ha)	C	Description
0.0840	0.68	S102
0.1970	0.90	S-BLDG1
0.1590	0.80	S101
0.4400	0.82	Weighted Average
0.4400		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 53S: Controlled



Summary for Subcatchment 54S: Uncontrolled

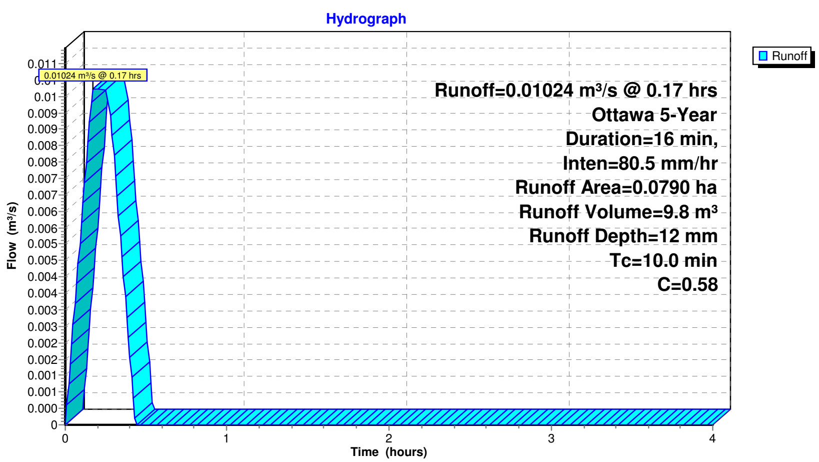
Runoff = 0.01024 m³/s @ 0.17 hrs, Volume= 9.8 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=16 min, Inten=80.5 mm/hr

Area (ha)	C	Description
0.0790	0.58	S103
0.0790		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 54S: Uncontrolled



Summary for Pond 83P: Infiltration Chamber

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 4,400.0 m², 0.00% Impervious, Inflow Depth = 18 mm for 5-Year event
Inflow = 0.08064 m³/s @ 0.17 hrs, Volume= 77.4 m³
Outflow = 0.05291 m³/s @ 0.32 hrs, Volume= 77.4 m³, Atten= 34%, Lag= 9.2 min
Primary = 0.05291 m³/s @ 0.32 hrs, Volume= 77.4 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 86.586 m @ 0.32 hrs Surf.Area= 149.0 m² Storage= 33.6 m³

Plug-Flow detention time= 9.1 min calculated for 77.2 m³ (100% of inflow)
Center-of-Mass det. time= 9.2 min (22.2 - 13.0)

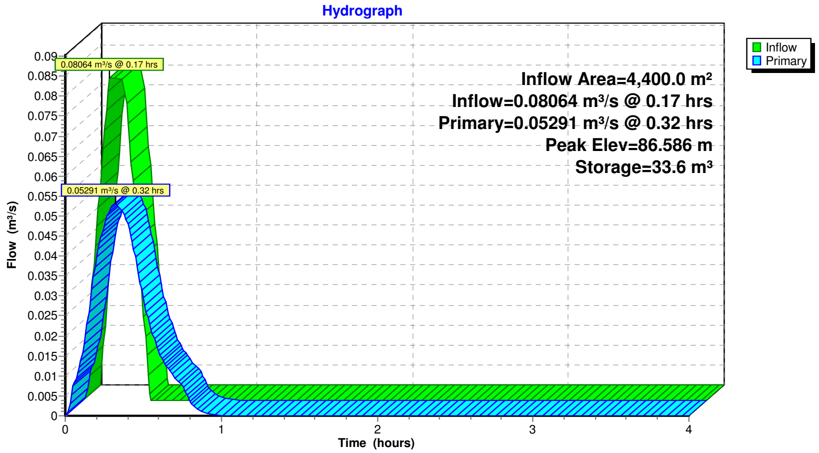
Volume	Invert	Avail.Storage	Storage Description
#1	86.360 m	162.4 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
86.360	149.0	0.0	0.0
87.450	149.0	162.4	162.4

Device	Routing	Invert	Outlet Devices
#1	Primary	86.290 m	**240 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.05289 m³/s @ 0.32 hrs HW=86.586 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.05289 m³/s @ 1.17 m/s)

Pond 83P: Infiltration Chamber

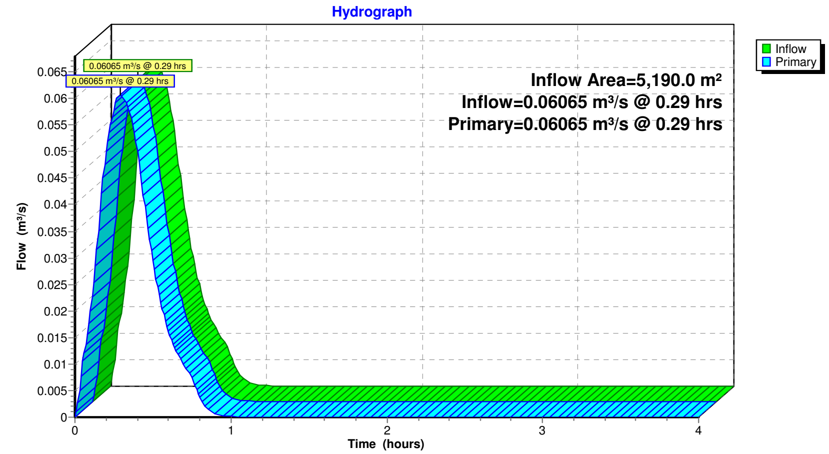


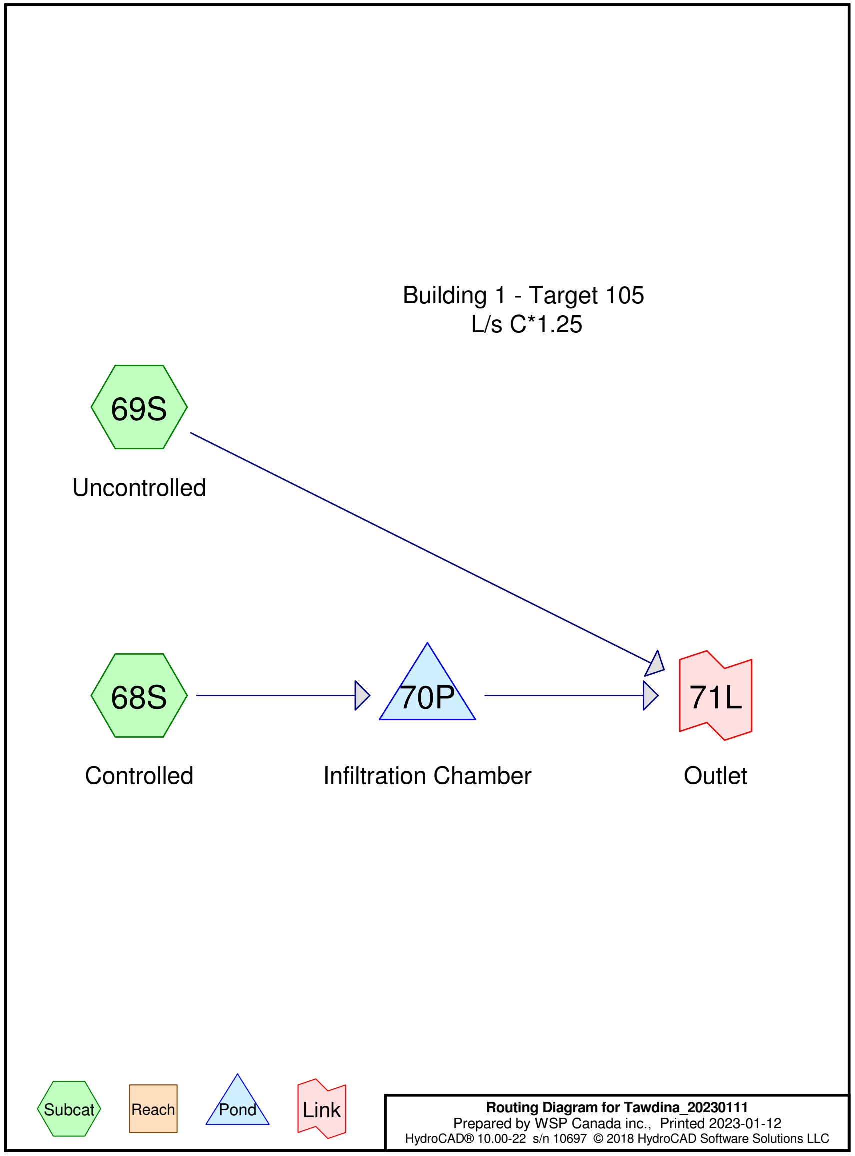
Summary for Link 56L: Outlet

Inflow Area = 5,190.0 m², 0.00% Impervious, Inflow Depth = 17 mm for 5-Year event
Inflow = 0.06065 m³/s @ 0.29 hrs, Volume= 87.2 m³
Primary = 0.06065 m³/s @ 0.29 hrs, Volume= 87.2 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 56L: Outlet





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,970.0	1.00	S-BLDG1 - 0.90 (68S)
1,590.0	1.00	S101 - 0.8 (68S)
840.0	0.85	S102 - 0.68 (68S)
790.0	0.72	S103 - 0.66 (69S)
5,190.0	**0.93**	**TOTAL AREA**

Time span=0.00-4.00 hrs, dt=0.01 hrs, 401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 68S: Controlled Runoff Area=0.4400 ha 80.91% Impervious Runoff Depth=37 mm
Tc=10.0 min C=0.97 Runoff=0.15185 m³/s 164.0 m³

Subcatchment 69S: Uncontrolled Runoff Area=0.0790 ha 0.00% Impervious Runoff Depth=28 mm
Tc=10.0 min C=0.72 Runoff=0.02024 m³/s 21.9 m³

Pond 70P: Infiltration Chamber Peak Elev=86.900 m Storage=80.5 m³ Inflow=0.15185 m³/s 164.0 m³
Outflow=0.08836 m³/s 164.0 m³

Link 71L: Outlet Inflow=0.10363 m³/s 185.9 m³
Primary=0.10363 m³/s 185.9 m³

Total Runoff Area = 5,190.0 m² Runoff Volume = 185.9 m³ Average Runoff Depth = 36 mm
31.41% Pervious = 1,630.0 m² 68.59% Impervious = 3,560.0 m²

Summary for Subcatchment 68S: Controlled

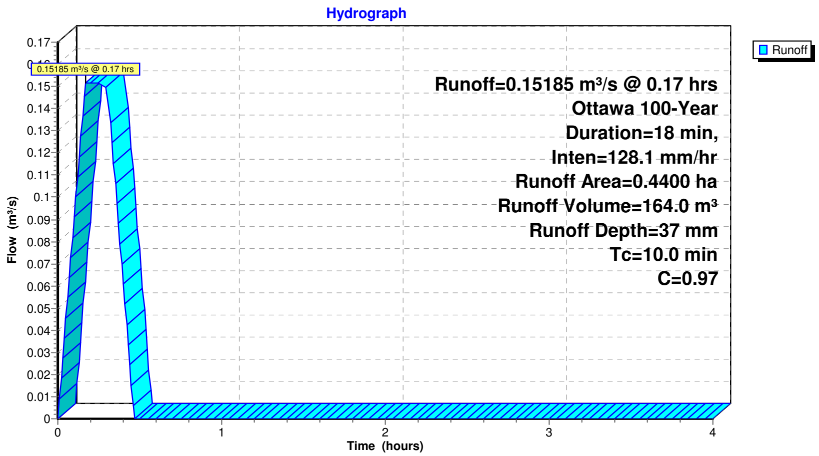
Runoff = 0.15185 m³/s @ 0.17 hrs, Volume= 164.0 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=18 min, Inten=128.1 mm/hr

Area (ha)	C	Description
0.0840	0.85	S102 - 0.68
0.1970	1.00	S-BLDG1 - 0.90
0.1590	1.00	S101 - 0.8
0.4400	0.97	Weighted Average
0.0840		19.09% Pervious Area
0.3560		80.91% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 68S: Controlled



Summary for Subcatchment 69S: Uncontrolled

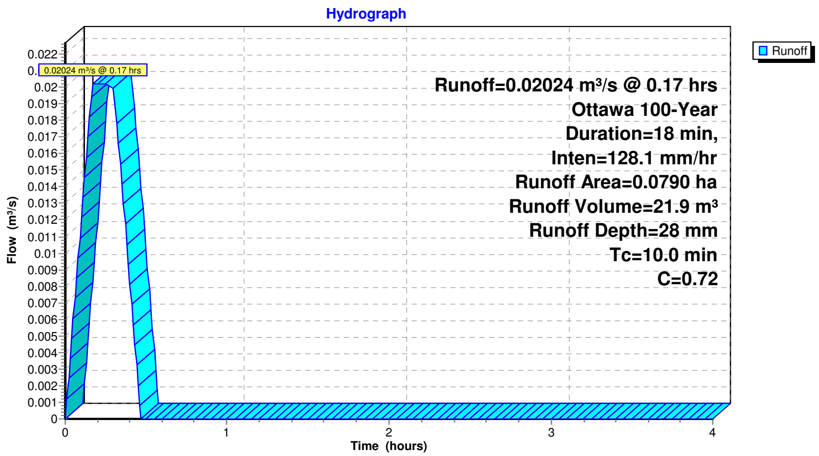
Runoff = 0.02024 m³/s @ 0.17 hrs, Volume= 21.9 m³, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=18 min, Inten=128.1 mm/hr

Area (ha)	C	Description
0.0790	0.72	S103 - 0.66
0.0790		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 69S: Uncontrolled



Summary for Pond 70P: Infiltration Chamber

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 4,400.0 m², 80.91% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.15185 m³/s @ 0.17 hrs, Volume= 164.0 m³
Outflow = 0.08836 m³/s @ 0.37 hrs, Volume= 164.0 m³, Atten= 42%, Lag= 12.0 min
Primary = 0.08836 m³/s @ 0.37 hrs, Volume= 164.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 86.900 m @ 0.37 hrs Surf.Area= 149.0 m² Storage= 80.5 m³

Plug-Flow detention time= 12.3 min calculated for 164.0 m³ (100% of inflow)
Center-of-Mass det. time= 12.2 min (26.2 - 14.0)

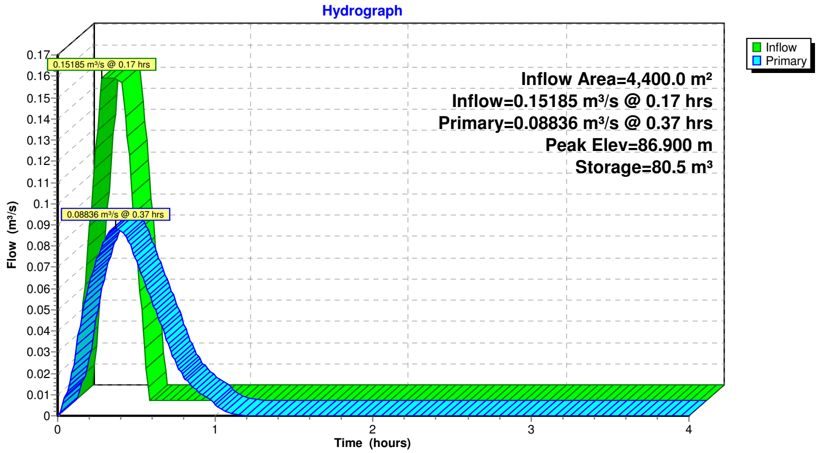
Volume	Invert	Avail.Storage	Storage Description
#1	86.360 m	162.4 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
86.360	149.0	0.0	0.0
87.450	149.0	162.4	162.4

Device	Routing	Invert	Outlet Devices
#1	Primary	86.290 m	**240 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.08836 m³/s @ 0.37 hrs HW=86.900 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.08836 m³/s @ 1.95 m/s)

Pond 70P: Infiltration Chamber

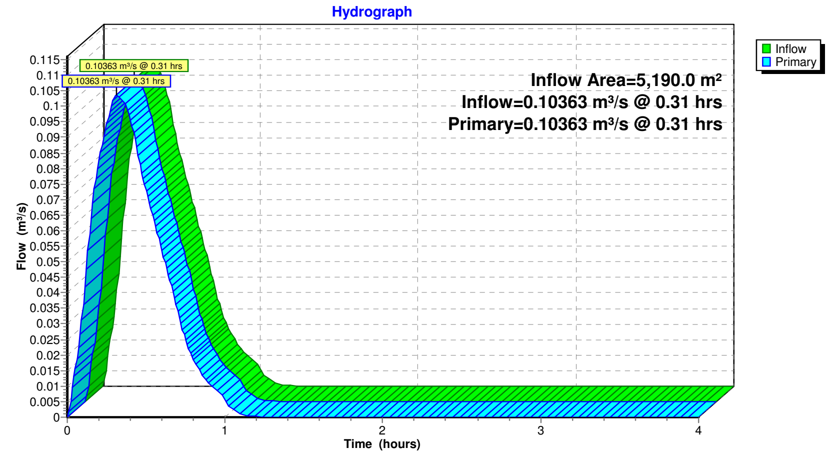


Summary for Link 71L: Outlet

Inflow Area = 5,190.0 m², 68.59% Impervious, Inflow Depth = 36 mm for 100-Year event
Inflow = 0.10363 m³/s @ 0.31 hrs, Volume= 185.9 m³
Primary = 0.10363 m³/s @ 0.31 hrs, Volume= 185.9 m³, Atten= 0%, Lag= 0.0 min

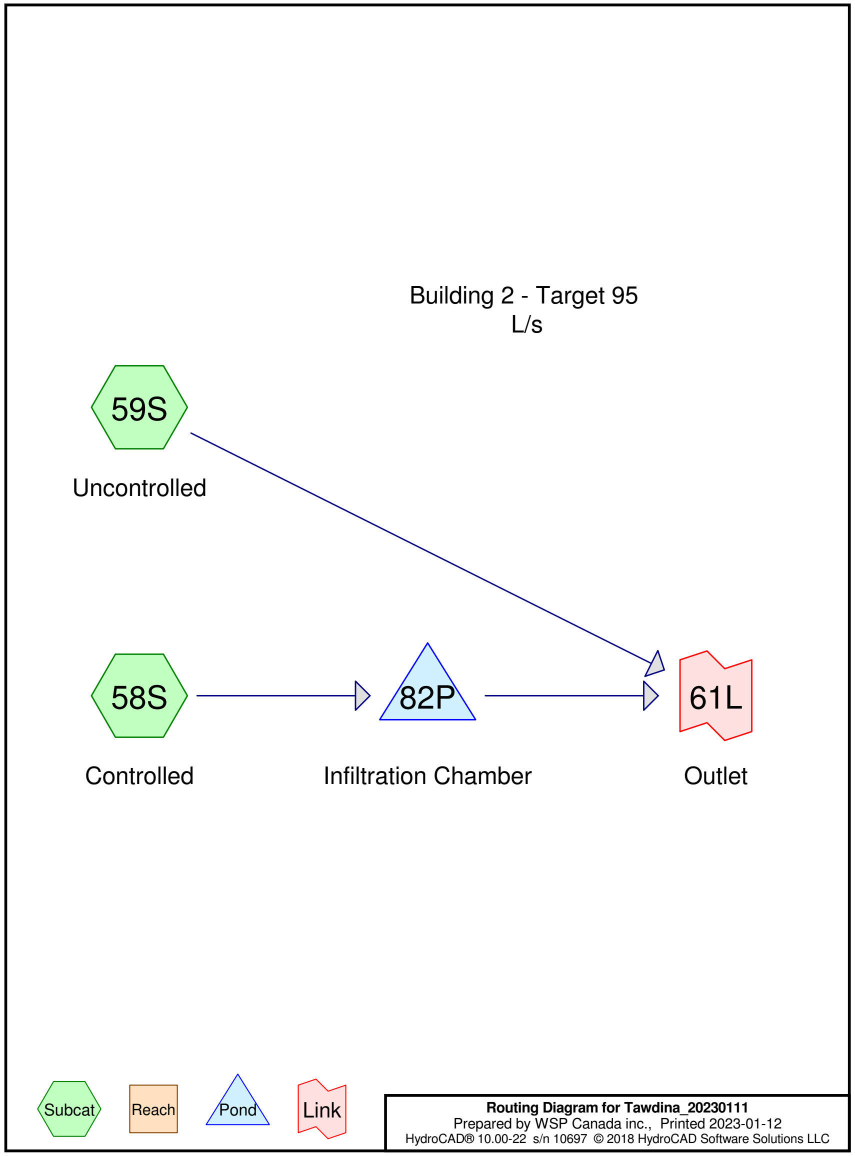
Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 71L: Outlet



APPENDIX

C-2 *BUILDING 2*



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,240.0	0.90	S-BLDG2 (58S)
980.0	0.74	S201 (58S)
1,050.0	0.59	S202 (58S)
470.0	0.66	S203 (59S)
3,740.0	**0.74**	**TOTAL AREA**

Time span=0.00-4.00 hrs, dt=0.01 hrs, 401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 58S: Controlled Runoff Area=0.3270 ha 0.00% Impervious Runoff Depth=14 mm
Tc=10.0 min C=0.75 Runoff=0.06451 m³/s 46.4 m³

Subcatchment 59S: Uncontrolled Runoff Area=0.0470 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.66 Runoff=0.00816 m³/s 5.9 m³

Pond 82P: Infiltration Chamber Peak Elev=86.606 m Storage=13.8 m³ Inflow=0.06451 m³/s 46.4 m³
Outflow=0.04735 m³/s 46.4 m³

Link 61L: Outlet Inflow=0.05370 m³/s 52.3 m³
Primary=0.05370 m³/s 52.3 m³

Total Runoff Area = 3,740.0 m² Runoff Volume = 52.3 m³ Average Runoff Depth = 14 mm
100.00% Pervious = 3,740.0 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 58S: Controlled

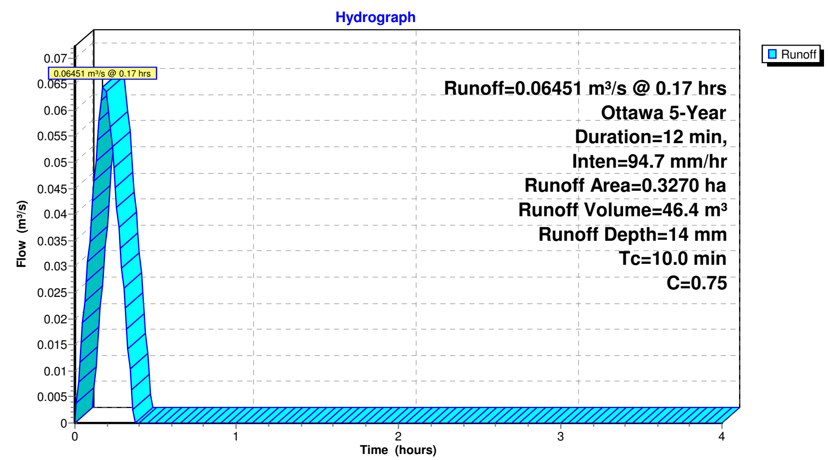
Runoff = 0.06451 m³/s @ 0.17 hrs, Volume= 46.4 m³, Depth= 14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=12 min, Inten=94.7 mm/hr

Area (ha)	C	Description
0.1050	0.59	S202
0.1240	0.90	S-BLDG2
0.0980	0.74	S201
0.3270	0.75	Weighted Average
0.3270		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 58S: Controlled



Summary for Subcatchment 59S: Uncontrolled

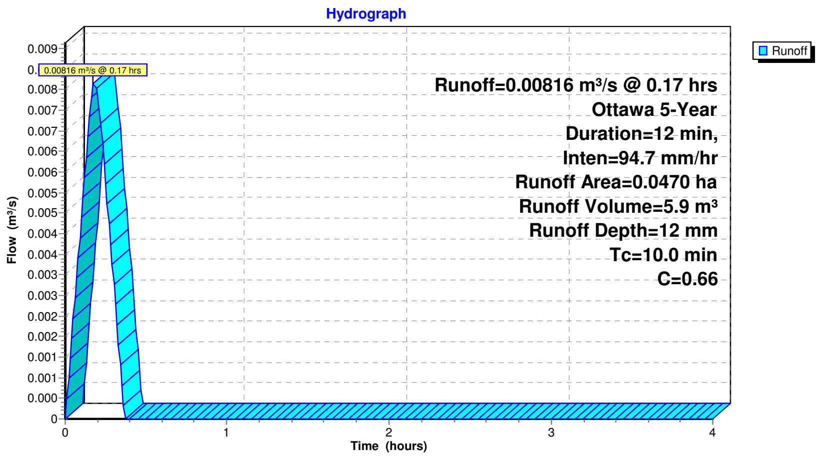
Runoff = 0.00816 m³/s @ 0.17 hrs, Volume= 5.9 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=12 min, Inten=94.7 mm/hr

Area (ha)	C	Description
0.0470	0.66	S203
0.0470		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 59S: Uncontrolled



Summary for Pond 82P: Infiltration Chamber

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 3,270.0 m², 0.00% Impervious, Inflow Depth = 14 mm for 5-Year event
Inflow = 0.06451 m³/s @ 0.17 hrs, Volume= 46.4 m³
Outflow = 0.04735 m³/s @ 0.24 hrs, Volume= 46.4 m³, Atten= 27%, Lag= 4.5 min
Primary = 0.04735 m³/s @ 0.24 hrs, Volume= 46.4 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 86.606 m @ 0.24 hrs Surf.Area= 101.0 m² Storage= 13.8 m³

Plug-Flow detention time= 4.0 min calculated for 46.3 m³ (100% of inflow)
Center-of-Mass det. time= 4.0 min (15.0 - 11.0)

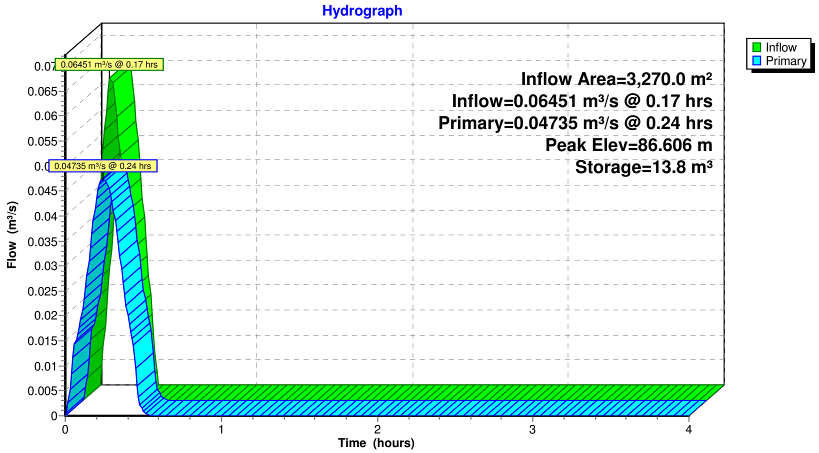
Volume	Invert	Avail.Storage	Storage Description
#1	86.470 m	110.1 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
86.470	101.0	0.0	0.0
87.560	101.0	110.1	110.1

Device	Routing	Invert	Outlet Devices
#1	Primary	86.370 m	**255 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.04735 m³/s @ 0.24 hrs HW=86.606 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.04735 m³/s @ 0.96 m/s)

Pond 82P: Infiltration Chamber

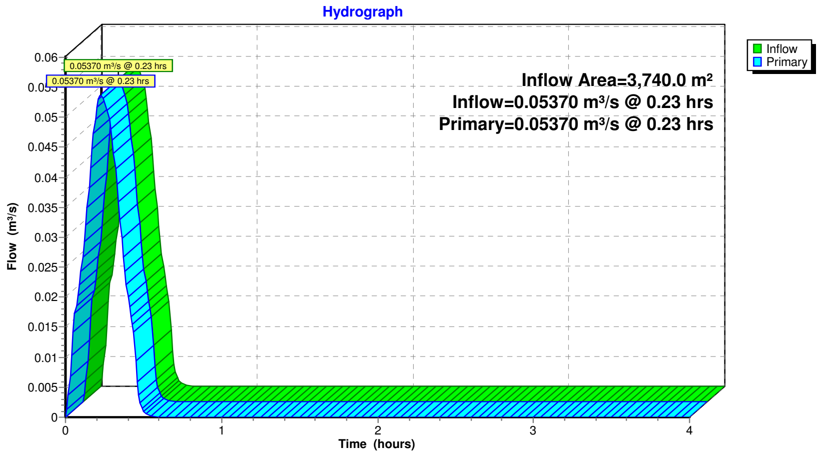


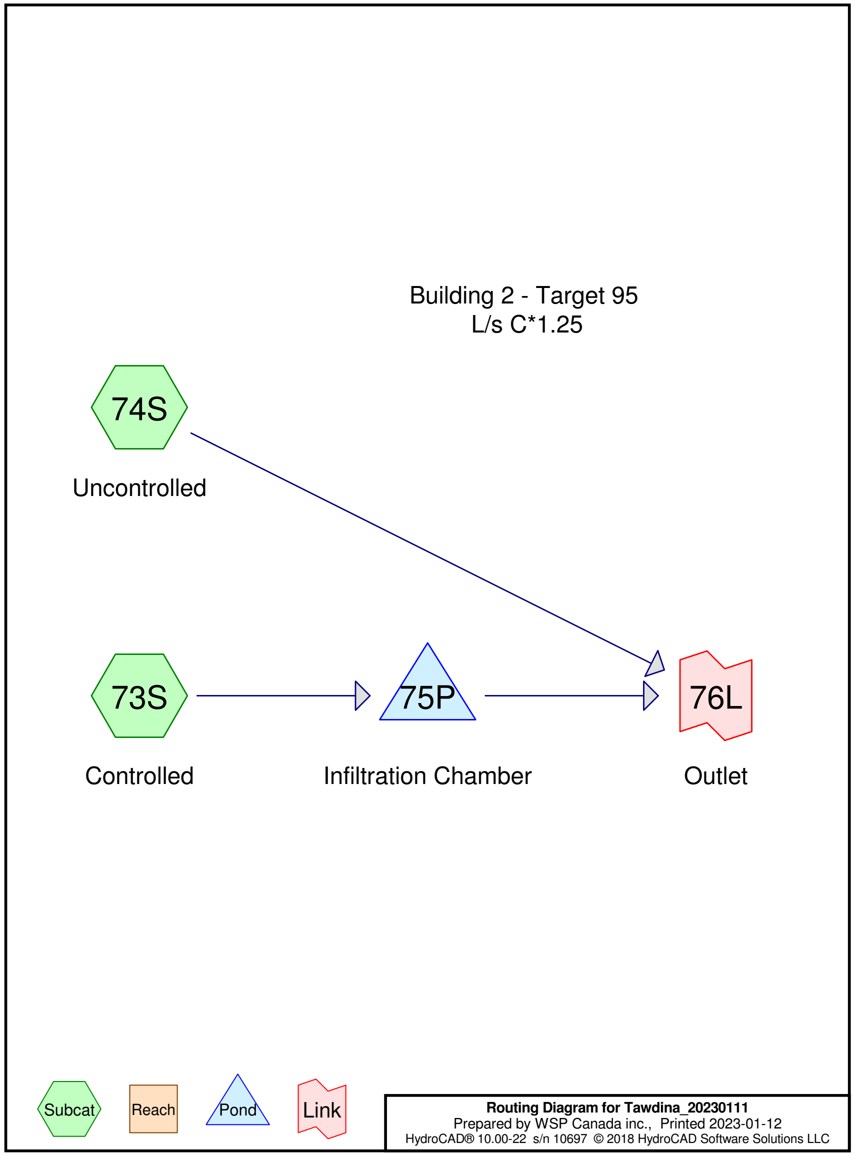
Summary for Link 61L: Outlet

Inflow Area = 3,740.0 m², 0.00% Impervious, Inflow Depth = 14 mm for 5-Year event
Inflow = 0.05370 m³/s @ 0.23 hrs, Volume= 52.3 m³
Primary = 0.05370 m³/s @ 0.23 hrs, Volume= 52.3 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 61L: Outlet





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,240.0	1.00	S-BLDG2 - 0.9 (73S)
980.0	0.92	S201 - 0.74 (73S)
1,050.0	0.74	S202 - 0.59 (73S)
470.0	0.82	S203 - 0.66 (74S)
3,740.0	**0.88**	**TOTAL AREA**

Time span=0.00-4.00 hrs, dt=0.01 hrs, 401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 73S: Controlled Runoff Area=0.3270 ha 37.92% Impervious Runoff Depth=31 mm
Tc=10.0 min C=0.89 Runoff=0.12023 m³/s 100.9 m³

Subcatchment 74S: Uncontrolled Runoff Area=0.0470 ha 0.00% Impervious Runoff Depth=28 mm
Tc=10.0 min C=0.82 Runoff=0.01592 m³/s 13.4 m³

Pond 75P: Infiltration Chamber Peak Elev=86.828 m Storage=36.1 m³ Inflow=0.12023 m³/s 100.9 m³
Outflow=0.08189 m³/s 100.9 m³

Link 76L: Outlet Inflow=0.09410 m³/s 114.3 m³
Primary=0.09410 m³/s 114.3 m³

Total Runoff Area = 3,740.0 m² Runoff Volume = 114.3 m³ Average Runoff Depth = 31 mm
66.84% Pervious = 2,500.0 m² 33.16% Impervious = 1,240.0 m²

Summary for Subcatchment 73S: Controlled

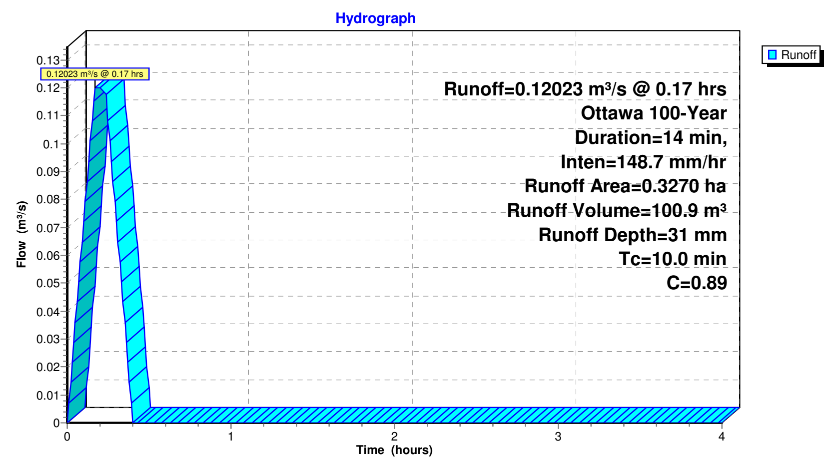
Runoff = 0.12023 m³/s @ 0.17 hrs, Volume= 100.9 m³, Depth= 31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=14 min, Inten=148.7 mm/hr

Area (ha)	C	Description
0.1050	0.74	S202 - 0.59
0.1240	1.00	S-BLDG2 - 0.9
0.0980	0.92	S201 - 0.74
0.3270	0.89	Weighted Average
0.2030		62.08% Pervious Area
0.1240		37.92% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 73S: Controlled



Summary for Subcatchment 74S: Uncontrolled

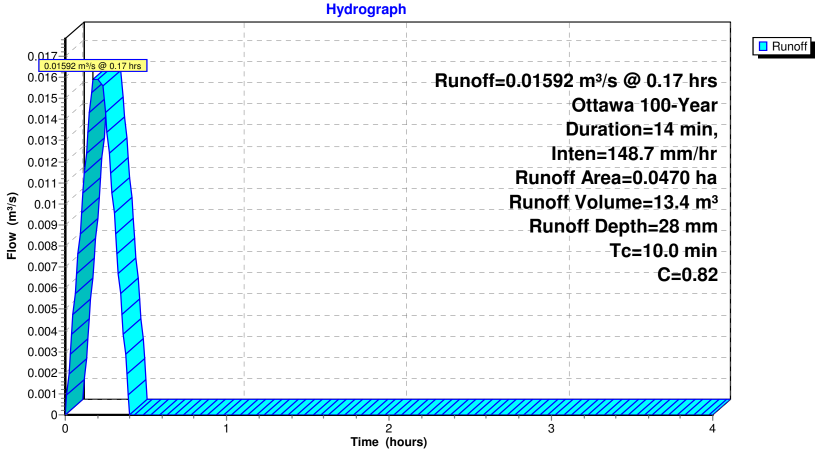
Runoff = 0.01592 m³/s @ 0.17 hrs, Volume= 13.4 m³, Depth= 28 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=14 min, Inten=148.7 mm/hr

Area (ha)	C	Description
0.0470	0.82	S203 - 0.66
0.0470		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 74S: Uncontrolled



Summary for Pond 75P: Infiltration Chamber

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 3,270.0 m², 37.92% Impervious, Inflow Depth = 31 mm for 100-Year event
Inflow = 0.12023 m³/s @ 0.17 hrs, Volume= 100.9 m³
Outflow = 0.08189 m³/s @ 0.29 hrs, Volume= 100.9 m³, Atten= 32%, Lag= 7.0 min
Primary = 0.08189 m³/s @ 0.29 hrs, Volume= 100.9 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 86.828 m @ 0.29 hrs Surf.Area= 101.0 m² Storage= 36.1 m³

Plug-Flow detention time= 5.8 min calculated for 100.7 m³ (100% of inflow)
Center-of-Mass det. time= 5.9 min (17.9 - 12.0)

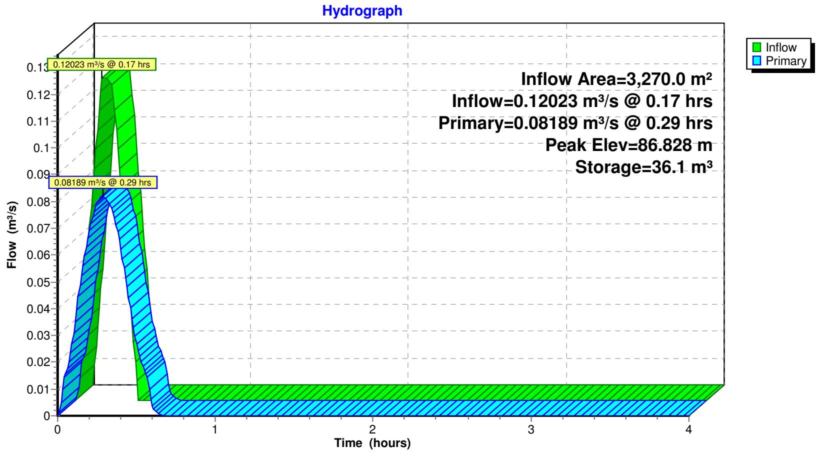
Volume	Invert	Avail.Storage	Storage Description
#1	86.470 m	110.1 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
86.470	101.0	0.0	0.0
87.560	101.0	110.1	110.1

Device	Routing	Invert	Outlet Devices
#1	Primary	86.370 m	**255 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.08186 m³/s @ 0.29 hrs HW=86.827 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.08186 m³/s @ 1.60 m/s)

Pond 75P: Infiltration Chamber

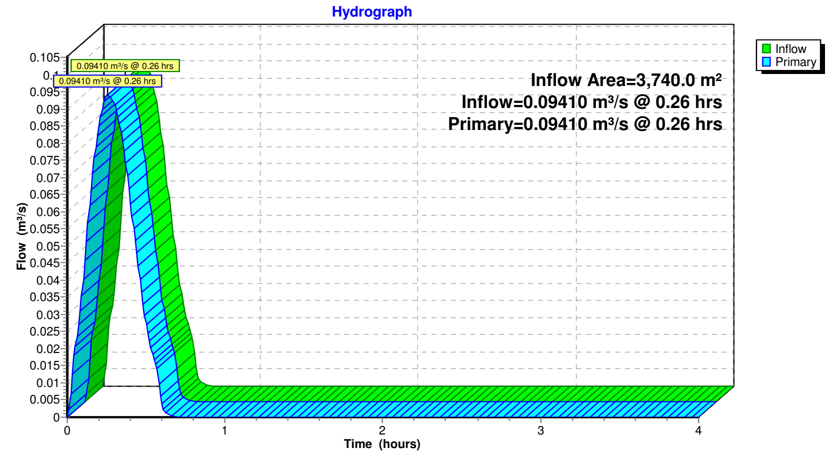


Summary for Link 76L: Outlet

Inflow Area = 3,740.0 m², 33.16% Impervious, Inflow Depth = 31 mm for 100-Year event
Inflow = 0.09410 m³/s @ 0.26 hrs, Volume= 114.3 m³
Primary = 0.09410 m³/s @ 0.26 hrs, Volume= 114.3 m³, Atten= 0%, Lag= 0.0 min

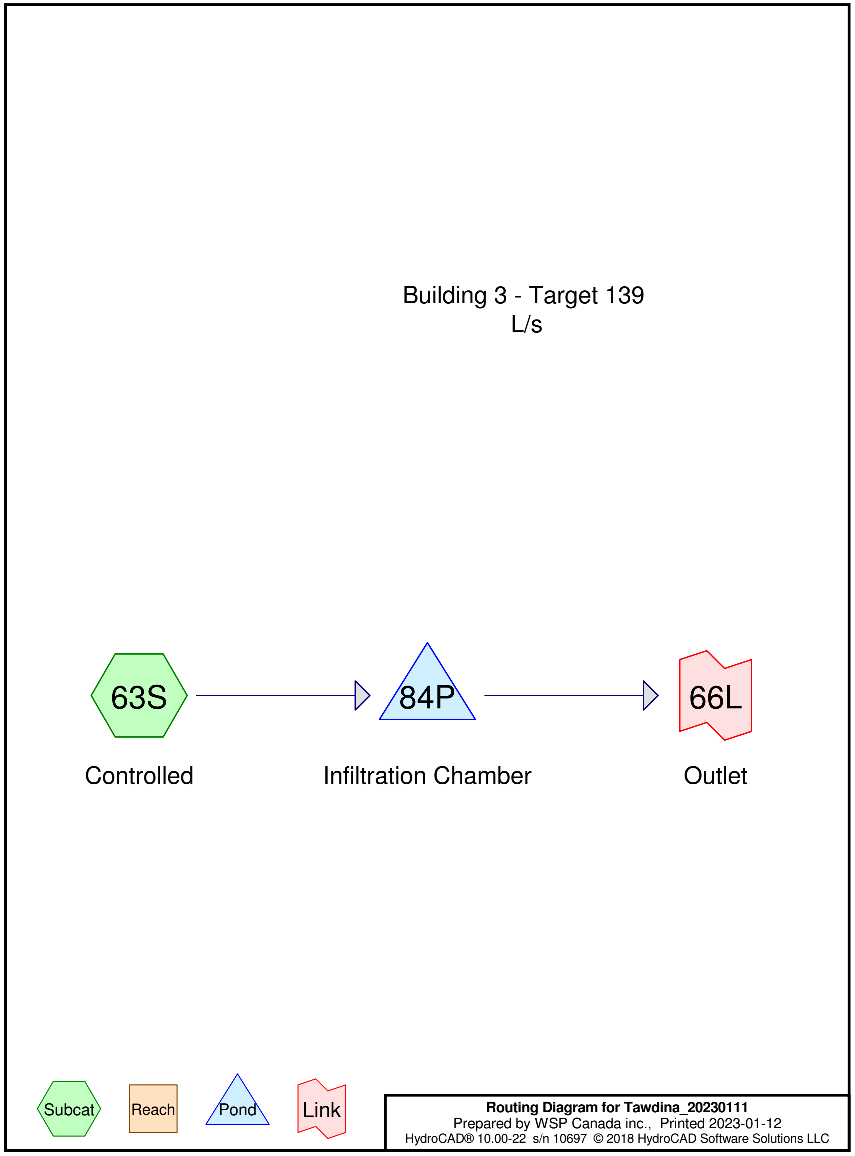
Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 76L: Outlet



APPENDIX

C-3 *BUILDING 3*



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,590.0	0.90	S-BLDG3 (63S)
620.0	0.51	S301 (63S)
300.0	0.53	S302 (63S)
1,230.0	0.70	S303 (63S)
3,740.0	**0.74**	**TOTAL AREA**

Time span=0.00-4.00 hrs, dt=0.01 hrs, 401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 63S: Controlled Runoff Area=0.3740 ha 0.00% Impervious Runoff Depth=13 mm
Tc=10.0 min C=0.74 Runoff=0.07664 m³/s 50.3 m³

Pond 84P: Infiltration Chamber Peak Elev=86.599 m Storage=14.0 m³ Inflow=0.07664 m³/s 50.3 m³
Outflow=0.06411 m³/s 50.3 m³

Link 66L: Outlet Inflow=0.06411 m³/s 50.3 m³
Primary=0.06411 m³/s 50.3 m³

Total Runoff Area = 3,740.0 m² Runoff Volume = 50.3 m³ Average Runoff Depth = 13 mm
100.00% Pervious = 3,740.0 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 63S: Controlled

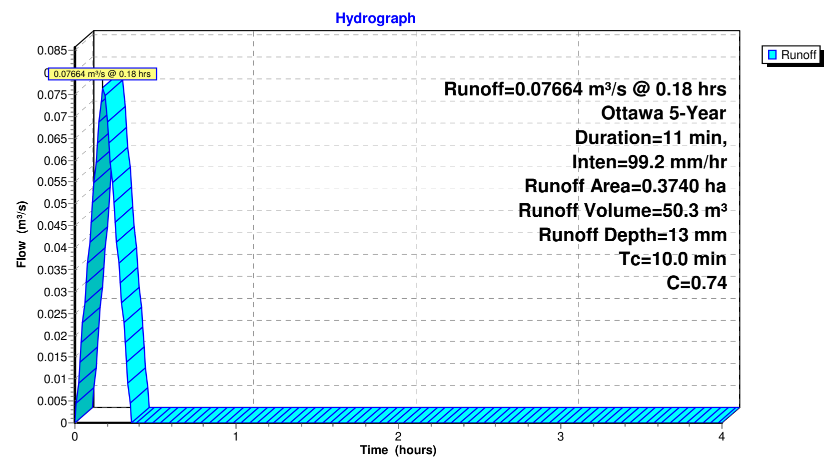
Runoff = 0.07664 m³/s @ 0.18 hrs, Volume= 50.3 m³, Depth= 13 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=11 min, Inten=99.2 mm/hr

Area (ha)	C	Description
0.1230	0.70	S303
0.0620	0.51	S301
0.0300	0.53	S302
0.1590	0.90	S-BLDG3
0.3740	0.74	Weighted Average
0.3740		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 63S: Controlled



Summary for Pond 84P: Infiltration Chamber

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 3,740.0 m², 0.00% Impervious, Inflow Depth = 13 mm for 5-Year event
Inflow = 0.07664 m³/s @ 0.18 hrs, Volume= 50.3 m³
Outflow = 0.06411 m³/s @ 0.21 hrs, Volume= 50.3 m³, Atten= 16%, Lag= 2.1 min
Primary = 0.06411 m³/s @ 0.21 hrs, Volume= 50.3 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 86.599 m @ 0.21 hrs Surf.Area= 88.0 m² Storage= 14.0 m³

Plug-Flow detention time= 4.2 min calculated for 50.2 m³ (100% of inflow)
Center-of-Mass det. time= 4.2 min (14.7 - 10.5)

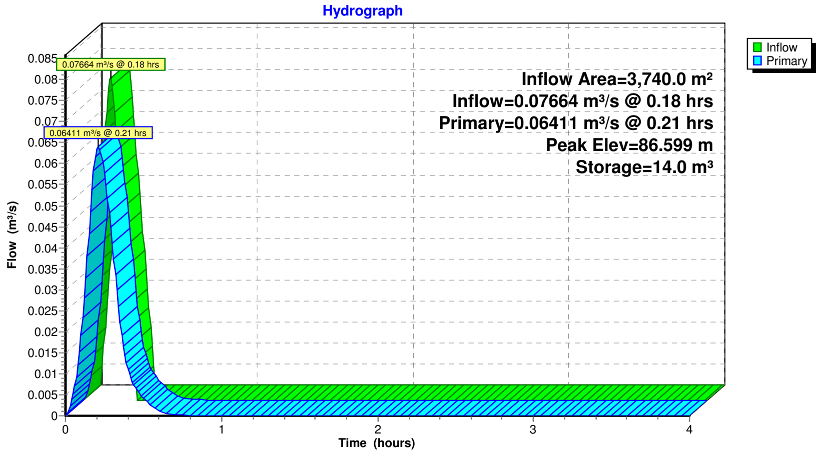
Volume	Invert	Avail.Storage	Storage Description
#1	86.440 m	95.9 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
86.440	88.0	0.0	0.0
87.530	88.0	95.9	95.9

Device	Routing	Invert	Outlet Devices
#1	Primary	86.410 m	**300 mm Vert. Orifice/Grate** C= 1.000

Primary OutFlow Max=0.06408 m³/s @ 0.21 hrs HW=86.599 m (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.06408 m³/s @ 1.36 m/s)

Pond 84P: Infiltration Chamber

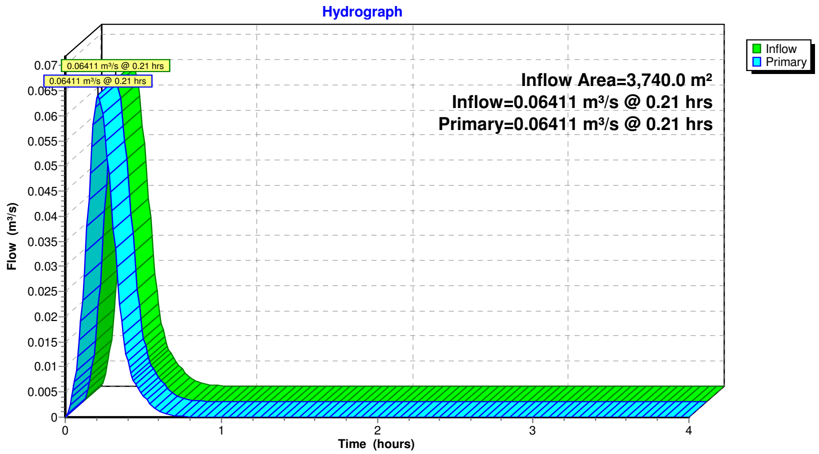


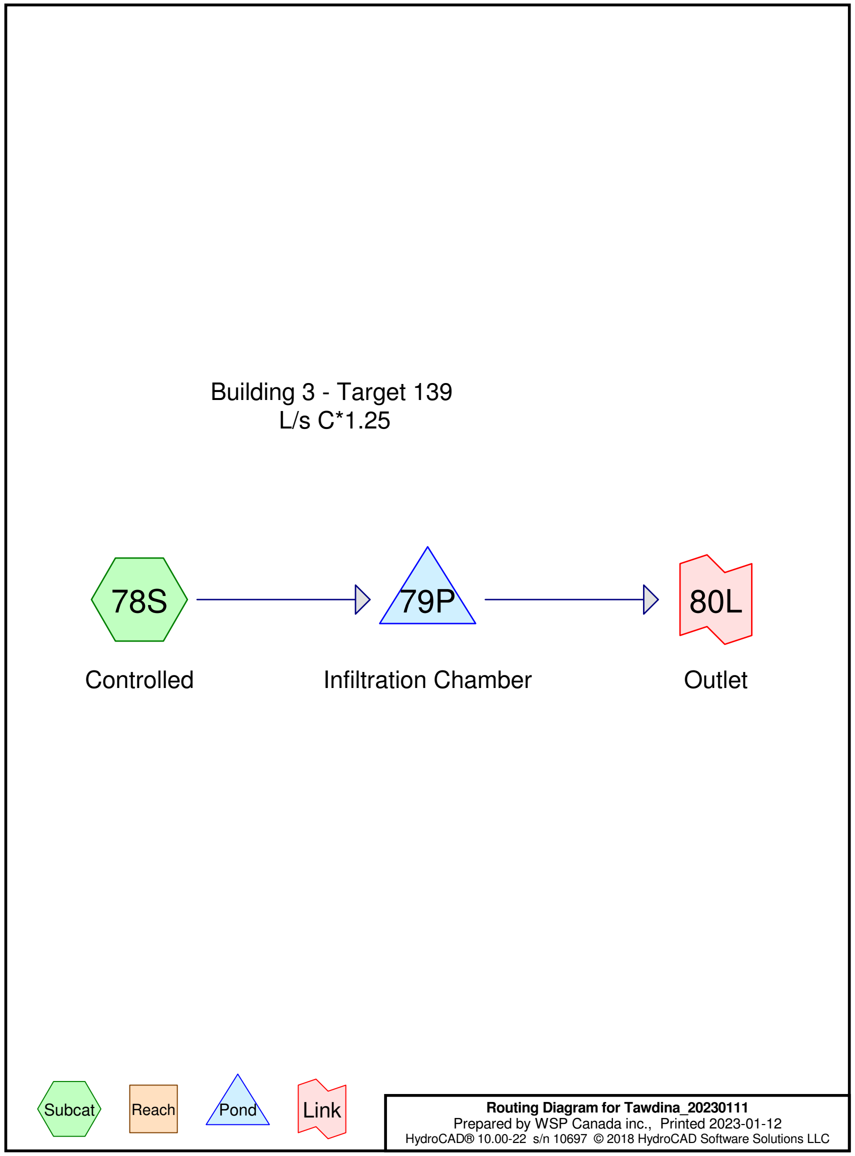
Summary for Link 66L: Outlet

Inflow Area = 3,740.0 m², 0.00% Impervious, Inflow Depth = 13 mm for 5-Year event
Inflow = 0.06411 m³/s @ 0.21 hrs, Volume= 50.3 m³
Primary = 0.06411 m³/s @ 0.21 hrs, Volume= 50.3 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 66L: Outlet





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
1,590.0	1.00	S-BLDG3 - 0.9 (78S)
620.0	0.64	S301 - 0.51 (78S)
300.0	0.66	S302 - 0.53 (78S)
1,230.0	0.87	S303 - 0.7 (78S)
3,740.0	**0.87**	**TOTAL AREA**

Time span=0.00-4.00 hrs, dt=0.01 hrs, 401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 78S: Controlled Runoff Area=0.3740 ha 42.51% Impervious Runoff Depth=27 mm
Tc=10.0 min C=0.87 Runoff=0.15434 m³/s 101.3 m³

Pond 79P: Infiltration Chamber Peak Elev=86.727 m Storage=25.2 m³ Inflow=0.15434 m³/s 101.3 m³
Outflow=0.12777 m³/s 101.3 m³

Link 80L: Outlet Inflow=0.12777 m³/s 101.3 m³
Primary=0.12777 m³/s 101.3 m³

Total Runoff Area = 3,740.0 m² Runoff Volume = 101.3 m³ Average Runoff Depth = 27 mm
57.49% Pervious = 2,150.0 m² 42.51% Impervious = 1,590.0 m²

Summary for Subcatchment 78S: Controlled

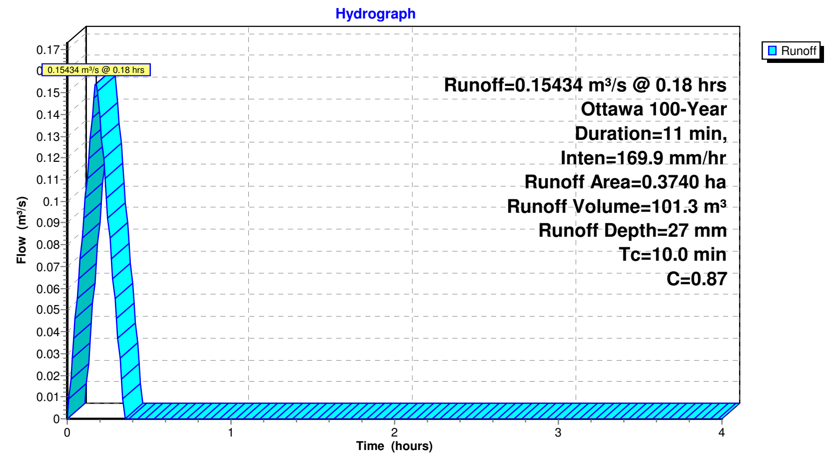
Runoff = 0.15434 m³/s @ 0.18 hrs, Volume= 101.3 m³, Depth= 27 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=11 min, Inten=169.9 mm/hr

Area (ha)	C	Description
0.1230	0.87	S303 - 0.7
0.0620	0.64	S301 - 0.51
0.0300	0.66	S302 - 0.53
0.1590	1.00	S-BLDG3 - 0.9
0.3740	0.87	Weighted Average
0.2150		57.49% Pervious Area
0.1590		42.51% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 78S: Controlled



Summary for Pond 79P: Infiltration Chamber

[44] Hint: Outlet device #1 is below defined storage

Inflow Area = 3,740.0 m², 42.51% Impervious, Inflow Depth = 27 mm for 100-Year event
Inflow = 0.15434 m³/s @ 0.18 hrs, Volume= 101.3 m³
Outflow = 0.12777 m³/s @ 0.21 hrs, Volume= 101.3 m³, Atten= 17%, Lag= 2.2 min
Primary = 0.12777 m³/s @ 0.21 hrs, Volume= 101.3 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 86.727 m @ 0.21 hrs Surf.Area= 88.0 m² Storage= 25.2 m³

Plug-Flow detention time= 3.5 min calculated for 101.0 m³ (100% of inflow)
Center-of-Mass det. time= 3.6 min (14.1 - 10.5)

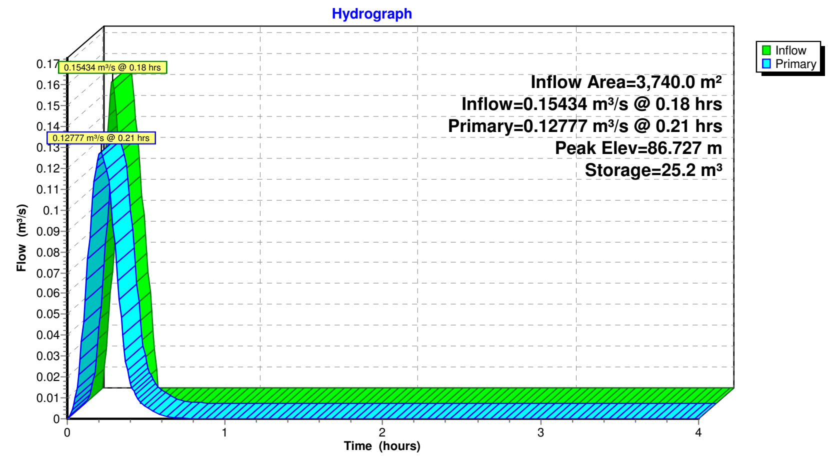
Volume	Invert	Avail.Storage	Storage Description
#1	86.440 m	95.9 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
86.440	88.0	0.0	0.0
87.530	88.0	95.9	95.9

Device	Routing	Invert	Outlet Devices
#1	Primary	86.410 m	**300 mm Vert. Orifice/Grate** C= 1.000

Primary OutFlow Max=0.12768 m³/s @ 0.21 hrs HW=86.726 m (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.12768 m³/s @ 1.81 m/s)

Pond 79P: Infiltration Chamber



Summary for Link 80L: Outlet

Inflow Area = 3,740.0 m², 42.51% Impervious, Inflow Depth = 27 mm for 100-Year event
Inflow = 0.12777 m³/s @ 0.21 hrs, Volume= 101.3 m³
Primary = 0.12777 m³/s @ 0.21 hrs, Volume= 101.3 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 80L: Outlet