1120 Cooke Blvd Three New Multi-Storey Buildings Phase 2

Preliminary

Functional Servicing and Stormwater Management Report

Project Location:
1120 Cooke Blvd, Burlington, ON

Prepared for:
ADI Developments (Masonry) Inc.
1100 Burloak Drive Suite 700, Burlington, ON

Prepared by:
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November 19, 2021

MTE File No.: 48247-100

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. were retained by ADI Developments (Masonry) Inc. to complete the site grading, servicing, and stormwater management design for the proposed mixed-used development located at 1120 Cooke Boulevard in the City of Burlington (see Figure 1 for Location Plan). This report will outline a functional servicing and stormwater management strategy for the proposed development.

The site is located on a 0.97ha parcel of land bounded by a floodplain storage area to the north, Cooke Boulevard and Phase 1 of Stationwest (existing residential) to the east, Masonry Court and industrial properties to the south, and Waterdown Road to the west. This development is Phase 2 of the Station West development. Phase 1 is located east of the Phase 2 development, and is comprised of stacked townhouses, back to back townhouses, standard townhouses, and 2-6 storey residential buildings.

The property is currently vacant with the exception of an existing sales office and parking lot in the southwest corner of site. The proponent plans to construct 3 residential buildings in 3 Phases of which 1 Phase will be above ground and 2 Phases will be above and bellow ground. Each Phase will include the following:

- Phase 1: Building B, 26-storeys;
- Phase 2: Building C, 36-storeys; and,
- Phase 3: Building A, 36-storeys.

Commercial space will be provided within the main level of Building B in the southeastern corner of the site. Parking will be provided on site for the proposed buildings via five levels of underground (below grade) parking, a few parking spaces will be available at grade for the commercial space along the eastern site entrance, and car-share parking will also be available at grade adjacent to the park.

A layby is proposed along the western side of Cooke Blvd. adjacent to Building B to provide a drop off area for the proposed commercial space. Waterdown Road and Masonry Court widening's will be required as outlined in the BA group. The proposed works consist of the following:

- 3.90m +/- of road widening for a designated left turn lane to Masonry Ct. on the western side of the Waterdown Rd. ROW;
- 3.0m +/- of road widening for a designated right turn lane into the site on the eastern side of the Waterdown Rd. ROW;
- 1.0m +/- of road widening for a designated right turn lane to Waterdown Rd. on the northern side of the Masonry Ct. ROW; and
- A signalized intersection at Masonry Ct. and Cooke Blvd.

Preliminary details of the proposed functional design for road improvements on Waterdown Rd. and Masonry Ct. are provided by BA Groups Functional Design Drawing (November, 2021). Refer to Figure A for the proposed schematic. Detailed design will be provided during the site plan application phase.

Existing municipal storm and sanitary sewers and watermain services are located on the abutting right-of-way's (ROW) which will be utilized to service the proposed development.

The functional servicing described in this report will provide additional detailed information on the proposed servicing scheme for the site. Please refer to the site plan and the enclosed MTE drawings for additional information.

1.2 Background Information

The following documents were referenced in the preparation of this report:

- Ref 1: *Geotechnical Investigation StationWest Phase 2 Residential Development*, Landtek Ltd. (April 15, 2021)
- Ref 2: *Functional Servicing and Stormwater Management Report*, Urbantech West (October 2017).
- Ref. 3: *Water and Wastewater Linear Design Manual (Version 2.0),* Regional Municipality of Halton (May 2014).
- Ref. 4: *Standard Drawing Manual*, City of Burlington Engineering Department (March 2014).
- Ref. 5: Ontario Building Code (2012).
- Ref. 6: *Low Impact Development Stormwater Management Planning and Design Guideline,* Credit Valley Conservation & Toronto and Region Conservation for the Living City, Version 1.0 (2010).
- Ref. 7: *Design Guidelines for Drinking-Water Systems*, Ministry of the Environment and Climate Change (2008).
- Ref. 8: *Erosion & Sediment Control Guideline for Urban Construction* (December, 2006).
- Ref. 9: *MOE Stormwater Management Practices Planning and Design Manual*, Ministry of Environment and Climate Change (March 2003).
- Ref. 10: *Water Supply for Public Fire Protection*, Fire Underwriters Survey (1999).

1.3 Geotechnical Investigation

A geotechnical investigation was undertaken by Landteck Ltd. dated April 15, 2021 (Ref. 1) for the Phase 2 development area. Four (4) boreholes were advanced to depths ranging from 6.6m to 18.5m below existing grade. The investigation found that there exists fill material and native soils, with clayey silt till underneath. Bedrock was identified in the two boreholes that were advanced to 18.5m, at a depth of 93.5masl (meters above sea level) and 93.9masl.

Groundwater was noted in all of the boreholes ranging from 3.0 to 8.0mbgs (meters below ground surface). It is noted that groundwater levels are subject to seasonal fluctuations and weather events, and also that the soils found on site are susceptible to perched water conditions. The report recommends that all subsurface structures are to be waterproofed where below the seasonally high groundwater level.

Due to the footprint of the underground parking structure taking nearly the entire site, the pavement design will be designed on top of the proposed structure, such that they will be designed “on deck”.

Based on the above information, a value of 79 was used for the pervious CN, falling under Hydrologic Soil Group B.

1.3.1 Hydrogeological Investigation and Phase 2 Environmental Site Assessment

A Phase 2 Environmental Site Assessment was undertaken by Landteck Ltd. dated June, 2016 (Ref. 2) for the Phase 1 and Phase 2 development areas. Fifteen (15) boreholes were advanced, with thirteen (13) of those having monitoring wells installed. The measured groundwater level elevation varied between 99.4 to 102.1 meters above sea level (masl). A total of eighteen (18) groundwater samples were analyzed, and only one (1) exceedance was determined based on the 2011 MOE Table 3 Standards in groundwater (Ref. 9). This one exceedance is located adjacent to the Highway 403 and is determined to be due to highways salting activities, and is deemed to not be of concern. Additionally, a record of site condition was completed for the site.

1.4 Site Grading

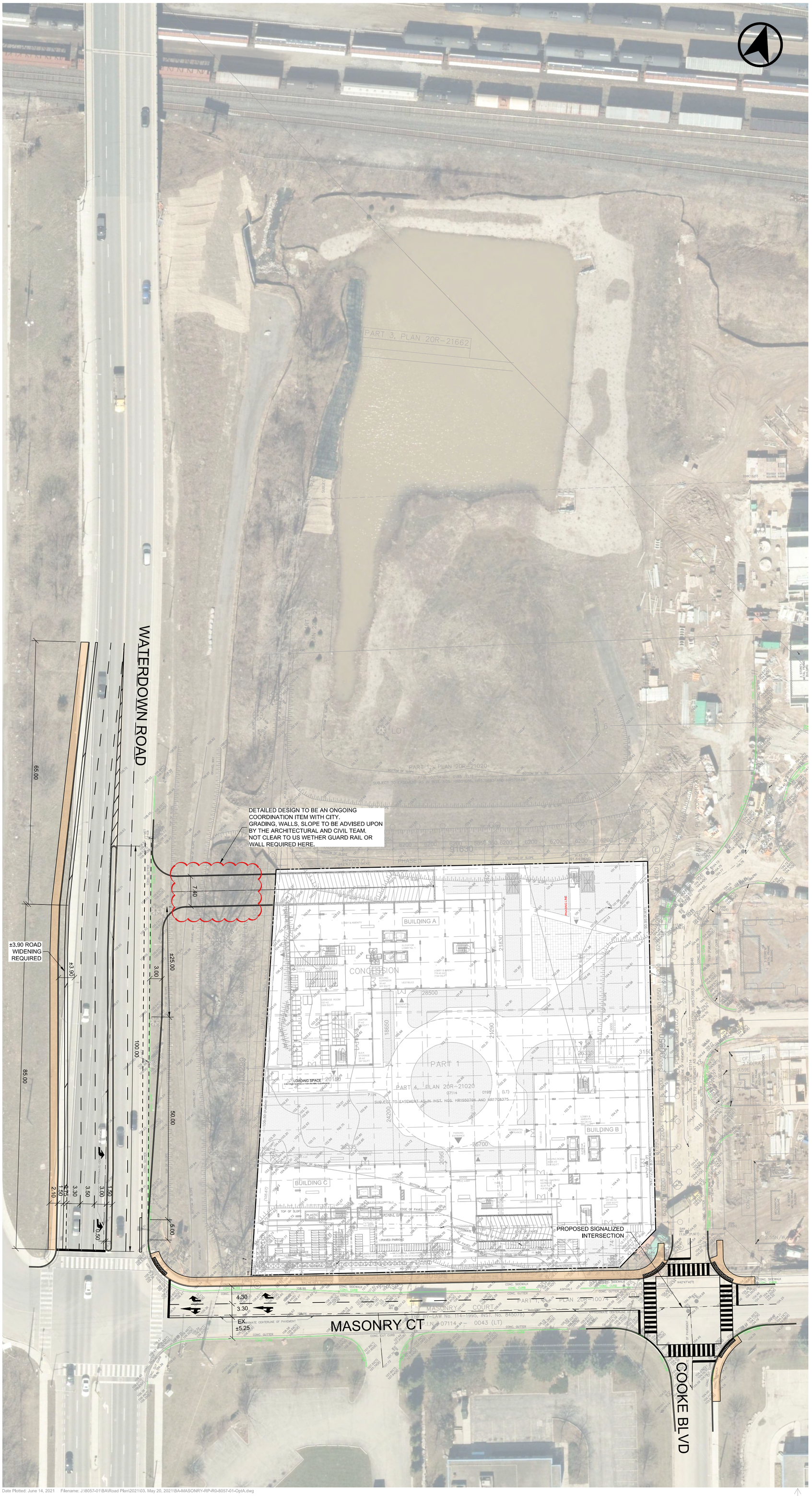
A topographic survey was performed by R. Avis Surveying Inc. dated April 23, 2021. The information indicates that the site is currently an excavated pit, which was excavated during the Phase 1 construction. There is currently a small sales office and parking in the southwest corner of the site that will be demolished prior to the commencement of Phase 2 construction. The only existing underground infrastructure on site is a underground storm service stub in the northeast corner which was constructed during the Phase 1 construction. The southwest corner is the highest point with an overall grade difference on site of approximately 7.93m. There is an existing gravel maintenance access road for the relief culvert floodplain area located, which is located north of the site. The existing gravel maintenance access road is located west of the the sites western property line. Based on the detailed topographic survey information and the site plan provided by CORE Architects, a grading scheme was developed.

Under proposed conditions, site elevations will range from approx. 109.11m in the southwestern corner, to 101.96m along the norther exposed building foundation. The proposed building first floor elevation (FFE) will be 105.06. The site is graded to self-contain drainage with the exceptions being the perimeter landscape which will drain uncontrolled off site (see Figure 3). The parking lot will we graded towards a series of area drains which will internally convey stormwater runoff to a proposed underground stormwater tank to be located within the underground parking structure. The overland flow route in case of a major storm event will be to the west, spilling into Cooke Blvd. ROW if such an event were to occur. The proposed ramp access to Waterdown Rd. cuts off the existing maintenance access road, therefore a new proposed maintenance access ramp which turns off of the proposed ramp to the north is proposed. Please see Drawing C2.1- Site Grading Plan for further details.

1.5 Aldershot Go Mobility Hub

The proposed development is located within the proposed Aldershot Go Mobility Hub, as shown in the figure included in Appendix D. The mobility hubs are proposed areas located near existing Go stations which are intended to become concentrated mixed use neighbourhoods. Due to the proposed developments proximity to the Aldershot Go station, it is located within the proposed Aldershot Go Central Precinct. This area is proposed to focus the most significant concentrated development of the proposed mobility hubs, with a focus on high rises and mixed use developments. The proposed development aligns with the vision of the proposed Aldershot Go Central Precinct by providing residential development close to the existing Go station and with a proposed minimum of two uses, residential and commercial, within the development (as described in the report included in Appendix D). To analyze the impact of the proposed

development in this growing area, an External Water and Wastewater Area Servicing plans are included in Sections 3.4 and 4.5.



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GENERAL NOTES

1. SURVEY PREPARED BY R. AVIS SURVEYING INC. DATED MARCH 2021
2. ARCHITECTURAL PLANS PREPARED BY CORE ARCHITECTS AND RECEIVED ON MAY 21, 2021
3. AERIAL DATED 2019

DRAFT

FOR DISCUSSION PURPOSES ONLY
NOT APPROVED FOR CONSTRUCTION

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BA Group

BA Consulting Group Ltd.
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Toronto ON M4V 1K9
TEL 416 961 7110
EMAIL bagroup@bagroup.com

MOVEMENT IN URBAN ENVIRONMENTS
BAGROUP.COM

101 MASONRY COURT

DRAFT FUNCTIONAL DESIGN
WATERDOWN RD / MASONRY CT
OPT A - WITHOUGHT METROLINX

Date: MAY 2021

Project No.: 8057-01

Scale: 1:500 (0 5 10 15 20m)

FD-01A

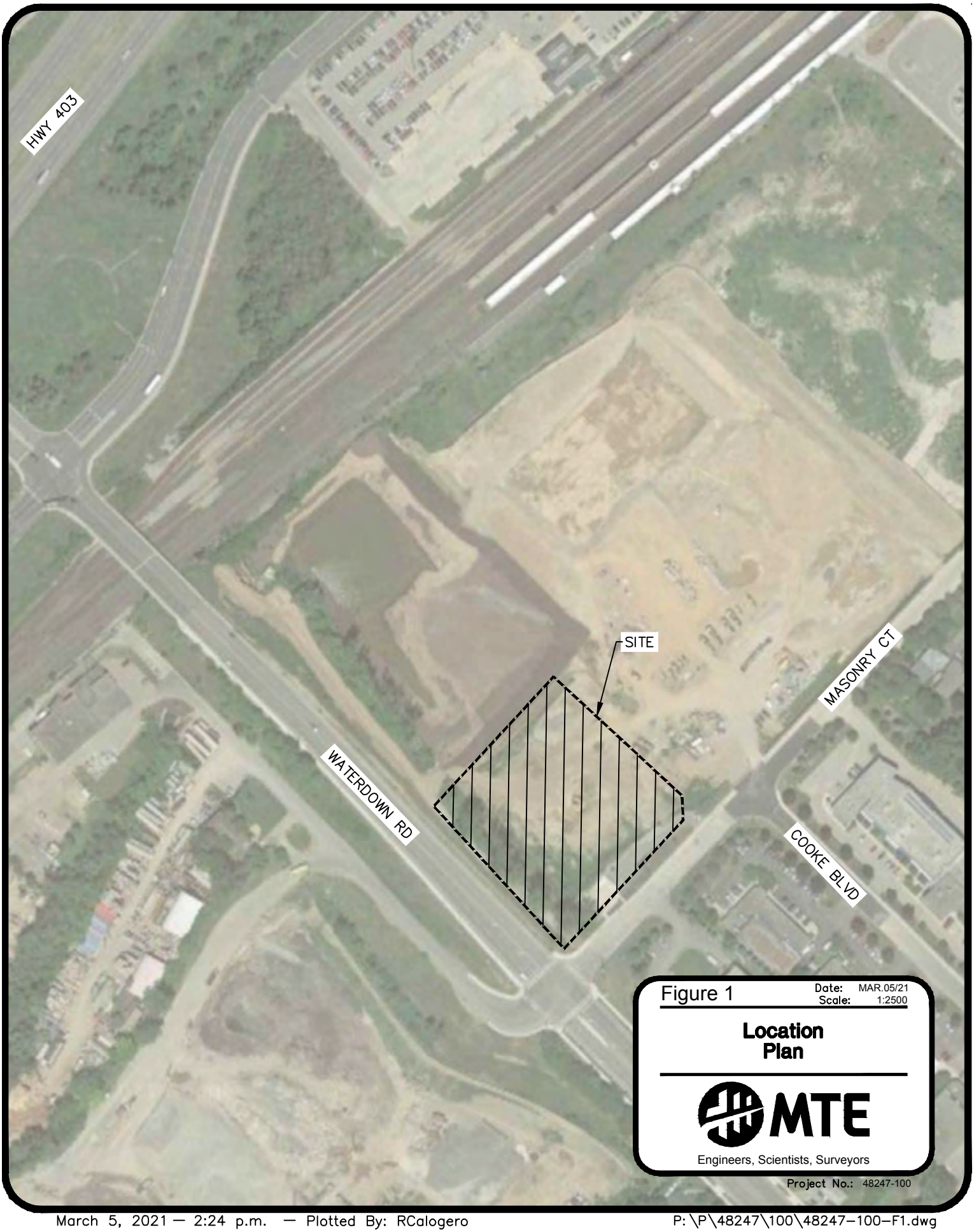


Figure 1

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Location Plan

MTE

Engineers, Scientists, Surveyors

Project No.: 48247-100

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2.0 Stormwater Management

The following sections will describe the proposed stormwater management (SWM) plan for the proposed development.

2.1 Stormwater Management Criteria

Based on email correspondence with City of Burlington Staff (see Appendix A), the following stormwater management (SWM) criteria will be applied to the site:

2.1.1 Water Balance

Retain 25 mm of storm runoff volume on site through infiltration, evapotranspiration or rain water reuse for the increase in percent impervious from existing conditions.

2.1.2 Quantity Control

Attenuation of the post-development peak flows for the 2 through 100-year storm events to the 2-year to 100-year storm events existing conditions peak flow rate. Design Runoff Coefficients are provided by the City.

2.1.3 Quality Control

An enhanced (Level 1) water quality treatment (80% TSS Removal) is required for all impacted surface runoff prior to discharging to the receiving system.

2.2 Existing Conditions

Under existing conditions, the majority of the site is comprised of an excavated dirt pit, with a small sales office and parking area in the southwestern corner. There is an existing 300 mm diameter storm sewer, which increases to a 600mm diameter storm sewer, which flows north at 0.50% within the Cooke Blvd. ROW, located east of the site. This storm sewer was part of Phase 1 of the Station West development. There is also an existing 300mm diameter storm sewer flowing east on Masonry Court, and a 300mm diameter storm sewer on the western side of Waterdown Road, west of the site. The majority of the site is graded as a seven-meter-deep pit, as it was pre-graded during Phase 1 to prepare for the Phase 2 development. The site sits approximately four meters lower than the Waterdown Road, located west of the site. The only known existing underground structure on site is a 450mm diameter storm sewer stub which flows east at 1.2%. All existing storm sewers within the Phase 1 development east of the site ultimately discharge to the existing 825mm diameter storm sewer at 0.40%, which outlets to the existing flood storage area located north of the site. There are no known existing stormwater management quantity or quality controls on site, however preliminary calculations for this proposed Phase 2 development were included in the Phase 1 Functional Servicing and Stormwater Management Report prepared by Urbantech West, dated October 2017.

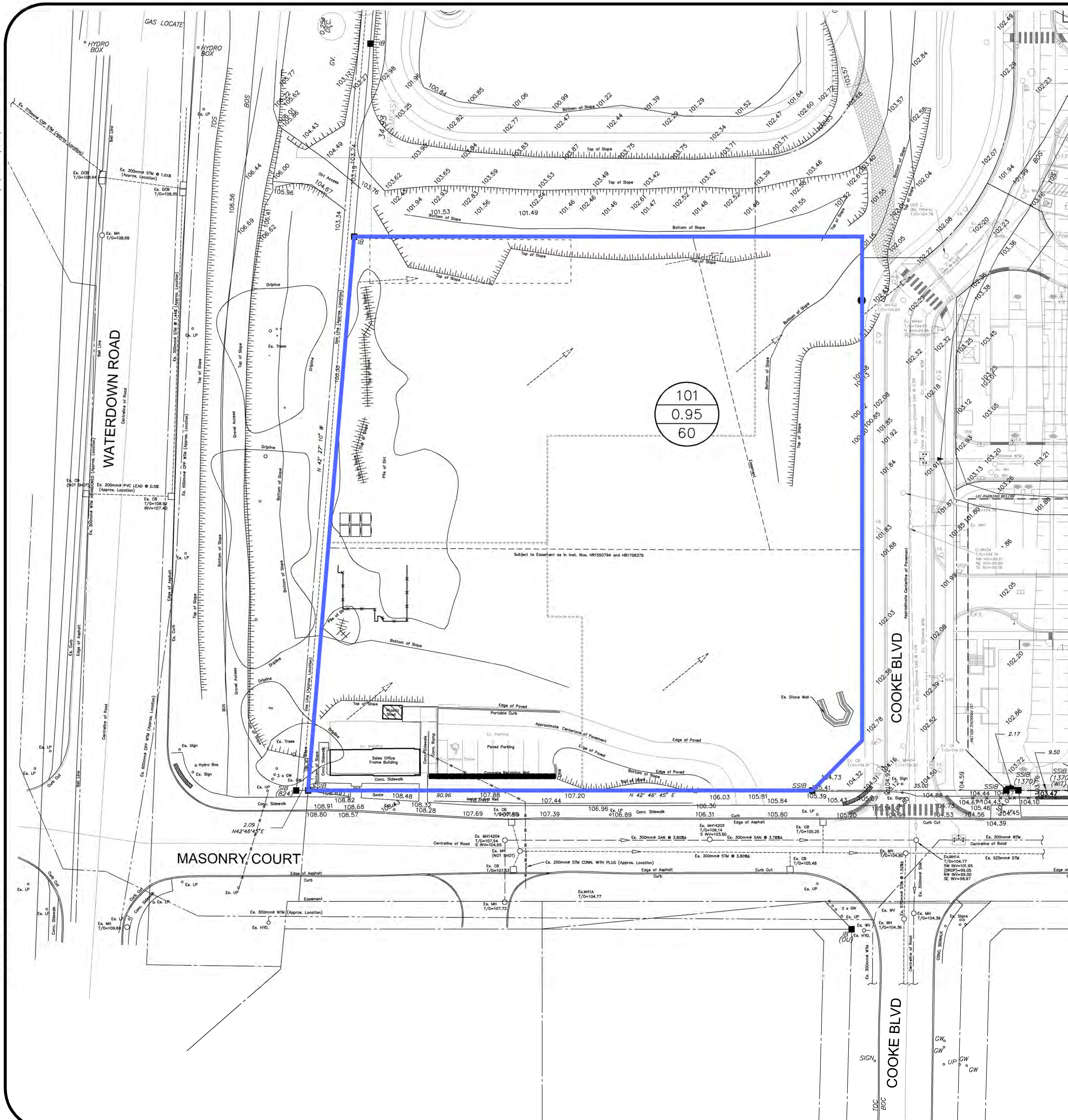
The proposed development is adjacent to Tributary 3 of Grimestone Creek. Recently a relief culvert floodplain area (both open water and dry storage) was approved by Conservation Halton and the City of Halton to bring the Regional flood elevation down to 103.74m from 104.92m as part of Phase 1. These floodplain improvement activities allowed the 1120 Cooke Blvd. developments to stay clear of the Regional flood elevation. These floodplain storage areas are located north of the site See Appendix D for the Approved Permit for the relief culvert and floodplain area.

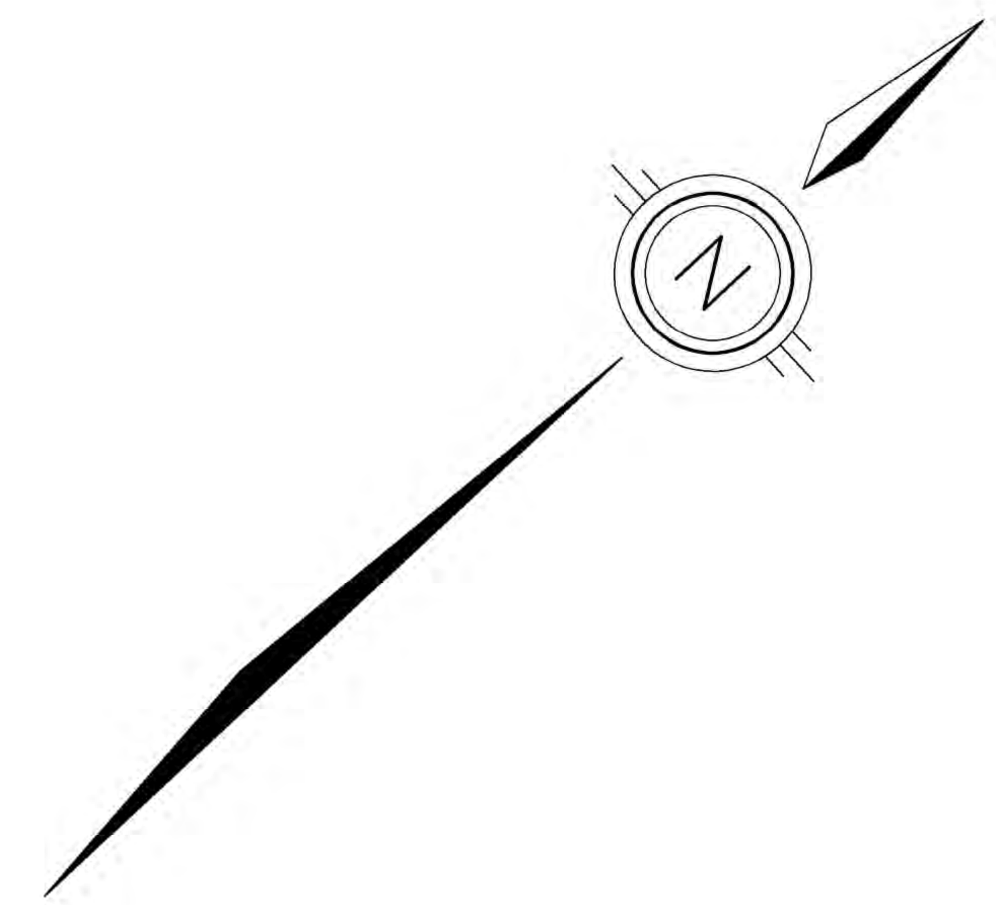
The existing conditions have been defined by one (1) catchment areas (see Table 2.1 and Figure 2). The existing percent impervious of the site was set at 60% based on comments from Conservation Halton (Ref. 2).

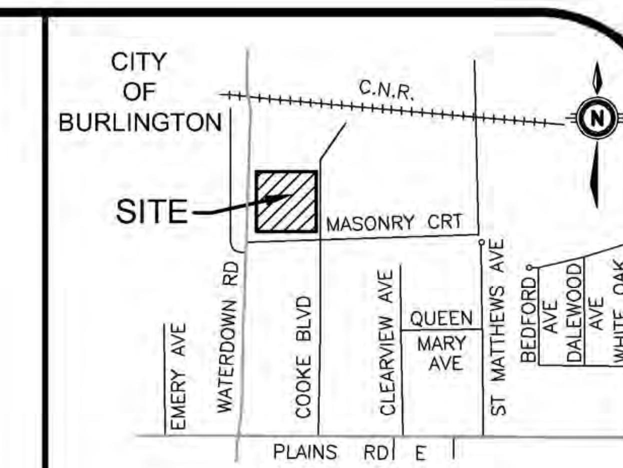
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KEY PLAN N.T.S.

GEODETIC BM **ELEV. = 100.718m**

ELEVATIONS ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK NO. 0011922u2445.

SITE BENCHMARK **ELEV. = m**

NOTE TO CONTRACTOR :

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THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	YYYY-MM-DD
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1.	ISSUED FOR ZBA	GPB	2021-07-21

LEGEND

SITE BOUNDARY

EXISTING DIRECTION OF DRAINAGE

Ex. 375mmø STM — Ex. MH — EXISTING STORM SEWER

CATCHMENT 101

101 — ID No.

0.95 — AREA (Ha)

60 — PERCENT IMPERVIOUS AS PER APPROVED PHASE 1 FSR AND SWM REPORT

MTE

Engineers, Scientists, Surveyors

905-639-2552

CLIENT

ADI DEVELOPMENT (MASONRY INC)

1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT

101 COOKE BLVD
THREE MULTI–STOREY BUILDING

101 MASONRY COURT BURLINGTON, ON

DRAWING

PRE-DEVELOPMENT CATCHMENT AREA

Project Manager: G. BERENYI	Project No.: **48247-100**
Design By: EXK	Checked By: GPB
Drawn By: LXQ/DXC	Checked By: LXQ
Surveyed By: OTHERS	Drawing No.: **Figure 2**
Date: Mar.05/21	
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Table 2.1 - Existing Conditions Catchment Area

Catchment ID	Description	Area (ha)	% Imp. [A]
101	Existing Site	0.95	60
[A] As Provided by the City of Burlington stated in the Phase 1 FSR and SWM Report (Ref. 1).			

The existing conditions were based of the allowable release rate outlines by the City (See Appendix A for correspondence), and the previously approved Phase 1 FSR and SWM Report (Ref. 2). Table 2.2 summarizes the allowable pre-development runoff rates

Table 2.2 - Allowable Site Discharge

Catchment	Area (ha)	Allowable Peak Discharge Rate (100-Year Storm)[A] (m^3/s)
101 (Existing Site)	0.95	0.182
[A] Discharge rate taken from Phase 1 FSR and SWM Report (Ref. 2).		

2.3 Proposed Conditions

Under proposed conditions, the proponent plans to construct three new 26 to 36-storey residential buildings over three phases, with commercial space on the first floor. Surface and underground parking will be included for both buildings. The perimeter of the site will consist of walkways and landscaped area.

The proposed conditions drainage pattern is delineated by two (2) catchment areas. The total proposed site area has increased from the existing site area due to the proposed access ramp onto Waterdown Rd. Stormwater runoff from the site will be collected by a series of area drains on the underground parking structure surface. These drains will connect to the internal plumbing of the building and therefore will be detailed by the mechanical consultant. The storm sewer outlet for the development will convey flows to the existing 600mm diameter combined sewer located on Cooke Blvd. Stormwater management controls in the form of an orifice and storm tank will be implemented to control post-development discharge rates to the allowable release rate for the site. Due to grading constraints, the exterior perimeter landscaped and walkway areas of the site will drain uncontrolled to the abutting ROWs via overland sheet flow.

Table 2.3 provides a brief description of each catchment area as well as the size and impervious cover associated with each. Figure 3 provides an illustration of the post-development catchment areas. Appendix A contains detailed information pertaining to the stormwater management model.

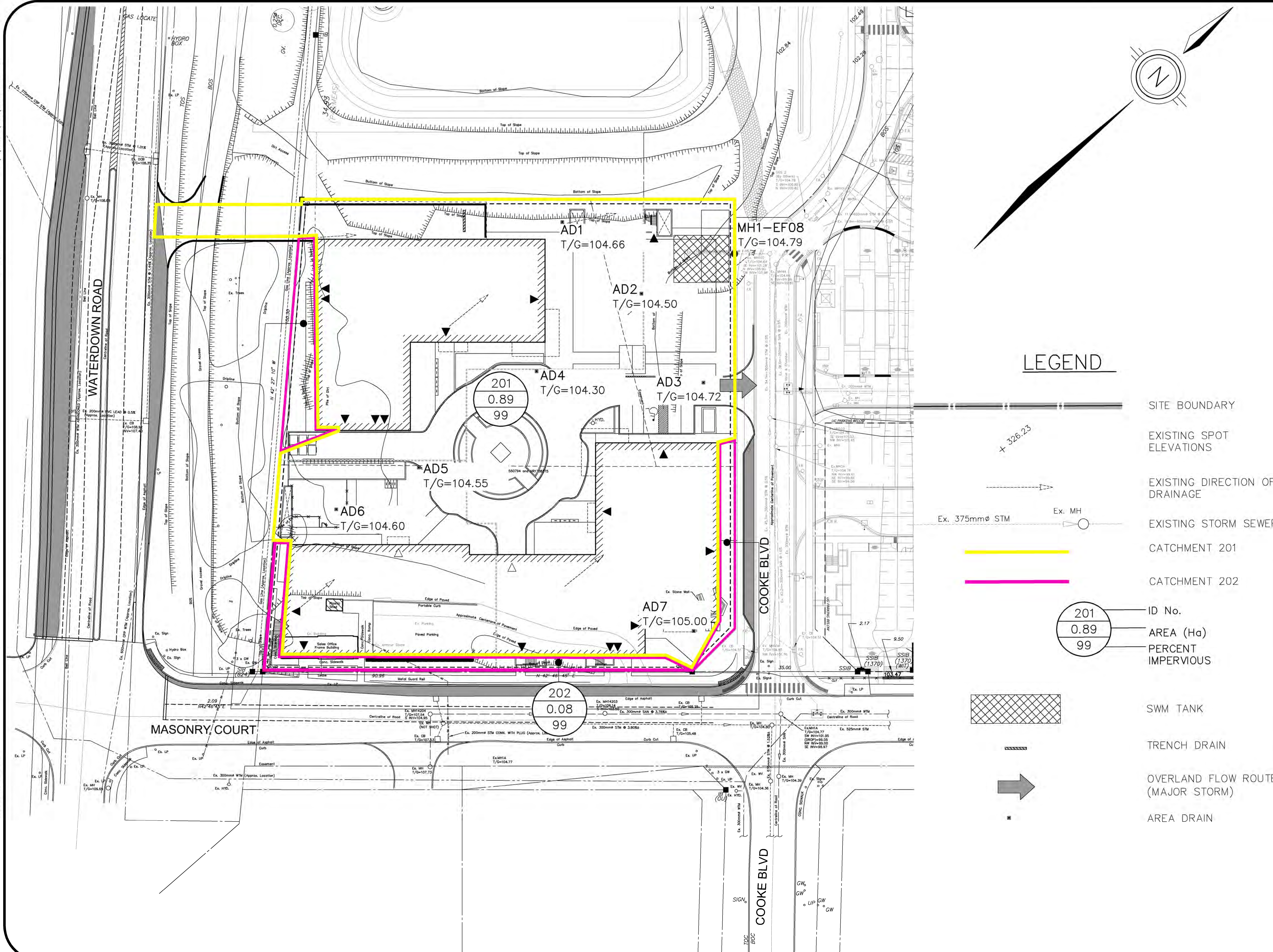
Table 2.3 - Proposed Conditions Catchment Areas

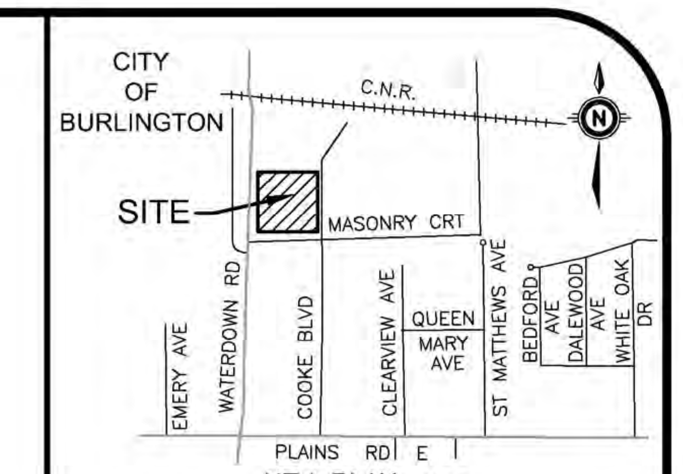
Catchment ID	Description	Area (ha)	%Imp.
201	Proposed site (Including ramp to Waterdown road) (controlled)	0.89	99
202	Proposed surrounding landscape (uncontrolled)	0.08	99
	Total	**0.97**	**99**

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1.	ISSUED FOR ZBA	GPB	2021-06-30

MTE

Engineers, Scientists, Surveyors

905-639-2552

CLIENT

ADI DEVELOPMENT (MASONRY INC)

1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT

101 MASONRY COURT FOUR MULTI–STOREY BUILDING

101 MASONRY COURT BURLINGTON, ON

DRAWING

POST-DEVELOPMENT CATCHMENT AREA

Project Manager: G. BERENYI	Project No.: **48247-100**
Design By: EXK	Checked By: GPB
Drawn By: LXQ/DXC	Checked By: LXQ
Surveyed By: OTHERS	Drawing No.: **Figure 3**
Date: Mar.05/21	
Scale: 1:350	Sheet 2 of 2

2.3.1 Water Balance

In order to meet the required stormwater retention of 25mm for the site (per Section 2.1), rain water harvesting will be implemented. The total require retention volume to be provided can be calculated as follows:

Retention Volume Required = Site Area x Increase in % Impervious x 25mm

= 9700 m^2 * (99%-60%) * 25mm /(1000mm/ m)

= 95 m^3

Some options that will be explored further during the detailed design stage includes using harvested rain water for landscape irrigation, process water in cooling towers, or for non-potable water uses. Further details will be provided by the mechanical consultant at a later stage.

2.3.2 Quantity Control

Stormwater management quantity controls for the site will be provided with an underground storage tank coupled with an orifice control located within the underground parking structure. The tank will form part of the underground parking structure and will require structural design and waterproofing (to be designed by others at the building permit stage). Backwater valves are to be installed within the building as indicated on drawing C2.2 for the proposed storm and sanitary services. Table 2.4 summarizes the stage-storage-discharge relationship of the proposed storm tank and orifice control. This information is used in the hydrologic model.

Table 2.4 - Stage-Storage-Discharge Calculations for Underground Storm Tank

Elevation (m)	Head, H (m)	Cumulative Storage Volume (m^3)[A]	Discharge Q (m^3/s)[B]	Comments
101.40	0.00	0.0	0.0000	Inside Bottom of Tank
101.51	0.00	13.2	0.0000	C/L of orifice
102.05	0.53	75.7	0.0811	1/3 Storm Tank
102.69	1.18	151.3	0.1206	2/3 Storm Tank
102.86	1.34	170.2	0.1286	75% Storm Tank
103.34	1.83	227.0	0.1500	Top of Tank

[A] Storage volume based on a tank with internal footprint of 117.0m2 and an internal height of 1.83m for an overall internal storage volume of 227.5m3. See Appendix A and drawing C1.2 for more details.
[B] From orifice equation Q = CA (2gH)0.5 for a 226 mm diameter orifice
Where: C = 0.62, A=cross-sectional area, g=9.81, H=pressure head

The proposed conditions were assessed using the SWMHYMO hydrologic modeling program developed by J.F. Sabourin & Associates for the 2 year to 100-year City of Burlington 4-hour Chicago Distribution design storms. Appendix A contains detailed hydrologic modeling parameters and input/output printouts for the proposed conditions.

Table 2.5 summarizes the proposed conditions site peak discharge rates for the site with the aforementioned stormwater management controls and compares them to the allowable discharge rate.

Table 2.5 - Comparison of Proposed and Existing Peak Discharge Rates to Cooke Bld

Storm Event	Proposed Peak Discharge Rate (m^3/s) [A]	Allowable Discharge Rate (m^3/s) [A]
2-yr	0.102	0.182
5-yr	0.126	
10-yr	0.141	
25-yr	0.159	
50-yr	0.170	
100-yr	0.181	
[A] Discharge rate taken from SWMHYMO Output (see Appendix A).		

As seen in Table 2.5 above, the proposed peak flow rates to Cooke Blvd. are controlled to below the allowable release rate.

The analysis indicates the following:

- For the 2-year to 100-year events, the total proposed conditions peak discharge rates from the site do not exceed the allowable release rate as illustrated in Table 2.5. This satisfies the stormwater management quantity control requirement set by the City of Burlington.
- Sufficient storage volume is provided within the storm tank to contain stormwater as illustrated within Table 2.4 and Appendix A.
- Overland flow to Cooke Blvd. for proposed conditions will be controlled to the allowable release rate for the site, as outlined in the approved Phase 1 FSR and SWM report (Ref. 2).

2.3.3 Water Quality Control

Water quality control for the proposed development will be provided by a Stormceptor oil/grit separator (or approved equivalent) that will be installed at the downstream end of the stormwater management system prior to connecting into the existing 600mm diameter storm sewer within the Cooke Blvd. ROW. The following parameters were used to size the oil/grit separator:

- Upstream Catchment Area = 0.89ha (Catchments 201);
- % Impervious = 99%;
- Particle Distribution = FINE ; and
- Upstream storage = none (per City requirements).

The analysis indicates that a Stormceptor EFO8 will provide 84% TSS Removal and treat over 90% of the average annual runoff, which meets the requirements for an “Enhanced” (Level 1 or 80% TSS removal) level of water quality protection. Stormceptor sizing output information is included in Appendix A.

Stormwater runoff generated from the remainder of the site perimeter (Catchment 202) will flow overland uncontrolled to the abutting ROWs. Since these areas are comprised of walkways and landscaped areas, stormwater runoff is generally considered to be clean and therefore no water quality controls will be provided for these areas.

Due to grading constraints and the nature of the proposed development with the buildings and parking lot taking up the majority of the subject site, there are limited opportunities for proposed low impact development (LID) features on the site. As such, the proposed OGS unit will be the only form of quality control proposed.

2.3.4 Private Storm Service Connection

An existing 450mm diameter private storm sewer service (downstream of the storm tank & orifice control) at a slope of 1.0% is stubbed 10m into the property line, as part of the Phase 1 development. Part of the existing 450mm diameter storm sewer service will be removed to make room for the proposed underground parking structure. The proposed underground stormwater tank, located in the underground parking structure, will outlet into the proposed EFO8, and will also have an access hatch for maintenance. From the EF08, stormwater will outlet to the existing 450mm diameter private storm service, which then discharges into the existing 600mm diameter storm sewer on Cooke Blvd. The existing 450mm diameter storm sewer has a full flow capacity of approximately 28.5 L/s which is greater than the 100-year controlled peak discharge of 15.0 L/s from the orifice (see Table 2.4). Therefore, the proposed storm lateral will have sufficient capacity to convey the proposed 100-year controlled peak flow from the site. The proposed OGS and stormwater tank are designed for the ultimate buildout conditions and will be constructed during the first phase of construction. Therefore, the interim conditions are addressed. Please refer to Drawing C2.2 for further site servicing details.

2.4 Sediment and Erosion Control

Sediment and erosion control measures will be implemented on site during construction and will conform to the Erosion & Sediment Control Guideline for Urban Construction (Ref. 8) and City of Burlington Standards.

Sediment and erosion control measures will include:

- Installation of silt control fencing at strategic locations around the perimeter of the site where feasible.
- Preventing silt or sediment laden water from entering inlets (catch basins / catch basin manholes) by wrapping their tops with filter fabric or installing silt sacks.
- Construction of 6m x 12m mud mat at the exit from the site to Cooke Blvd. to mitigate the transportation of sediments to the surrounding roads.
- Maintaining sediment and erosion control structures in good repair (including periodic cleaning as required) until such time that the Engineer or City of Burlington approves their removal. Erosion control measures to be inspected daily and after any rainfall event.

3.0 Sanitary Sewer Servicing

3.1 Existing Conditions

Based on plan & profile drawings provided by the City of Burlington ('the City') and Halton Region ('the Region'), the site has servicing available via an existing 200mm diameter and 300mm diameter mainline sewer in Cooke Blvd, and a 300mm diameter mainline sewer in Masonry Court. Table 3.1 summarizes the existing sanitary sewers.

Table 3.1 – Summary of Mainline Sanitary Sewers fronting the Site

Street	Direction of Flow	Diameter	Slope	Capacity [A]
Cooke Blvd.	South	200 mm	0.69%	43.5 L/s
Cooke Blvd.	South	300 mm	1.04%	84.9 L/s
Masonry Court	East	300 mm	3.80%	162.4 L/s

[A] Full flow capacity calculated using Manning's Formula

3.2 Sanitary Demands

The anticipated sanitary discharge from the proposed development was estimated using Halton Region design criteria and the Ontario Building Code (2012) based on the proposed building use. Table 3.2 provides an estimate of the total residential population and the number of units for all phases. For a population breakdown by phase refer to Appendix. A.

Table 3.2 - Population Estimate

Unit Types	Total Number of Units [A]	People per unit [B]	Population (people) [C]
1 Bedroom	424	2	848
1 Bedroom + Den	424	3	1272
2 Bedroom	277	4	1108
2 Bedroom + Den	13	5	65
3 Bedroom	1	6	6
		Total Estimated Population	**3299**

[A] Unit Count taken from Site plan by Core Architecture received October 7, 2021
[B] Population density based on OBC Occupancy Loads Section 3.1.7.17.1. clause 1b)
(2 persons per bedroom). Population Densities for 1 Bedroom + Den was estimated to be 3 persons per unit due to possibility of den being used at small bedroom.
[C] Population calculated as (Total # of Units) X (Persons per Unit)

In addition to the residential population of the buildings, the development will include a commercial area. To determine sanitary discharge rates from this use, the commercial floor area was used along with the Region of Halton Design Standards (Ref. 3). The sanitary sewer

discharge rates from the development are summarized in Table 3.3 and detailed calculations and a breakdown by phase, are found in Appendix B (the below numbers are based off a per phase calculation provided in Appendix B, the below table is a summary and thus the calculations based on totals would not match the calculations performed per phase; the phased totals are what is shown below).

Table 3.3 - Sanitary Sewer Discharge from Site

Land Use	Population (people) / Commercial Area (ha)	Average Flow (L/s)	Peak Flow (L/s)
Proposed Residential	3299 [A]	10.50 [B]	39.68 [C]
Commercial Space	0.0231	0.0066 [D]	0.026 [C]
		Total Peak Sanitary Demand for Site	39.70 [E]
Total Peak Sanitary Demand for Site (with infiltration allowance)			**39.98 [F]**

[A] Population Estimate: see Table 3.1
[B] Average flow based on 275 L/ca/day. Avg Flow = 275*3299/(24*60*60) = 10.650 L/s
[C] Peak flow = Average Flow*PF, where Harmon Peaking Factor (PF) = 1+(14/(4+(P/1000)½)) = 1 + (14/(4+(3299/1000)½)) = 3.41 (max 5.0)
[D] Average flow = (0.29 L/s/ha)*(0.0231 ha floor space) = 0.0066 L/s
[E] Total Peak flow = Peak flow from Residential + Commercial
[F] Total Peak flow with infiltration = Total Peak flow + infiltration allowance = 39.70+ 0.28 = 39.98 L/s
Where infiltration is based on 0.286 l/s/ha. Area reflects site area (0.97 ha), I = 0.286*0.97 = 0.28 L/s

3.3 Proposed Sanitary Servicing Plan and Capacity Analysis

As calculated in Table 3.3, the total peak sanitary discharge for all phases from the site is 39.98 L/s. The proposed buildings will be serviced in three phases by three 200mm diameter sanitary services at 2.0% slope (full flow capacity = 40.82 L/s) that will connect to the Cooke Blvd and Masonry Blvd. ROW's. sanitary sewer (see Drawing C2.2). Table 3.4 summarizes the sanitary sewers and their proposed loads from the site.

Table 3.4 – Summary of Proposed Loading on Mainline Sewers

SAN Sewer	Full Flow Capacity on ROW Sewer(L/s) [A]	Peak Load from Site (L/s) [B]	Percent Sewer Capacity Demand on ROW Sewer
Cooke Blvd. –Phase 3	43.5	11.1	25%
Cooke Blvd. –Phase 2	84.9	14.3	17%
Masonry Court–Phase 1	162.4	14.5	8.9%

[A] Full flow capacity calculated using Manning's Formula
[B] Peak load from each phase calculated in Appendix B.

3.4 External Sanitary Sewer - Area Servicing Plan

A downstream sanitary sewer capacity analysis was conducted to assess the hydraulic capacity of the receiving municipal sewers based on the Region of Halton Water and Wastewater Linear Design Manual (Ref. 3). A dynamic sanitary sewer system model using Infoworks ICM was built and integrated with the Region's provided InfoSewer model, the modelling approach, calibration/ validation, and the results of the analysis are discussed in a Sanitary System Hydrologic and

Hydraulic Modelling Technical Memorandum which is included in Appendix B. The Infoworks ICM model was calibrated/validated using design sheets based off of the Harmon Equation.

The limits of the analysis were the drainage area upstream of the existing 675mm diameter municipal sanitary trunk sewer located on Waterdown Rd. Based on sanitary drainage area plans and plan and profile drawings provided by the City of Burlington, this development falls within that drainage area. Current development projects on the City of Burlington website were reviewed and incorporated into the analysis to ensure proposed external sanitary sewer upgrades incorporated proposed future development in the area. The existing and proposed sanitary drainage plan is delineated on drawing SA1 (see Appendix B).

The results of the analysis indicate that under proposed conditions, there is a surcharge in the existing downstream municipal sanitary sewer system. Based off of Halton Region Design Guidelines (Ref. 3), existing pipes less than or equal to 450mm diameters are required to be upsized if the pipe reaches 70% full. MTE recommends consultation with Region to confirm scope of any sewer replacements/upgrades. In some cases, relaxation of the 70% full requirement should be considered. For proposed sewers pipes should be designed to no more than 60% full. Table 3.5 and 3.6 summarizes the impact of the proposed development on the existing sanitary sewer infrastructure. (See Appendix B for sanitary design sheets and catchment area figure)

Table 3.5 – Summary of Impacts of Proposed Development on Existing Sanitary Sewer Infrastructure on Plains Road

Scenario	Ex. Diameter	Ex. Capacity [A]	Proposed Peak Flow [A]	Pipe Full Design [A]	Proposed Peak Flow [B]	Pipe Full Model [B]	Upgrade Required?
Existing Conditions	250 mm	35.9 L/s	25.1 L/s	70%	48.1 L/s	160%	No
Existing Conditions + Approved Developments			35.7 L/s	99%	N/A	N/A	Yes
Existing Conditions + Approved Developments + Proposed Development			64.4 L/s	179%	62.2 L/s	207%	Yes

[A] Full flow capacity calculated using Manning's Formula at worst case scenario sewer leg (from ex. MH 13314 to ex. MH 19205

[B] Peak flow from the wet weather flow Infoworks ICM analysis. Refer to technical memo in Appendix B for details.

Table 3.6 – Summary of Impacts of Proposed Development on Existing Sanitary Sewer Infrastructure on Cooke Blvd.

Scenario	Ex. Diameter	Ex. Capacity [A]	Proposed Peak Flow [A]	Pipe Full Design [A]	Proposed Peak Flow [B]	Pipe Full Model [B]	Upgrade Required?
Existing Conditions	300 mm	52.0 L/s	17.7 L/s	34%	31.3 L/s	53%	No
Existing Conditions +			20.8 L/s	40%	N/A	N/A	No

Approved Developments							
Existing Conditions + Approved Developments + Proposed Development			51.1 L/s	98%	43.0 L/s	73%	Yes

[A] Full flow capacity calculated using Manning's Formula at worst case scenario sewer leg (from ex. MH 13301 to ex. MH 13310

[B] Peak flow from the wet weather flow Infoworks ICM analysis. Refer to technical memo in Appendix B for details.

The above Table 3.5 indicates that the existing 250mm diameter sanitary sewer pipe on Plains Road will be required to be replaced prior to the proposed development, based off the currently approved development applications underway. Additionally, Table 3.6 shows that the existing sanitary sewers on Cooke Blvd. will be required to be replaced as a result of the proposed development.

Based on the sanitary analysis, the proposed development will require the downstream sanitary sewer upgrades to be completed. The upgrades required are as follows:

- 234m of existing sanitary sewer on Cooke Blvd. is to be upgraded from a 300mm to a 375 mm diameter pipe; and,
- 168m of existing sanitary sewer on Plains Rd. is to be upgraded from a 250mm to a 450 mm diameter pipe.

The required upgrades are highlighted on the sanitary sewer design sheets and on the sanitary sewer catchment figure located in Appendix B. It should be noted that without the other proposed developments on Plains Road, only a 375mm diameter sanitary sewer would be required on Plains Rd. to accommodate this proposed development. These upgrades would allow the proposed development to release 40.57 L/s of sanitary discharge by gravity as calculated in Table 3.2 above, and account for future proposed developments in this external sanitary drainage area. Proposed external sanitary sewer upgrades are proposed for the first phase of construction of this proposed development. Refer to detailed Sanitary System Hydrologic and Hydraulic Modelling Technical Memorandum included in Appendix B for further model analysis and information.

4.0 Domestic and Fire Water Supply Servicing

4.1 Existing Conditions

The existing municipal water distribution system around the site consists of a 300mm diameter watermain within the Cooke Blvd. and Masonry Court ROW. The proposed development is located in the B1A pressure zone. This pressure zone is serviced by the Kingsway Dr. Booster Pumping Station with the Waterdown Reservoir providing storage and pressure control.

Hydrant flow testing was conducted for the hydrant located at Masonry Ct. and Cooke Blvd. in June 2021. Coordination with the Region was completed to ensure that the hydrant test was done when the booster pumps were off. Results of the hydrant flow test can be found in Appendix C.

4.2 Domestic Water Demands

The expected domestic water demands for the proposed development were estimated using Halton Region design criteria (Ref. 3). Table 4.1 summarizes the domestic water demand requirements for the Average Day, Maximum Day and Peak Hour demand scenarios and detailed calculations are provided in Appendix C. It should be noted that average day peak factor is 1.0, the max day peak factor is 2.25 and the peak hour factor is 4.0 for residential developments, and the peak hour factor is 2.25 for commercial developments, as in accordance with Halton Region standards. A summary of the demands for all phases are summarized in Table 4.1 below. Refer to Appendix C for water demands broken down by phase.

Table 4.1 - Domestic Water Demands

Residential Demands		
Population:	3299 people (see Table 3.1)	
Average Day Demand:	275 L/c/d x 3299 people =	10.50 L/s
Maximum Day Demand:	2.25 x 10.50 L/s =	23.64 L/s
Peak Hour Demand:	4.0 x 10.50 L/s =	42.00 L/s
Commercial Demands		
Floor area:	0.0231 ha (see Appendix C)	
Average Day Demand:	0.29 L/ha/d x 0.0231 ha =	0.0066 L/s
Maximum Day Demand:	2.25 x 0.0066 L/s =	0.016 L/s
Peak Hour Demand:	2.25 x 0.0066 L/s =	0.016 L/s
Total Residential + Commercial Demands		**42.01 L/s**

4.3 Fire Flow Demands

Fire flow demands for the proposed development were also determined using the methodology outlined in Water Supply for Public Fire Protection (Ref. 10). The fire flows for each building were evaluated. The fire demands are summarized in Table 4.2 and detailed calculations are provided in Appendix C.

Table 4.2 - FUS Fire Flow Requirements

Building	Fire Underwriters Survey (FUS) Flow Rate
Phase 1- Building B	117 L/s (7,480 L/min)
Phase 2 - Building C	100 L/s (5,780 L/min)
Phase 3- Building A	100 L/s (5,738 L/min)

4.4 Proposed Water Servicing Plan and Analysis

Water servicing for the site will include the installation of three 300mm diameter water service teed off the existing 300mm diameter watermain on Cooke Blvd and Masonry Rd. to service the proposed development buildings. The service will be split into a 250mm diameter domestic water service and 300mm diameter fire water service. Please refer to Drawing C2.2 for further details.

The site will be serviced by the existing municipal hydrants located on the east side of Cooke Blvd., southeast of the proposed development, and the west side of Cooke Blvd., northeast of the proposed development. The proposed developments fire department connection will be within 45m of the fire hydrant located southeast of the proposed development.

4.5 External Watermain - Area Servicing Plan

The Bentley water distribution system analysis program (WaterCAD Connect Version 10.03) was utilized for the analysis of this study. The network for the analysis was developed by assigning physical parameters to each node and pipe. The model was run under four demand scenarios: Average Day, Maximum Day, Peak Hour, and Maximum Day + Fire Flow. Each scenario was checked against guidelines for pressure and fire flow availability. The water distribution model incorporates the full build-out of the proposed development and uses the hydrant flow test pressure results to simulate the connection to the existing distribution system.

The Hazen-Williams “C” friction factor was used to assess friction loses though the system in the model. Based on the Halton Region Water and Wastewater Linear Design Manual (Ref. 3) a C factor of 130 was used for all pipes in the model, which are assumed to be new PVC material.

Minor losses are caused by appurtenances and fittings along the length of pipe in the system. A value of 1.0 was assumed for minor losses at this time. These minor losses will be updated during detailed design in coordination with the mechanical consultant and the model will be updated accordingly.

Based on a worst case Maximum Day + Fire Flow Demand of 123.60 L/s (117 L/s + 6.60 L/s from Appendix C), the modeled pressure is 20.3 psi (140 kPa), which exceeds the minimum required residual pressure of 20 psi (140 kPa) required by the MOE and Halton Region. However, booster pumps will be required within the building to satisfy the fire and domestic consumption needs at upper levels. Appendix C provides the proposed pipe network and a

series of tables summarizing the output results of the WaterCAD analysis. Further analysis and information is required to confirm the system wide operating characteristics.

5.0 Conclusions and Recommendations

Based on the information provided herein, it is concluded that the development can be constructed to meet the requirements of the City of Burlington and Halton Region. Therefore, it is recommended that:

i. A stormwater storage tank complete with an orifice control to be provided to control proposed conditions stormwater site discharge rates to the allowable release rate as described in Section 2.3 of this report.

ii. Erosion and sediment controls be installed as described in Section 2.4 of this report.

iii. Sanitary servicing for the development and required external sanitary upgrades be installed as described in Section 3.3 of this report.

iv. Water servicing for the development be installed as described in Section 4.4 of this report to meet OBC minimum water supply requirements.

v. The proposed stormwater management plan presented in this report and the site servicing works described in this report and as shown on Drawings C1.1, C2.1, C2.2, C2.3, C2.4, C2.5 and C2.6 be accepted in support of the site plan approval process.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

All of which is respectfully submitted,

MTE Consultants Inc.





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George Berenyi, P.Eng.
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EXK:exk

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Appendix A

Stormwater Management Information

Erin Kennelly

From: Medeiros, Joshua <Joshua.Medeiros@burlington.ca>
Sent: Thursday, October 22, 2020 1:24 PM
To: Erin Kennelly
Cc: George Berenyi
Subject: RE: 1120 Cooke Boulevard - Pre-consultation meeting notes

Yes, please adhere to the criteria outlined in the FSR for Phase 1

Quantity/Quality Control Criteria:

- quantity control storage for the site should be based on controlling the post-development flows to pre-development level for the 2-year to 100-year storm events (Page 15 of the report).

- The stormwater management servicing strategy for erosion, quality and quantity control within the future Phase 2 development will be similar to those proposed for Phase 1.The strategy will include an independent Stormwater Storage Tank to be located in the future underground parking structure and will outlet to the proposed storm sewer on the new municipal right-of-way which will direct minor system flows north through the proposed neighbourhood park and connect to a storm sewer receiving controlled drainage from the Phase 1 SWM tank. From this location, all site drainage will be directed to a single storm headwall to be location with the proposed Flood Storage Area.
- Similar to Phase 1, the 25mm storm runoff volume to be retained on-site within the future SWM tank and the grey water is to be re-used on-site. Details on the layout, size and control structure for the Phase 2 SWM tank will be provided as part of the detailed design once Phase 2 proceeds with development.
- Quality control for Phase 2 will be provided by an independent oil/grit separator installed within the limits of the future high density block. Refer to Appendix B for oil/grit separator sizing reports. (Page 12 of the report).

I apologize for the confusion.

Joshua Medeiros, C.E.T.
Senior Engineering Technologist
Site Engineering | Development & Stormwater Engineering
Capital Works Department

(905) 335-7600 ext.7868
joshua.medeiros@burlington.ca

CITY OF Burlington

From: Erin Kennelly
Sent: Thursday, October 22, 2020 12:57 PM
To: Medeiros, Joshua
Cc: George Berenyi
Subject: RE: 1120 Cooke Boulevard - Pre-consultation meeting notes

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Joshua,

Thank you for the quick reply!

Should we be matching post-development flows to pre-development for all storms (as per Phase 1 FSR), or matching all post development storm flows to the 2-year pre-development flow (as per Pre-consultation notes)?

Thank you,

Erin Kennelly | Designer
MTE Consultants Inc.
T: 905-639-2552 x2470 | EKennelly@mte85.com

From: Medeiros, Joshua <Joshua.Medeiros@burlington.ca>
Sent: Thursday, October 22, 2020 12:47 PM
To: Erin Kennelly <EKennelly@mte85.com>
Cc: George Berenyi <GBerenyi@mte85.com>
Subject: RE: 1120 Cooke Boulevard - Pre-consultation meeting notes

Good afternoon Erin,

You are correct, that was a typo on my behalf. The overall area of the Phase 2 lands is 0.95ha and the calculated runoff coefficient is 0.75.

Thank you for bringing this to my attention.

Joshua Medeiros, C.E.T.
Senior Engineering Technologist
Site Engineering | Development & Stormwater Engineering
Capital Works Department

(905) 335-7600 ext.7868
joshua.medeiros@burlington.ca



From: Erin Kennelly <EKennelly@mte85.com>
Sent: Thursday, October 22, 2020 12:19 PM
To: Medeiros, Joshua <Joshua.Medeiros@burlington.ca>
Cc: George Berenyi <GBerenyi@mte85.com>
Subject: 1120 Cooke Boulevard - Pre-consultation meeting notes

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good afternoon Joshua,

I hope you are doing well. I am e-mailing regarding the attached pre-consultation meeting minutes for 1120 Cooke Boulevard.

I am working on the Stormwater Report, and am just hoping for some clarification regarding the SWM criteria. The attached pre-consultation SWM criteria states that the post-development flows must match the 2year pre-development flows, with a runoff coefficient of 0.95 applied to the Phase 2 site. This seems to be different from the approved Phase 1 FSR and SWM report (see below link), which states in section 5 that the criteria are matching post-development flows for all storms to the pre-development flows, with a percent imperviousness of 75% applied to the Phase 2 site.

Please click on the following link to download the attachments:
https://files.mte85.ca/message/QvIn5ce5miDt5H19LFzLJx

The attachments are available until: **Monday, 26 October.**

Files attached to this message

Filename	Size
14-137W-171019_FSR (FINAL).pdf	128 MB

Message ID: QvIn5ce5miDt5H19LFzLJx

If you could please clarify that would be much appreciated. Please feel free to call to discuss further.

Thank you,

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COVID-19 Update: We remain operational and are currently available by email and phone, however, our offices are closed. Staff that are required to visit job sites or perform field work are required to follow MTE health and safety policies and procedures, as well as additional COVID-19 protocols, which can be viewed here.

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STATION WEST PHASE 2
CITY OF BURLINGTON
STORMWATER MANAGEMENT

ALLOWABLE RELEASE RATE

Catchment ID	Catchment Description	Hydrograph Method	Area (ha)	Perv. CN	Perv. Ia (mm)	Impervious (%) TIMP	Impervious (%) XIMP	Flow Length (m) Perv.	Flow Length (m) Imperv.	Manning "n" Perv.	Manning "n" Imperv.	Slope (%) Perv.	Slope (%) Imperv.	Release rate (m^3/s)
101	Allowable drainage from the proposed development	N/A	0.95			60	60							0.182
		TOTAL	**0.95**											

* Release rate taken from Phase 1 FSR by Urbantech West dated Oct 2017

POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING PARAMETERS

Catchment ID	Catchment Description	Hydrograph Method	Area (ha)	Perv. CN	Perv. Ia (mm)	Impervious (%) TIMP	Impervious (%) XIMP	Flow Length (m) Perv.	Flow Length (m) Imperv.	Manning "n" Perv.	Manning "n" Imperv.	Slope (%) Perv.	Slope (%) Imperv.	Time to Peak Tp (hrs)
201	Proposed site- controlled (Including ramp to Waterdown road)	STANDHYD	0.89	79	6.8	99	99	16	35	0.250	0.013	3.0	2.0	
202	Proposed surrounding landscape- uncontrolled	STANDHYD	0.08	79	6.8	99	99	4	4	0.250	0.013	2.0	2.0	
		TOTAL	**0.97**											

Notes: Increase in post development area is due to new ramp to Waterdown Rd.

For STANDHYD Commands:
- Pervious Initial Abstraction (Perv. Ia) = 0.1 x S , where S = (25400 / CN) - 254
-CN taken based off Soil Type B

STATION WEST PHASE 2
CITY OF BURLINGTON
STORMWATER MANAGEMENT

Project Number: 48247-100
Date: April 5, 2021
File: Q:\48247\100\SWM\48247-100 SWM Calculations.xlsx

Orifice Calculations for Catchment 202A +202B $Q_o=C_d*A_o*(2*g*H_o)^{0.5}$		
	Orifice	**Description**
C_d	0.63	Orifice plate
Invert (m)	101.4	
CL elevation (m)	101.51	
Diameter (mm)	225	
Type (H/V)	V	

STAGE-STORAGE-DISCHARGE RELATIONSHIP

Description	**Stage**	**Contour Area**	**Incremental Volume**	**Cumulative Volume**	**Orifice**		
					Orifice Area	**H_o**	**Flow**
	m	m^2	m^3	m^3	m^2	*m*	m^3/s
Inside Bottom of Tank	101.40	117.0	0.0	0.0	0.040	0.00	0.0000
C/L of orifice	101.51	117.0	13.2	13.2	0.040	0.00	0.0000
1/3 Storm Tank	102.05	117.0	62.5	75.7	0.040	0.53	0.0811
2/3 Storm Tank	102.69	117.0	75.7	151.3	0.040	1.18	0.1206
75% Storm Tank	102.86	117.0	18.9	170.2	0.040	1.34	0.1286
Top of Tank	103.34	117.0	56.7	227.0	0.040	1.83	0.1500

```
00001> 2     Metric units
00002> *#*************************************************************************|
00003> *#  Project Name: STATION WEST PH2
00004> *#               BURLINGTON, ONTARIO
00005> *#  JOB NUMBER  : 48247-100
00006> *#       Date   : APRIL 2021
00007> *#  Modeller    : EXK
00008> *#    Company   : MTE CONSULTANTS INC.
00009> *#       File   : 48247-100.DAT
00010> *
00011> *%-----------------|-------------------------------------------------------|
00012> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
00013>                     ["BURL_002.stm"]
00014> READ STORM          STORM_FILENAME=["STORM.001"]
00015> *
00016> *#########################################################################|
00017> *#
00018> *#                POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00019> *#                ==============================================
00020> *#
00021> *#########################################################################|
00022> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00023> CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[0.89](ha),
00024>                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
00025>                     SCS curve number CN=[79],
00026>                     Pervious   surfaces: IAper=[6.8](mm), SLPP=[3.0](%),
00027>                                          LGP=[16](m), MNP=[0.250], SCP=[0](min),
00028>                     Impervious surfaces: IAimp=[6.8](mm), SLPI=[2.0](%),
00029>                                          LGI=[35](m), MNI=[0.013], SCI=[0](min),
00030>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00031> *%-----------------|-------------------------------------------------------|
00032> *#Route Catchment 201 through Tank and Orifice Control
00033>
00034> ROUTE RESERVOIR     IDout=[2],   NHYD=["TANK"],  IDin=[1],
00035>                     RDT=[1](min),
00036>                           TABLE of ( OUTFLOW-STORAGE ) values
00037>                                       (cms) - (ha-m)
00038>  0.0000    0.00000
00039>  0.0000    0.00132
00040>  0.0811    0.00757
00041>  0.1206    0.01513
00042>  0.1286    0.01702
00043>  0.1500    0.02270
00044>                                    -1       -1   (max twenty pts)
00045>                           IDovf=[3], NHYDovf=["TANK-OVF"]
00046> *%-----------------|-------------------------------------------------------|
00047> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00048> CALIB STANDHYD      ID=[1], NHYD=["202"], DT=[1](min), AREA=[0.08](ha),
00049>                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
00050>                     SCS curve number CN=[79],
00051>                     Pervious   surfaces: IAper=[6.8](mm), SLPP=[2.0](%),
00052>                                          LGP=[4](m), MNP=[0.250], SCP=[0](min),
00053>                     Impervious surfaces: IAimp=[6.8](mm), SLPI=[2.0](%),
00054>                                          LGI=[4](m), MNI=[0.013], SCI=[0](min),
00055>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00056> *%-----------------|-------------------------------------------------------|
00057> *# TOTAL SITE DISCHARGE
00058> ADD HYD             IDsum=[4], NHYD=["CONTD"], IDs to add=[1,2,3]
00059> *%-----------------|-------------------------------------------------------|
00060> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
00061> *
00062> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
00063>                     {"BURL_005.stm"]
00064>
00065> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
00066>                    ["BURL_010.stm"]
00067>
00068> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
00069>                    {"BURL_025.stm"]
00070>
00071> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
00072>                    ["BURL_050.stm"]
00073>
00074> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00075>                    ["BURL_100.stm"]
00076>
00077> *%-----------------|-------------------------------------------------------|
00078> FINISH
00079>
00080>
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00098>
00099>
```

```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S  W W   M   M  H   H    Y    M   M  O   O      9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO          9      9   =========
00008>                                                        9   9  9   9   # 3057174
00009>         StormWater Management HYdrologic Model          999    999    =========
00010>
00011>  ***************************************************************************
00012>  ***************************** SWMHYMO Ver/4.05  *****************************
00013>  *********  A single event and continuous hydrologic simulation model  *********
00014>  *********     based on the principles of HYMO and its successors      *********
00015>  *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
00016>  ***************************************************************************
00017>  ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
00018>  *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019>  *********                  Gatineau, Quebec: (819) 243-6858           *********
00020>  *********                  E-Mail: swmhymo@jfsa.com                   *********
00021>  ***************************************************************************
00022>
00023>  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++++ Licensed user: MTE Consultants Inc.                       +++++++++
00025>  +++++++++                  in any City          SERIAL#:3057174     +++++++++
00026>  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ***************************************************************************
00029>  *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
00030>  *********          Maximum value for ID numbers  :     10          *********
00031>  *********          Max. number of rainfall points: 105408          *********
00032>  *********          Max. number of flow points    : 105408          *********
00033>  ***************************************************************************
00034>
00035>
00036>  *********************   D E T A I L E D   O U T P U T   *********************
00037>  ***************************************************************************
00038>  *         DATE: 2021-04-05     TIME: 10:22:11     RUN COUNTER: 000409         *
00039>  ***************************************************************************
00040>  * Input   filename: Q:\48247\100\SWM\SWMHYMO\48247-~1.DAT                   *
00041>  * Output  filename: Q:\48247\100\SWM\SWMHYMO\48247-~1.out                   *
00042>  * Summary filename: Q:\48247\100\SWM\SWMHYMO\48247-~1.sum                   *
00043>  * User comments:                                                           *
00044>  * 1:_____________________________________________________________________*
00045>  * 2:_____________________________________________________________________*
00046>  * 3:_____________________________________________________________________*
00047>  ***************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*************************************************************************|
00052> *#  Project Name: STATION WEST PH2
00053> *#               BURLINGTON, ONTARIO
00054> *#  JOB NUMBER  : 48247-100
00055> *#       Date   : APRIL 2021
00056> *#  Modeller    : EXK
00057> *#    Company   : MTE CONSULTANTS INC.
00058> *#       File   : 48247-100.DAT
00059> *
00060>   ** END OF RUN :   1
00061>
00062> ***************************************************************************
00063>
00064>
00065>
00066>
00067>
00068> --------------------
00069> | START            |  Project  dir.: Q:\48247\100\SWM\SWMHYMO\
00070> --------------------  Rainfall dir.: Q:\48247\100\SWM\SWMHYMO\
00071>    TZERO =   .00 hrs on       0
00072>    METOUT=   2 (output = METRIC)
00073>    NRUN  = 002
00074>    NSTORM=   1
00075>              #  1=BURL_002.stm
00076> --------------------------------------------------------------------------------
00077> 002:0002--------------------------------------------------------------------------
00078> *#*************************************************************************|
00079> *#  Project Name: STATION WEST PH2
00080> *#               BURLINGTON, ONTARIO
00081> *#  JOB NUMBER  : 48247-100
00082> *#       Date   : APRIL 2021
00083> *#  Modeller    : EXK
00084> *#    Company   : MTE CONSULTANTS INC.
00085> *#       File   : 48247-100.DAT
00086> *
00087> --------------------------------------------------------------------------------
00088> 002:0002--------------------------------------------------------------------------
00089> --------------------
00090> | READ STORM       |    Filename: 2-YR BURLINGTON CHICAGO STORM (4-HR DURA
00091> | Ptotal=  37.20 mm|    Comments: 2-YR BURLINGTON CHICAGO STORM (4-HR DURA
00092> --------------------
00093>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00094>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00095>                .17   2.522 |   1.17  19.646 |   2.17   6.005 |   3.17   3.030
00096>                .33   2.888 |   1.33  78.391 |   2.33   5.111 |   3.33   2.815
00097>                .50   3.399 |   1.50  25.776 |   2.50   4.467 |   3.50   2.632
00098>                .67   4.172 |   1.67  13.777 |   2.67   3.978 |   3.67   2.474
00099>                .83   5.492 |   1.83   9.511 |   2.83   3.595 |   3.83   2.335
00100>               1.00   8.325 |   2.00   7.331 |   3.00   3.286 |   4.00   2.213
00101>
00102> --------------------------------------------------------------------------------
00103> 002:0003--------------------------------------------------------------------------
00104> *
00105> *#########################################################################|
00106> *#
00107> *#               POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00108> *#               ==============================================
00109> *#
00110> *#########################################################################|
00111> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00112> ----------------------
00113> | CALIB STANDHYD     |   Area    (ha)=     .89
00114> | 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00115> ----------------------
00116>                              IMPERVIOUS    PERVIOUS (i)
00117>      Surface Area     (ha)=       .88          .01
00118>      Dep. Storage     (mm)=      6.80         6.80
00119>      Average Slope     (%)=      2.00         3.00
00120>      Length            (m)=     35.00        16.00
00121>      Mannings n             =      .013         .250
00122>
00123>      Max.eff.Inten.(mm/hr)=     78.39        15.77
00124>                 over (min)       1.00         9.00
00125>      Storage Coeff.   (min)=     1.22 (ii)    8.77 (ii)
00126>      Unit Hyd. Tpeak (min)=       1.00         9.00
00127>      Unit Hyd. peak  (cms)=        .95          .13
00128>                                                          *TOTALS*
00129>      PEAK FLOW       (cms)=        .19          .00          .192 (iii)
00130>      TIME TO PEAK    (hrs)=       1.33         1.47         1.333
00131>      RUNOFF VOLUME    (mm)=      30.40         9.44        30.186
00132>      TOTAL RAINFALL   (mm)=      37.20        37.20        37.195
00133>      RUNOFF COEFFICIENT   =        .82          .25          .812
00134>
00135>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00136>            CN* =  79.0    Ia = Dep. Storage  (Above)
00137>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00138>            THAN THE STORAGE COEFFICIENT.
00139>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00140>
00141> --------------------------------------------------------------------------------
00142> 002:0004--------------------------------------------------------------------------
00143> *#Route Catchment 201 through Tank and Orifice Control
00144> --------------------
00145> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00146> |  IN>01:(201   )   |
00147> | OUT<02:(TANK  )   |    =========  OUTLFOW STORAGE TABLE  =========
00148> --------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00149>                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
00150>                           .000  .0000E+00   |     .121  .1513E-01
00151>                           .000  .1320E-02   |     .129  .1702E-01
00152>                           .081  .7570E-02   |     .150  .2270E-01
00153>
00154>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00155>      --------------------       (ha)     (cms)     (hrs)       (mm)
00156>      INFLOW >01: (201   )        .89      .192     1.333     30.186
00157>      OUTFLOW<02: (TANK  )        .89      .088     1.367     28.702
00158>     OVERFLOW<03: (TANK-O)        .00      .000      .000       .000
00159>
00160>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00161>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00162>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00163>
00164>
00165>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   45.795
00166>                    TIME SHIFT OF PEAK FLOW         (min)=     2.00
00167>                    MAXIMUM  STORAGE   USED       (ha.m.)=.8873E-02
00168>
00169>       *** WARNING: Outflow volume is less than inflow volume.
00170> --------------------------------------------------------------------------------
00171> 002:0005--------------------------------------------------------------------------
00172> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00173> ----------------------
00174> | CALIB STANDHYD     |   Area    (ha)=     .08
00175> | 01:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00176> ----------------------
00177>                              IMPERVIOUS    PERVIOUS (i)
00178>      Surface Area     (ha)=       .08          .00
00179>      Dep. Storage     (mm)=      6.80         6.80
00180>      Average Slope     (%)=      2.00         2.00
00181>      Length            (m)=      4.00         4.00
00182>      Mannings n             =      .013         .250
00183>
00184>      Max.eff.Inten.(mm/hr)=     78.39        20.94
00185>                 over (min)       1.00         4.00
00186>      Storage Coeff.  (min)=       .33 (ii)    3.65 (ii)
00187>      Unit Hyd. Tpeak (min)=       1.00         4.00
00188>      Unit Hyd. peak  (cms)=       1.62          .30
00189>                                                          *TOTALS*
00190>      PEAK FLOW       (cms)=        .02          .00          .017 (iii)
00191>      TIME TO PEAK    (hrs)=       1.25         1.37         1.333
00192>      RUNOFF VOLUME    (mm)=      30.40         9.44        30.186
00193>      TOTAL RAINFALL   (mm)=      37.20        37.20        37.195
00194>      RUNOFF COEFFICIENT   =        .82          .25          .812
00195>
00196>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00197>            CN* =  79.0    Ia = Dep. Storage  (Above)
00198>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00199>            THAN THE STORAGE COEFFICIENT.
00200>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00201>
00202> --------------------------------------------------------------------------------
00203> 002:0006--------------------------------------------------------------------------
00204> *# TOTAL SITE DISCHARGE
00205> ----------------------
00206> | ADD HYD (CONTD     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00207> ----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00208>                        ID1 01:202          .08     .017    1.33  30.19    .000
00209>                       +ID2 02:TANK         .89     .088    1.37  28.70    .000
00210>                       +ID3 03:TANK-OVF     .00     .000     .00    .00    .000
00211>                        ========================================================
00212>                        SUM 04:CONTD         .97     .102    1.33  28.82    .000
00213>
00214>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00215>
00216> --------------------------------------------------------------------------------
00217> 002:0007--------------------------------------------------------------------------
00218> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
00219> *
00220>   ** END OF RUN :   4
00221>
00222> ***************************************************************************
00223>
00224>
00225>
00226>
00227>
00228> --------------------
00229> | START            |  Project  dir.: Q:\48247\100\SWM\SWMHYMO\
00230> --------------------  Rainfall dir.: Q:\48247\100\SWM\SWMHYMO\
00231>    TZERO =   .00 hrs on       0
00232>    METOUT=   2 (output = METRIC)
00233>    NRUN  = 005
00234>    NSTORM=   1
00235>              #  1=BURL_005.stm
00236> --------------------------------------------------------------------------------
00237> 005:0002--------------------------------------------------------------------------
00238> *#*************************************************************************|
00239> *#  Project Name: STATION WEST PH2
00240> *#               BURLINGTON, ONTARIO
00241> *#  JOB NUMBER  : 48247-100
00242> *#       Date   : APRIL 2021
00243> *#  Modeller    : EXK
00244> *#    Company   : MTE CONSULTANTS INC.
00245> *#       File   : 48247-100.DAT
00246> *
00247> --------------------------------------------------------------------------------
00248> 005:0002--------------------------------------------------------------------------
00249> --------------------
00250> | READ STORM       |    Filename: 5-YR BURLINGTON CHICAGO STORM (4-HR DURA
00251> | Ptotal=  47.95 mm|    Comments: 5-YR BURLINGTON CHICAGO STORM (4-HR DURA
00252> --------------------
00253>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00254>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00255>                .17   3.407 |   1.17  24.479 |   2.17   7.826 |   3.17   4.065
00256>                .33   3.881 |   1.33 101.312 |   2.33   6.709 |   3.33   3.788
00257>                .50   4.539 |   1.50  31.941 |   2.50   5.897 |   3.50   3.550
00258>                .67   5.523 |   1.67  17.333 |   2.67   5.279 |   3.67   3.344
```

```
00259>                .83   7.185 |   1.83  12.145 |   2.83   4.790 |   3.83   3.164
00260>               1.00  10.690 |   2.00   9.469 |   3.00   4.394 |   4.00   3.004
00261>
00262> ---------------------------------------------------------------------------
00263> 005:0003-----------------------------------------------------------------
00264> *
00265> *#########################################################################|
00266> *#
00267> *#               POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00268> *#               ==============================================
00269> *#
00270> *#########################################################################|
00271> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00272> ---------------------
00273> | CALIB STANDHYD     |   Area    (ha)=     .89
00274> | 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00275> ---------------------
00276>                              IMPERVIOUS    PERVIOUS (i)
00277>      Surface Area     (ha)=        .88          .01
00278>      Dep. Storage     (mm)=       6.80         6.80
00279>      Average Slope     (%)=       2.00         3.00
00280>      Length            (m)=      35.00        16.00
00281>      Mannings n            =       .013         .250
00282>
00283>      Max.eff.Inten.(mm/hr)=     101.31        31.66
00284>                  over (min)        1.00         7.00
00285>      Storage Coeff.  (min)=       1.10 (ii)    6.81 (ii)
00286>      Unit Hyd. Tpeak (min)=       1.00         7.00
00287>      Unit Hyd. peak  (cms)=       1.01          .16
00288>                                                          *TOTALS*
00289>      PEAK FLOW       (cms)=         .25          .00          .248 (iii)
00290>      TIME TO PEAK    (hrs)=        1.33         1.42         1.333
00291>      RUNOFF VOLUME    (mm)=       41.15        15.58        40.897
00292>      TOTAL RAINFALL   (mm)=       47.95        47.95        47.952
00293>      RUNOFF COEFFICIENT   =         .86          .32          .853
00294>
00295>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00296>            CN* =  79.0    Ia = Dep. Storage  (Above)
00297>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00298>            THAN THE STORAGE COEFFICIENT.
00299>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00300>
00301> ---------------------------------------------------------------------------
00302> 005:0004-----------------------------------------------------------------
00303> *#Route Catchment 201 through Tank and Orifice Control
00304> ---------------------
00305> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00306> |  IN>01:(201   )   |
00307> | OUT<02:(TANK  )   |   =========  OUTLFOW STORAGE TABLE  =========
00308> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00309>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00310>                             .000  .0000E+00   |     .121  .1513E-01
00311>                             .000  .1320E-02   |     .129  .1702E-01
00312>                             .081  .7570E-02   |     .150  .2270E-01
00313>
00314>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00315>      --------------------       (ha)     (cms)     (hrs)       (mm)
00316>      INFLOW >01: (201   )        .89      .248     1.333     40.897
00317>      OUTFLOW<02: (TANK  )        .89      .107     1.367     39.413
00318>     OVERFLOW<03: (TANK-O)        .00      .000      .000       .000
00319>
00320>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00321>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00322>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00323>
00324>
00325>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   43.066
00326>                     TIME SHIFT OF PEAK FLOW          (min)=     2.00
00327>                     MAXIMUM  STORAGE   USED       (ha.m.)=.1252E-01
00328>
00329>       *** WARNING: Outflow volume is less than inflow volume.
00330> ---------------------------------------------------------------------------
00331> 005:0005-----------------------------------------------------------------
00332> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00333> ---------------------
00334> | CALIB STANDHYD     |   Area    (ha)=     .08
00335> | 01:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00336> ---------------------
00337>                              IMPERVIOUS    PERVIOUS (i)
00338>      Surface Area     (ha)=        .08          .00
00339>      Dep. Storage     (mm)=       6.80         6.80
00340>      Average Slope     (%)=       2.00         2.00
00341>      Length            (m)=       4.00         4.00
00342>      Mannings n            =       .013         .250
00343>
00344>      Max.eff.Inten.(mm/hr)=     101.31        37.36
00345>                  over (min)        1.00         3.00
00346>      Storage Coeff.  (min)=        .30 (ii)    2.93 (ii)
00347>      Unit Hyd. Tpeak (min)=       1.00         3.00
00348>      Unit Hyd. peak  (cms)=       1.64          .38
00349>                                                          *TOTALS*
00350>      PEAK FLOW       (cms)=         .02          .00          .022 (iii)
00351>      TIME TO PEAK    (hrs)=        1.27         1.35         1.333
00352>      RUNOFF VOLUME    (mm)=       41.15        15.58        40.897
00353>      TOTAL RAINFALL   (mm)=       47.95        47.95        47.952
00354>      RUNOFF COEFFICIENT   =         .86          .32          .853
00355>
00356>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00357>            CN* =  79.0    Ia = Dep. Storage  (Above)
00358>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00359>            THAN THE STORAGE COEFFICIENT.
00360>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00361>
00362> ---------------------------------------------------------------------------
00363> 005:0006-----------------------------------------------------------------
00364> *# TOTAL SITE DISCHARGE
00365> ----------------------
00366> | ADD HYD (CONTD     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00367> ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00368>                      ID1 01:202            .08      .022    1.33  40.90    .000
00369>                     +ID2 02:TANK           .89      .107    1.37  39.41    .000
00370>                     +ID3 03:TANK-OVF       .00      .000     .00    .00    .000
00371>                      ========================================================
00372>                      SUM 04:CONTD           .97      .126    1.33  39.54    .000
00373>
00374>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00375>
00376> ---------------------------------------------------------------------------
00377> 005:0007-----------------------------------------------------------------
00378> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
00379> *
00380> ---------------------------------------------------------------------------
00381> 005:0002-----------------------------------------------------------------
00382>   ** END OF RUN :   9
00383>
00384> *************************************************************************
00385>
00386>
00387>
00388>
00389>
00390> --------------------
00391> | START            |  Project  dir.: Q:\48247\100\SWM\SWMHYMO\
00392> --------------------  Rainfall dir.: Q:\48247\100\SWM\SWMHYMO\
00393>     TZERO =   .00 hrs on        0
00394>     METOUT=   2 (output = METRIC)
00395>     NRUN  = 010
00396>     NSTORM=   1
00397>           #  1=BURL_010.stm
00398> ---------------------------------------------------------------------------
00399> 010:0002-----------------------------------------------------------------
00400> *#########################################################################|
00401> *#  Project Name: STATION WEST PH2
00402> *#               BURLINGTON, ONTARIO
00403> *#  JOB NUMBER  : 48247-100
00404> *#       Date   : APRIL 2021
00405> *#  Modeller    : EXK
00406> *#    Company   : MTE CONSULTANTS INC.
00407> *#       File   : 48247-100.DAT
00408> *
00409> ---------------------------------------------------------------------------
00410> 010:0002-----------------------------------------------------------------
00411> --------------------
00412> | READ STORM       |    Filename: 10-YR BURLINGTON CHICAGO STORM (4-HR DUR
00413> | Ptotal=  55.20 mm|    Comments: 10-YR BURLINGTON CHICAGO STORM (4-HR DUR
00414> --------------------
00415>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00416>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00417>               .17   3.937 |   1.17  28.176 |   2.17   9.030 |   3.17   4.696
00418>               .33   4.483 |   1.33 116.310 |   2.33   7.743 |   3.33   4.376
00419>               .50   5.242 |   1.50  36.748 |   2.50   6.808 |   3.50   4.102
00420>               .67   6.377 |   1.67  19.967 |   2.67   6.095 |   3.67   3.864
00421>               .83   8.291 |   1.83  14.001 |   2.83   5.532 |   3.83   3.656
00422>              1.00  12.326 |   2.00  10.921 |   3.00   5.075 |   4.00   3.472
00423>
00424> ---------------------------------------------------------------------------
00425> 010:0003-----------------------------------------------------------------
00426> *
00427> *#########################################################################|
00428> *#
00429> *#               POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00430> *#               ==============================================
00431> *#
00432> *#########################################################################|
00433> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00434> ---------------------
00435> | CALIB STANDHYD     |   Area    (ha)=     .89
00436> | 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00437> ---------------------
00438>                              IMPERVIOUS    PERVIOUS (i)
00439>      Surface Area     (ha)=        .88          .01
00440>      Dep. Storage     (mm)=       6.80         6.80
00441>      Average Slope     (%)=       2.00         3.00
00442>      Length            (m)=      35.00        16.00
00443>      Mannings n            =       .013         .250
00444>
00445>      Max.eff.Inten.(mm/hr)=     116.31        43.88
00446>                  over (min)        1.00         6.00
00447>      Storage Coeff.  (min)=       1.04 (ii)    6.05 (ii)
00448>      Unit Hyd. Tpeak (min)=       1.00         6.00
00449>      Unit Hyd. peak  (cms)=       1.05          .19
00450>                                                          *TOTALS*
00451>      PEAK FLOW       (cms)=         .28          .00          .285 (iii)
00452>      TIME TO PEAK    (hrs)=        1.33         1.40         1.333
00453>      RUNOFF VOLUME    (mm)=       48.40        20.21        48.123
00454>      TOTAL RAINFALL   (mm)=       55.20        55.20        55.205
00455>      RUNOFF COEFFICIENT   =         .88          .37          .872
00456>
00457>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00458>            CN* =  79.0    Ia = Dep. Storage  (Above)
00459>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00460>            THAN THE STORAGE COEFFICIENT.
00461>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00462>
00463> ---------------------------------------------------------------------------
00464> 010:0004-----------------------------------------------------------------
00465> *#Route Catchment 201 through Tank and Orifice Control
00466> ---------------------
00467> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00468> |  IN>01:(201   )   |
00469> | OUT<02:(TANK  )   |   =========  OUTLFOW STORAGE TABLE  =========
00470> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00471>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00472>                             .000  .0000E+00   |     .121  .1513E-01
00473>                             .000  .1320E-02   |     .129  .1702E-01
00474>                             .081  .7570E-02   |     .150  .2270E-01
00475>
00476>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00477>      --------------------       (ha)     (cms)     (hrs)       (mm)
00478>      INFLOW >01: (201   )        .89      .285     1.333     48.123
00479>      OUTFLOW<02: (TANK  )        .89      .120     1.367     46.640
00480>     OVERFLOW<03: (TANK-O)        .00      .000      .000       .000
00481>
00482>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00483>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00484>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00485>
00486>
00487>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   41.901
00488>                     TIME SHIFT OF PEAK FLOW          (min)=     2.00
00489>                     MAXIMUM  STORAGE   USED       (ha.m.)=.1492E-01
00490>
00491>       *** WARNING: Outflow volume is less than inflow volume.
00492> ---------------------------------------------------------------------------
00493> 010:0005-----------------------------------------------------------------
00494> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00495> ---------------------
00496> | CALIB STANDHYD     |   Area    (ha)=     .08
00497> | 01:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00498> ---------------------
00499>                              IMPERVIOUS    PERVIOUS (i)
00500>      Surface Area     (ha)=        .08          .00
00501>      Dep. Storage     (mm)=       6.80         6.80
00502>      Average Slope     (%)=       2.00         2.00
00503>      Length            (m)=       4.00         4.00
00504>      Mannings n            =       .013         .250
00505>
00506>      Max.eff.Inten.(mm/hr)=     116.31        48.80
00507>                  over (min)        1.00         3.00
00508>      Storage Coeff.  (min)=        .28 (ii)    2.65 (ii)
00509>      Unit Hyd. Tpeak (min)=       1.00         3.00
00510>      Unit Hyd. peak  (cms)=       1.65          .41
00511>                                                          *TOTALS*
00512>      PEAK FLOW       (cms)=         .03          .00          .026 (iii)
00513>      TIME TO PEAK    (hrs)=        1.25         1.35         1.333
00514>      RUNOFF VOLUME    (mm)=       48.40        20.21        48.123
00515>      TOTAL RAINFALL   (mm)=       55.20        55.20        55.205
00516>      RUNOFF COEFFICIENT   =         .88          .37          .872
```

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00517>
00518>       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00519>           CN* =  79.0    Ia = Dep. Storage  (Above)
00520>      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00521>           THAN THE STORAGE COEFFICIENT.
00522>     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00523>
00524> ------------------------------------------------------------------------------
00525> 010:0006----------------------------------------------------------------------
00526> *# TOTAL SITE DISCHARGE
00527> ----------------------
00528> | ADD HYD (CONTD     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00529> ----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00530>                       ID1 01:202            .08     .026    1.33  48.12    .000
00531>                      +ID2 02:TANK           .89     .120    1.37  46.64    .000
00532>                      +ID3 03:TANK-OVF       .00     .000     .00    .00    .000
00533>                       ========================================================
00534>                       SUM 04:CONTD           .97     .141    1.33  46.76    .000
00535>
00536>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00537>
00538> ------------------------------------------------------------------------------
00539> 010:0007----------------------------------------------------------------------
00540> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
00541> *
00542> ------------------------------------------------------------------------------
00543> 010:0002----------------------------------------------------------------------
00544> ------------------------------------------------------------------------------
00545> 010:0002----------------------------------------------------------------------
00546>   ** END OF RUN :  24
00547>
00548> ******************************************************************************
00549>
00550>
00551>
00552>
00553>
00554> --------------------
00555> | START            |  Project  dir.: Q:\48247\100\SWM\SWMHYMO\
00556> --------------------  Rainfall dir.: Q:\48247\100\SWM\SWMHYMO\
00557>     TZERO =   .00 hrs on        0
00558>     METOUT=   2 (output = METRIC)
00559>     NRUN  = 025
00560>     NSTORM=   1
00561>             #  1=BURL_025.stm
00562> ------------------------------------------------------------------------------
00563> 025:0002----------------------------------------------------------------------
00564> *#*************************************************************************|
00565> *#  Project Name: STATION WEST PH2
00566> *#               BURLINGTON, ONTARIO
00567> *#  JOB NUMBER  : 48247-100
00568> *#       Date   : APRIL 2021
00569> *#  Modeller    : EXK
00570> *#    Company   : MTE CONSULTANTS INC.
00571> *#       File   : 48247-100.DAT
00572> *
00573> ------------------------------------------------------------------------------
00574> 025:0002----------------------------------------------------------------------
00575> --------------------
00576> | READ STORM       |    Filename: 25-YR BURLINGTON CHICAGO STORM (4-HR DUR
00577> | Ptotal=  64.44 mm|    Comments: 25-YR BURLINGTON CHICAGO STORM (4-HR DUR
00578> --------------------
00579>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00580>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00581>               .17   4.612 |   1.17  32.881 |   2.17  10.563 |   3.17   5.499
00582>               .33   5.251 |   1.33 135.380 |   2.33   9.061 |   3.33   5.125
00583>               .50   6.138 |   1.50  42.866 |   2.50   7.968 |   3.50   4.805
00584>               .67   7.465 |   1.67  23.321 |   2.67   7.135 |   3.67   4.527
00585>               .83   9.700 |   1.83  16.365 |   2.83   6.477 |   3.83   4.284
00586>              1.00  14.410 |   2.00  12.771 |   3.00   5.943 |   4.00   4.068
00587>
00588> ------------------------------------------------------------------------------
00589> 025:0003----------------------------------------------------------------------
00590> *
00591> *#############################################################################|
00592> *#
00593> *#               POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00594> *#               ==============================================
00595> *#
00596> *#############################################################################|
00597> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00598> ---------------------
00599> | CALIB STANDHYD     |   Area    (ha)=     .89
00600> | 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00601> ---------------------
00602>                              IMPERVIOUS    PERVIOUS (i)
00603>      Surface Area     (ha)=        .88          .01
00604>      Dep. Storage     (mm)=       6.80         6.80
00605>      Average Slope     (%)=       2.00         3.00
00606>      Length            (m)=      35.00        16.00
00607>      Mannings n            =       .013         .250
00608>
00609>      Max.eff.Inten.(mm/hr)=     135.38        60.65
00610>                  over (min)        1.00         5.00
00611>      Storage Coeff.  (min)=        .98 (ii)    5.38 (ii)
00612>      Unit Hyd. Tpeak (min)=       1.00         5.00
00613>      Unit Hyd. peak  (cms)=       1.09          .22
00614>                                                          *TOTALS*
00615>      PEAK FLOW       (cms)=        .33          .00          .332 (iii)
00616>      TIME TO PEAK    (hrs)=       1.33         1.38         1.333
00617>      RUNOFF VOLUME    (mm)=      57.64        26.54        57.325
00618>      TOTAL RAINFALL   (mm)=      64.44        64.44        64.436
00619>      RUNOFF COEFFICIENT   =        .89          .41          .890
00620>
00621>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00622>            CN* =  79.0    Ia = Dep. Storage  (Above)
00623>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00624>            THAN THE STORAGE COEFFICIENT.
00625>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00626>
00627> ------------------------------------------------------------------------------
00628> 025:0004----------------------------------------------------------------------
00629> *#Route Catchment 201 through Tank and Orifice Control
00630> ---------------------
00631> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00632> |  IN>01:(201   )   |
00633> | OUT<02:(TANK  )   |    =========  OUTLFOW STORAGE TABLE  =========
00634> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00635>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00636>                             .000  .0000E+00    |     .121  .1513E-01
00637>                             .000  .1320E-02    |     .129  .1702E-01
00638>                             .081  .7570E-02    |     .150  .2270E-01
00639>
00640>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00641>      --------------------       (ha)     (cms)     (hrs)       (mm)
00642>      INFLOW >01: (201   )        .89      .332     1.333     57.325
00643>      OUTFLOW<02: (TANK  )        .89      .132     1.367     55.842
00644>     OVERFLOW<03: (TANK-O)        .00      .000      .000       .000
00645>
00646>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00647>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00648>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00649>
00650>
00651>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   39.831
00652>                    TIME SHIFT OF PEAK FLOW         (min)=     2.00
00653>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1802E-01
00654>
00655>       *** WARNING: Outflow volume is less than inflow volume.
00656> ------------------------------------------------------------------------------
00657> 025:0005----------------------------------------------------------------------
00658> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00659> ---------------------
00660> | CALIB STANDHYD     |   Area    (ha)=     .08
00661> | 01:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00662> ---------------------
00663>                              IMPERVIOUS    PERVIOUS (i)
00664>      Surface Area     (ha)=        .08          .00
00665>      Dep. Storage     (mm)=       6.80         6.80
00666>      Average Slope     (%)=       2.00         2.00
00667>      Length            (m)=       4.00         4.00
00668>      Mannings n            =       .013         .250
00669>
00670>      Max.eff.Inten.(mm/hr)=     135.38        66.14
00671>                  over (min)        1.00         2.00
00672>      Storage Coeff.  (min)=        .27 (ii)    2.36 (ii)
00673>      Unit Hyd. Tpeak (min)=       1.00         2.00
00674>      Unit Hyd. peak  (cms)=       1.66          .50
00675>                                                          *TOTALS*
00676>      PEAK FLOW       (cms)=        .03          .00          .030 (iii)
00677>      TIME TO PEAK    (hrs)=       1.25         1.33         1.333
00678>      RUNOFF VOLUME    (mm)=      57.64        26.54        57.325
00679>      TOTAL RAINFALL   (mm)=      64.44        64.44        64.436
00680>      RUNOFF COEFFICIENT   =        .89          .41          .890
00681>
00682>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00683>            CN* =  79.0    Ia = Dep. Storage  (Above)
00684>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00685>            THAN THE STORAGE COEFFICIENT.
00686>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00687>
00688> ------------------------------------------------------------------------------
00689> 025:0006----------------------------------------------------------------------
00690> *# TOTAL SITE DISCHARGE
00691> ----------------------
00692> | ADD HYD (CONTD     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00693> ----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00694>                       ID1 01:202            .08     .030    1.33  57.32    .000
00695>                      +ID2 02:TANK           .89     .132    1.37  55.84    .000
00696>                      +ID3 03:TANK-OVF       .00     .000     .00    .00    .000
00697>                       ========================================================
00698>                       SUM 04:CONTD           .97     .159    1.33  55.96    .000
00699>
00700>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00701>
00702> ------------------------------------------------------------------------------
00703> 025:0007----------------------------------------------------------------------
00704> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
00705> *
00706> ------------------------------------------------------------------------------
00707> 025:0002----------------------------------------------------------------------
00708> ------------------------------------------------------------------------------
00709> 025:0002----------------------------------------------------------------------
00710> ------------------------------------------------------------------------------
00711> 025:0002----------------------------------------------------------------------
00712>   ** END OF RUN :  49
00713>
00714> ******************************************************************************
00715>
00716>
00717>
00718>
00719>
00720> --------------------
00721> | START            |  Project  dir.: Q:\48247\100\SWM\SWMHYMO\
00722> --------------------  Rainfall dir.: Q:\48247\100\SWM\SWMHYMO\
00723>     TZERO =   .00 hrs on        0
00724>     METOUT=   2 (output = METRIC)
00725>     NRUN  = 050
00726>     NSTORM=   1
00727>             #  1=BURL_050.stm
00728> ------------------------------------------------------------------------------
00729> 050:0002----------------------------------------------------------------------
00730> *#*************************************************************************|
00731> *#  Project Name: STATION WEST PH2
00732> *#               BURLINGTON, ONTARIO
00733> *#  JOB NUMBER  : 48247-100
00734> *#       Date   : APRIL 2021
00735> *#  Modeller    : EXK
00736> *#    Company   : MTE CONSULTANTS INC.
00737> *#       File   : 48247-100.DAT
00738> *
00739> ------------------------------------------------------------------------------
00740> 050:0002----------------------------------------------------------------------
00741> --------------------
00742> | READ STORM       |    Filename: 50-YR BURLINGTON CHICAGO STORM (4-HR DUR
00743> | Ptotal=  71.26 mm|    Comments: 50-YR BURLINGTON CHICAGO STORM (4-HR DUR
00744> --------------------
00745>              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00746>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00747>               .17   5.119 |   1.17  36.356 |   2.17  11.707 |   3.17   6.102
00748>               .33   5.827 |   1.33 149.296 |   2.33  10.045 |   3.33   5.688
00749>               .50   6.809 |   1.50  47.374 |   2.50   8.836 |   3.50   5.333
00750>               .67   8.278 |   1.67  25.806 |   2.67   7.913 |   3.67   5.025
00751>               .83  10.753 |   1.83  18.121 |   2.83   7.185 |   3.83   4.755
00752>              1.00  15.961 |   2.00  14.149 |   3.00   6.593 |   4.00   4.516
00753>
00754> ------------------------------------------------------------------------------
00755> 050:0003----------------------------------------------------------------------
00756> *
00757> *#############################################################################|
00758> *#
00759> *#               POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00760> *#               ==============================================
00761> *#
00762> *#############################################################################|
00763> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00764> ---------------------
00765> | CALIB STANDHYD     |   Area    (ha)=     .89
00766> | 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00767> ---------------------
00768>                              IMPERVIOUS    PERVIOUS (i)
00769>      Surface Area     (ha)=        .88          .01
00770>      Dep. Storage     (mm)=       6.80         6.80
00771>      Average Slope     (%)=       2.00         3.00
00772>      Length            (m)=      35.00        16.00
00773>      Mannings n            =       .013         .250
00774>
```

```
00775>      Max.eff.Inten.(mm/hr)=     149.30        72.31
00776>                   over (min)        1.00         5.00
00777>      Storage Coeff.  (min)=         .94 (ii)    5.05 (ii)
00778>      Unit Hyd. Tpeak (min)=        1.00         5.00
00779>      Unit Hyd. peak  (cms)=        1.11          .22
00780>                                                        *TOTALS*
00781>      PEAK FLOW       (cms)=         .37          .00          .367 (iii)
00782>      TIME TO PEAK    (hrs)=        1.33         1.37         1.333
00783>      RUNOFF VOLUME    (mm)=       64.46        31.48        64.128
00784>      TOTAL RAINFALL   (mm)=       71.26        71.26        71.258
00785>      RUNOFF COEFFICIENT   =         .90          .44          .900
00786>
00787>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00788>            CN* =  79.0    Ia = Dep. Storage  (Above)
00789>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00790>            THAN THE STORAGE COEFFICIENT.
00791>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00792>
00793> ----------------------------------------------------------------------------
00794> 050:0004------------------------------------------------------------------------
00795> *#Route Catchment 201 through Tank and Orifice Control
00796> ---------------------
00797> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00798> |  IN>01:(201   )   |
00799> | OUT<02:(TANK  )   |    =========  OUTLFOW STORAGE TABLE  =========
00800> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00801>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00802>                             .000  .0000E+00    |     .121  .1513E-01
00803>                             .000  .1320E-02    |     .129  .1702E-01
00804>                             .081  .7570E-02    |     .150  .2270E-01
00805>
00806>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00807>      ---------------------      (ha)     (cms)     (hrs)       (mm)
00808>      INFLOW >01: (201   )        .89      .367     1.333     64.128
00809>      OUTFLOW<02: (TANK  )        .89      .141     1.367     62.645
00810>     OVERFLOW<03: (TANK-O)        .00      .000      .000      .000
00811>
00812>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00813>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00814>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00815>
00816>
00817>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.456
00818>                     TIME SHIFT OF PEAK FLOW         (min)=     2.00
00819>                     MAXIMUM  STORAGE   USED       (ha.m.)=.2032E-01
00820>
00821>       *** WARNING: Outflow volume is less than inflow volume.
00822> ----------------------------------------------------------------------------
00823> 050:0005------------------------------------------------------------------------
00824> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00825> ---------------------
00826> | CALIB STANDHYD     |   Area    (ha)=     .08
00827> | 01:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00828> ---------------------
00829>                              IMPERVIOUS    PERVIOUS (i)
00830>      Surface Area     (ha)=        .08          .00
00831>      Dep. Storage     (mm)=       6.80         6.80
00832>      Average Slope     (%)=       2.00         2.00
00833>      Length            (m)=       4.00         4.00
00834>      Mannings n            =       .013         .250
00835>
00836>      Max.eff.Inten.(mm/hr)=     149.30        78.33
00837>                   over (min)        1.00         2.00
00838>      Storage Coeff.  (min)=         .26 (ii)    2.21 (ii)
00839>      Unit Hyd. Tpeak (min)=        1.00         2.00
00840>      Unit Hyd. peak  (cms)=        1.66          .52
00841>                                                        *TOTALS*
00842>      PEAK FLOW       (cms)=         .03          .00          .033 (iii)
00843>      TIME TO PEAK    (hrs)=        1.23         1.33         1.333
00844>      RUNOFF VOLUME    (mm)=       64.46        31.48        64.128
00845>      TOTAL RAINFALL   (mm)=       71.26        71.26        71.258
00846>      RUNOFF COEFFICIENT   =         .90          .44          .900
00847>
00848>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00849>            CN* =  79.0    Ia = Dep. Storage  (Above)
00850>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00851>            THAN THE STORAGE COEFFICIENT.
00852>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00853>
00854> ----------------------------------------------------------------------------
00855> 050:0006------------------------------------------------------------------------
00856> *# TOTAL SITE DISCHARGE
00857> ------------------------
00858> | ADD HYD (CONTD     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00859> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00860>                       ID1 01:202           .08      .033    1.33  64.13    .000
00861>                      +ID2 02:TANK          .89      .141    1.37  62.64    .000
00862>                      +ID3 03:TANK-OVF      .00      .000     .00    .00    .000
00863>                       ============================================================
00864>                       SUM 04:CONTD          .97      .170    1.33  62.77    .000
00865>
00866>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00867>
00868> ----------------------------------------------------------------------------
00869> 050:0007------------------------------------------------------------------------
00870> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
00871> *
00872> ----------------------------------------------------------------------------
00873> 050:0002------------------------------------------------------------------------
00874> ----------------------------------------------------------------------------
00875> 050:0002------------------------------------------------------------------------
00876> ----------------------------------------------------------------------------
00877> 050:0002------------------------------------------------------------------------
00878> ----------------------------------------------------------------------------
00879> 050:0002------------------------------------------------------------------------
00880>   ** END OF RUN :  99
00881>
00882> ****************************************************************************
00883>
00884>
00885>
00886>
00887>
00888> --------------------
00889> | START            |  Project  dir.: Q:\48247\100\SWM\SWMHYMO\
00890> --------------------  Rainfall dir.: Q:\48247\100\SWM\SWMHYMO\
00891>     TZERO =   .00 hrs on       0
00892>     METOUT=   2 (output = METRIC)
00893>     NRUN  = 100
00894>     NSTORM=   1
00895>               #  1=BURL_100.stm
00896> ----------------------------------------------------------------------------
00897> 100:0002----------------------------------------------------------------------
00898> *#*************************************************************************|
00899> *#  Project Name: STATION WEST PH2
00900> *#               BURLINGTON, ONTARIO
00901> *#  JOB NUMBER  : 48247-100
00902> *#       Date   : APRIL 2021
00903> *#  Modeller    : EXK
00904> *#    Company   : MTE CONSULTANTS INC.
00905> *#       File   : 48247-100.DAT
00906> *
00907> ----------------------------------------------------------------------------
00908> 100:0002----------------------------------------------------------------------
00909> --------------------
00910> | READ STORM       |    Filename: 100-YR BURLINGTON CHICAGO STORM (4-HR DU
00911> | Ptotal=  77.88 mm|    Comments: 100-YR BURLINGTON CHICAGO STORM (4-HR DU
00912> --------------------
00913>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00914>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00915>                .17   5.595 |   1.17  39.736 |   2.17  12.795 |   3.17   6.670
00916>                .33   6.369 |   1.33 163.177 |   2.33  10.979 |   3.33   6.217
00917>                .50   7.443 |   1.50  51.779 |   2.50   9.657 |   3.50   5.829
00918>                .67   9.048 |   1.67  28.205 |   2.67   8.649 |   3.67   5.492
00919>                .83  11.752 |   1.83  19.806 |   2.83   7.853 |   3.83   5.197
00920>               1.00  17.445 |   2.00  15.465 |   3.00   7.206 |   4.00   4.936
00921>
00922> ----------------------------------------------------------------------------
00923> 100:0003----------------------------------------------------------------------
00924> *
00925> *#########################################################################|
00926> *#
00927> *#               POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00928> *#               ==============================================
00929> *#
00930> *#########################################################################|
00931> *# CATCHMENT 201 - SITE CONTROLLED VIA SWM TANK AND ORIFICE
00932> ---------------------
00933> | CALIB STANDHYD     |   Area    (ha)=     .89
00934> | 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00935> ---------------------
00936>                              IMPERVIOUS    PERVIOUS (i)
00937>      Surface Area     (ha)=        .88          .01
00938>      Dep. Storage     (mm)=       6.80         6.80
00939>      Average Slope     (%)=       2.00         3.00
00940>      Length            (m)=      35.00        16.00
00941>      Mannings n            =       .013         .250
00942>
00943>      Max.eff.Inten.(mm/hr)=     163.18        84.29
00944>                   over (min)        1.00         5.00
00945>      Storage Coeff.  (min)=         .91 (ii)    4.77 (ii)
00946>      Unit Hyd. Tpeak (min)=        1.00         5.00
00947>      Unit Hyd. peak  (cms)=        1.13          .23
00948>                                                        *TOTALS*
00949>      PEAK FLOW       (cms)=         .40          .00          .401 (iii)
00950>      TIME TO PEAK    (hrs)=        1.33         1.37         1.333
00951>      RUNOFF VOLUME    (mm)=       71.08        36.46        70.737
00952>      TOTAL RAINFALL   (mm)=       77.88        77.88        77.883
00953>      RUNOFF COEFFICIENT   =         .91          .47          .908
00954>
00955>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00956>            CN* =  79.0    Ia = Dep. Storage  (Above)
00957>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00958>            THAN THE STORAGE COEFFICIENT.
00959>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00960>
00961> ----------------------------------------------------------------------------
00962> 100:0004----------------------------------------------------------------------
00963> *#Route Catchment 201 through Tank and Orifice Control
00964> ---------------------
00965> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00966> |  IN>01:(201   )   |
00967> | OUT<02:(TANK  )   |    =========  OUTLFOW STORAGE TABLE  =========
00968> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00969>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00970>                             .000  .0000E+00    |     .121  .1513E-01
00971>                             .000  .1320E-02    |     .129  .1702E-01
00972>                             .081  .7570E-02    |     .150  .2270E-01
00973>
00974>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00975>      ---------------------      (ha)     (cms)     (hrs)       (mm)
00976>      INFLOW >01: (201   )        .89      .401     1.333     70.737
00977>      OUTFLOW<02: (TANK  )        .89      .149     1.367     69.254
00978>     OVERFLOW<03: (TANK-O)        .00      .000      .000      .000
00979>
00980>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00981>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00982>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00983>
00984>
00985>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   37.291
00986>                     TIME SHIFT OF PEAK FLOW         (min)=     2.00
00987>                     MAXIMUM  STORAGE   USED       (ha.m.)=.2258E-01
00988>
00989>       *** WARNING: Outflow volume is less than inflow volume.
00990> ----------------------------------------------------------------------------
00991> 100:0005----------------------------------------------------------------------
00992> *# CATCHMENT 202 - UNCONTROLLED DISCHARGE TO MASONRY COURT
00993> ---------------------
00994> | CALIB STANDHYD     |   Area    (ha)=     .08
00995> | 01:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00996> ---------------------
00997>                              IMPERVIOUS    PERVIOUS (i)
00998>      Surface Area     (ha)=        .08          .00
00999>      Dep. Storage     (mm)=       6.80         6.80
01000>      Average Slope     (%)=       2.00         2.00
01001>      Length            (m)=       4.00         4.00
01002>      Mannings n            =       .013         .250
01003>
01004>      Max.eff.Inten.(mm/hr)=     163.18        90.81
01005>                   over (min)        1.00         2.00
01006>      Storage Coeff.  (min)=         .25 (ii)    2.09 (ii)
01007>      Unit Hyd. Tpeak (min)=        1.00         2.00
01008>      Unit Hyd. peak  (cms)=        1.67          .54
01009>                                                        *TOTALS*
01010>      PEAK FLOW       (cms)=         .04          .00          .036 (iii)
01011>      TIME TO PEAK    (hrs)=        1.23         1.33         1.333
01012>      RUNOFF VOLUME    (mm)=       71.08        36.46        70.737
01013>      TOTAL RAINFALL   (mm)=       77.88        77.88        77.883
01014>      RUNOFF COEFFICIENT   =         .91          .47          .908
01015>
01016>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01017>            CN* =  79.0    Ia = Dep. Storage  (Above)
01018>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01019>            THAN THE STORAGE COEFFICIENT.
01020>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01021>
01022> ----------------------------------------------------------------------------
01023> 100:0006----------------------------------------------------------------------
01024> *# TOTAL SITE DISCHARGE
01025> ------------------------
01026> | ADD HYD (CONTD     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01027> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
01028>                       ID1 01:202           .08      .036    1.33  70.74    .000
01029>                      +ID2 02:TANK          .89      .149    1.37  69.25    .000
01030>                      +ID3 03:TANK-OVF      .00      .000     .00    .00    .000
01031>                       ============================================================
01032>                       SUM 04:CONTD          .97      .181    1.33  69.38    .000
```

```
01033>
01034>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01035>
01036> ---------------------------------------------------------------------------
01037> 100:0007----------------------------------------------------------------
01038> * RUN REMAINING DESIGN STORMS (City of Burlington 4-hour duration 5 TO 100-YR)
01039> *
01040> ---------------------------------------------------------------------------
01041> 100:0002----------------------------------------------------------------
01042> ---------------------------------------------------------------------------
01043> 100:0002----------------------------------------------------------------
01044> ---------------------------------------------------------------------------
01045> 100:0002----------------------------------------------------------------
01046> ---------------------------------------------------------------------------
01047> 100:0002----------------------------------------------------------------
01048> ---------------------------------------------------------------------------
01049> 100:0002----------------------------------------------------------------
01050>       FINISH
01051> ---------------------------------------------------------------------------
01052> ***************************************************************************
01053>      WARNINGS / ERRORS / NOTES
01054>      -------------------------
01055>  002:0004 ROUTE RESERVOIR
01056>       *** WARNING: Outflow volume is less than inflow volume.
01057>       *** WARNING: Outflow volume is less than inflow volume.
01058>       *** WARNING: Outflow volume is less than inflow volume.
01059>       *** WARNING: Outflow volume is less than inflow volume.
01060>       *** WARNING: Outflow volume is less than inflow volume.
01061>       *** WARNING: Outflow volume is less than inflow volume.
01062>    Simulation ended on 2021-04-05     at 10:22:15
01063> ===========================================================================
01064>
```

Stormceptor®

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

04/06/2021

Province:	Ontario
City:	Burlington
Nearest Rainfall Station:	HAMILTON AP
NCDC Rainfall Station Id:	3195
Years of Rainfall Data:	34

Site Name:	Station West Ph. 2
Drainage Area (ha):	0.89
% Imperviousness:	99.00

Runoff Coefficient 'c': 0.89

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	30.29
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Station West Ph.2
Project Number:	48247-100
Designer Name:	Erin Kennelly
Designer Company:	MTE Consulting
Designer Email:	EKennelly@mte85.com
Designer Phone:	905-639-2552
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	69
EFO6	79
EFO8	84
EFO10	87
EFO12	89

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 84

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

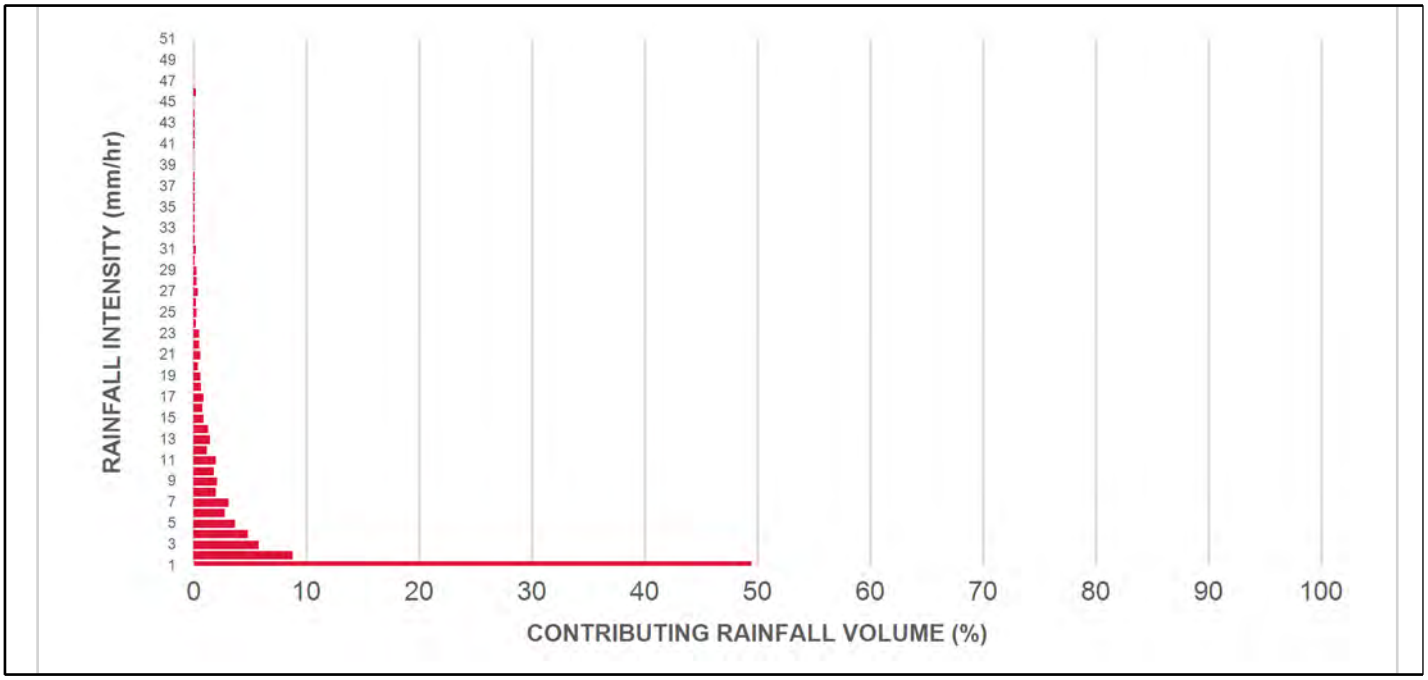
Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	49.5	49.5	2.21	133.0	28.0	93	46.0	46.0
2	8.8	58.3	4.42	265.0	56.0	92	8.1	54.1
3	5.8	64.1	6.64	398.0	85.0	89	5.2	59.3
4	4.8	68.9	8.85	531.0	113.0	86	4.1	63.4
5	3.7	72.6	11.06	664.0	141.0	83	3.1	66.5
6	2.8	75.4	13.27	796.0	169.0	79	2.2	68.7
7	3.1	78.5	15.48	929.0	198.0	77	2.4	71.1
8	2.0	80.5	17.70	1062.0	226.0	74	1.5	72.6
9	2.1	82.6	19.91	1194.0	254.0	72	1.5	74.1
10	1.8	84.4	22.12	1327.0	282.0	69	1.2	75.3
11	2.0	86.4	24.33	1460.0	311.0	66	1.3	76.6
12	1.2	87.6	26.54	1593.0	339.0	64	0.8	77.4
13	1.5	89.1	28.76	1725.0	367.0	62	0.9	78.3
14	1.3	90.4	30.97	1858.0	395.0	59	0.8	79.1
15	0.9	91.3	33.18	1991.0	424.0	57	0.5	79.6
16	0.8	92.1	35.39	2123.0	452.0	57	0.5	80.0
17	0.9	93.0	37.60	2256.0	480.0	56	0.5	80.5
18	0.7	93.7	39.81	2389.0	508.0	55	0.4	80.9
19	0.6	94.3	42.03	2522.0	537.0	54	0.3	81.3
20	0.4	94.7	44.24	2654.0	565.0	53	0.2	81.5
21	0.6	95.3	46.45	2787.0	593.0	52	0.3	81.8
22	0.5	95.8	48.66	2920.0	621.0	52	0.3	82.0
23	0.5	96.3	50.87	3052.0	649.0	52	0.3	82.3
24	0.2	96.5	53.09	3185.0	678.0	52	0.1	82.4
25	0.3	96.8	55.30	3318.0	706.0	52	0.2	82.6

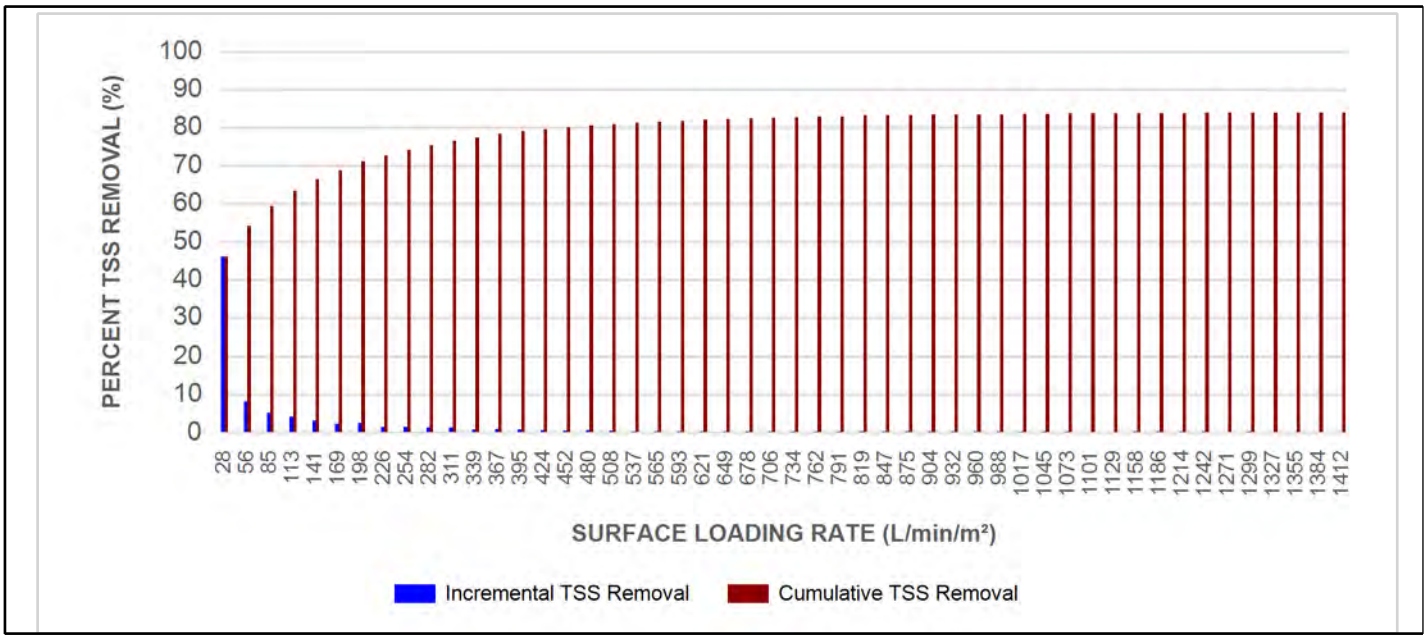
Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.2	97.0	57.51	3451.0	734.0	51	0.1	82.7
27	0.4	97.4	59.72	3583.0	762.0	51	0.2	82.9
28	0.3	97.7	61.93	3716.0	791.0	51	0.2	83.0
29	0.3	98.0	64.15	3849.0	819.0	51	0.2	83.2
30	0.1	98.1	66.36	3981.0	847.0	51	0.1	83.2
31	0.2	98.3	68.57	4114.0	875.0	51	0.1	83.3
32	0.1	98.4	70.78	4247.0	904.0	51	0.1	83.4
33	0.1	98.5	72.99	4380.0	932.0	50	0.1	83.4
34	0.1	98.6	75.21	4512.0	960.0	50	0.1	83.5
35	0.1	98.7	77.42	4645.0	988.0	50	0.1	83.5
36	0.1	98.8	79.63	4778.0	1017.0	50	0.1	83.6
37	0.1	98.9	81.84	4910.0	1045.0	50	0.1	83.6
38	0.1	99.0	84.05	5043.0	1073.0	49	0.0	83.7
39	0.0	99.0	86.27	5176.0	1101.0	49	0.0	83.7
40	0.0	99.0	88.48	5309.0	1129.0	49	0.0	83.7
41	0.1	99.1	90.69	5441.0	1158.0	49	0.0	83.7
42	0.1	99.2	92.90	5574.0	1186.0	48	0.0	83.8
43	0.1	99.3	95.11	5707.0	1214.0	48	0.0	83.8
44	0.1	99.4	97.33	5840.0	1242.0	48	0.0	83.9
45	0.0	99.4	99.54	5972.0	1271.0	47	0.0	83.9
46	0.2	99.6	101.75	6105.0	1299.0	47	0.1	84.0
47	0.0	99.6	103.96	6238.0	1327.0	47	0.0	84.0
48	0.0	99.6	106.17	6370.0	1355.0	47	0.0	84.0
49	0.0	99.6	108.38	6503.0	1384.0	46	0.0	84.0
50	0.0	99.6	110.60	6636.0	1412.0	46	0.0	84.0
Estimated Net Annual Sediment (TSS) Load Reduction =								**84 %**

RAINFALL DATA FROM HAMILTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

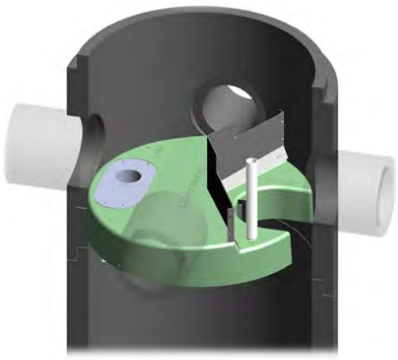
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

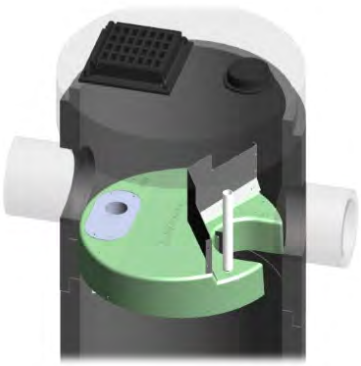
DESIGN FLEXIBILITY

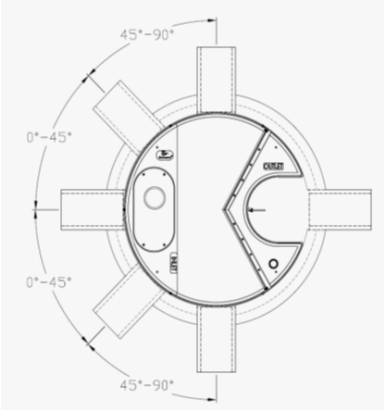
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

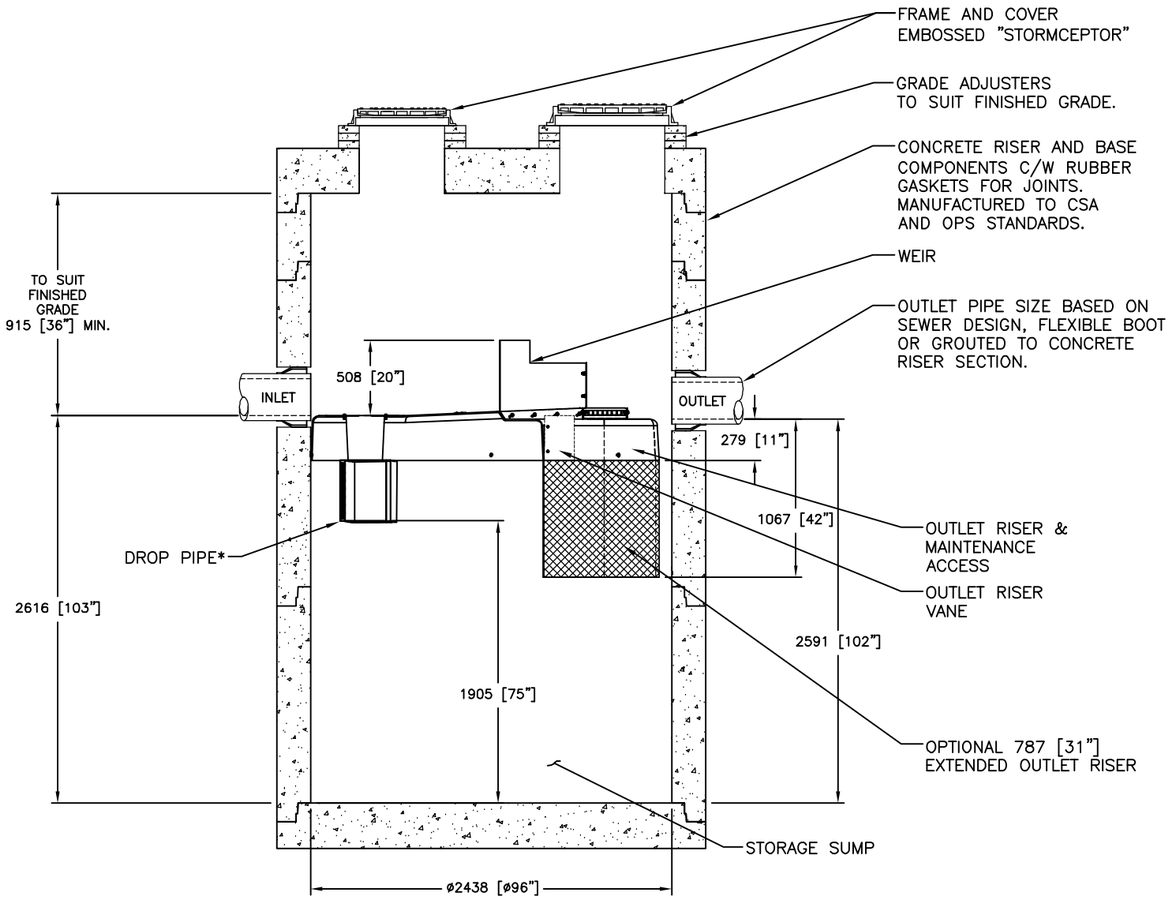
3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

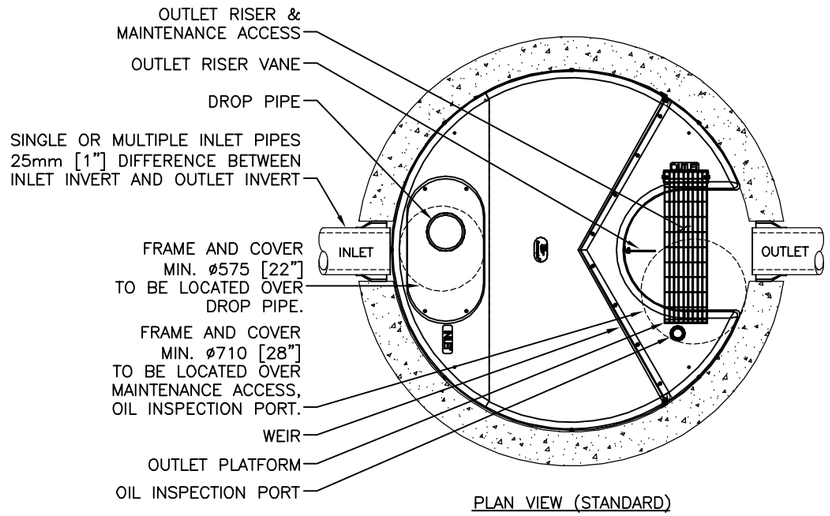
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m2 to 2600 L/min/m2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

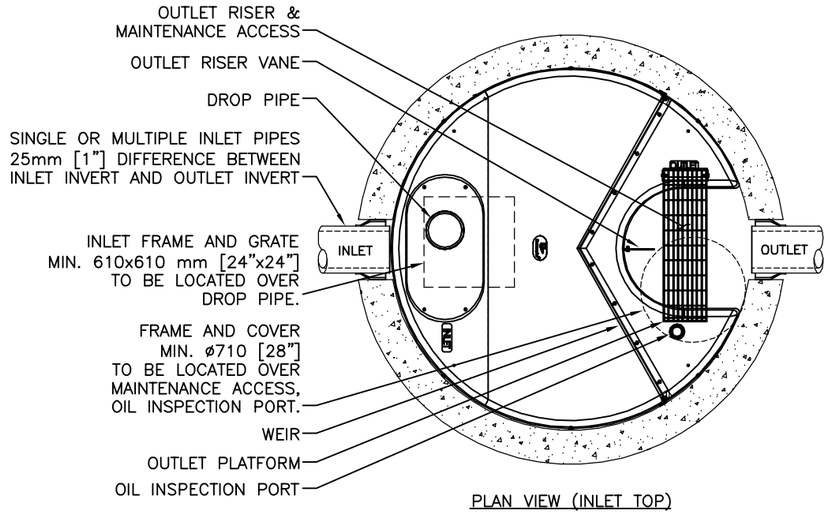
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF8 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO8 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO8				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

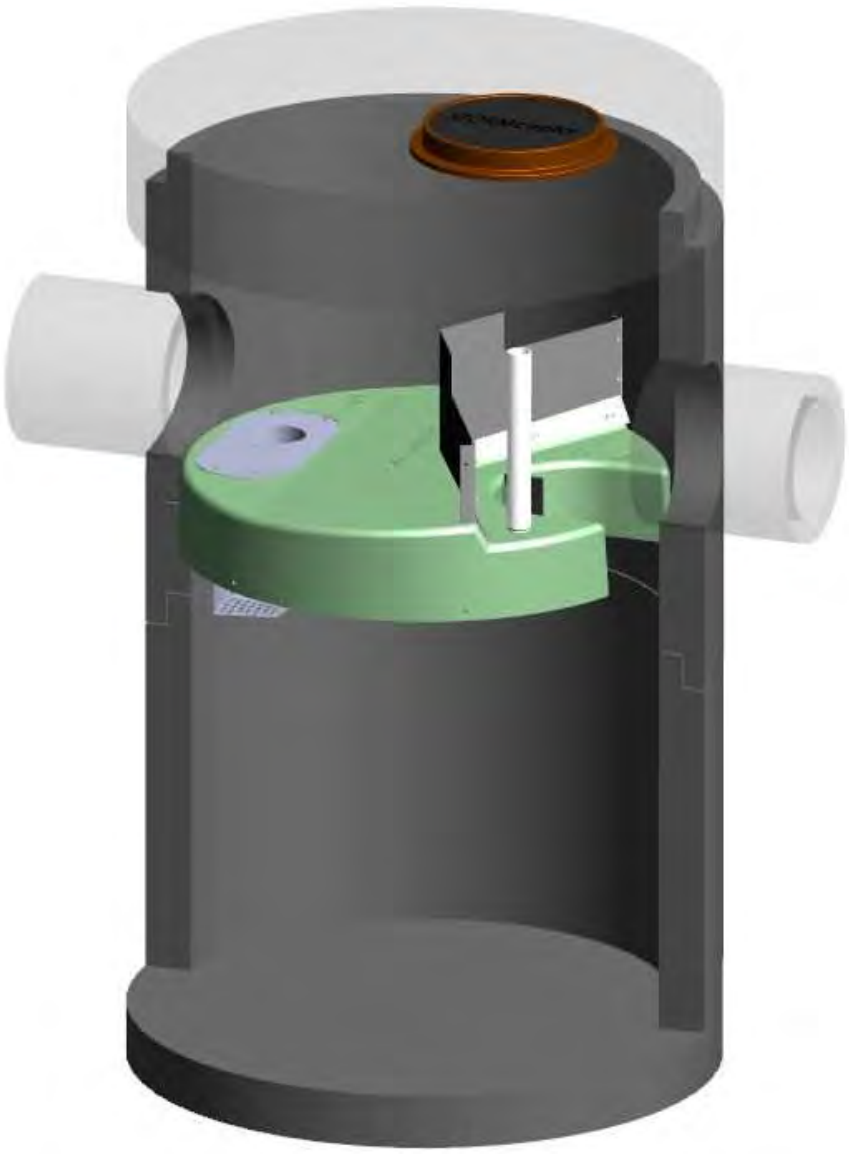
imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 9A9
TF 800-565-6801 CA 416-665-8600 INTL +1-416-665-8600

DATE:	10/13/2017
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: *
PROJECT No.: EFO8	SEQUENCE No.: *
SHEET:	1 OF 1

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Stormceptor® EF

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,180,305
Canadian Patent No. 2,327,768
Canadian Patent No. 2,694,159
Canadian Patent No. 2,697,287
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 729,096
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Japanese Patent No. 5,997,750
Japanese Patent No. 5,555,160
Korean Patent No. 0519212
Korean Patent No. 1451593
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Patent pending

Table of Contents:

1 - Stormceptor EF Overview

2 - Stormceptor EF Operation, Components

3 - Stormceptor EF Model Details

4 - Stormceptor EF Identification

5 - Stormceptor EF Inspection & Maintenance

6 – Stormceptor Contacts

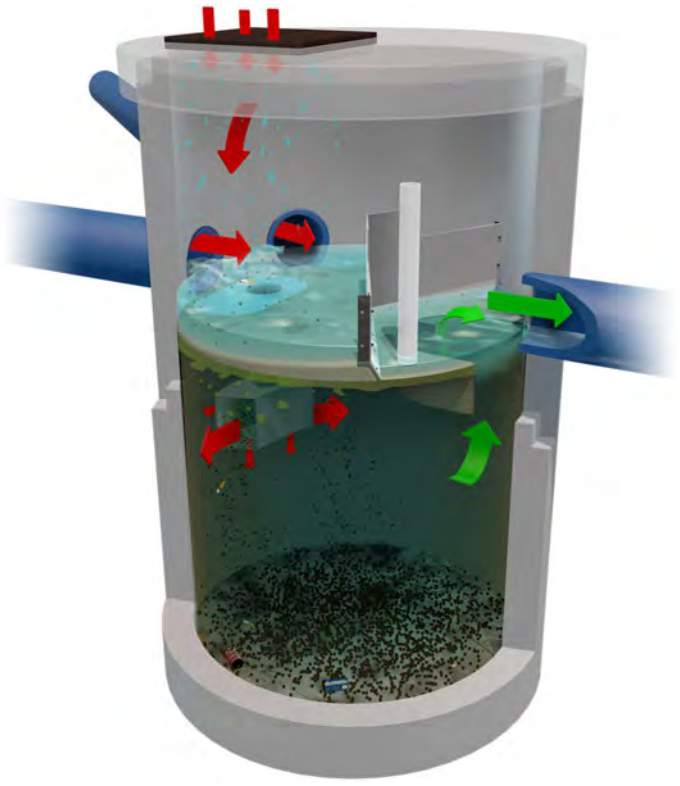
OVERVIEW

Stormceptor® EF is a continuation and evolution of the most globally recognized oil grit separator (OGS) stormwater treatment technology - ***Stormceptor®***. Also known as a hydrodynamic separator, the enhanced flow Stormceptor EF is a high performing oil grit separator that effectively removes a wide variety of pollutants from stormwater and snowmelt runoff at flow rates higher than the original Stormceptor. Stormceptor EF captures and retains sediment (TSS), free oils, gross pollutants and other pollutants that attach to particles, such as nutrients and metals. Stormceptor EF's patent-pending treatment and scour prevention platform ensures sediment is retained during all rainfall events.

Stormceptor EF offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe, multiple inlet pipes, and/or from the surface through an inlet grate. Stormceptor EF can also serve as a junction structure, accommodate a 90-degree inlet to outlet bend angle, and be modified to ensure performance in submerged conditions. With its scour prevention and internal bypass, Stormceptor EF can be installed online, eliminating the need for costly additional bypass structures.

OPERATION

- Stormwater enters the Stormceptor upper chamber through the inlet pipe(s) or a surface inlet grate. A specially designed insert reduces the influent velocity by creating a pond upstream of the insert's weir. Sediment particles immediately begin to settle. Swirling flow sweeps water, sediment, and floatables across the sloped surface of the insert to the inlet opening of the drop pipe, where a strong vortex draws water, sediment, oil, and debris down the drop pipe cone.
- Influent exits the cone into the drop pipe duct. The duct has two large rectangular outlet openings as well as perforations in the backside and floor of the duct. Influent is diffused through these various opening in multiple directions and at low velocity into the lower chamber.
- Free oils and other floatables rise up within the channel surrounding the central riser pipe and are trapped beneath the insert, while sediment settles to the sump. Pollutants are retained for later removal during maintenance cleaning.
- Treated effluent enters the outlet riser, moves upward, and discharges to the top side of the insert downstream of the weir, where it flows out the outlet pipe.
- During intense storm events with very high influent flow rates, the pond height on the upstream side of the weir may exceed the height of the weir, and the excess flow passes over the top of the weir to the downstream side of the insert, and exits through the outlet pipe. This internal bypass feature allows for in-line installation, avoiding the cost of additional bypass structures. During bypass, the pond separates sediment from all incoming flows, while full treatment in the lower chamber continues at the maximum flow rate.
- Stormceptor EF's patent-pending enhanced flow and scour prevention technology ensures pollutants are captured and retained, allowing excess flows to bypass during infrequent, high intensity storms.



COMPONENTS

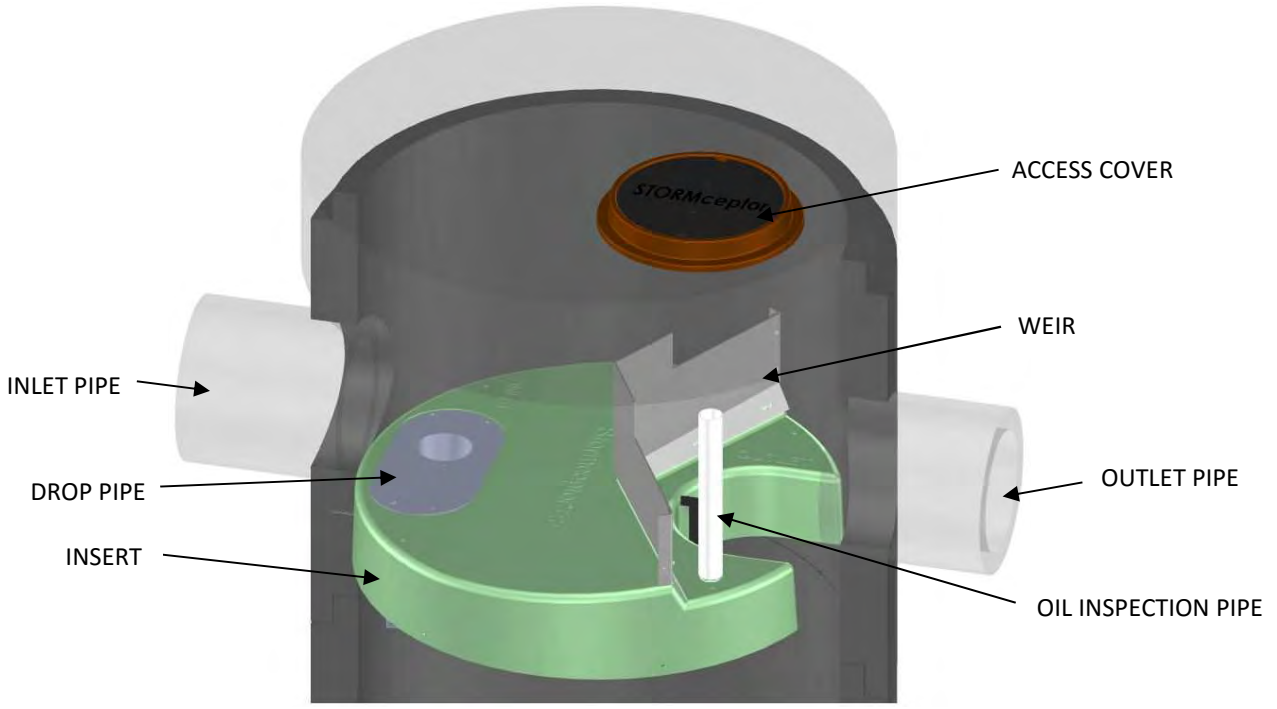


Figure 1

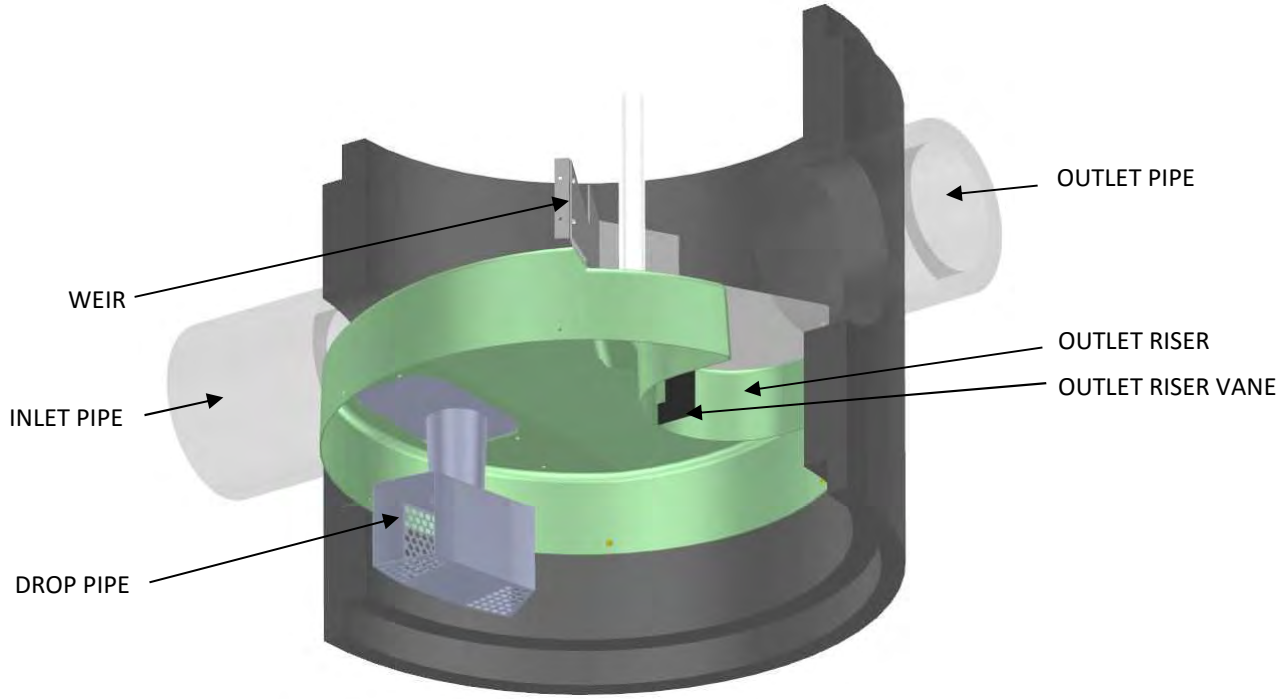


Figure 2

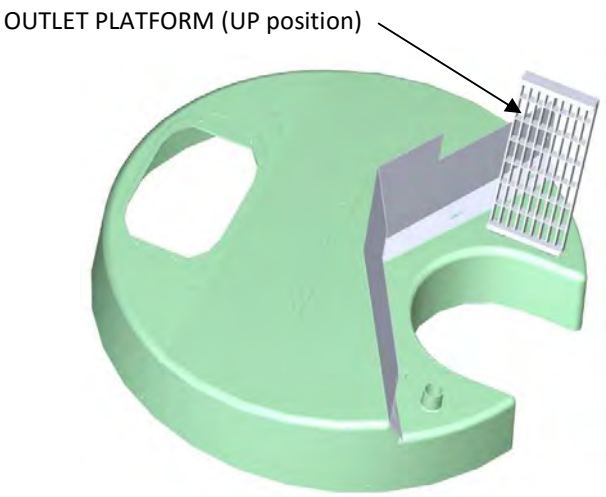


Figure 3A

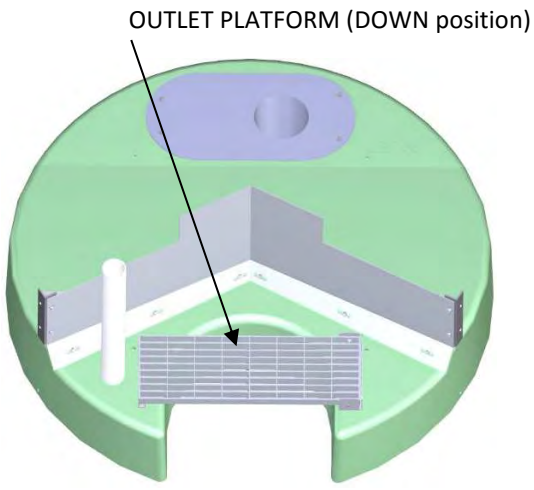


Figure 3B

- **Insert** – separates vessel into upper and lower chambers, and provides double-wall containment of hydrocarbons
- **Weir** – creates stormwater ponding and driving head on top side of insert
- **Drop pipe** – conveys stormwater and pollutants into the lower chamber
- **Outlet riser** – conveys treated stormwater from the lower chamber to the outlet pipe, and provides primary inspection and maintenance access into the lower chamber
- **Outlet riser vane** – prevents formation of a vortex in the outlet riser during high flow rate conditions
- **Outlet platform (optional)** – safety platform in the event of manned entry into the unit
- **Oil inspection pipe** – primary access for measuring oil depth

PRODUCT DETAILS

METRIC DIMENSIONS AND CAPACITIES

Table 1

Stormceptor Model	Inside Diameter (m)	Minimum Surface to Outlet Invert Depth (mm)	Depth Below Outlet Pipe Invert (mm)	Wet Volume (L)	Sediment Capacity [1] (m^3)	Hydrocarbon Storage Capacity [2] (L)	Maximum Flow Rate into Lower Chamber [3] (L/s)	Peak Conveyance Flow Rate [4] (L/s)
EF4 / EFO4	1.22	915	1524	1780	1.19	265	22.1 / 10.4	425
EF6 / EFO6	1.83	915	1930	5070	3.47	610	49.6 / 23.4	990
EF8 / EFO8	2.44	1219	2591	12090	8.78	1070	88.3 / 41.6	1700
EF10 / EFO10	3.05	1219	3251	23700	17.79	1670	138 / 65	2830
EF12 / EFO12	3.66	1524	3886	40800	31.22	2475	198.7 / 93.7	2830

[1] Sediment Capacity is measured from the floor to the bottom of the drop pipe cone. Sediment Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[2] Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[3] EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 1135 L/min/m^2.
EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 535 L/min/m^2.
[4] Peak Conveyance Flow Rate is limited by a maximum velocity of 1.5 m/s.

U.S. DIMENSIONS AND CAPACITIES

Table 2

Stormceptor Model	Inside Diameter (ft)	Minimum Surface to Outlet Invert Depth (in)	Depth Below Outlet Pipe Invert (in)	Wet Volume (gal)	Sediment Capacity [1] (ft^3)	Hydrocarbon Storage Capacity [2] (gal)	Maximum Flow Rate into Lower Chamber [3] (cfs)	Peak Conveyance Flow Rate [4] (cfs)
EF4 / EFO4	4	36	60	471	42	70	0.78 / 0.37	15
EF6 / EFO6	6	36	76	1339	123	160	1.75 / 0.83	35
EF8 / EFO8	8	48	102	3194	310	280	3.12 / 1.47	60
EF10 / EFO10	10	48	128	6261	628	440	4.87 / 2.30	100
EF12 / EFO12	12	60	153	10779	1103	655	7.02 / 3.31	100

[1] Sediment Capacity is measured from the floor to the bottom of the drop pipe cone. Sediment Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[2] Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[3] EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 27.9 gpm/ft^2.
EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 13.1 gpm/ft^2.
[4] Peak Conveyance Flow Rate is limited by a maximum velocity of 5 fps.

IDENTIFICATION

Each Stormceptor EF/EFO unit is easily identifiable by the trade name ***Stormceptor***® embossed on the access cover at grade as shown in **Figure 3**. The tradename ***Stormceptor***® is also embossed on the top of the insert upstream of the weir as shown in **Figure 3**.

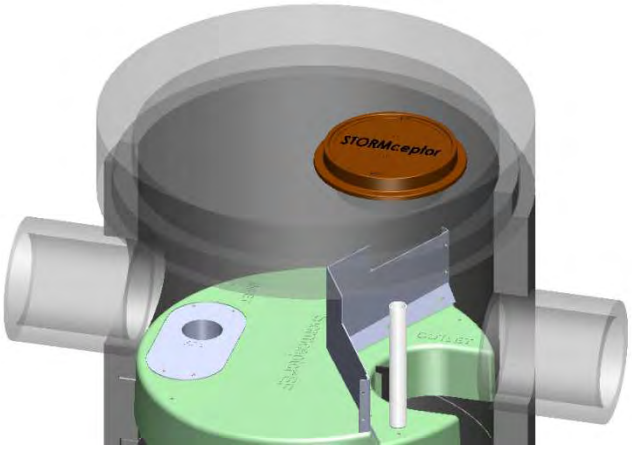


Figure 4

The specific Stormceptor EF/EFO model number is identified on the top of the aluminum Drop Pipe as shown in **Figure 4**. The unit serial number is identified on the top of the insert upstream of the weir as shown in **Figure 4**.

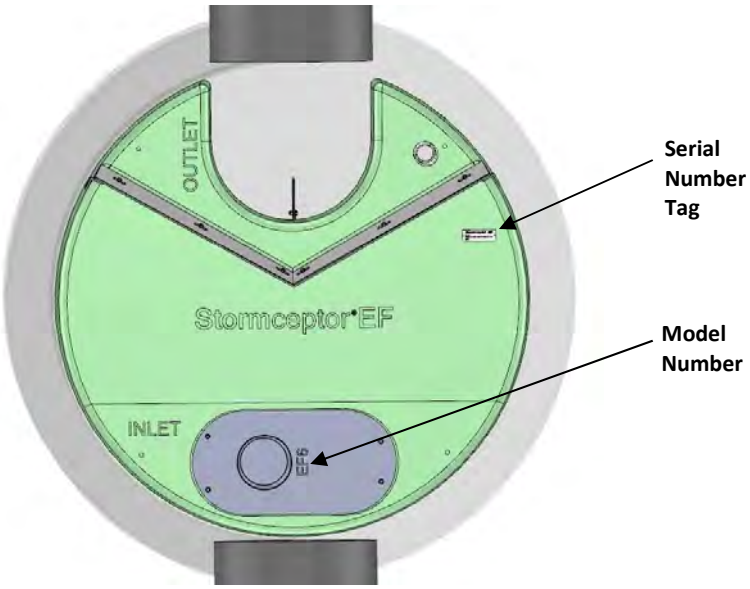


Figure 5

INSPECTION AND MAINTENANCE

It is very important to perform regular inspection and maintenance. Regular inspection and maintenance ensures maximum operation efficiency, keeps maintenance costs low, and provides continued of natural waterways.

Quick Reference

- Typical inspection and maintenance is performed from grade
- Remove manhole **cover(s)** or **inlet grate** to access insert and lower chamber
  NOTE: EF4/EFO4 requires the removal of a **flow deflector** beneath inlet grate
- Use Sludge Judge® or similar sediment probe to check sediment depth through the **outlet riser**
- Oil dipstick can be inserted through the **oil inspection pipe**
- Visually inspect the **insert** for debris, remove debris if present
- Visually inspect the **drop pipe** opening for blockage, remove blockage if present
- Visually inspect **insert** and **weir** for damage, schedule repair if needed
- Insert vacuum hose and jetting wand through the outlet riser and extract sediment and floatables
- Replace flow deflector (EF4/EFO4), inlet grate, and cover(s)
- **NOTE:** If the unit has an **outlet platform**, the outlet platform is typically in the UP position (see Figure 3A) for normal treatment conditions, and for inspection and maintenance. If manned entry into the unit is required, the outlet platform must first be placed in the DOWN position (see Figure 3B). After manned entry is completed, return the outlet platform to the UP position for treatment.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess pollutant accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

When is maintenance cleaning needed?

- If the post-construction inspection indicates presence of construction sediment of a depth greater than a few inches, maintenance is recommended at that time.
- For optimum performance and normal operation the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, see **Table 3**.
- Maintain immediately after an oil, fuel, or other chemical spill.

Table 3

Recommended Sediment Depths for Maintenance Service*	
MODEL	Sediment Depth (in/mm)
EF4 / EFO4	8 / 203
EF6 / EFO6	12 /305
EF8 / EFO8	24 / 610
EF10 / EFO10	24 / 610
EF12 / EFO12	24 / 610

* Based on a minimum distance of 40 inches (1,016 mm) from bottom of outlet riser to top of sediment bed

The frequency of inspection and maintenance may need to be adjusted based on site conditions to ensure the unit is operating and performing as intended. Maintenance costs will vary based on the size of the unit, site conditions, local requirements, disposal costs, and transportation distance.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required (adhere to all OSHA / CCOSH standards)

What conditions can compromise Stormceptor performance?

- Presence of construction sediment and debris in the unit prior to activation
- Excessive sediment depth beyond the recommended maintenance depth
- Oil spill in excess of the oil storage capacity
- Clogging or restriction of the drop pipe inlet opening with debris
- Downstream blockage that results in a backwater condition

Maintenance Procedures

- Maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is maintained from grade through a standard surface manhole access cover or inlet grate.
- In the case of submerged or tailwater conditions, extra measures are likely required, such as plugging the inlet and outlet pipes prior to conducting maintenance.
- Inspection and maintenance of upstream catch basins and other stormwater conveyance structures is also recommended to extend the time between future maintenance cycles.

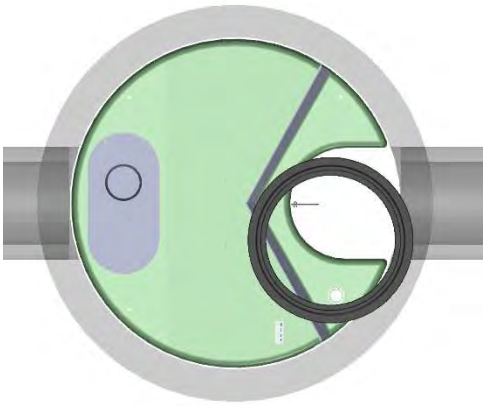


Figure 6

- Sediment depth inspections are performed through the **Outlet Riser** and oil presence can be determined through the **Oil Inspection Pipe**.
- Oil presence and sediment depth are determined by inserting a Sludge Judge® or measuring stick to quantify the pollutant depths.

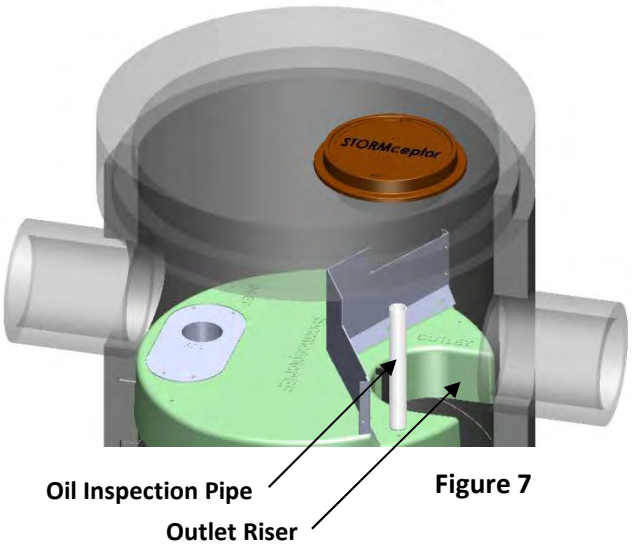


Figure 7



Figure 8

- Visually inspect the insert, weir, and drop pipe inlet opening to ensure there is no damage or blockage.
- **NOTE:** If the unit has an **outlet platform**, the outlet platform is typically in the UP position (see Figure 3A) for normal treatment conditions, and for inspection and maintenance. If manned entry into the unit is required, the outlet platform must first be placed in the DOWN position (see Figure 3B). After manned entry is completed, return the outlet platform to the UP position for treatment.

- When maintenance is required, a standard vacuum truck is used to remove the pollutants from the lower chamber of the unit through the **Outlet Riser**.



Figure 9

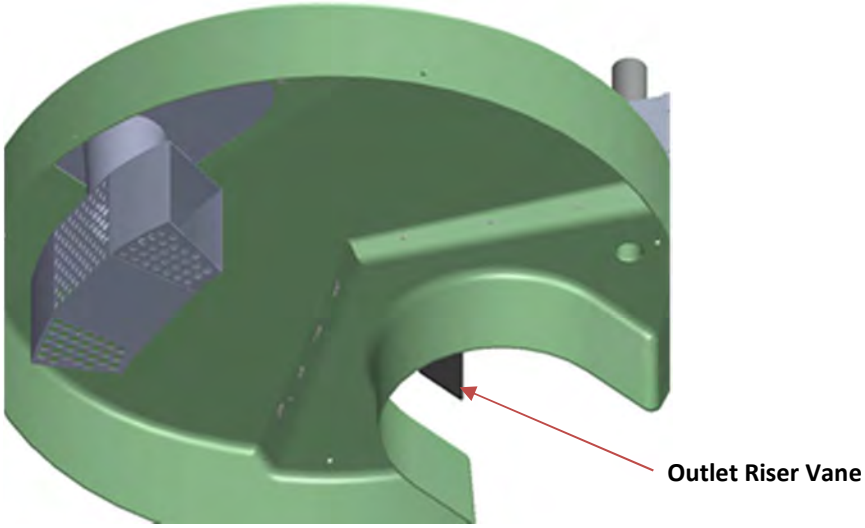
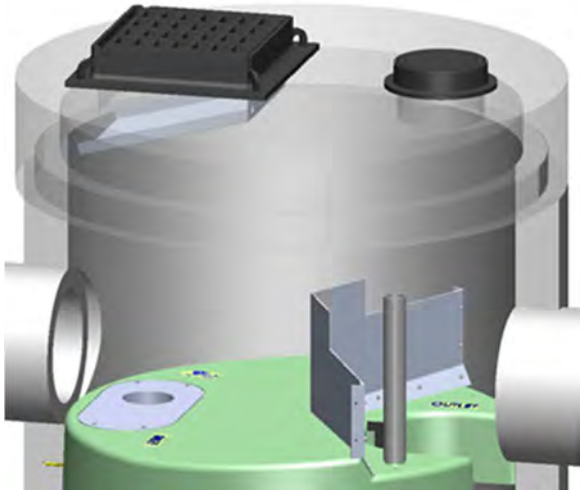


Figure 10

NOTE: The Outlet Riser Vane is durable and flexible and designed to allow maintenance activities with minimal, if any, interference.

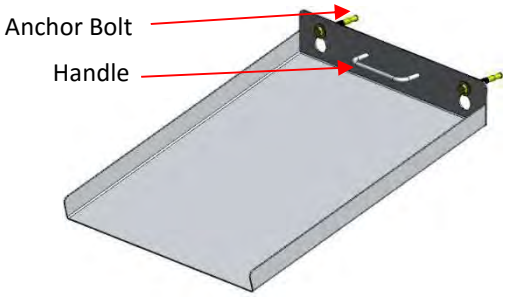
Removable Flow Deflector

- Top grated inlets for the Stormceptor EF4/EFO4 model requires a removable flow deflector staged underneath a 24-inch x 24-inch (600 mm x 600 mm) square inlet grate to direct flow towards the inlet side of the insert, and avoid flow and pollutants from entering the outlet side of the insert from grade. The EF6/EFO6 and larger models do not require the flow deflector.



How to Remove:

1. Loosen anchor bolts
2. Pull up and out using the handle



Removable Flow Deflector

Figure 11

Hydrocarbon Spills

Stormceptor is often installed on high pollutant load hotspot sites with vehicular traffic where hydrocarbon spill potential exists. Should a spill occur, or presence of oil be identified within a Stormceptor EF/EFO, it should be cleaned immediately by a licensed liquid waste hauler.

Disposal

Maintenance providers are to follow all federal, state/ provincial, and local requirements for disposal of material.

Oil Sheens

When oil is present in stormwater runoff, a sheen may be noticeable at the Stormceptor outlet. An oil rainbow or sheen can be noticeable at very low oil concentrations (< 10 mg/L). Despite the appearance of a sheen, Stormceptor EF/EFO may still be functioning as intended.

Oil Level Alarm

To mitigate spill liability with 24/7 detection, an electronic monitoring system can be employed to trigger a visual and audible alarm when a pre-set level of oil is captured within the lower chamber or when an oil spill occurs. The oil level alarm is available as an optional feature to include with Stormceptor EF/EFO as shown in **Figure 11**. For additional details about the Oil Level Alarm please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-systems.

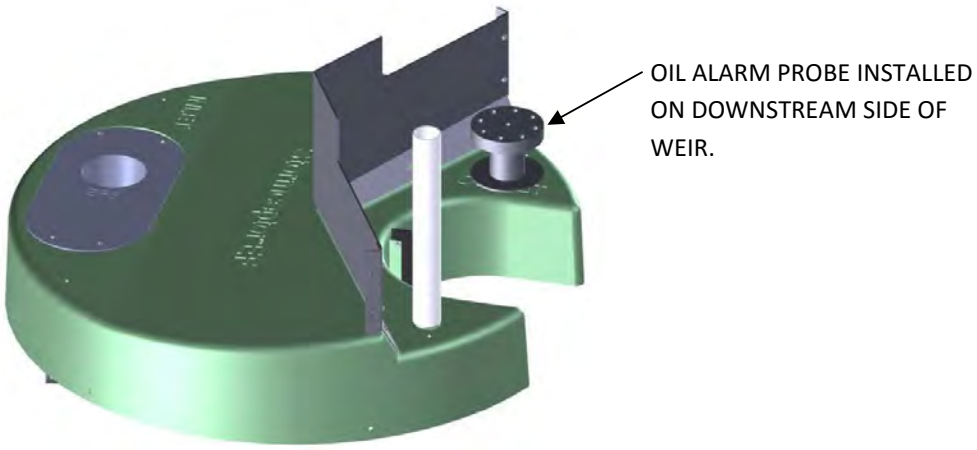


Figure 12

Replacement Parts

Stormceptor has no moving parts to wear out. Therefore inspection and maintenance activities are generally focused on pollutant removal. Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. However, if replacement parts are necessary, they may be purchased by contacting your local Stormceptor representative.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Recommended Sediment Maintenance Depth: _____

DATE	SEDIMENT DEPTH (inch or mm)	OIL DEPTH (inch or mm)	SERVICE REQUIRED (Yes / No)	MAINTENANCE PERFORMED	MAINTENANCE PROVIDER	COMMENTS

Other Comments:

Contact Information

Questions regarding Stormceptor EF/EFO can be addressed by contacting your local Stormceptor representative or by visiting our website at **www.stormceptor.com.**

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827

www.imbriumsystems.com
www.stormceptor.com
info@imbriumsystems.com

Appendix B

Sanitary Demand Calculations

Station West
101 Masonry Court
MTE Project #: 48247-100
Date: October 2021
By: EXK

Sanitary Demand Calculations

Location	Residential					Commercial		Total Residential and Commercial		
	Site Area (ha)	Units [6]	Population Density	Population (persons)	Demand [2] (L/s)	Floor Area (ha)	Demand [3] (L/s)	Total Demand (L/s)	Total Peaked Demand [4] (L/s)	Total Peaked Demand +Infiltration [5] (L/s)
As Desgined per Phase 1 FSR										
Entire Site	0.95		285	271	0.862			0.862	3.53	
Total Designed per Phase 1 FSR										3.80
Residential Towers (Phase 1- Building B)										
1 Bedroom [1]		22	2	44	0.140				0.524	
1 Bedroom + Den [7]		154	3	462	1.470				5.507	
2 Bedroom [1]		66	4	264	0.840				3.147	
2 Bedroom + Den [7]		0	5	0	0.000				0.000	
3 Bedroom [1]		0	6	0	0.000				0.000	
Sub Total		242		770	2.451			2.451	**9.381**	
Residential Towers (Phase 1- Building BC)										
1 Bedroom [1]		5	2	10	0.032				0.119	
1 Bedroom + Den [7]		27	3	81	0.258				0.965	
2 Bedroom [1]		2	4	8	0.025				0.095	
2 Bedroom + Den [7]		6	5	30	0.095				0.358	
3 Bedroom [1]		1	6	6	0.019				0.072	
Sub Total		41		135	0.430			0.430	**1.645**	
									Phase 1 Total	**11.102**
Residential Towers (Phase 2- Building BC)										
1 Bedroom [1]		4	2	8	0.025				0.095	
1 Bedroom + Den [7]		21	3	63	0.201				0.751	
2 Bedroom [1]		1	4	4	0.013				0.048	
2 Bedroom + Den [7]		4	5	20	0.064				0.238	
3 Bedroom [1]		0	6	0	0.000				0.000	
Sub Total		30		95	0.302			0.302	**1.142**	
Residential Towers (Phase 2- Building C)										
1 Bedroom [1]		192	2	384	1.222				4.577	
1 Bedroom + Den [7]		64	3	192	0.611				2.289	
2 Bedroom [1]		128	4	512	1.630				6.103	
2 Bedroom + Den [7]		0	5	0	0.000				0.000	
3 Bedroom [1]		0	6	0	0.000				0.000	
Sub Total		384		1088	3.463			3.463	**13.076**	
Commercial Area (Phase 2 - Building B)						0.0231	0.00662	0.0070	**0.0264**	
									48247	**14.336**
Residential Towers (Phase 3- Building A)										
1 Bedroom [1]		201	2	402	1.280				4.792	
1 Bedroom + Den [7]		158	3	474	1.509				5.650	
2 Bedroom [1]		80	4	320	1.019				3.814	
2 Bedroom + Den [7]		3	5	15	0.048				0.179	
3 Bedroom [1]		0	6	0	0.000				0.000	
Sub Total		442		1211	3.854			3.854	**14.434**	
									Phase 3 Total	**14.543**
Total (Residential + Commercial) - All Phases				**3299**	**10.500**	**0.023**	**0.0066**	**10.507**	**39.704**	**39.982**

Sanitary Demand		
Residential Daily Demands [2]	275	L/ca/day
	0.0032	L/ca/sec
Commercial Space Daily Demands [3]	24.75	m^3/d/ha
	0.29	L/s/ha
Harmon PF [4] (Ex. Design)	4.10	
Harmon PF [4] (Proposed- Phase 1)	3.83	
Harmon PF [4] (Proposed- Phase 2)	3.78	
Harmon PF [4] (Proposed- Phase 3)	3.74	
Site Area- Phase 1	0.27	ha
Site Area- Phase 2	0.32	ha
Site Area- Phase 3	0.38	ha
Infiltration Allowance [5]	0.286	L/s/ha
Phase 1	0.077	L/s
Phase 2	0.092	L/s
Phase 3	0.109	L/s

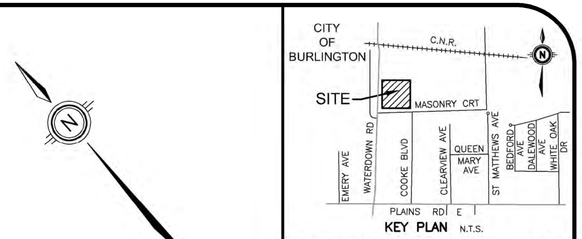
Note 1: Population Density based on OBC Section 3.1.17.1, Clause 1(b). 2 Persons per bedroom
Note 2: Residential Demand based on Halton Region Design Standards
Note 3: Commercial Space Demand based on Halton Region Design Standards
Note 4:Harmon Peaking Factor = 1 + (14/(4+(P/1000)½)), 5.0 max (modified 0.8PF for commercial)
Note 5: Infiltration allowance from Halton Region Design Standards.
Note 6: Unit Count taken from Site plan by Core Architecture received October 7, 2021
Note 7: Population Densities for 1 Bedroom + Den was estimated to be 3 persons per unit due to possibility of den being used at small bedroom

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MTE FILE PATH:

POPULATION DENSITIES
(PER HALTON REGION: TABLE 2-1, WATER & WASTEWATER LINEAR DESIGN MANUAL, MAY 2014)

TYPE OF DEVELOPMENT	EQUIVALENT POP. DENSITY (ppha)
SINGLE FAMILY	55
SEMI-DETACHED, DUPLEX AND 4-PLEX	100
TOWNHOUSE, MAISONETTE (6 STOREY OR LESS)	135
APARTMENT (OVER 6 STORIES HIGH)	285
LIGHT COMMERCIAL AREAS	90
COMMUNITY SERVICES	40
LIGHT INDUSTRIAL AREAS	125
HOSPITALS	4 PERSONS/BED





KEY PLAN N.T.S.

GEODETIC BM ELEV. = 100.718m
ELEVATIONS ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK NO. 0011922u2445.

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

LEGEND

- EX. SANITARY SEWER/MANHOLE
- MH.12345 — REGION OF HALTON WASTEWATER MANHOLE No.
- CATCHMENT AREAS
- 11 / 0.56 / 90 — SUB-CATCHMENT NUMBER; AREA (ha.); POPULATION PER HECTARE (ppha)
- 2 / 0.97 / OBC — SUB-CATCHMENT NUMBER; AREA (ha.); POPULATION CALCULATED PER OBC (SEE APPENDIX B FOR CALCULATIONS)

No.	REVISION	BY	YYYY-MM-DD
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR SPA	GPB	2021-04-26

MTE
Engineers, Scientists, Surveyors
905-639-2552

NOT FOR CONSTRUCTION

CLIENT
ADI DEVELOPMENT (MASONRY INC)
1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT
101 MASONRY COURT
FOUR MULTI-STOREY BUILDING
101 MASONRY COURT BURLINGTON, ON

DRAWING
EXISTING CONDITIONS CATCHMENT - AREA SERVICING PLAN

Project Manager: G. BERENYI	Project No.: 48247-100
Design By: EXK	Checked By: GPB
Drawn By: LXQ/DXC	Checked By: GPB
Surveyed By: OTHERS	Drawing No.: SA-EX
Date: Apr.19/21	
Scale: 1:1000	Sheet 1 of 4

May 27, 2021 - 3:43:46 PM - Plotted By: Dejana Curcic

Station West- Phase 2 - Existing conditions
CITY OF BURLINGTON

Project No. 48247-100
Date: June 9, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

DESIGN PARAMETERS

Design Flow
Design flow factor 275 L/c/d
Infiltration Factor: 0.286 L/s/ha
Mannings n: 0.015 dia < 600mm
0.013 dia ≥ 600mm
Min Velocity: 0.6 m/s
Max Velocoty: 3 m/s

Peaking Factor
Harmon Formula

$$M = K_{wf} \times \left(1 + \frac{14}{4 + \sqrt{P + P_r}}\right)$$

$$K_{wf} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.40					453	0.7	4.00	1.44	5.8	6.4	250	PVC	0.69%	43.48	0.8755	0.6270	15%	
2	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY)	EX. MH3A	0.00	0.00		285.00		0	0	0.00	4.50	0.00	0.0	0.0	200	PVC	1.00%	28.87	0.9083	0.0000	0%	
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	3.12					758	0.9	3.87	2.41	9.3	10.2	300	PVC	1.04%	84.98	1.2074	0.8142	12%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. EX. MH1A		3.12					758	0.9	3.87	2.41	9.3	10.2	300	PVC	1.04%	84.98	1.2074	0.8142	12%	

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: June 9, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{res} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{res} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	0.71		125.00		89	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
	Masonry Ct.	EX. MH 1403	EX. MH1A		0.71				0	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
12	Cooke Blvd.	EX. MH1A	EX. MH 3A	1.15	1.86		125.00		144	233	0.5	4.12	0.74	3.1	3.6	300	PVC	0.50%	58.92	0.8372	0.4616	6%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		4.98		125.00		0	990.8	1.4	3.80	3.15	12.0	13.4	300	PVC	4.20%	170.78	2.4264	1.4427	8%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.42	6.40		125.00		178	1168.8	1.8	3.76	3.72	14.0	15.8	300	PVC	0.38%	51.37	0.7298	0.6422	31%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	7.52		125.00		140	1308.8	2.2	3.72	4.17	15.5	17.7	300	PVC	0.39%	52.04	0.7394	0.6682	34%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		7.52				0	1308.8	2.2	3.72	4.17	15.5	17.7	300	PVC	0.40%	52.70	0.7488	0.6744	33%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.72	1.72		51.00		88	88	0.5	4.26	0.28	1.2	1.7	200	PVC	1.70%	37.64	1.1843	0.5956	4%	
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	197	1.1	4.15	0.63	2.6	3.7	200	PVC	2.00%	40.82	1.2845	0.7948	9%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	244	1.3	4.12	0.78	3.2	4.5	200	PVC	0.50%	20.41	0.6423	0.5149	22%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	295	1.5	4.08	0.94	3.8	5.3	250	PVC	0.43%	34.32	0.6912	0.5005	15%	
15	Plains Road	EX. MH 13327	EX. MH 13319	0.91	6.00		125.00		114	409	1.7	4.02	1.30	5.2	6.9	250	PVC	0.43%	34.32	0.6912	0.5412	20%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	13.90		90.00		35	1752.8	4.0	3.63	5.58	20.2	24.2	250	PVC	0.46%	35.50	0.7149	0.7691	68%	
	Plains Road	EX. MH 13317	EX. MH 13314		13.90					1752.8	4.0	3.63	5.58	20.2	24.2	250	PVC	0.76%	45.63	0.9189	0.9324	53%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.68	14.58		90.00		62	1814.8	4.2	3.62	5.78	20.9	25.1	250	PVC	0.47%	35.89	0.7226	0.7814	70%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		14.58					1814.8	4.2	3.62	5.78	20.9	25.1	675	PVC	0.70%	687.89	1.9545	0.9243	4%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		14.58					1814.8	4.2	3.62	5.78	20.9	25.1	675	PVC	0.260%	419.23	1.1912	0.6530	6%	

Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)

Station West- Phase 2 - Pumping at Previously Approved during Phase 1

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{ex} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{ex} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL							DESIGN													
																Proposed Sewer Design								
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.40					453	0.7	4.00	1.44	5.8	6.4	250	PVC	0.69%	43.48	0.8755	0.6270	15%	
2	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY)	EX. MH3A	0.95	0.95		285.00		271	271	0.27	4.10	0.86	3.5	3.8	200	PVC	1.00%	28.87	0.9083	0.6288	13%	
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. EX. MH1A		4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{ex} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{ex} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
																Proposed Sewer Design					Actual	%	
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Velocity m/s	Pipe Full	Remarks
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	0.71		125.00		89	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
	Masonry Ct.	EX. MH 1403	EX. MH1A		0.71				0	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
12	Cooke Blvd.	EX. MH1A	EX. MH 3A	1.15	1.86		125.00		144	233	0.5	4.12	0.74	3.1	3.6	300	PVC	0.50%	58.92	0.8372	0.4616	6%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.93		125.00		0	1261.6	1.7	3.73	4.02	15.0	16.7	300	PVC	4.20%	170.78	2.4264	1.5386	10%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.42	7.35		125.00		178	1439.6	2.1	3.69	4.58	16.9	19.0	300	PVC	0.38%	51.37	0.7298	0.6751	37%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.47		125.00		140	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.39%	52.04	0.7394	0.6982	40%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.47				0	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.40%	52.70	0.7488	0.7047	40%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.72	1.72		51.00		88	88	0.5	4.26	0.28	1.2	1.7	200	PVC	1.70%	37.64	1.1843	0.5956	4%	
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	197	1.1	4.15	0.63	2.6	3.7	200	PVC	2.00%	40.82	1.2845	0.7948	9%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	244	1.3	4.12	0.78	3.2	4.5	200	PVC	0.50%	20.41	0.6423	0.5149	22%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	295	1.5	4.08	0.94	3.8	5.3	250	PVC	0.43%	34.32	0.6912	0.5005	15%	
15	Plains Road	EX. MH 13327	EX. MH 13319	0.91	6.00		125.00		114	409	1.7	4.02	1.30	5.2	6.9	250	PVC	0.43%	34.32	0.6912	0.5412	20%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	14.85		90.00		35	2023.5	4.2	3.58	6.44	23.1	27.3	250	PVC	0.46%	35.50	0.7149	0.7884	77%	
	Plains Road	EX. MH 13317	EX. MH 13314		14.85					2023.5	4.2	3.58	6.44	23.1	27.3	250	PVC	0.76%	45.63	0.9189	0.9598	60%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.68	15.53		90.00		62	2085.5	4.4	3.57	6.64	23.7	28.1	250	PVC	0.47%	35.89	0.7226	0.7998	78%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.53					2085.5	4.4	3.57	6.64	23.7	28.1	675	PVC	0.70%	687.89	1.9545	0.9559	4%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.53					2085.5	4.4	3.57	6.64	23.7	28.1	675	PVC	0.260%	419.23	1.1912	0.6774	7%	
		Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)																					

Station West- Phase 2 - Existing conditions with Approved Developments

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275 L/c/d
Infiltration Factor:	0.286 L/s/ha
Mannings n:	0.015 dia < 600mm
	0.013 dia ≥ 600mm
Min Velocity:	0.6 m/s
Max Velocoty:	3 m/s

Peaking Factor

Harmon Formula

$$M = K_{ext} \times \left(1 + \frac{14}{4 + \sqrt{P + P_r}}\right)$$

$$K_{ext} = \frac{A_R + 0.80 \times (A_I + A_{IC})}{A_R + A_I + A_{IC}}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.40					453	0.7	4.00	1.44	5.8	6.4	250	PVC	0.69%	43.48	0.8755	0.6270	15%	
2	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY)	EX. MH3A	0.95	0.95		285.00		271	271	0.27	4.10	0.86	3.5	3.8	200	PVC	1.00%	28.87	0.9083	0.6288	13%	Approved as per Phase 1 of the development
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. EX. MH1A		4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{av} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{av} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

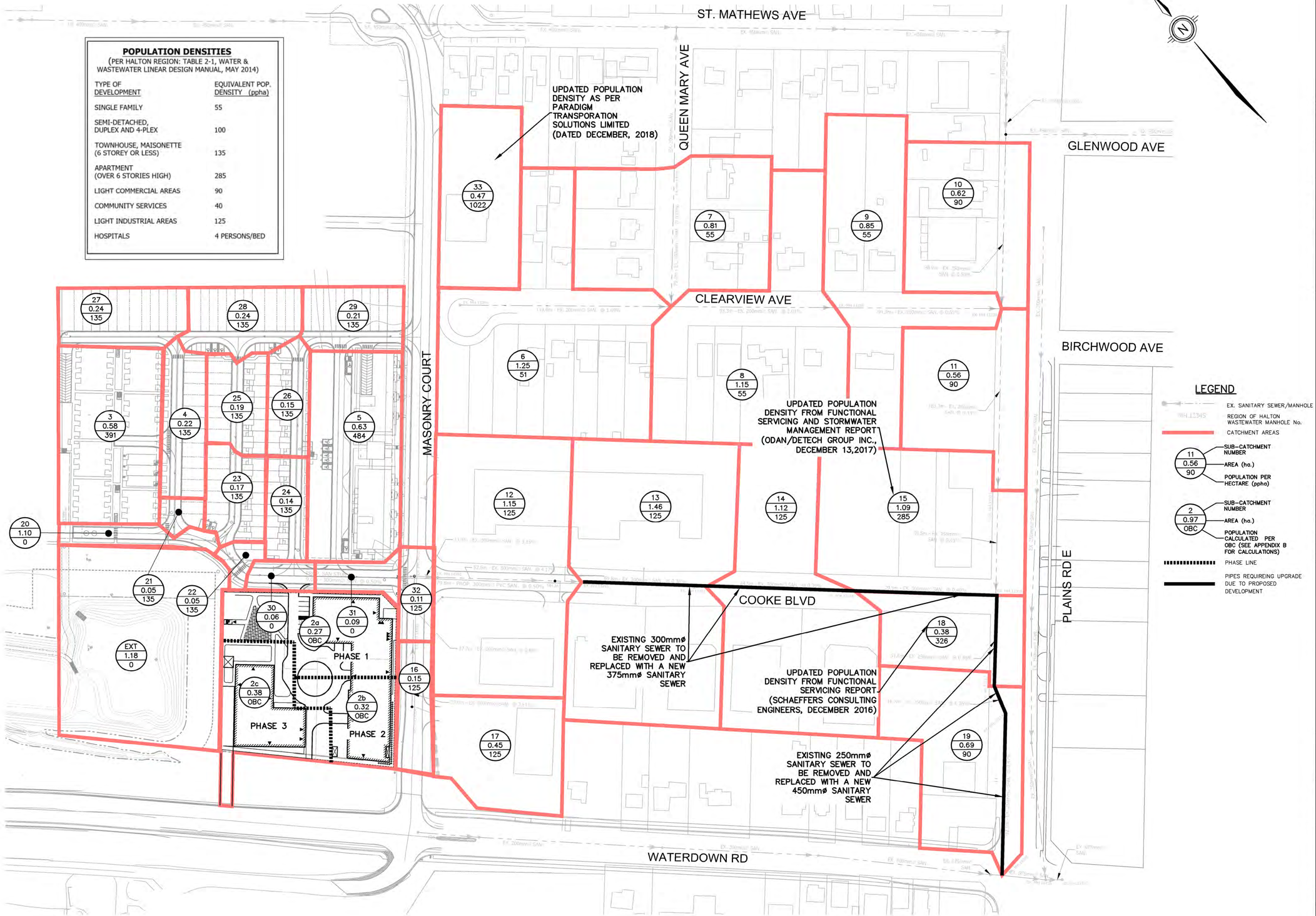
Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	0.71		125.00		89	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
	Masonry Ct.	EX. MH 1403	EX. MH1A		0.71				0	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
12	Cooke Blvd.	EX. MH1A	EX. MH 3A	1.15	1.86		125.00		144	233	0.5	4.12	0.74	3.1	3.6	300	PVC	0.50%	58.92	0.8372	0.4616	6%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.93		125.00		0	1261.6	1.7	3.73	4.02	15.0	16.7	300	PVC	4.20%	170.78	2.4264	1.5386	10%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.42	7.35		125.00		178	1439.6	2.1	3.69	4.58	16.9	19.0	300	PVC	0.38%	51.37	0.7298	0.6751	37%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.47		125.00		140	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.39%	52.04	0.7394	0.6982	40%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.47				0	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.40%	52.70	0.7488	0.7047	40%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.25	1.25		51.00		64	64	0.4	4.29	0.20	0.9	1.2	200	PVC	1.70%	37.64	1.1843	0.5433	3%	
33	Clearview Ave.	EX. MH. 13299	EX. MH 13316	0.47	0.47		1022		481	481	0.1	3.98	1.53	6.1	6.2	200	PVC	1.70%	37.64	1.1843	0.8762	17%	160 units proposed. Assumed 3 persons per unit.
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	654	1.1	3.91	2.08	8.1	9.2	200	PVC	2.00%	40.82	1.2845	1.0368	23%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	701	1.3	3.89	2.23	8.7	10.0	200	PVC	0.50%	20.41	0.6423	0.6386	49%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	752	1.5	3.88	2.39	9.3	10.7	250	PVC	0.43%	34.32	0.6912	0.6108	31%	
15	Plains Road	EX. MH 13327	EX. MH 13319	1.09	6.18		285.00		311	1063	1.8	3.78	3.38	12.8	14.6	250	PVC	0.43%	34.32	0.6912	0.6627	42%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	15.03		326.00		124	2766.6	4.3	3.47	8.81	30.6	34.9	250	PVC	0.46%	35.50	0.7149	0.8148	98%	
	Plains Road	EX. MH 13317	EX. MH 13314		15.03					2766.6	4.3	3.47	8.81	30.6	34.9	250	PVC	0.76%	45.63	0.9189	1.0120	76%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.68	15.71		90.00		62	2828.6	4.5	3.46	9.00	31.2	35.7	250	PVC	0.47%	35.89	0.7226	0.8236	99%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.71					2828.6	4.5	3.46	9.00	31.2	35.7	675	PVC	0.70%	687.89	1.9545	1.0280	5%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.71					2828.6	4.5	3.46	9.00	31.2	35.7	675	PVC	0.260%	419.23	1.1912	0.7260	9%	
		Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)											Updated per current development projects underway as found on City of Burlington website and by BA Group's research for traffic impacts in the area.										

MTE FILE PATH: P:\P\48247\100\48247-100-SA1

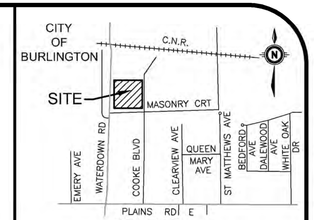
POPULATION DENSITIES
(PER HALTON REGION: TABLE 2-1, WATER & WASTEWATER LINEAR DESIGN MANUAL, MAY 2014)

TYPE OF DEVELOPMENT	EQUIVALENT POP. DENSITY (ppha)
SINGLE FAMILY	55
SEMI-DETACHED, DUPLEX AND 4-PLEX	100
TOWNHOUSE, MAISONETTE (6 STOREY OR LESS)	135
APARTMENT (OVER 6 STORIES HIGH)	285
LIGHT COMMERCIAL AREAS	90
COMMUNITY SERVICES	40
LIGHT INDUSTRIAL AREAS	125
HOSPITALS	4 PERSONS/BED



LEGEND

- EX. SANITARY SEWER/MANHOLE
- REGION OF HALTON WASTEWATER MANHOLE No.
- CATCHMENT AREAS
- SUB-CATCHMENT NUMBER / AREA (ha.) / POPULATION PER HECTARE (ppha)
- SUB-CATCHMENT NUMBER / AREA (ha.) / POPULATION CALCULATED PER OBC (SEE APPENDIX B FOR CALCULATIONS)
- PHASE LINE
- PIPES REQUIREING UPGRADE DUE TO PROPOSED DEVELOPMENT



KEY PLAN N.T.S.

GEODETIC BM ELEV. = 100.718m
ELEVATIONS ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK NO. 0011922u2445.

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	YYYY-MM-DD
1.	ISSUED FOR ZBA	GPB	2021-07-21
2.			
3.			
4.			
5.			
6.			
7.			
8.			

MTE
Engineers, Scientists, Surveyors
905-639-2552

NOT FOR CONSTRUCTION

CLIENT
ADI DEVELOPMENT (MASONRY INC)
1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT
101 COOKE BLVD
THREE MULTI-STOREY BUILDING
101 MASONRY COURT BURLINGTON, ON

DRAWING
EXTERNAL SANITARY SEWER CATCHMENT - AREA SERVICING PLAN

Project Manager G. BERENYI	Project No. 48247-100
Design By EXK	Checked By GPB
Drawn By LXQ/DXC	Checked By GPB
Surveyed By OTHERS	Drawing No. SA1
Date Apr.19/21	
Scale 1:1000	Sheet 2 of 4

July 21, 2021 - 5:11:29 PM - Plotted By: Alla X. Gulkin

Station West- Phase 2 - Proposed Phase 2 Demands- No pipe upgrades

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{pf} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{pf} = \frac{A_p + 0.80 \times (A_i + A_c)}{A_p + A_i + A_c}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN													
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
2C	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 3	EX. MH 4A	0.38	0.38				1242	1242	0.1	3.74	3.95	14.8	14.9	200	PVC	2.00%	40.82	1.2845	1.1832	36%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.78					1695	0.8	3.64	5.39	19.6	20.4	250	PVC	0.69%	43.48	0.8755	0.8618	47%	
2A	Masonry Ct.	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 1	EX. MH 14204	0.27	0.27				921	921	0.08	3.82	2.93	11.2	11.3	200	PVC	2.00%	40.82	1.2845	1.0974	28%	
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. MH1A		3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
2B	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 2	EX. MH3A	0.32	0.32				1189	1199	0.1	3.75	3.82	14.3	14.4	200	PVC	2.00%	40.82	1.2845	1.1726	35%	Population increased to account for commercial area. Refer to SAN calculations for detailed demand calculations.

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{ex} \times \left(1 + \frac{14}{4 + \sqrt{P + P_i}}\right)$$

$$K_{ex} = \frac{A_r + 0.80 \times (A_i + A_c)}{A_r + A_i + A_c}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN												
																Proposed Sewer Design							
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	1.03		125.00		89	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
	Masonry Ct.	EX. MH 1403	EX. MH 14202		1.03				0	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
12	Cooke Blvd.	EX. MH 14202	EX. MH 3A	1.15	2.18		125.00		144	1432	0.6	3.69	4.56	16.8	17.5	300	PVC	0.50%	58.92	0.8372	0.7292	30%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.95		125.00		0	4352.8	1.7	3.30	13.85	45.7	47.4	300	PVC	4.20%	170.78	2.4264	2.0755	28%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.46	7.41		125.00		183	4535.8	2.1	3.28	14.44	47.4	49.5	300	PVC	0.38%	51.37	0.7298	0.8312	96%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.53		125.00		140	4675.8	2.4	3.27	14.88	48.7	51.1	300	PVC	0.39%	52.04	0.7394	0.8427	98%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.53				0	4675.8	2.4	3.27	14.88	48.7	51.1	300	PVC	0.40%	52.70	0.7488	0.8531	97%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.25	1.25		51.00		64	64	0.4	4.29	0.20	0.9	1.2	200	PVC	1.70%	37.64	1.1843	0.5433	3%	
33	Clearview Ave.	EX. MH. 13299	EX. MH 13316	0.47	0.47		1022		481	481	0.1	3.98	1.53	6.1	6.2	200	PVC	1.70%	37.64	1.1843	0.8762	17%	160 units proposed. Assumed 3 persons per unit.
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	654	1.1	3.91	2.08	8.1	9.2	200	PVC	2.00%	40.82	1.2845	1.0368	23%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	701	1.3	3.89	2.23	8.7	10.0	200	PVC	0.50%	20.41	0.6423	0.6386	49%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	752	1.5	3.88	2.39	9.3	10.7	250	PVC	0.43%	34.32	0.6912	0.6108	31%	
15	Plains Road	EX. MH 13327	EX. MH 13319	1.09	6.18		285.00		311	1063	1.8	3.78	3.38	12.8	14.6	250	PVC	0.43%	34.32	0.6912	0.6627	42%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	15.09		326.00		124	5862.8	4.3	3.18	18.66	59.3	63.7	250	PVC	0.46%	35.50	0.7149	ERROR!	179%	
	Plains Road	EX. MH 13317	EX. MH 13314		15.09					5862.8	4.3	3.18	18.66	59.3	63.7	250	PVC	0.76%	45.63	0.9189	ERROR!	140%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.69	15.78		90.00		63	5925.8	4.5	3.18	18.86	59.9	64.4	250	PVC	0.47%	35.89	0.7226	ERROR!	179%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.70%	687.89	1.9545	1.2245	9%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.260%	419.23	1.1912	0.8619	15%	
		Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)											Updated per current development projects underway as found on City of Burlington website and by BA Group's research for traffic impacts in the area.										

Station West- Phase 2 - Proposed Phase 2 Demands- Upgrading d/s Pipes

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{pf} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{pf} = \frac{A_p + 0.80 \times (A_i + A_c)}{A_p + A_i + A_c}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN													
																Proposed Sewer Design								
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
2C	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 3	EX. MH 4A	0.38	0.38				1242	1242	0.1	3.74	3.95	14.8	14.9	200	PVC	2.00%	40.82	1.2845	1.1832	36%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.78					1695	0.8	3.64	5.39	19.6	20.4	250	PVC	0.69%	43.48	0.8755	0.8618	47%	
2A	Masonry Ct.	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 1	EX. MH 14204	0.27	0.27				921	921	0.08	3.82	2.93	11.2	11.3	200	PVC	2.00%	40.82	1.2845	1.0974	28%	Population increased to account for commercial area. Refer to SAN calculations for detailed demand calculations.
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. MH1A		3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
2B	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 2	EX. MH3A	0.32	0.32				1189	1199	0.1	3.75	3.82	14.3	14.4	200	PVC	2.00%	40.82	1.2845	1.1726	35%	Population increased to account for commercial area. Refer to SAN calculations for detailed demand calculations.

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{adj} \times \left(1 + \frac{14}{4 + \sqrt{P + P_i}}\right)$$

$$K_{adj} = \frac{A_r + 0.80 \times (A_i + A_c)}{A_r + A_i + A_c}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN												
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	1.03		125.00		89	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
	Masonry Ct.	EX. MH 1403	EX. MH 14202		1.03				0	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
12	Cooke Blvd.	EX. MH 14202	EX. MH 3A	1.15	2.18		125.00		144	1432	0.6	3.69	4.56	16.8	17.5	300	PVC	0.50%	58.92	0.8372	0.7292	30%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.95		125.00		0	4352.8	1.7	3.30	13.85	45.7	47.4	300	PVC	4.20%	170.78	2.4264	2.0755	28%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.46	7.41		125.00		183	4535.8	2.1	3.28	14.44	47.4	49.5	**375**	PVC	0.38%	88.06	0.8351	0.8594	56%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.53		125.00		140	4675.8	2.4	3.27	14.88	48.7	51.1	**375**	PVC	0.39%	89.21	0.8460	0.8746	57%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.53				0	4675.8	2.4	3.27	14.88	48.7	51.1	**375**	PVC	0.40%	90.35	0.8568	0.8831	57%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.25	1.25		51.00		64	64	0.4	4.29	0.20	0.9	1.2	200	PVC	1.70%	37.64	1.1843	0.5433	3%	
33	Clearview Ave.	EX. MH. 13299	EX. MH 13316	0.47	0.47		1022		481	481	0.1	3.98	1.53	6.1	6.2	200	PVC	1.70%	37.64	1.1843	0.8762	17%	160 units proposed. Assumed 3 persons per unit.
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	654	1.1	3.91	2.08	8.1	9.2	200	PVC	2.00%	40.82	1.2845	1.0368	23%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	701	1.3	3.89	2.23	8.7	10.0	200	PVC	0.50%	20.41	0.6423	0.6386	49%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	752	1.5	3.88	2.39	9.3	10.7	250	PVC	0.43%	34.32	0.6912	0.6108	31%	
15	Plains Road	EX. MH 13327	EX. MH 13319	1.09	6.18		285.00		311	1063	1.8	3.78	3.38	12.8	14.6	250	PVC	0.43%	34.32	0.6912	0.6627	42%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	15.09		326.00		124	5862.8	4.3	3.18	18.66	59.3	63.7	**450**	PVC	0.46%	165.48	1.0504	0.9815	38%	
	Plains Road	EX. MH 13317	EX. MH 13314		15.09					5862.8	4.3	3.18	18.66	59.3	63.7	**450**	PVC	0.76%	212.70	1.3501	1.1794	30%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.69	15.78		90.00		63	5925.8	4.5	3.18	18.86	59.9	64.4	**450**	PVC	0.47%	167.27	1.0617	0.9924	39%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.70%	687.89	1.9545	1.2245	9%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.260%	419.23	1.1912	0.8619	15%	

Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)

Proposed Pipes to be upgraded part of this development

Updated per current development projects underway as found on City of Burlington website and by BA Group's research for traffic impacts in the area.

1120 Cooke Blvd Three New Multi-Storey Buildings Phase 2

Preliminary

Sanitary System Hydrologic and Hydraulic Modelling Technical Memorandum

Project Location:

1120 Cooke Blvd, Burlington, ON

Prepared for:

ADI Developments (Masonry) Inc.
1100 Burloak Drive Suite 700, Burlington, ON

Prepared by:

MTE Consultants
1016 Sutton Drive, Unit A
Burlington, ON L7L 6B8

November 23, 2021

MTE File No.: 48247-100

Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) were retained by ADI Developments (Masonry) Inc. to complete the site grading, servicing, and stormwater management design for the proposed mixed-used development located at 1120 Cooke Boulevard in the City of Burlington (see Figure 1 for Location Plan). This memo will outline the external sanitary system analysis that was done to assess the impacts of the proposed development on the existing sanitary system infrastructure. Please refer to the functional servicing and stormwater management report for further information on the proposed development.

The site is located on a 0.97ha parcel of land bounded by a stormwater management pond to the north, Cooke Boulevard and residential properties to the east, Masonry Court and industrial properties to the south, and Waterdown Road to the west. This development is Phase 2 of the Station West development. Phase 1 is located east of the Phase 2 development, and is comprised of townhouses and a 6- storey residential building.

The property is currently an excavated dirt pit with an existing sales office and parking lot in the southwestern corner of the site. The proponent plans to construct 3 residential buildings in 3 Phases. Each Phase will include the following:

- Phase 1: Building B, 26-storeys;
- Phase 2: Building C, 36-storeys; and
- Phase 3: Building A, 36-storeys.

Commercial space will be provided within the main level of Building B in the southeastern corner of the site. Parking will be provided on site for the proposed buildings via five levels of underground (below grade) parking, and a few parking spaces will be available at grade for the commercial space along the eastern site entrance.

Existing municipal storm and sanitary sewers and watermain services are located on the abutting right-of-way's (ROW) which will be utilized to service the proposed development

1.2 Modelling Purpose

Design sheets were developed by MTE for the study area using the Harmon Equation to assess the existing infrastructure, the impacts of the proposed development on sanitary flows, and recommend required sanitary sewer upgrades as a result of the proposed development. .

The Region of Halton requested that the impacts of the proponent's development on the sanitary sewer system be modelled dynamically to confirm the required infrastructure upgrades. The main objectives of the dynamic modelling exercise include:

1) Development of a dynamic hydraulic model to verify the capacity bottlenecks and impact of proposed sanitary flows on the existing sanitary sewer system from the proponent's development, including all completed and proposed phases along Masonry Court and the Cooke Boulevard extension; and

2) Verify the recommended sewer upgrades on Cooke Boulevard and Plains Road determined using the Harmon Equation are correct.

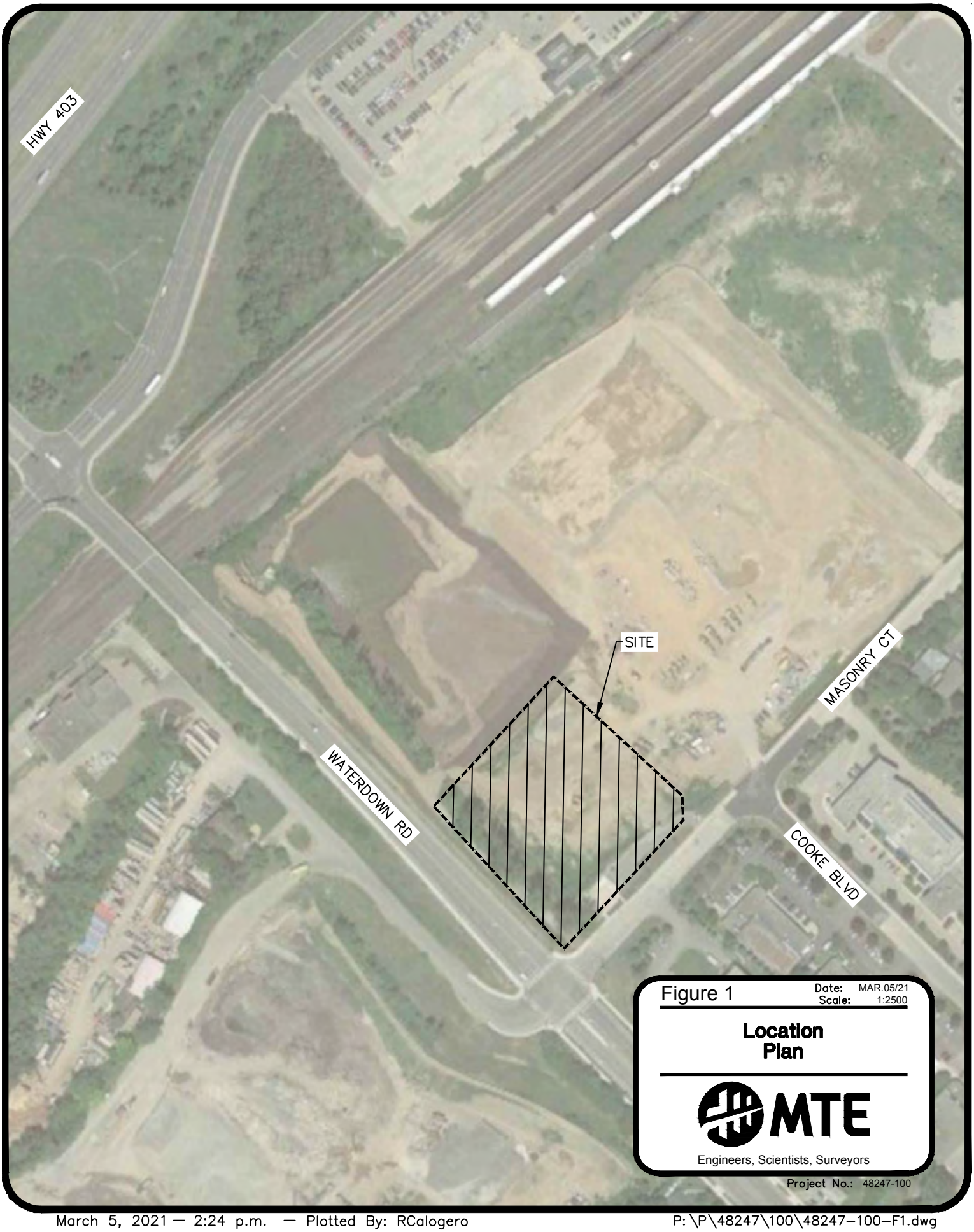


Figure 1

Date: MAR.05/21
Scale: 1:2500

Location Plan

MTE

Engineers, Scientists, Surveyors

Project No.: 48247-100

March 5, 2021 — 2:24 p.m. — Plotted By: RCalogero

P:\P\48247\100\48247-100-F1.dwg

2.0 Modelling Approach

This section summarizes our approach to the hydrologic and hydraulic (H&H) modelling of the sanitary sewer system within the Study Area.

2.1 Rational Method Calculations

MTE developed the design sheets for the Study Area under both existing and proposed Phase 2 development conditions for the existing sanitary sewer system, and the proposed upgrades in order to assed the proposed development conditions. These design sheets follow the previously approved external sanitary drainage plan as per Phase 1, and were updated to include the updated Phase 2 population densities and phasing (Functional Servicing and Stormwater Management Report, Urbantech West (October 2017).

2.2 Modelling Platform

There are two kinds of hydraulic models used for sanitary collection systems: static (steady state flow) and dynamic (both steady and unsteady flow conditions).

A static (steady state) model assumes a single flow rate for each element in the system that does not vary with time, and typically attempts to represent the peak flow that would be expected to occur during design conditions. Extended period simulations can be completed which string together snapshots of flow and level simulations to estimate the impacts of the downstream water levels over time; however, volume attenuation impacts are not considered, typically resulting in conservative estimates of flows and hydraulic grade lines. These models are best used for assessing the system capacity under design conditions where the effects of surcharge and storage elements are minimal.

Dynamic flow models compute time-varying flows and levels at each element in the system, solving complex hydraulic equations that account for attenuation of peak flows in the system network, and depending on the complexity of the computation engine, may also account for storage capacity/overflow volumes. These dynamic systems better represent the hydrologic response and hydraulic behaviour of the system under a variety of flow conditions. Detailed volumetric assessment is enabled, which allows assessment of surcharging, storage, pump cycling, and inflow/infiltration allowance (I/I) responses.

The Region of Halton's InfoSewer sanitary system model appears to be a quasi-dynamic model with static dry weather flow inputs and dynamic flow generated by wet weather flow inputs. For the purposes of assessing the impacts of the Phase 2 development on the sanitary sewer system under both dry weather and wet weather conditions, MTE used InfoWorks ICM for its dynamic modelling capabilities as well as the ability to build and run integrated hydrologic and hydraulic models in general for sanitary, combined and storm systems.

2.3 Model Network Build

2.3.1 Clipped Pipe Network

Through the assistance of the modelling software supplier Innovyze Inc., the InfoSewer model was imported into the InfoWorks modelling platform. Due to the restricted license limitations (maximum of 100 nodes) the network was clipped to the Study Area extent tracing the relevant part of the network upstream from MH19737as seen in Figure 2. The pipe attribute data is tabulated in Appendix A.

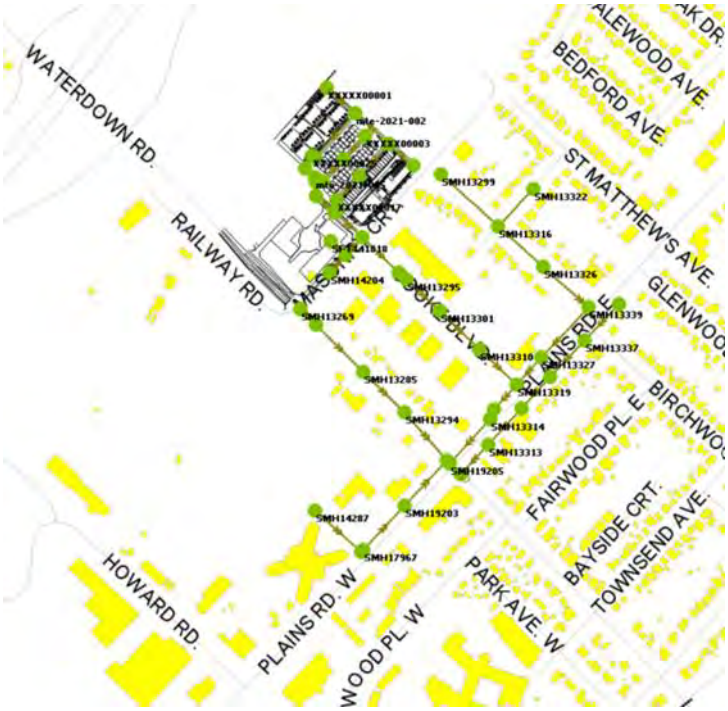


Figure 2 Clipped Model Representing Sanitary Sewers within the Study Area

2.3.2 Subcatchment Area Delineations

During the export and import process from InfoSewer to InfoWorks, no sewer subtachment data from the InfoSewer model nor any wet weather flow data that was imported in the InfoWorks model was included. This is due to the different model platforms and a two-step conversion process. As a result, once the sanitary sewer pipe model was imported into InfoWorks, subcachment areas were then delineated using AutoCAD subcatchment delineations developed by MTE. Each subcatchment area was defined using population density data from Region of Halton as well as projected population data for the Phase 2 development. Land-use data was updated to reflect the current development projects underway based off of the City of Burlington development application website, the proposed Phase 2 development, as well as existing areas within and adjacent to the Study Area.

Subcatchment areas were defined for (1) Existing conditions (Pre-Phase 2 development) and (2) Proposed Conditions (Post-Phase 2 development) for the existing sewer network as shown in Figures 3 and 4 respectively. The contributing areas and populations are tabulated in Appendix A.

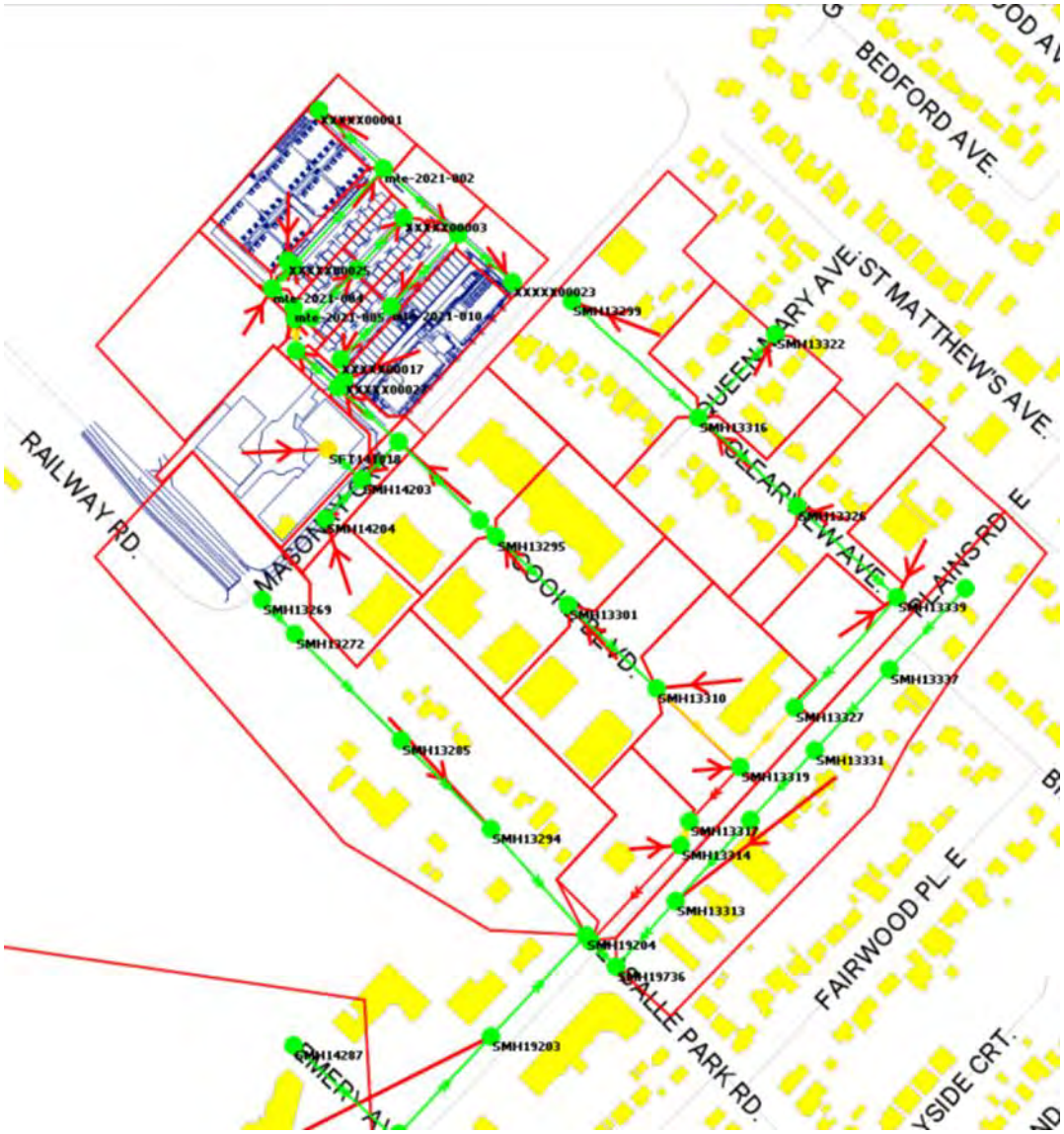


Figure 3: Modelled Subcatchment Areas – Existing Conditions Pre-Phase 2 Development

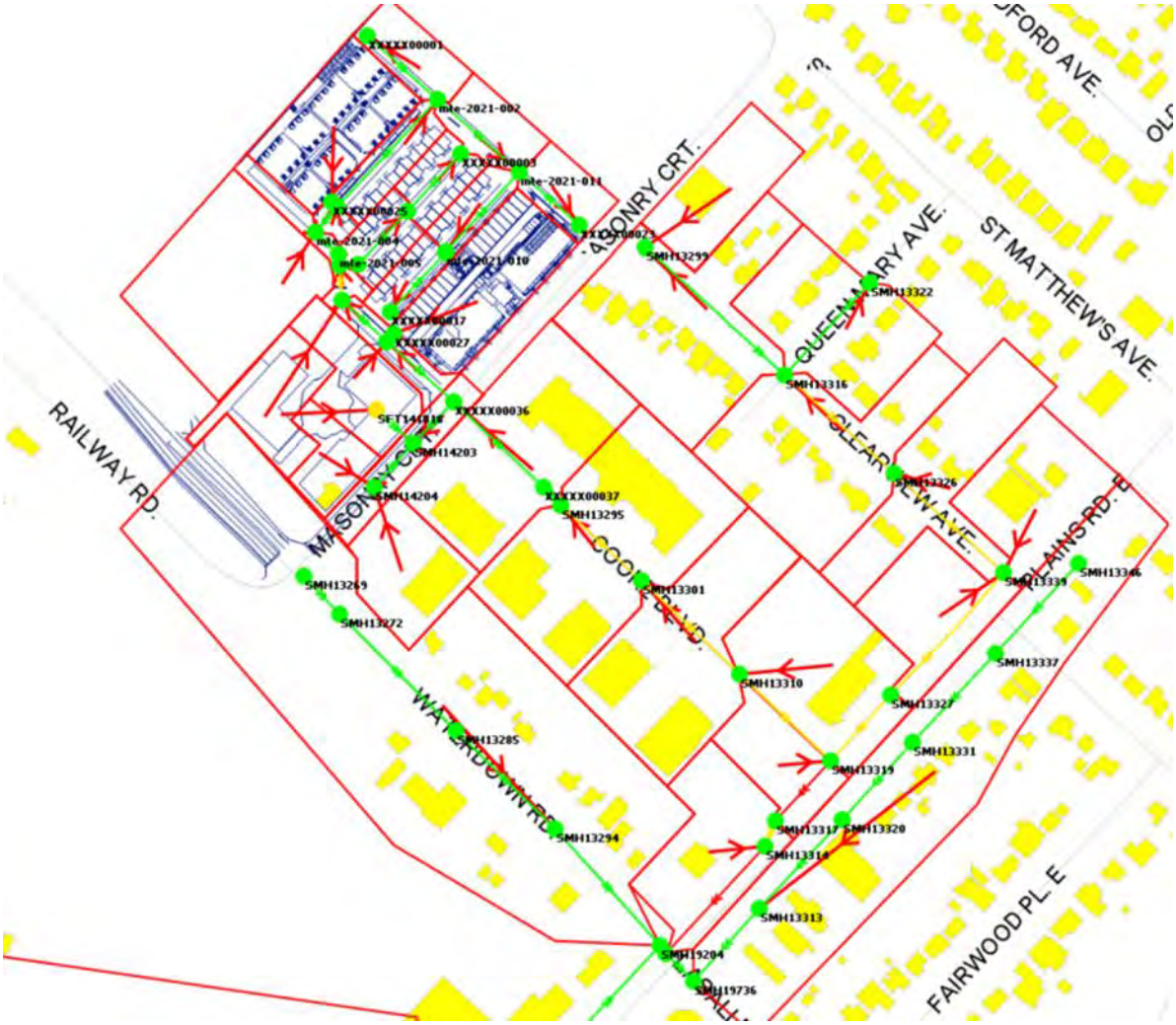


Figure 4: Modelled Subcatchments – Proposed Conditions Post-Phase 2 Development

Once the sanitary subcatchment boundaries for the existing conditions and proposed development scenarios were established, the sanitary subcatchment parameters were populated based off of information provided by the City (as per the City's development manual and development applications website) and the Developer for Phase 1 and 2, and other sources such as the City of Toronto Basement Flooding Study Modelling Guideline (July, 2020).

2.3.3 Land-Use and Population Data

InfoWorks ICM contains default values for population densities for different Land-Uses. The Land-Use type and associated population density was expanded to include the City's standards for development as well as hydrid land-use and population densities to include mixed-use, high density and commercial development associated with the Phase 1 and Phase 2 development sites and large areas representing the external subcatchments. Table1 summarizes the Land Use and associated population densities used in the model.

Table 1: Model Land-Use and Population Density

Type of Development	Equivalent Population Density (ppha)	Land Use ID in Infoworks
Single Family	55	1
Semi-Detached Duplex and 4-plex	100	3
Townhouse (6 storey high or less)	135	5
Apartment (over 6 storey's high)	285	13
Light commercial areas	90	7
Community services	40	14
Light industrial areas	125	9
Phase 1 Townhome [A]	391	15
Phase 1 Apartment [A]	484	16
Phase 1 Street Custom density [A]	51	17
Paradigm solutions development study [B]	1022	18
Functional Servicing Report by Schaffers Consulting Engineers (December 2016) [C]	326	20
Phase 2 - phase 3 of this proposed development [D]	3268	22
Phase 2 - phase 1 of this proposed development [D]	3411	23
Phase 2 - phase 2 of this proposed development [D]	3747	24

[A] Densities as per previously approved external sanitary drainage plan as per Phase 1 (Functional Servicing and Stormwater Management Report, Urbantech West (October 2017)).

[B] Information provided by Paradigm Solutions as part of the Traffic Study for the proposed Phase 2 Development.

[C] Information collected from the City of Burlington Development Applications website.

Refer to Functional Servicing and Stormwater Management Report Table 3.2 and Appendix A for population calculation. Unit Count taken from Site plan by Core Architecture received June 11, 2021.

Additionally, absolute populations were directly assigned to subcatchment areas with known population projections in the subcatchment properties that superseded the per-hectare population densities in the total domestic flow calculations.

2.3.4 Data Flagging

Infoworks ICM has the capabilities to flag data inputs to track data sources and edits made to a model. This tool was utilized to indicate various assumptions made (names the MTE data flag), as well as the multiple data sources where information was input from. A table breakdown of the various data flags used in this model is included in the Appendix.

2.3.5 Domestic Dry-Weather Flow

A Diurnal Flow pattern based on Dry Weather Flow monitoring data from municipalities with a similar population (Niagara Region) were used to represent the typical dynamic domestic flow over a 24-hour period in the absence of flow monitoring data per Figure 5. The 24-hour domestic flow derived from the Niagara Region data represents a population of approximately 3,000 persons with approximately 75% residential and 25% commercial properties. The monitored flow also includes the groundwater infiltration (GWI) component of the base flow. From the diurnal flow pattern in Figure 5, a dry weather per capita flow generation rate and pattern was developed and input into the model. The lowest point of the diurnal curve at approximately 6 L/s was assumed to be a constant baseflow from groundwater infiltration. The population and land-use data made available by the City and developer (Table 1) was used with the per capita dry-weather generation rates to determine the dry-weather flow.

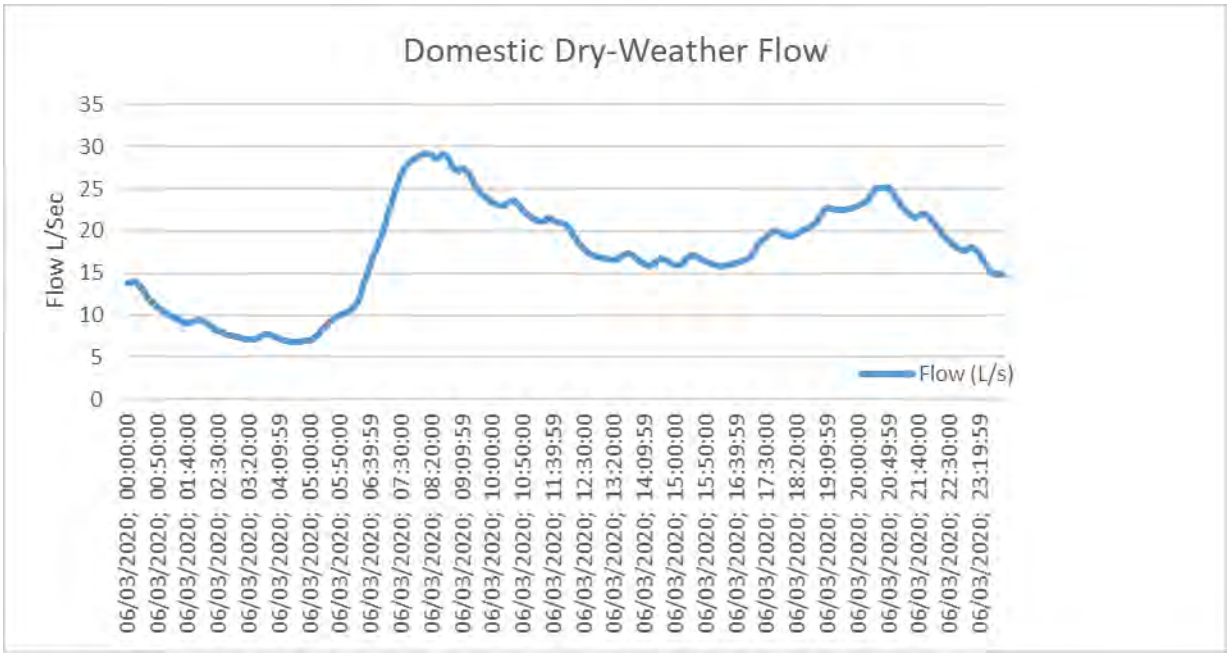


Figure 5: Representative Diurnal Flow (Base flow)

The domestic flow pattern was resolved to a unit hydrograph with average flow representing a factor of 1 for the purposed of the InfoWorks model input; a screenshot of the domestic flow representation in the model is shown in Appendix A.

2.3.6 Boundary Conditions

Boundary conditions were defined at the downstream end where the local sewers servicing the Study Area outlet to the trunk sewer on LaSalle Park Road. A free outfall was assumed at MH19737 on LaSalle Park Road. External flows from adjacent areas to the Study Area were estimated by creating aggregated subcatchment areas representative of the population clusters upstream along Plains Road (see Figure 6) and estimating the total contributing population based on the Region's population and land-use data per Table 1.

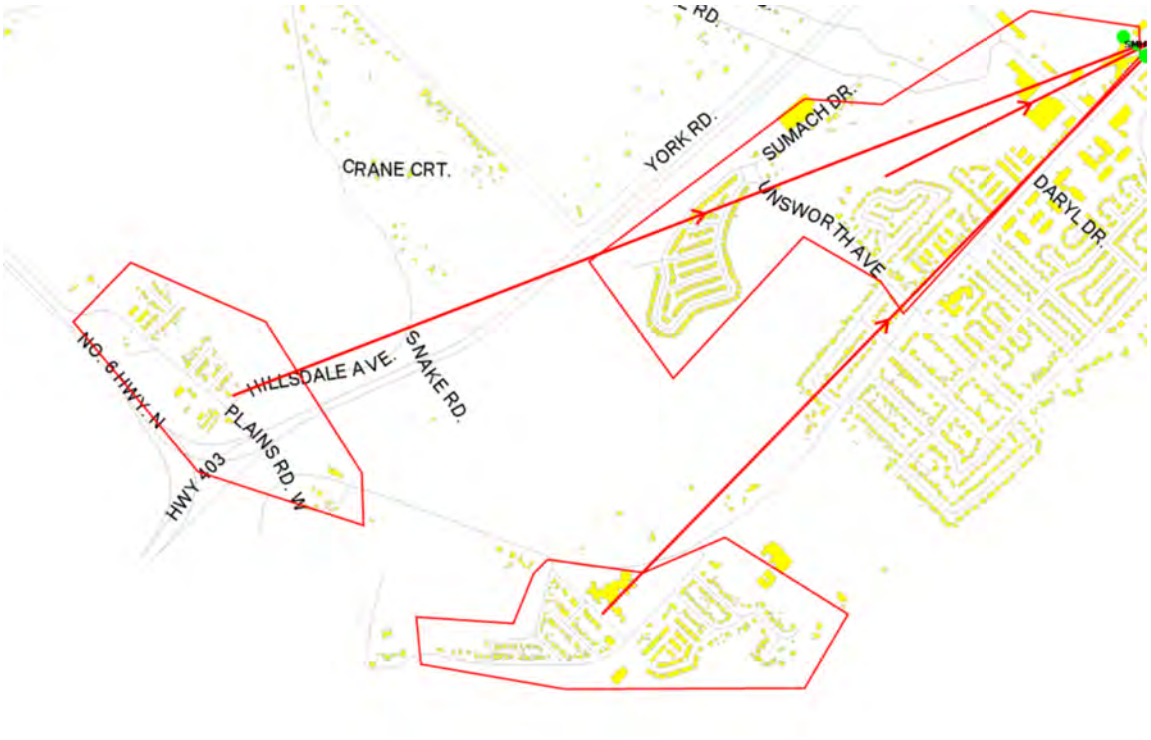


Figure 6: External Sanitary Flow Subcatchment Areas

2.3.7 Wet Weather Flow

The Region of Halton's engineering design standards state that the sanitary sewer system must accommodate Rainfall Derived Inflow and Infiltration (RDII) generated from the 10-year 4-hour design storm assuming the allowable I/I rate into the sanitary sewer of 0.283 L/s/ha. Sources of RDII into the sanitary sewer include inflow from connected downspouts and maintenance hole covers, infiltration from connected foundation drains, pipe and maintenance hole joints, and other potential inflow opportunities.

The 10-year design IDF for the Region of Halton area summarized is in Table 2. The 10-Year design storm hyetograph seen in Figure 7 was calculated over a 4-hour period with a storm peak adjusted to 10:00 AM, which represents the time just after the peak domestic flow rate shown in Figure 6

Table 2: 10-Year Design Storm IDF Parameters

Event	A	B	C
10 year	918.28	5	0.763

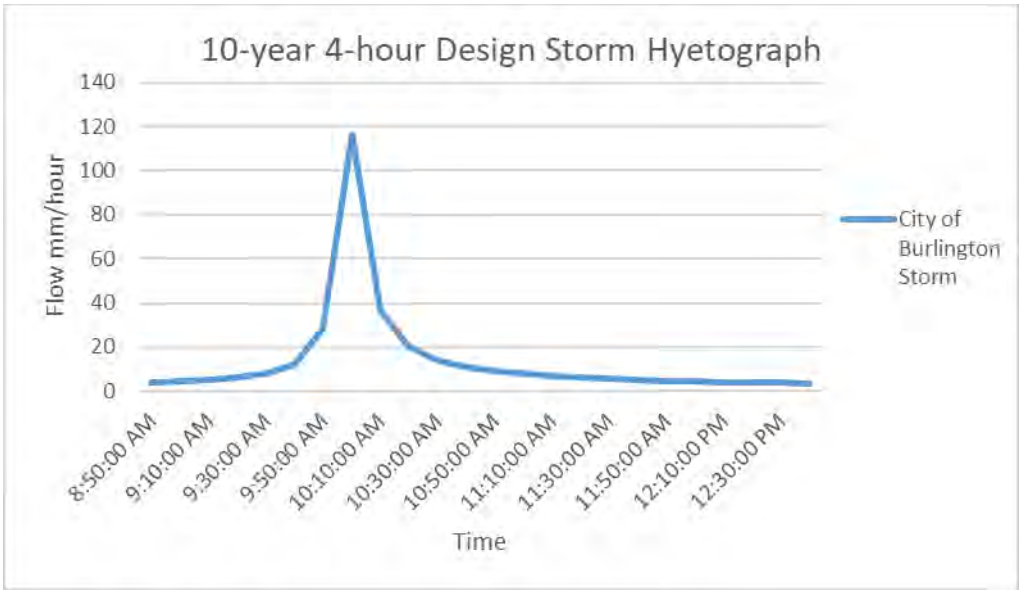


Figure 7: 10-Year 4-Hour Design Event

RDII Definition

As mentioned above, there are various sources of RDII within the sewer system that can be determined through flow monitoring. Direct inflows into the sewer generates a quick response in the system where the peak flow is reached rapidly with a rapid recession. Indirect flows (infiltration) are more gradual and generate a slower response where the volume of flow peaks and recedes gradually over a longer period of time relative to the direct inflows. The peak flows associated with infiltration are lower than for a rapid inflow. An example of the direct versus indirect inflows (quick and slow response) from a sewer system monitoring study is shown in Figure 8.

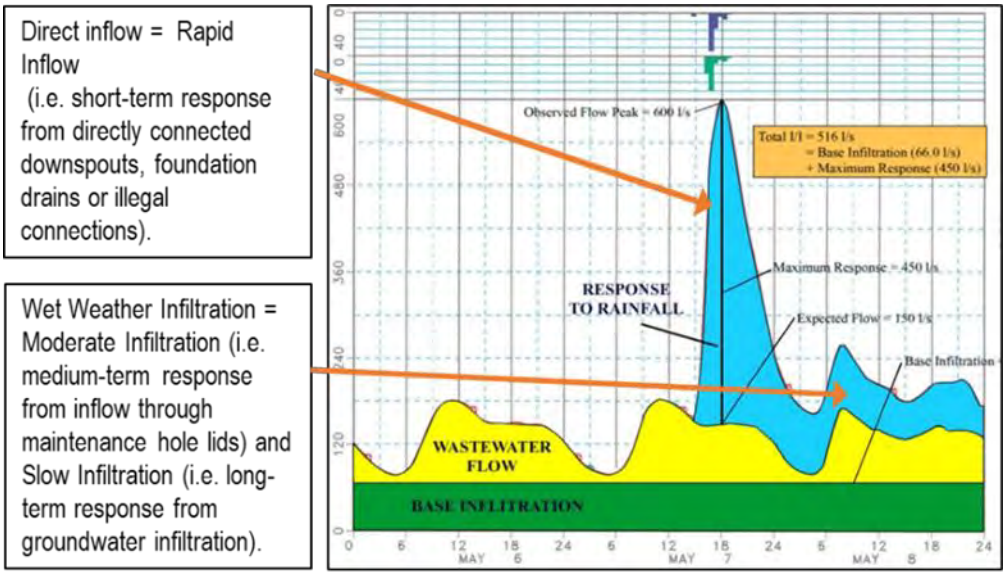


Figure 8: Sample Sanitary System Wet Weather Response (TQI, City of Winnipeg)

Modelling RDII

In H&H modelling of the sanitary sewer system, RDII was modelled using R, T and K parameters.

InfoWorks ICM uses the RTK method to generate a hydrograph used to determine RDII from a subcatchment. Each set of RTK parameters defines a triangular graph against time, where:

- R is the area under the graph representing the proportion of rainfall falling on the subcatchment area (InfoWorks networks) or node (SWMM networks) that enters the sewer system;
- T is the time from the onset of rainfall to the peak of the triangle; and,
- K is the ratio of 'time to recession' to the ' time to peak' of the hydrograph.

The components for RTK hydrograph are graphically displayed in Figure 9.

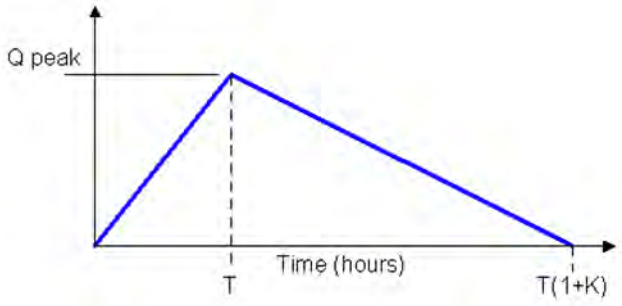


Figure 9: R-T-K Hydrograph Components

Three sets of RTK parameters can be defined, representing short-term, medium-term and long-term rainfall response. The three triangular graphs are combined to define the Unit Hydrograph per Figure 10.

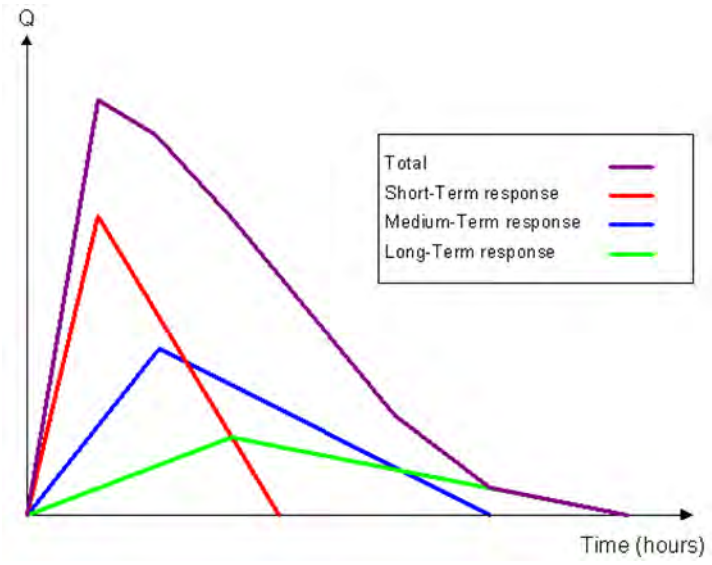


Figure 10: RTK Unit Hydrograph

As flow monitoring data for wet weather was not available at the time of the assessment, the WWF response was estimated based on a design RDII rate of 0.283 L/s/ha over a 4-hour period under the 10-Year design storm to develop the R, T and K parameters. The development of the RTK unit hydrograph is discussed in Section 3. It was assumed that the peak rainfall intensity from the 10-year design storm generated a short to medium-term response corresponding with a time just after the morning peak diurnal flow.

2.4 Modelling Assumptions

The reliability of the H&H model depends on the available data quality. In absence of data, assumptions based on engineering judgement need to be made in an effort to minimize errors as best as possible. Key assumptions in the model development for the Study Area include the following:

- Niagara Region domestic flow pattern is representative of flow from the site and the adjacent areas;
- RDII of 0.283 L/s/ha based on Region of Halton engineering standards is assumed for the 10-year 4-hour design storm and not subject to increases time;
- Existing and projected population densities are based on Region of Halton's and developer data;
- Boundary conditions include a free outfall at LaSalle Park trunk sewer and flows from the adjacent areas upstream of MH19737 along Plains Road.

3.0 Calibration/Validation

3.1 Overview

Model calibration of a dynamic H&H model involves a comparative analysis of the simulated response in the modelling system – in this case the sanitary sewer – to observed flow data from a set of flow monitors for DWF and WWF. The simulated response is "tweaked" by identifying parameters in the model that can be perturbed to bring the model simulation to within a

reasonable tolerance of the observed data. The parameters used to perturb the model included the following:

- Population density for DWF; and,
- RDII parameters for WWF.

Generally, based on other modelling studies using InfoWorks and modelling guidelines, such as those used in the City of Toronto, a model is considered calibrated when simulated peak flows are within 15% of the observed flows and volumes. However, in the absence of flow monitoring data for this model, a comparative analysis was performed (a validation exercise) using the Harmon average flow under dry weather and peak/design flow under wet weather to determine if the simulated flow and state of surcharge was within reason. The results were also compared against qualitative data on areas identified as vulnerable to flooding / surcharging of the system and areas identified as deficient.

3.2 Interpreting the Results for Calibration and Modelling

Model simulation results from InfoWorks can be shown a variety of ways, including, ESRI-style graphics, hydraulic grade line (HGL) profiles, hydrograph analysis and tabulated results. Additionally, to interpret the results a frame of reference should be used that includes comparison to specific criteria, such as comparison to observed/calculated data, owner criteria, system state (surcharged) and modelling best practices such as a default level of service. The various types of results generation for this study area are summarized below:

Calibration results were summarized as follows:

- Within Calculated Range (+/- 10%) – Good
- Within Maximum limits of Calculated Range (+/-15%) – Moderate
- Outside Calculated Range – Poor

The state of pipe surcharge is summarized as follows:

- Pipe Surcharge State <= 1, Pipe under 100% full (Green)
- Pipe Surcharge State > 1 and < 2, Pipe > 100% full but not causing potential flooding (Yellow)
- Pipe Surcharged and potentially causing flooding (Red)

The HGL was summarized based on a level of service criteria maintaining the HGL below a typical residential basement elevation of greater than 1.8 m below the ground elevation as summarized below:

- HGL >= 1.8 m below ground (Green)
- HGL between 1.8 m and 0 m below ground (Yellow)
- HGL above ground (Red)

The tabulated simulation results are shown in Appendix B for all pipes.

3.3 DWF Validation

As previously mentioned, population density values were updated per the City's development standards, Developer information, and land-uses that were mixed and required a hybrid population density as shown in Table 1. Each subcatchment was reviewed after the initial modelling iteration to determine if the correct land-use and population density value was

assigned. The calibration results were tested on the downstream sections on Cooke Boulevard and Plains Road and are summarized in Table 3.

Table 3: DWF Validation Results- Existing Conditions

Location (Upstream MH description excel/ model)	Average Flow Excel(m3/s)	Average Flow Model (m3/s)	% Difference	% Pipe full Excel	% Pipe full Model	% Difference
Masonry Ct and Cooke Blvd. (MH14202 / XXXXX00036)	0.00315	0.00314	0.3	2	4	50
Cooke Blvd. and Plains Rd. (SMH13310)	0.00417	0.00452	8.4	8	8	0
Plains Rd. and Waterdown Rd. (SMH13314)	0.00578	0.00587	1.6	16	20	25

The results show a general agreement between the modelled peak flow and calculated average flow. The average flow was the basis of comparison as the run did not include any RDII.

3.4 WWF Validation

R, T and K parameters were initially estimated based on the difference between DWF and WWF from the sample Niagara region data, and adjusted under the 10-Year Design Storm based on peak flow and the expected surcharge state of the Cooke Boulevard and Plains Road sanitary sewers. The design storm used was adjusted to peak just after the initial domestic flow peak to capture the most conservative estimation of sanitary flows into the system. Iteration 1 used one RTK hydrograph and a high proportion of runoff as RDII. Iterations 2 and 3 used 2 RTK hydrographs each with substantially reduced R values and larger Time to Peak and recession (K) constants. After concluding that the peak flows and surcharge state was too high and sustained, a single RTK hydrograph with reduced peak and longer T and K was used and "tweaked" (Table 4) until the modelled response better matched with the Harmon calculations for peak flow rate and state of surcharge under existing conditions as per Figure 11 and Table 5. Figure 12 summarizes the HGL profiles showing the simulated HGL elevation under existing conditions. Figure 13 summaries the hydrograph response to wet weather based on the peak design rainfall occurring at 10:00 AM with a comparison to the calculated peak flow per the calculated design sheets.

Table 4: RTK Iterations for RDII Comparison to Harmon Calculations

I/I Modelling Parameters	Iterations					
	1		4	5	6	7
R1	0.2		0.05	0.025	0.035	0.04
T1	1		1.2	1.2	1.2	1.2
K1	1		2	1.8	1.8	1.8

Table 5: WWF Validation Results - Existing Conditions

Location (Upstream MH description excel/ model)	Total Flow Excel(m3/s)	Flow Model (m3/s)	% Difference	% Pipe full Design	% Pipe full model	% Difference
Masonry Ct and Cooke Blvd. (MH14202 / XXXXX00036)	0.0134	0.0210	57	8	41	80
Cooke Blvd. and Plains Rd. (SMH13310)	0.0177	0.0313	77	33	53	61
Plains Rd. and Waterdown Rd. (SMH13314)	0.0251	0.0481	92	70	160	129

Under wet weather flow, the modelled flows exceed the Harmon values by and order of magnitude and is a poor match. RDII flow iterations plus domestic and baseflow from all upstream subcatchments indicate potential pre-existing capacity issues downstream. It should also be noted that although the model indicates surcharged pipes downstream, the HGL is below 1.8 m and does not indicate a basement flooding issue.



Figure 11: Calibration Results - HGL and Pipe Surcharge State

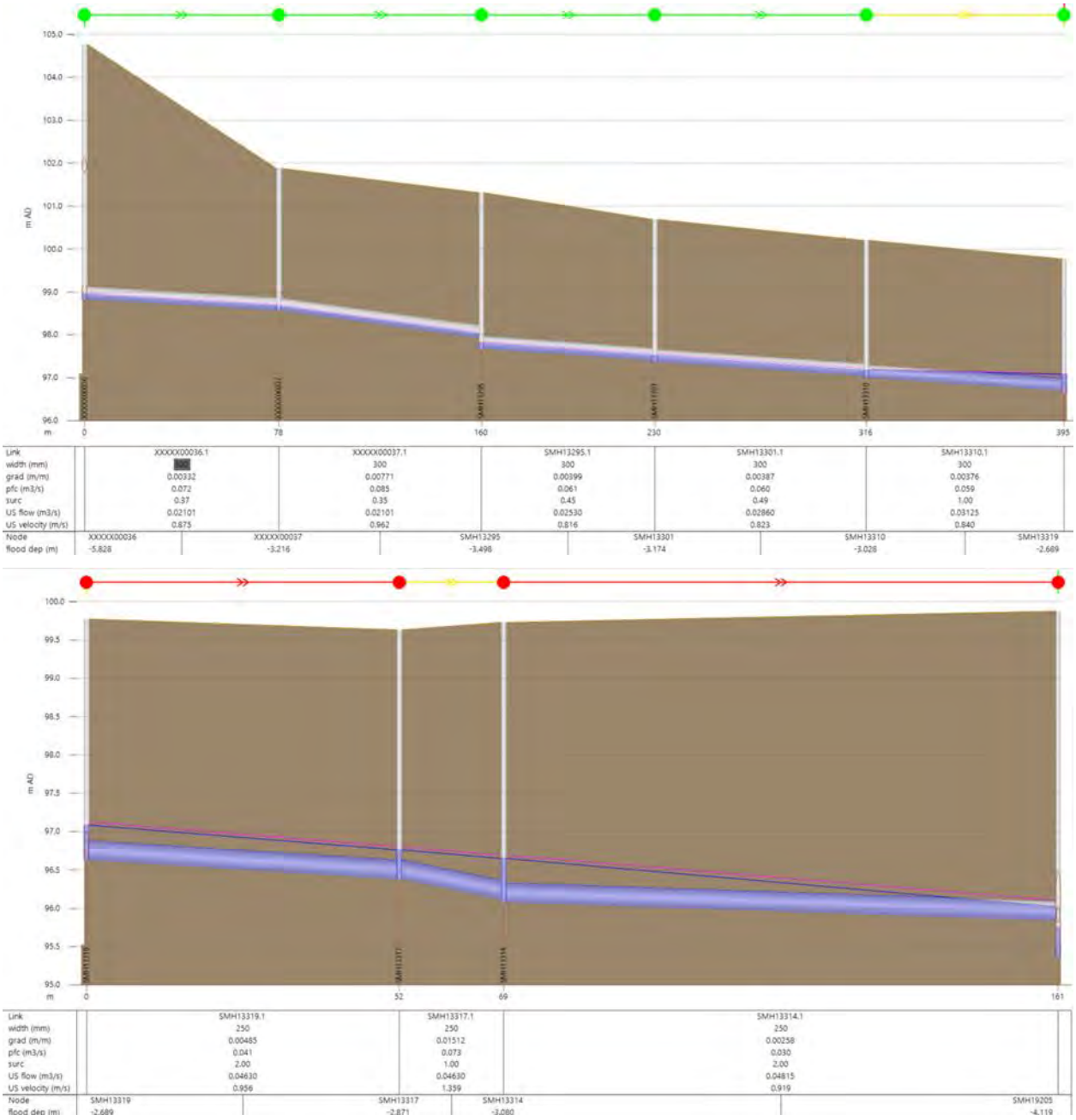


Figure 12: HGL Profiles for Cooke Boulevard and Plains Road – Existing Conditions

The hydrographs in Figure 13 shows the wet weather response with a peak RDII under two hours after the peak of the 10-year design storm consistent with RTK hydrograph input peaking after the peak domestic flow period. The hydrograph response represents a conservative estimate of RDII and does not differentiate the rapid and slow into the sanitary system in the absence of flow monitoring data.

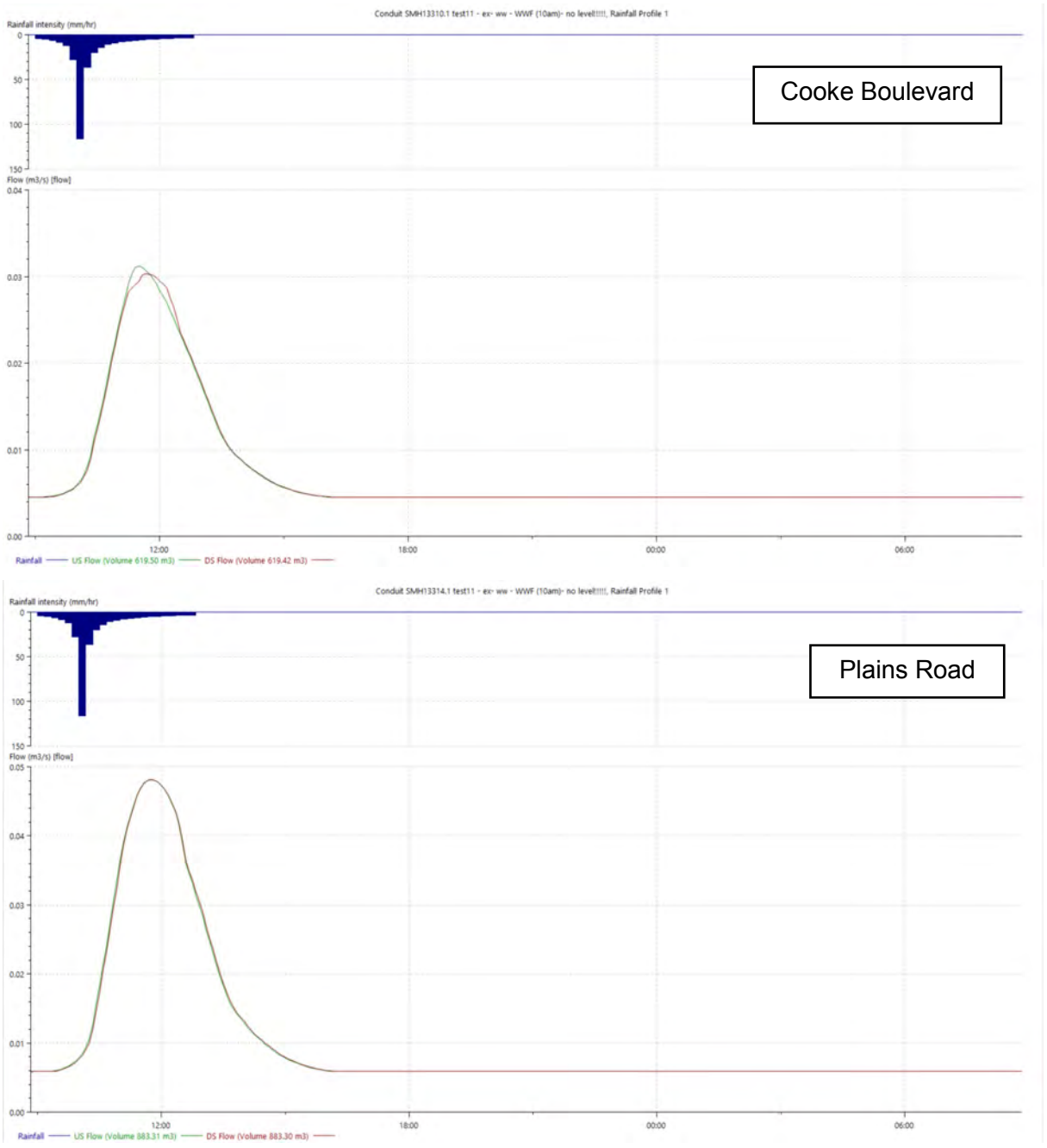


Figure 13: WWF Hydrographs for Cooke Bolevard and Plains Road

Typically, under wet weather without a flow monitoring and rainfall event volumes over 15 mm, getting a good calibration/validation fit is difficult due to the lack of RDII response. Flow monitoring data from events greater than 15 mm have been found to allow a better identification of the types of responses (rapid versus slow) that helps develop the RTK hydrograph for realistic simulated response. Validating to calculated values, while a very rough approximation, still has some benefits in performing an exercise where the model can potentially verify the design sheets or identify design deficiencies or potential missing elements requiring further study (i.e. flow monitoring data).

In conclusion, the simulated dry weather response generally agrees with the Harmon-calculated flow rate values, and while the modelled wet weather flow response exceeds the calculated total flow rates and is a poor match, that can be resolved with comparisons to flow monitoring data. However, the results are generally consistent in terms of indicating the location of potential system bottlenecks.

4.0 Scenario Results

After calibrating the model to the design sheets, two scenarios were modelled to show the limitations of the existing sanitary system with the Phase 1 and Phase 2 developments and confirming that the recommended sewer upgrades meet the design capacities and Region of Halton design criteria.

4.1 Scenario 1 – Proposed Conditions Post-Phase 2 Development – Existing Infrastructure

The model was run assuming a full build-out of Phases 1 and 2 with the existing infrastructure in place. Figure 14 shows the additional flows impacting the sewers on Plains Road and Clearview Avenue and the downstream sections of Cooke Boulevard. Figure 15 shows the HGL profile of the flows along Cooke Boulevard and Plains Road clearly indicating a major bottleneck resulting from the Phase 2 development.



Figure 14: HGL and Pipe Surcharge State - Post-Development - Existing Infrastructure

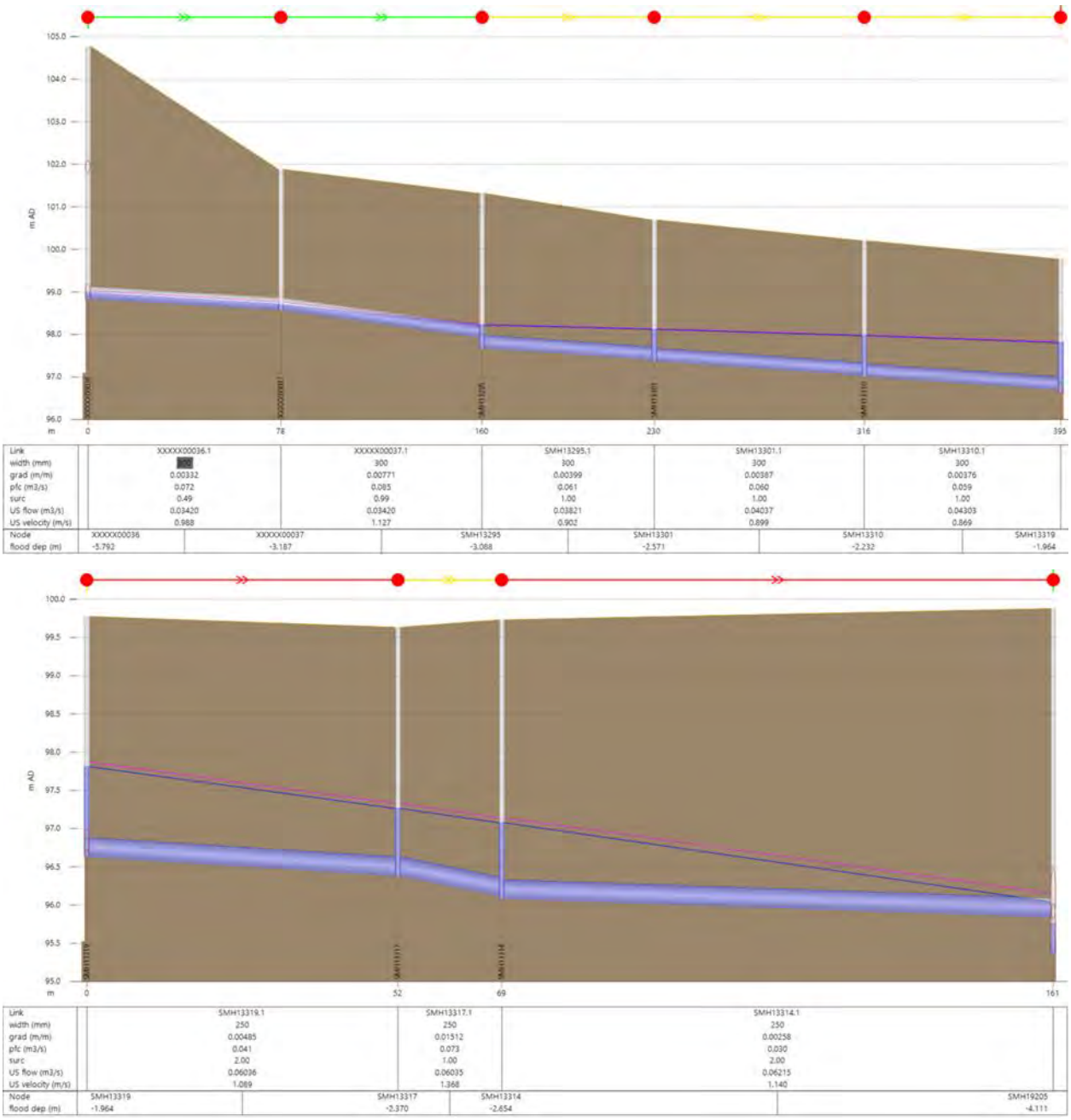


Figure 15: HGL Profiles - Post- Phase 2 Development - Existing Infrastructure

Table 6 summarizes the modelled results in comparison with the design sheets and shows the peak flow is on average within 14% of the calculated values. The pipes indicated as under a state of surcharge in the model are the pipes that the Harmon calculations indicate as 80% to 90% full and recommended for upgrade.

Table 6: Comparison of Harmon and Modelled Results - Post-Phase 2 Development – Existing Infrastructure

Location (Upstream MH description excel/ model)	Total Flow Design (m3/s)	Flow Model (m3/s)	% Difference	% Pipe full Design	% Pipe full model	% Difference
Masonry Ct and Cooke Blvd. (MH14202 / XXXXX00036)	0.0474	0.0342	23	28	48	72
Cooke Blvd. and Plains Rd. (SMH13310)	0.0511	0.0430	16	97	73	33
Plains Rd. and Waterdown Rd. (SMH13314)	0.0644	0.0622	3.5	179	207	14

The above Table indicates that the modelled peak flow rate is similar to the calculated total flows in the design sheet. The sanitary sewer pipes that were determined to have capacity issues in the design sheets, are confirmed as surcharged in the modelled results.

4.2 Scenario 2 – Proposed Conditions Post-Phase 2 Development – Proposed Infrastructure

The recommended pipe upgrades were included into the proposed conditions and the results were compared with the design sheets. The modelled results indicate that the proposed sewer upgrades on Cooke Boulevard are more than adequate and agree with the Harmon calculations as well. Figure 16 shows that the sewer network capacity issues are resolved with the upgraded sewers on Cooke Boulevard and Plains Road. Figure 17 indicates that that upgraded sewers have more than adequate capacity to meet the Region's criteria. Table 6 summarizes the modelled results in comparison with the design sheets and shows the peak flow is on average within 15% of the calculated values. The state of surcharge also is in relatively good agreement with the Harmon calculations.



Figure 16: HGL and Pipe Surcharge State – Post-Phase 2 Development – Proposed Infrastructure

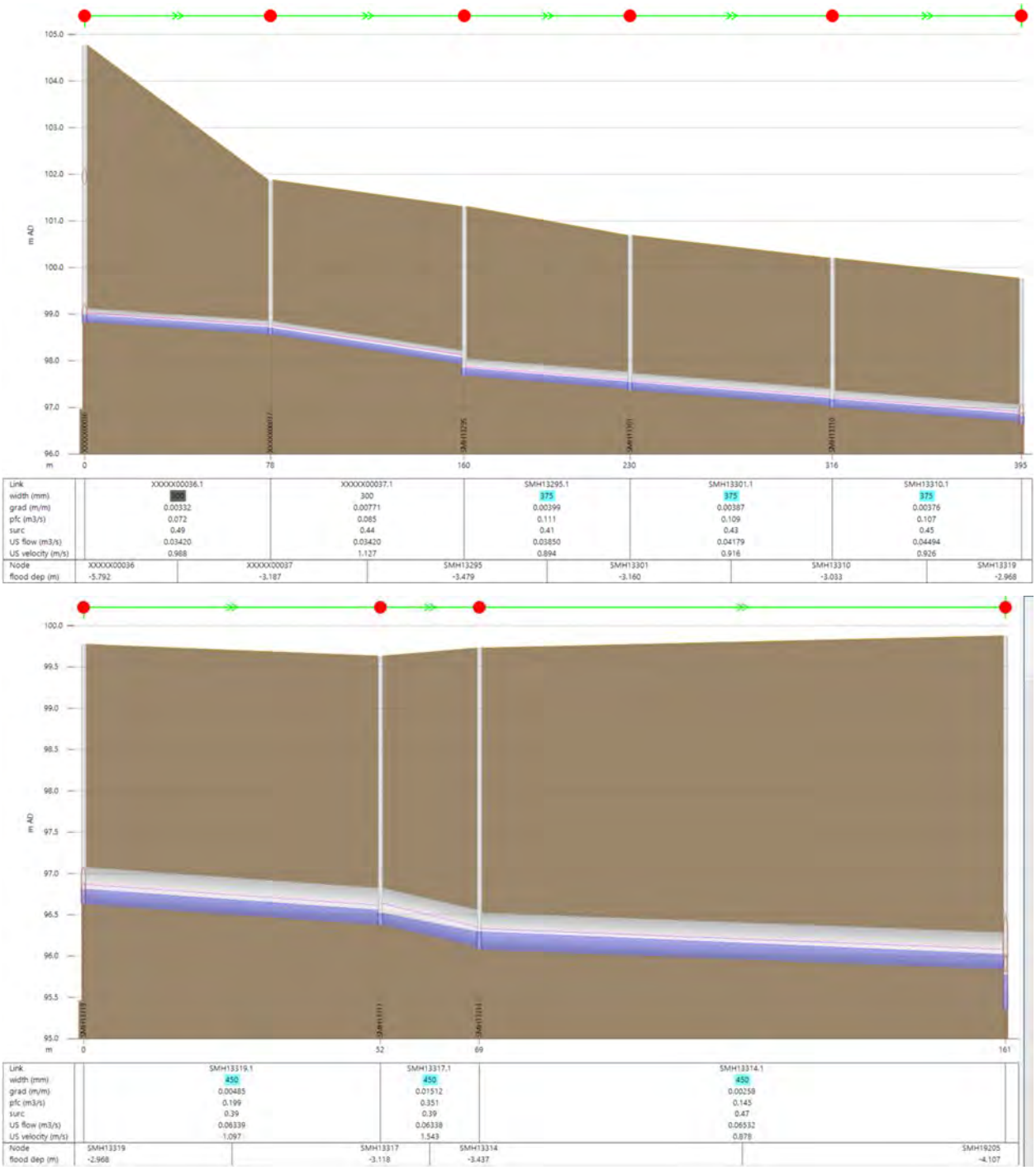


Figure 17: HGL Profiles - Post-Phase 2 Development - Proposed Infrastructure

Table 7: Results Comparison - Post-Phase 2 Development - Proposed Infrastructure

Location (Upstream MH description excel/ model)	Total Flow Design (m3/s)	Flow Model (m3/s)	% Difference	% Pipe full Design	% Pipe full model	% Difference
Masonry Ct and Cooke Blvd. (MH14202 / XXXXX00036)	0.0474	0.0342	34	28	48	71
Cooke Blvd. and Plains Rd. (SMH13310)	0.0511	0.0449	14	57	42	36
Plains Rd. and Waterdown Rd. (SMH13314)	0.0644	0.0653	1.4	39	45	15

5.0 Conclusions

The conclusions of the modelling are summarized below:

- Dynamic modelling has differences from Harmon methodology and therefore a comparison between results of dynamic and rational (static) calculations must include flows, HGL and pipe capacity analysis and general trends in the lack of flow monitoring data;
- The model is essentially and uncalibrated model using the Harmon calculations to validate the modelled results in the absence of observed flow monitoring data;
- The validation for DWF was reasonable given the modelling assumptions with flows within 155 of the calculated flows;
- The validation for WWF was poor with modelled flow an order of magnitude higher. Wet weather response within sewer system are difficult to calibrate under low flows and lack of observed flow data. However, the modelled WWF indicated system potential bottlenecks in areas where the calculated values indicated the pipe being greater than 70% full. This comparison is ambiguous as the static calculations do not account for the dynamic behavior of RDII under the 10-year design storm;
- The modelling generally agrees with the design calculations under the proposed conditions and the locations where sanitary sewer upgrades are necessary; and
- The recommended sanitary sewer upgrades are more than adequate to meet the Region's design criteria.

6.0 Recommendations and Next Steps

Given the limited data available for a fully calibrated and validated model, it is recommended that:

1. Sewer flow monitoring data for within or adjacent to the Study Area be provided for a more accurate calibration through a direct comparison between observed and predicted flows; we request flow monitoring data from the Region under DWF and WWF conditions to further refine the R-T-K analysis
2. The downstream boundary conditions should include depth monitoring data in the LaSalle Park Trunk Sewer to better assess the impacts of the downstream conditions on the development.

All of which is respectfully submitted,
MTE Consultants Inc.



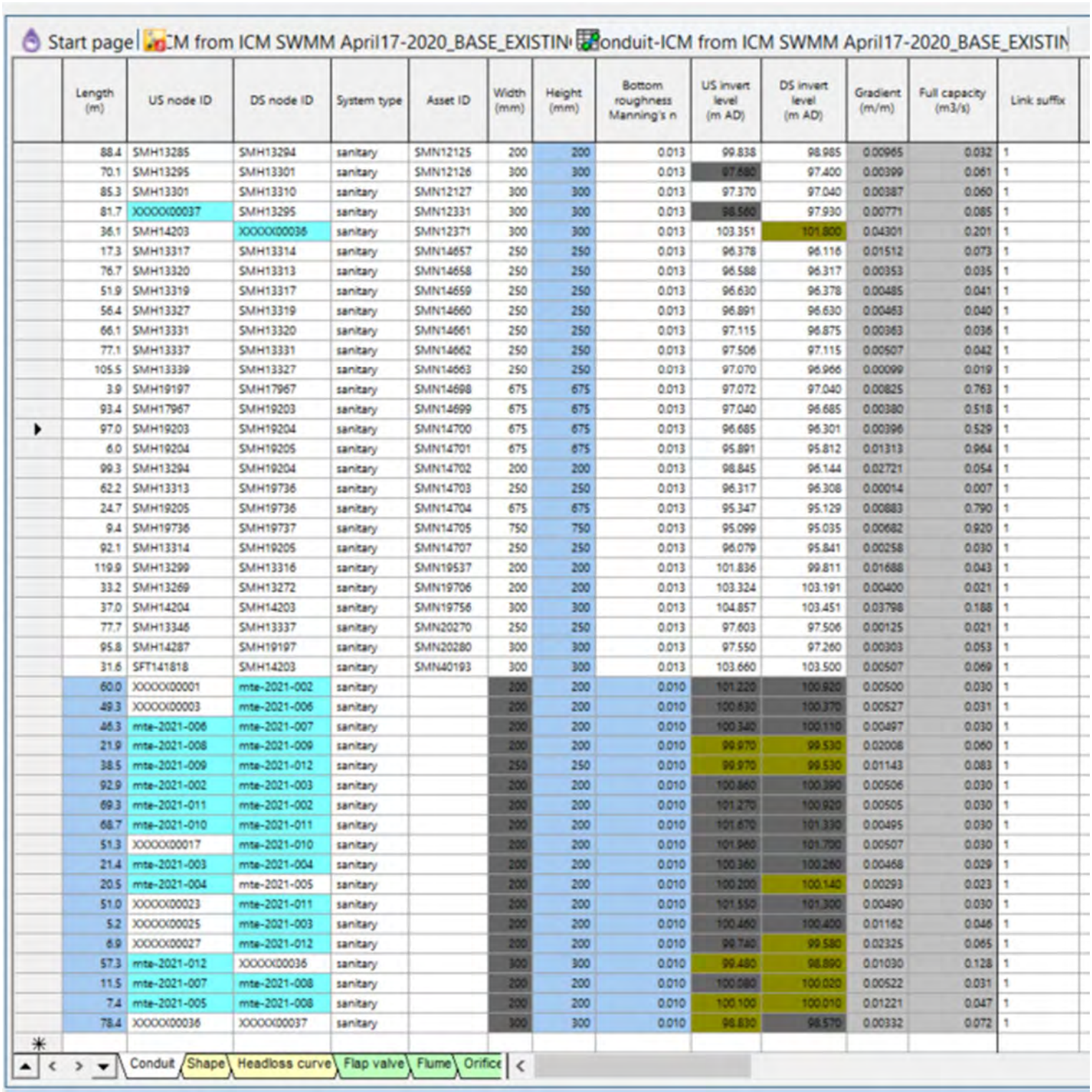
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Appendix

Infoworks ICM Model Inputs

Conduit Input – existing conditions



Start page | ...M from ICM SWMM April17-2020_BASE_EXISTIN | ...onduit-ICM from ICM SWMM April17-2020_BASE_EXISTIN

	Length (m)	US node ID	DS node ID	System type	Asset ID	Width (mm)	Height (mm)	Bottom roughness Manning's n	US invert level (m AD)	DS invert level (m AD)	Gradient (m/m)	Full capacity (m3/s)	Link suffix
	88.4	SMH13285	SMH13294	sanitary	SMN12125	200	200	0.013	99.838	98.985	0.00965	0.032	1
	70.1	SMH13295	SMH13301	sanitary	SMN12126	300	300	0.013	97.680	97.400	0.00399	0.061	1
	85.3	SMH13301	SMH13310	sanitary	SMN12127	300	300	0.013	97.370	97.040	0.00387	0.060	1
	81.7	XXXXX00037	SMH13295	sanitary	SMN12331	300	300	0.013	98.560	97.930	0.00771	0.085	1
	36.1	SMH14203	XXXXX00036	sanitary	SMN12371	300	300	0.013	103.351	101.800	0.04301	0.201	1
	17.3	SMH13317	SMH13314	sanitary	SMN14657	250	250	0.013	96.378	96.116	0.01512	0.073	1
	76.7	SMH13320	SMH13313	sanitary	SMN14658	250	250	0.013	96.588	96.317	0.00353	0.035	1
	51.9	SMH13319	SMH13317	sanitary	SMN14659	250	250	0.013	96.630	96.378	0.00485	0.041	1
	56.4	SMH13327	SMH13319	sanitary	SMN14660	250	250	0.013	96.891	96.630	0.00463	0.040	1
	66.1	SMH13331	SMH13320	sanitary	SMN14661	250	250	0.013	97.115	96.875	0.00363	0.036	1
	77.1	SMH13337	SMH13331	sanitary	SMN14662	250	250	0.013	97.506	97.115	0.00507	0.042	1
	105.5	SMH13339	SMH13327	sanitary	SMN14663	250	250	0.013	97.070	96.966	0.00099	0.019	1
	3.9	SMH19197	SMH17967	sanitary	SMN14698	675	675	0.013	97.072	97.040	0.00825	0.763	1
	93.4	SMH17967	SMH19203	sanitary	SMN14699	675	675	0.013	97.040	96.685	0.00380	0.518	1
▶	97.0	SMH19203	SMH19204	sanitary	SMN14700	675	675	0.013	96.685	96.301	0.00396	0.529	1
	6.0	SMH19204	SMH19205	sanitary	SMN14701	675	675	0.013	95.891	95.812	0.01313	0.964	1
	99.3	SMH13294	SMH19204	sanitary	SMN14702	200	200	0.013	98.845	96.144	0.02721	0.054	1
	62.2	SMH13313	SMH19736	sanitary	SMN14703	250	250	0.013	96.317	96.308	0.00014	0.007	1
	24.7	SMH19205	SMH19736	sanitary	SMN14704	675	675	0.013	95.347	95.129	0.00883	0.790	1
	9.4	SMH19736	SMH19737	sanitary	SMN14705	750	750	0.013	95.099	95.035	0.00682	0.920	1
	92.1	SMH13314	SMH19205	sanitary	SMN14707	250	250	0.013	96.079	95.841	0.00258	0.030	1
	119.9	SMH13299	SMH13316	sanitary	SMN19537	200	200	0.013	101.836	99.811	0.01688	0.043	1
	33.2	SMH13269	SMH13272	sanitary	SMN19706	200	200	0.013	103.324	103.191	0.00400	0.021	1
	37.0	SMH14204	SMH14203	sanitary	SMN19756	300	300	0.013	104.857	103.451	0.03798	0.188	1
	77.7	SMH13346	SMH13337	sanitary	SMN20270	250	250	0.013	97.603	97.506	0.00125	0.021	1
	95.8	SMH14287	SMH19197	sanitary	SMN20280	300	300	0.013	97.550	97.260	0.00303	0.053	1
	31.6	SFT141818	SMH14203	sanitary	SMN40193	300	300	0.013	103.660	103.500	0.00507	0.069	1
	60.0	XXXXX00001	mte-2021-002	sanitary		200	200	0.010	101.220	100.920	0.00500	0.030	1
	49.3	XXXXX00003	mte-2021-006	sanitary		200	200	0.010	100.630	100.370	0.00527	0.031	1
	46.3	mte-2021-006	mte-2021-007	sanitary		200	200	0.010	100.340	100.110	0.00497	0.030	1
	21.9	mte-2021-008	mte-2021-009	sanitary		200	200	0.010	99.970	99.530	0.02008	0.060	1
	38.5	mte-2021-009	mte-2021-012	sanitary		250	250	0.010	99.970	99.530	0.01143	0.083	1
	92.9	mte-2021-002	mte-2021-003	sanitary		200	200	0.010	100.860	100.390	0.00506	0.030	1
	69.3	mte-2021-011	mte-2021-002	sanitary		200	200	0.010	101.270	100.920	0.00505	0.030	1
	68.7	mte-2021-010	mte-2021-011	sanitary		200	200	0.010	101.670	101.330	0.00495	0.030	1
	51.3	XXXXX00017	mte-2021-010	sanitary		200	200	0.010	101.960	101.700	0.00507	0.030	1
	21.4	mte-2021-003	mte-2021-004	sanitary		200	200	0.010	100.360	100.260	0.00468	0.029	1
	20.5	mte-2021-004	mte-2021-005	sanitary		200	200	0.010	100.200	100.140	0.00293	0.023	1
	51.0	XXXXX00023	mte-2021-011	sanitary		200	200	0.010	101.550	101.300	0.00490	0.030	1
	5.2	XXXXX00025	mte-2021-003	sanitary		200	200	0.010	100.460	100.400	0.01162	0.046	1
	6.9	XXXXX00027	mte-2021-012	sanitary		200	200	0.010	99.740	99.580	0.02325	0.065	1
	57.3	mte-2021-012	XXXXX00036	sanitary		300	300	0.010	99.480	98.890	0.01030	0.128	1
	11.5	mte-2021-007	mte-2021-008	sanitary		200	200	0.010	100.080	100.020	0.00522	0.031	1
	7.4	mte-2021-005	mte-2021-008	sanitary		200	200	0.010	100.100	100.010	0.01221	0.047	1
	78.4	XXXXX00036	XXXXX00037	sanitary		300	300	0.010	98.830	98.570	0.00332	0.072	1
✳													

Conduit | Shape | Headloss curve | Flap valve | Flume | Orifice

Subcatchment- existing conditions

Start page | CM from ICM SWMM April17-2020_BASE_EXISTIN | ubcatchment-ICM from ICM SWMM April17-2

Subcatchment ID	Drains to	Node ID	Total area (ha)	Land use ID	Population	Wastewater profile
26599	Node	SMH13301	1.118	10	139.74	1
265A6	Node	SMH13295	1.456	10	181.99	1
265B5	Node	SMH14204	0.446	10	55.74	1
265BE	Node	XOOOOX00036	1.134	10	141.71	1
265C8	Node	SMH13322	0.814	2	44.77	1
265E4	Node	SMH13316	1.146	2	63.04	1
265F3	Node	SMH13326	0.854	2	46.94	1
26603	Node	SMH13339	0.615	1	33.83	1
2660C	Node	SMH13339	0.556	8	50.00	1
26616	Node	SMH13310	0.910	10	113.73	1
26622	Node	SMH13319	0.375	8	33.79	1
2662C	Node	SMH13314	0.685	8	61.69	1
26648	Node	SFT141818	0.981	99	3362.00	1
26653	Node	XOOOOX00001	0.243	6	32.75	1
2665B	Node	mte-2021-011	0.240	6	32.44	1
26669	Node	mte-2021-003	0.048	6	6.52	1
26671	Node	mte-2021-002	0.214	6	28.84	1
26679	Node	mte-2021-004	0.108	1	0.00	1
26686	Node	mte-2021-006	0.178	6	24.02	1
26693	Node	mte-2021-008	0.046	6	6.22	1
266A0	Node	mte-2021-009	0.064	1	0.00	1
266A7	Node	XOOOOX00017	0.142	6	19.23	1
266AD	Node	XOOOOX00003	0.184	6	24.90	1
266B9	Node	mte-2021-010	0.153	6	20.65	1
266C0	Node	mte-2021-012	0.090	1	0.00	1
266C8	Node	mte-2021-004	1.024	1	0.00	1
266D3	Node	SMH14203	0.107	10	13.32	1
266D9	Node	SMH14204	0.156	10	19.48	1
266E1	Node	XOOOOX00025	0.586	15	229.02	1
266E7	Node	XOOOOX00023	0.210	6	28.30	1
266EF	Node	XOOOOX00027	0.625	16	302.40	1
botanical dr. s plains	Node	SMH19203	45.987	7	4138.80	1
Plains Rd N of hillside	Node	SMH19203	39.113	7	3520.16	1
unsworth/ howard N of plains	Node	SMH19203	85.379	1	4695.87	1
sub-S-ex	Node	SMH13299	1.721	17	87.76	1
plains rd. south	Node	SMH13313	2.515	8	226.31	1
waterdown rd.	Node	SMH13294	4.699	8	422.92	1

User Defined Flags

	Name	Display Colour	Obsolete	Description
▶	#A		☐	Asset Data
	#D		☐	System Default
	#G		☐	Data From GeoPlan
	#I		☐	Model Import
	#S		☐	System Calculated
	#V		☐	CSV Import
	ASC		☐	From As constructed ph 1 drawing
	BUR		☐	from city of burlington stds
	CAD		☐	AutoCAD imports
	IFC		☐	from issued for construction ph.1 drawings
	MTE		☐	model edits
✳			☐	

Land use ID	Population density (person/ha)	'astewat profile	Connectivity (%)	)llutic index	Description	Runoff surface 1
DEFAU	0.0	1	100	1		1
1	55.0	1	100	1	Low density residential (combine	10
2	55.0	1	100	2	Low density residential (separate)	10
3	100.0	1	100	3	Medium density residential (coml	10
4	100.0	1	100	4	Medium density residential (sepa	10
5	135.0	1	100	5	High density residential (combine	10
6	135.0	1	100	6	High density residential (separate	10
7	90.0	1	100	7	Commercial (combined)	10
8	90.0	1	100	8	Commercial (separate)	10
9	125.0	1	100	9	Industrial (combined)	10
10	125.0	1	100	10	Industrial (separate)	10
11	100.0	1	100	11	Mixed suburbs (combined)	10
12	100.0	1	100	12	Mixed suburbs (separate)	10
99	0.0	1	0	1	SPIDA Compatibility Definition	10
13	285.0	1	100	13	Apartment (over 6 stories high)	10
14	40.0	1	100	14	Community services	10
15	391.0	1	100	1	ph.1 townhome density	10
16	484.0	1	100	1	ph.1 apartment density	10
17	51.0	1	100	1	street custom density	10
18	1022.0	1	100	1	per paradigm solutions developm	10
19	285.0	1	100	1	per city of burlington developme	10
20	326.0	1	100	1	per city of burlington developme	10
21	3431.0	1	100	1	ph.2 density	10
22	3268.0	1	100	1	ph.2 density- phase 3	10
23	3411.0	1	100	1	ph.2 density- phase 1	10
24	3747.0	1	100	1	ph.2 density- phase 1	10

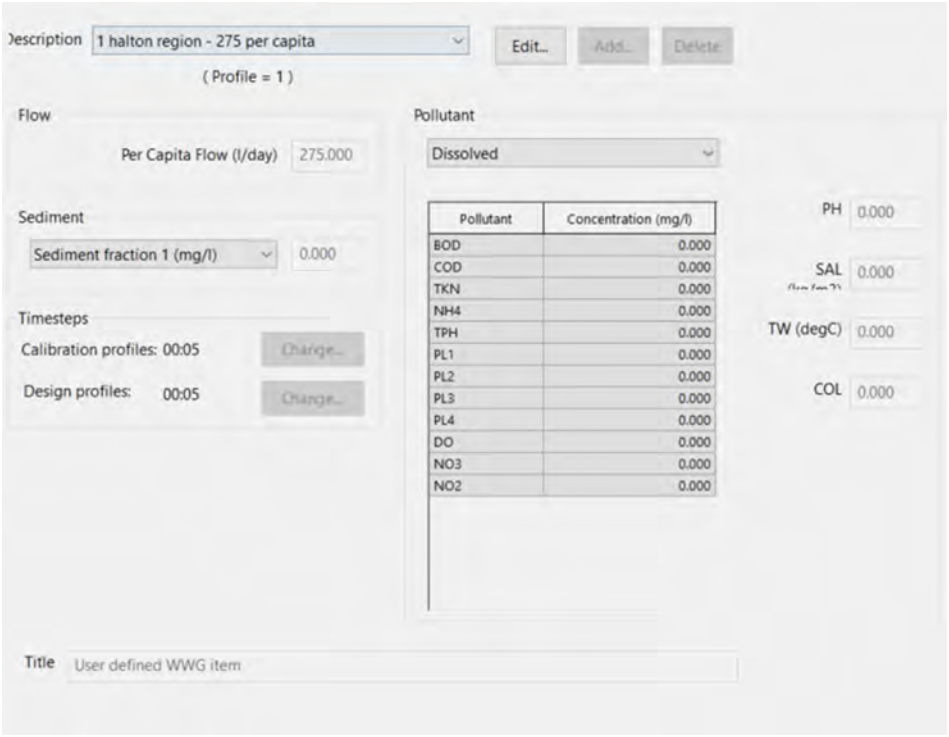
Dry weather flow patterns

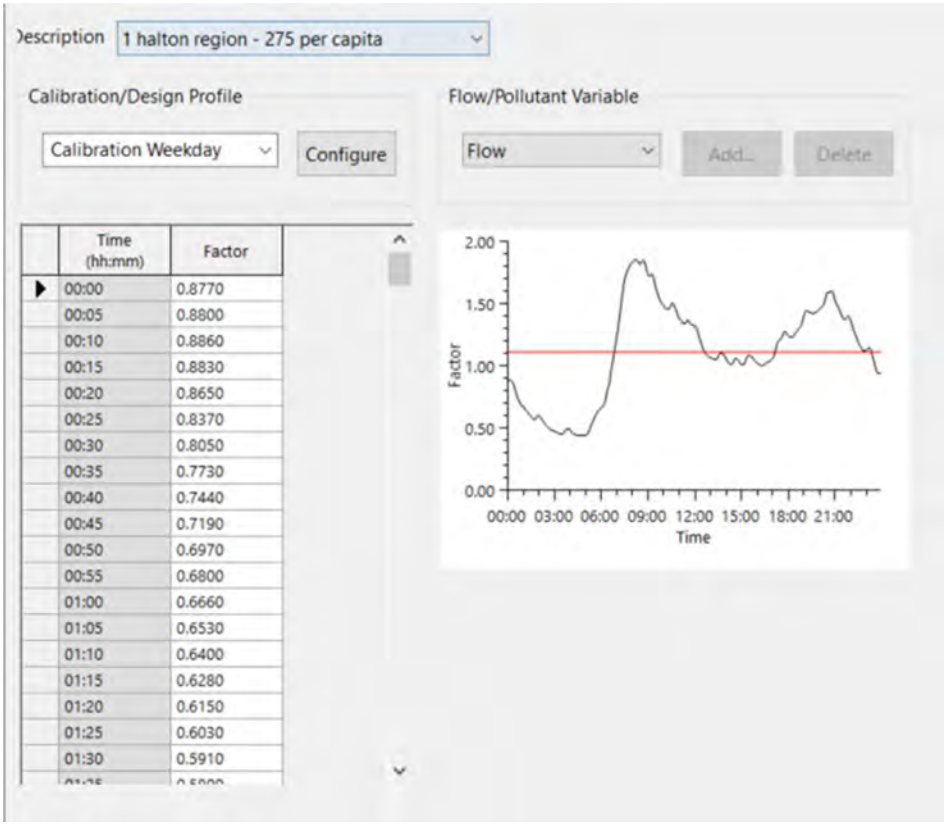
Time	1 (mm/hr)
SUB-EVENT 1	
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00::00:10	0.000000
00::00:20	0.000000
00::00:30	0.000000
00::00:40	0.000000
00::00:50	0.000000
00::01:00	0.000000
00::01:10	0.000000
00::01:20	0.000000
00::01:30	0.000000
00::01:40	0.000000
00::01:50	0.000000
00::02:00	0.000000
00::02:10	0.000000
00::02:20	0.000000
00::02:30	0.000000
00::02:40	0.000000
00::02:50	0.000000
00::03:00	0.000000
00::03:10	0.000000
00::03:20	0.000000
00::03:30	0.000000
00::03:40	0.000000
00::03:50	0.000000

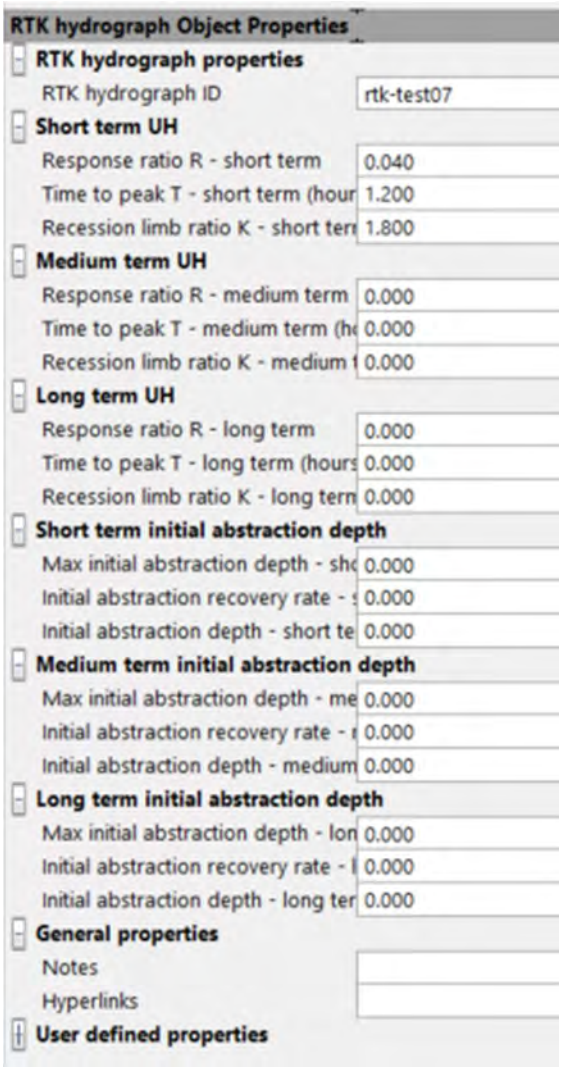
Rainfall City of Burlington 10 year- 10am peak

Time	1 (mm/hr)
SUB-EVENT 1	
00::08:50	0.000000
00::09:00	4.483000
00::09:10	5.242000
00::09:20	6.377000
00::09:30	8.291000
00::09:40	12.326000
00::09:50	28.176000
00::10:00	116.310000
00::10:10	36.748000
00::10:20	19.967000
00::10:30	14.001000
00::10:40	10.921000
00::10:50	9.030000
00::11:00	7.743000
00::11:10	6.808000
00::11:20	6.095000
00::11:30	5.532000
00::11:40	5.075000
00::11:50	4.696000
00::12:00	4.376000
00::12:10	4.102000
00::12:20	3.864000
00::12:30	3.656000
00::12:40	3.472000

Domestic Flow Profile






RTK hydrograph Object Properties
RTK hydrograph properties
RTK hydrograph ID
rtk-test07
Short term UH
Response ratio R - short term
0.040
Time to peak T - short term (hour
1.200
Recession limb ratio K - short ter
1.800
Medium term UH
Response ratio R - medium term
0.000
Time to peak T - medium term (h
0.000
Recession limb ratio K - medium t
0.000
Long term UH
Response ratio R - long term
0.000
Time to peak T - long term (hours
0.000
Recession limb ratio K - long term
0.000
Short term initial abstraction depth
Max initial abstraction depth - sh
0.000
Initial abstraction recovery rate - s
0.000
Initial abstraction depth - short te
0.000
Medium term initial abstraction depth
Max initial abstraction depth - me
0.000
Initial abstraction recovery rate - r
0.000
Initial abstraction depth - medium
0.000
Long term initial abstraction depth
Max initial abstraction depth - lon
0.000
Initial abstraction recovery rate - l
0.000
Initial abstraction depth - long ter
0.000
General properties
Notes
Hyperlinks
User defined properties

Appendix

Infoworks ICM Model Inputs

Existing conditions- DWF

US node ID	Surcharge state	US flow (m3/s)	US Froude number	US velocity (m/s)	DS flow (m3/s)	DS Froude number	DS velocity (m/s)
SMH13310	0.20	0.00452	0.706	0.452	0.00452	0.898	0.539
SMH13322	0.11	0.00014	0.188	0.073	0.00014	0.190	0.074
SMH13316	0.13	0.00062	0.639	0.265	0.00062	0.639	0.265
SMH13326	0.15	0.00077	0.551	0.251	0.00077	0.578	0.260
SMH13272	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13285	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13295	0.18	0.00372	0.710	0.430	0.00372	0.876	0.502
SMH13301	0.19	0.00416	0.706	0.442	0.00416	0.889	0.523
XXXXX00037	0.14	0.00314	0.914	0.496	0.00314	0.914	0.496
SMH14203	0.10	0.00028	0.160	0.073	0.00028	0.160	0.073
SMH13317	0.21	0.00567	1.236	0.746	0.00567	1.236	0.746
SMH13320	0.20	-0.00000	0.000	-0.000	-0.00000	0.000	-0.000
SMH13319	0.26	0.00566908	0.804	0.546	0.00567	0.911	0.598
SMH13327	0.26	0.00104	0.542	0.259	0.00104	0.147	0.100
SMH13331	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13337	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13339	0.18	0.00104	0.316	0.174	0.00104	0.607	0.282
SMH19197	0.05	-0.00000	0.000	-0.000	0.00000	0.000	0.000
SMH17967	0.19	0.00000	0.000	0.000	-0.00000	0.000	-0.000
SMH19203	0.19	0.03932	0.870	0.819	0.03932	0.946	0.870
SMH19204	0.17	0.04067	1.142	1.009	0.04067	1.142	1.009
SMH13294	0.14	0.00135	1.085	0.480	0.00135	1.085	0.480
SMH13313	0.20	0.00072	0.175	0.102	0.00072	0.492	0.219
SMH19205	0.17	0.04654	1.297	1.148	0.04654	1.297	1.148
SMH19736	0.16	0.04726	1.159	1.043	0.04726	1.159	1.043
SMH13314	0.31	0.00587	0.619	0.457	0.00587	0.936	0.615
SMH13299	0.12	0.00028	0.353	0.139	0.00028	0.353	0.139
SMH13269	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14204	0.10	0.00024	0.137	0.062	0.00024	0.137	0.062
SMH13346	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14287	0.07	0.00000	0.000	0.000	-0.00000	0.000	0.000
SFT141818	0.07	0.00000	0.000	0.000	0.00000	0.000	0.000
XXXXX00001	0.11	0.00010	0.149	0.057	0.00010	0.149	0.057
XXXXX00003	0.11	0.00008	0.117	0.044	0.00008	0.117	0.044
mte-2021-006	0.11	0.00016	0.207	0.080	0.00016	0.207	0.080
mte-2021-008	1.00	0.00144	0.458	0.260	0.00144	0.005	0.043
mte-2021-009	0.13	0.00144	0.768	0.366	0.00144	0.768	0.366
mte-2021-002	0.13	0.00052	0.485	0.206	0.00052	0.485	0.206
mte-2021-011	0.12	0.00032	0.355	0.144	0.00032	0.355	0.144
mte-2021-010	0.11	0.00013	0.175	0.067	0.00013	0.175	0.067
XXXXX00017	0.11	0.00006	0.093	0.035	0.00006	0.093	0.035
mte-2021-003	0.17	0.00127	0.729	0.352	0.00127	0.729	0.352
mte-2021-004	0.19	0.00127	0.612	0.310	0.00127	0.700	0.342
XXXXX00023	0.11	0.00009	0.131	0.050	0.00009	0.131	0.050
XXXXX00025	0.13	0.00073	0.704	0.297	0.00073	0.704	0.297
XXXXX00027	0.13	0.00096	0.953	0.399	0.00096	0.953	0.399
mte-2021-012	0.14	0.00240	0.788	0.414	0.00240	0.788	0.414
mte-2021-007	0.11	0.00016	0.208	0.081	0.00016	0.208	0.081
mte-2021-005	0.15	0.00127	0.984	0.439	0.00127	0.984	0.439
XXXXX00036	0.15	0.00314	0.814	0.455	0.00314	0.834	0.463

Existing conditions- WWF

US node ID	Surcharge state	US flow (m3/s)	US Froude number	US velocity (m/s)	DS flow (m3/s)	DS Froude number	DS velocity (m/s)
SMH13310	1.00	0.03125	0.800	0.840	0.03032	0.984	0.931
SMH13322	0.22	0.00223	0.807	0.442	0.00223	0.807	0.442
SMH13316	0.33	0.01007	1.607	1.097	0.01007	1.606	1.097
SMH13326	0.51	0.01240	0.872	0.765	0.01240	0.961	0.825
SMH13272	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13285	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13295	0.45	0.02530	0.823	0.816	0.02530	0.980	0.931
SMH13301	0.49	0.02860	0.811	0.823	0.02859	0.988	0.969
XOOOOX00037	0.35	0.02101	1.132	0.962	0.02100	1.131	0.962
SMH14203	0.14	0.00462	1.396	0.749	0.00462	1.396	0.749
SMH13317	1.00	0.04630	1.481	1.359	0.04630	1.368	0.957
SMH13320	0.52	0.00000	0.000	0.000	-0.00010	0.008	-0.006
SMH13319	2.00	0.04630	0.868	0.956	0.04630	0.986	1.148
SMH13327	1.00	0.01547	0.844	0.731	0.01502	0.257	0.307
SMH13331	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13337	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13339	0.68	0.01566	0.401	0.440	0.01565	0.995	0.846
SMH19197	0.20	-0.00009	0.012	-0.006	-0.00024	0.013	-0.009
SMH17967	0.73	-0.00034	0.021	-0.015	-0.00605	0.022	-0.035
SMH19203	0.73	0.47667	0.965	1.703	0.47664	0.995	1.931
SMH19204	0.51	0.49004	1.639	2.646	0.49004	1.639	2.646
SMH13294	0.47	0.01341	1.880	1.344	0.01340	1.907	1.290
SMH13313	0.52	0.00716	0.277	0.278	0.00716	0.987	0.676
SMH19205	0.61	0.53612	1.423	2.364	0.53611	1.420	2.363
SMH19736	0.56	0.54327	1.272	2.135	0.54327	1.270	2.135
SMH13314	2.00	0.04815	0.633	0.919	0.04815	0.992	1.274
SMH13299	0.24	0.00470	1.355	0.789	0.00469	1.355	0.789
SMH13269	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14204	0.12	0.00178	0.742	0.366	0.00178	0.742	0.366
SMH13346	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14287	0.07	0.00000	0.000	0.000	-0.00000	0.000	0.000
SFT141818	0.14	0.00252	0.739	0.400	0.00252	0.809	0.427
XOOOOX00001	0.14	0.00073	0.594	0.262	0.00073	0.594	0.262
XOOOOX00003	0.14	0.00055	0.510	0.218	0.00055	0.510	0.218
mte-2021-006	0.16	0.00109	0.712	0.332	0.00109	0.712	0.332
mte-2021-008	1.00	0.01009	0.846	0.703	0.01009	0.033	0.299
mte-2021-009	0.26	0.01025	1.512	1.016	0.01025	1.512	1.016
mte-2021-002	0.25	0.00360	0.967	0.574	0.00360	0.967	0.574
mte-2021-011	0.21	0.00223	0.878	0.470	0.00223	0.878	0.470
mte-2021-010	0.15	0.00088	0.656	0.296	0.00088	0.656	0.296
XOOOOX00017	0.13	0.00043	0.430	0.179	0.00043	0.430	0.179
mte-2021-003	0.32	0.00597	1.005	0.677	0.00597	1.004	0.677
mte-2021-004	0.44	0.00887	0.830	0.671	0.00887	0.949	0.736
XOOOOX00023	0.14	0.00063	0.543	0.236	0.00063	0.543	0.236
XOOOOX00025	0.18	0.00223	1.181	0.584	0.00223	1.181	0.584
XOOOOX00027	0.17	0.00257	1.583	0.751	0.00257	1.583	0.751
mte-2021-012	0.24	0.01305	1.466	1.026	0.01305	1.466	1.026
mte-2021-007	0.22	0.00109	0.712	0.332	0.00108	0.629	0.279
mte-2021-005	0.31	0.00887	1.622	1.073	0.00887	1.622	1.073
XOOOOX00036	0.37	0.02101	0.973	0.875	0.02101	0.972	0.875

Proposed development- WWF- existing infrastructure

US node ID	Surcharge state	US flow (m3/s)	US Froude number	US velocity (m/s)	DS flow (m3/s)	DS Froude number	DS velocity (m/s)
SMH13310	1.00	0.04303	0.796	0.869	0.04302	0.983	0.987
SMH13322	0.22	0.00223	0.807	0.442	0.00223	0.807	0.442
SMH13316	1.00	0.01153	1.620	1.157	0.01153	1.620	1.157
SMH13326	1.00	0.01387	0.872	0.772	0.01319	0.962	0.834
SMH13272	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13285	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13295	1.00	0.03821	0.823	0.902	0.03764	0.985	1.041
SMH13301	1.00	0.04037	0.809	0.899	0.04018	0.985	1.036
XXXXX00037	0.99	0.03420	1.141	1.127	0.03419	1.140	1.127
SMH14203	0.18	0.00925	1.848	1.107	0.00925	1.848	1.107
SMH13317	1.00	0.06035	1.479	1.368	0.06035	1.041	1.110
SMH13320	0.52	0.00000	0.000	0.000	-0.00010	0.008	-0.006
SMH13319	2.00	0.06036	0.844	1.089	0.06035	0.986	1.153
SMH13327	1.00	0.01609	0.835	0.681	0.01608	0.178	0.290
SMH13331	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13337	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13339	1.00	0.01619	0.400	0.432	0.01615	0.981	0.800
SMH19197	0.20	-0.00009	0.011	-0.006	-0.00024	0.013	-0.008
SMH17967	0.73	-0.00034	0.020	-0.014	-0.00589	0.022	-0.034
SMH19203	0.73	0.47667	0.965	1.703	0.47664	0.995	1.931
SMH19204	0.51	0.49004	1.638	2.646	0.49004	1.638	2.646
SMH13294	0.47	0.01341	1.880	1.344	0.01340	1.863	1.262
SMH13313	0.52	0.00716	0.277	0.278	0.00716	0.987	0.676
SMH19205	0.62	0.54753	1.422	2.364	0.54753	1.421	2.363
SMH19736	0.57	0.55469	1.272	2.153	0.55469	1.270	2.153
SMH13314	2.00	0.06215	0.597	1.140	0.06215	0.994	1.455
SMH13299	0.28	0.00616	1.396	0.870	0.00616	1.396	0.869
SMH13269	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14204	0.16	0.00642	1.587	0.899	0.00642	1.587	0.899
SMH13346	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14287	0.07	0.00000	0.000	0.000	-0.00000	0.000	0.000
SFT141818	0.14	0.00252	0.739	0.400	0.00252	0.809	0.427
XXXXX00001	0.14	0.00073	0.594	0.262	0.00073	0.594	0.262
XXXXX00003	0.14	0.00055	0.510	0.218	0.00055	0.510	0.218
mte-2021-006	0.16	0.00109	0.712	0.332	0.00109	0.712	0.332
mte-2021-008	1.00	0.01009	0.722	0.636	0.01009	0.033	0.299
mte-2021-009	0.31	0.01518	1.629	1.197	0.01518	1.629	1.197
mte-2021-002	0.25	0.00360	0.967	0.574	0.00360	0.967	0.574
mte-2021-011	0.21	0.00223	0.878	0.470	0.00223	0.878	0.470
mte-2021-010	0.15	0.00088	0.656	0.296	0.00088	0.656	0.296
XXXXX00017	0.13	0.00043	0.430	0.179	0.00043	0.430	0.179
mte-2021-003	0.32	0.00597	1.005	0.677	0.00597	1.004	0.677
mte-2021-004	0.44	0.00887	0.830	0.671	0.00887	0.949	0.736
XXXXX00023	0.14	0.00063	0.543	0.236	0.00063	0.543	0.236
XXXXX00025	0.18	0.00223	1.181	0.584	0.00223	1.181	0.584
XXXXX00027	0.17	0.00257	1.583	0.751	0.00257	1.583	0.751
mte-2021-012	0.29	0.02160	1.583	1.248	0.02160	1.583	1.248
mte-2021-007	0.25	0.00109	0.698	0.328	0.00108	0.512	0.220
mte-2021-005	0.31	0.00887	1.622	1.073	0.00887	1.622	1.073
XXXXX00036	0.49	0.03420	0.974	0.988	0.03420	0.982	1.026

Proposed development- WWF- proposed infrastructure upgrade

US node ID	Surcharge state	US flow (m3/s)	US Froude number	US velocity (m/s)	DS flow (m3/s)	DS Froude number	DS velocity (m/s)
SMH13310	0.45	0.04494	0.839	0.926	0.04493	0.988	1.053
SMH13322	0.22	0.00223	0.807	0.442	0.00223	0.807	0.442
SMH13316	0.35	0.01153	1.620	1.157	0.01153	1.620	1.157
SMH13326	0.56	0.01387	0.872	0.773	0.01387	0.965	0.859
SMH13272	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13285	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13295	0.41	0.03850	0.864	0.894	0.03849	0.986	1.003
SMH13301	0.43	0.04179	0.851	0.916	0.04179	0.987	1.029
XOOOOX00037	0.44	0.03420	1.141	1.127	0.03419	1.140	1.127
SMH14203	0.18	0.00925	1.848	1.107	0.00925	1.848	1.107
SMH13317	0.39	0.06338	1.568	1.543	0.06338	1.340	1.108
SMH13320	0.52	0.00000	0.000	0.000	-0.00010	0.008	-0.006
SMH13319	0.39	0.06339	0.985	1.097	0.06338	0.987	1.114
SMH13327	0.71	0.01711	0.845	0.769	0.01711	0.369	0.462
SMH13331	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13337	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH13339	0.72	0.01713	0.400	0.450	0.01711	0.986	0.871
SMH19197	0.20	-0.00010	0.012	-0.006	-0.00025	0.013	-0.009
SMH17967	0.73	-0.00034	0.021	-0.014	-0.00605	0.022	-0.035
SMH19203	0.73	0.47667	0.965	1.703	0.47663	0.995	1.931
SMH19204	0.51	0.49004	1.639	2.646	0.49003	1.639	2.646
SMH13294	0.47	0.01341	1.880	1.344	0.01340	1.907	1.290
SMH13313	0.52	0.00716	0.277	0.278	0.00716	0.987	0.676
SMH19205	0.63	0.55464	1.422	2.366	0.55462	1.421	2.364
SMH19736	0.57	0.56178	1.271	2.166	0.56177	1.270	2.166
SMH13314	0.47	0.06532	0.721	0.878	0.06530	0.991	1.127
SMH13299	0.28	0.00616	1.396	0.870	0.00616	1.396	0.869
SMH13269	0.10	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14204	0.16	0.00642	1.587	0.899	0.00642	1.587	0.899
SMH13346	0.08	0.00000	0.000	0.000	0.00000	0.000	0.000
SMH14287	0.07	0.00000	0.000	0.000	-0.00000	0.000	0.000
SFT141818	0.14	0.00252	0.739	0.400	0.00252	0.809	0.427
XOOOOX00001	0.14	0.00073	0.594	0.262	0.00073	0.594	0.262
XOOOOX00003	0.14	0.00055	0.510	0.218	0.00055	0.510	0.218
mte-2021-006	0.16	0.00109	0.712	0.332	0.00109	0.712	0.332
mte-2021-008	1.00	0.01009	0.722	0.636	0.01009	0.033	0.299
mte-2021-009	0.31	0.01518	1.629	1.197	0.01518	1.629	1.197
mte-2021-002	0.25	0.00360	0.967	0.574	0.00360	0.967	0.574
mte-2021-011	0.21	0.00223	0.878	0.470	0.00223	0.878	0.470
mte-2021-010	0.15	0.00088	0.656	0.296	0.00088	0.656	0.296
XOOOOX00017	0.13	0.00043	0.430	0.179	0.00043	0.430	0.179
mte-2021-003	0.32	0.00597	1.005	0.677	0.00597	1.004	0.677
mte-2021-004	0.44	0.00887	0.830	0.671	0.00887	0.949	0.736
XOOOOX00023	0.14	0.00063	0.543	0.236	0.00063	0.543	0.236
XOOOOX00025	0.18	0.00223	1.181	0.584	0.00223	1.181	0.584
XOOOOX00027	0.17	0.00257	1.583	0.751	0.00257	1.583	0.751
mte-2021-012	0.29	0.02160	1.583	1.248	0.02160	1.583	1.248
mte-2021-007	0.25	0.00109	0.698	0.328	0.00108	0.519	0.222
mte-2021-005	0.31	0.00887	1.622	1.073	0.00887	1.622	1.073
XOOOOX00036	0.49	0.03420	0.974	0.988	0.03420	0.982	1.026

Appendix

Harmon Calculations

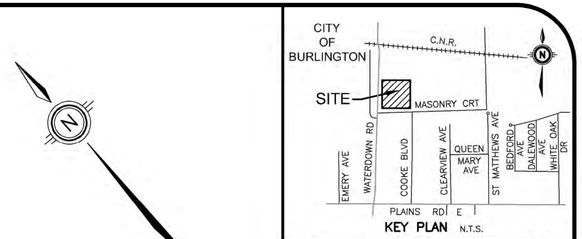
MTE

P:\P\48247\100\48247-100-SA1
MTE FILE PATH:

POPULATION DENSITIES
(PER HALTON REGION: TABLE 2-1, WATER & WASTEWATER LINEAR DESIGN MANUAL, MAY 2014)

TYPE OF DEVELOPMENT	EQUIVALENT POP. DENSITY (ppha)
SINGLE FAMILY	55
SEMI-DETACHED, DUPLEX AND 4-PLEX	100
TOWNHOUSE, MAISONETTE (6 STOREY OR LESS)	135
APARTMENT (OVER 6 STORIES HIGH)	285
LIGHT COMMERCIAL AREAS	90
COMMUNITY SERVICES	40
LIGHT INDUSTRIAL AREAS	125
HOSPITALS	4 PERSONS/BED





KEY PLAN N.T.S.

GEODETIC BM ELEV. = 100.718m
ELEVATIONS ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK NO. 0011922u2445.

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

LEGEND

- EX. SANITARY SEWER/MANHOLE
- MH.12345 — REGION OF HALTON WASTEWATER MANHOLE No.
- CATCHMENT AREAS
- 11 / 0.56 / 90 — SUB-CATCHMENT NUMBER; AREA (ha.); POPULATION PER HECTARE (ppha)
- 2 / 0.97 / OBC — SUB-CATCHMENT NUMBER; AREA (ha.); POPULATION CALCULATED PER OBC (SEE APPENDIX B FOR CALCULATIONS)

No.	REVISION	BY	YYYY-MM-DD
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	ISSUED FOR SPA	GPB	2021-04-26

MTE
Engineers, Scientists, Surveyors
905-639-2552

NOT FOR CONSTRUCTION

CLIENT
ADI DEVELOPMENT (MASONRY INC)
1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT
101 MASONRY COURT
FOUR MULTI-STOREY BUILDING
101 MASONRY COURT BURLINGTON, ON

DRAWING
EXISTING CONDITIONS CATCHMENT - AREA SERVICING PLAN

Project Manager: G. BERENYI	Project No.: 48247-100
Design By: EXK	Checked By: GPB
Drawn By: LXQ/DXC	Checked By: GPB
Surveyed By: OTHERS	Drawing No.: SA-EX
Date: Apr.19/21	
Scale: 1:1000	Sheet 1 of 4

May 27, 2021 - 3:43:46 PM - Plotted By: Dejana Curcic

Station West- Phase 2 - Existing conditions
CITY OF BURLINGTON

Project No. 48247-100
Date: June 9, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

DESIGN PARAMETERS

Design Flow
Design flow factor 275 L/c/d
Infiltration Factor: 0.286 L/s/ha
Mannings n: 0.015 dia < 600mm
0.013 dia ≥ 600mm
Min Velocity: 0.6 m/s
Max Velocoty: 3 m/s

Peaking Factor
Harmon Formula

$$M = K_{wf} \times \left(1 + \frac{14}{4 + \sqrt{P + P_r}}\right)$$

$$K_{wf} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.40					453	0.7	4.00	1.44	5.8	6.4	250	PVC	0.69%	43.48	0.8755	0.6270	15%	
2	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY)	EX. MH3A	0.00	0.00		285.00		0	0	0.00	4.50	0.00	0.0	0.0	200	PVC	1.00%	28.87	0.9083	0.0000	0%	
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	3.12					758	0.9	3.87	2.41	9.3	10.2	300	PVC	1.04%	84.98	1.2074	0.8142	12%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. EX. MH1A		3.12					758	0.9	3.87	2.41	9.3	10.2	300	PVC	1.04%	84.98	1.2074	0.8142	12%	

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: June 9, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{res} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{res} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	0.71		125.00		89	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
	Masonry Ct.	EX. MH 1403	EX. MH1A		0.71				0	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
12	Cooke Blvd.	EX. MH1A	EX. MH 3A	1.15	1.86		125.00		144	233	0.5	4.12	0.74	3.1	3.6	300	PVC	0.50%	58.92	0.8372	0.4616	6%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		4.98		125.00		0	990.8	1.4	3.80	3.15	12.0	13.4	300	PVC	4.20%	170.78	2.4264	1.4427	8%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.42	6.40		125.00		178	1168.8	1.8	3.76	3.72	14.0	15.8	300	PVC	0.38%	51.37	0.7298	0.6422	31%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	7.52		125.00		140	1308.8	2.2	3.72	4.17	15.5	17.7	300	PVC	0.39%	52.04	0.7394	0.6682	34%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		7.52				0	1308.8	2.2	3.72	4.17	15.5	17.7	300	PVC	0.40%	52.70	0.7488	0.6744	33%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.72	1.72		51.00		88	88	0.5	4.26	0.28	1.2	1.7	200	PVC	1.70%	37.64	1.1843	0.5956	4%	
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	197	1.1	4.15	0.63	2.6	3.7	200	PVC	2.00%	40.82	1.2845	0.7948	9%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	244	1.3	4.12	0.78	3.2	4.5	200	PVC	0.50%	20.41	0.6423	0.5149	22%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	295	1.5	4.08	0.94	3.8	5.3	250	PVC	0.43%	34.32	0.6912	0.5005	15%	
15	Plains Road	EX. MH 13327	EX. MH 13319	0.91	6.00		125.00		114	409	1.7	4.02	1.30	5.2	6.9	250	PVC	0.43%	34.32	0.6912	0.5412	20%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	13.90		90.00		35	1752.8	4.0	3.63	5.58	20.2	24.2	250	PVC	0.46%	35.50	0.7149	0.7691	68%	
	Plains Road	EX. MH 13317	EX. MH 13314		13.90					1752.8	4.0	3.63	5.58	20.2	24.2	250	PVC	0.76%	45.63	0.9189	0.9324	53%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.68	14.58		90.00		62	1814.8	4.2	3.62	5.78	20.9	25.1	250	PVC	0.47%	35.89	0.7226	0.7814	70%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		14.58					1814.8	4.2	3.62	5.78	20.9	25.1	675	PVC	0.70%	687.89	1.9545	0.9243	4%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		14.58					1814.8	4.2	3.62	5.78	20.9	25.1	675	PVC	0.260%	419.23	1.1912	0.6530	6%	

Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)

Station West- Phase 2 - Pumping at Previously Approved during Phase 1

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{ex} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{ex} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL							DESIGN													
																Proposed Sewer Design								
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.40					453	0.7	4.00	1.44	5.8	6.4	250	PVC	0.69%	43.48	0.8755	0.6270	15%	
2	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY)	EX. MH3A	0.95	0.95		285.00		271	271	0.27	4.10	0.86	3.5	3.8	200	PVC	1.00%	28.87	0.9083	0.6288	13%	
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. EX. MH1A		4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{ex} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{ex} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

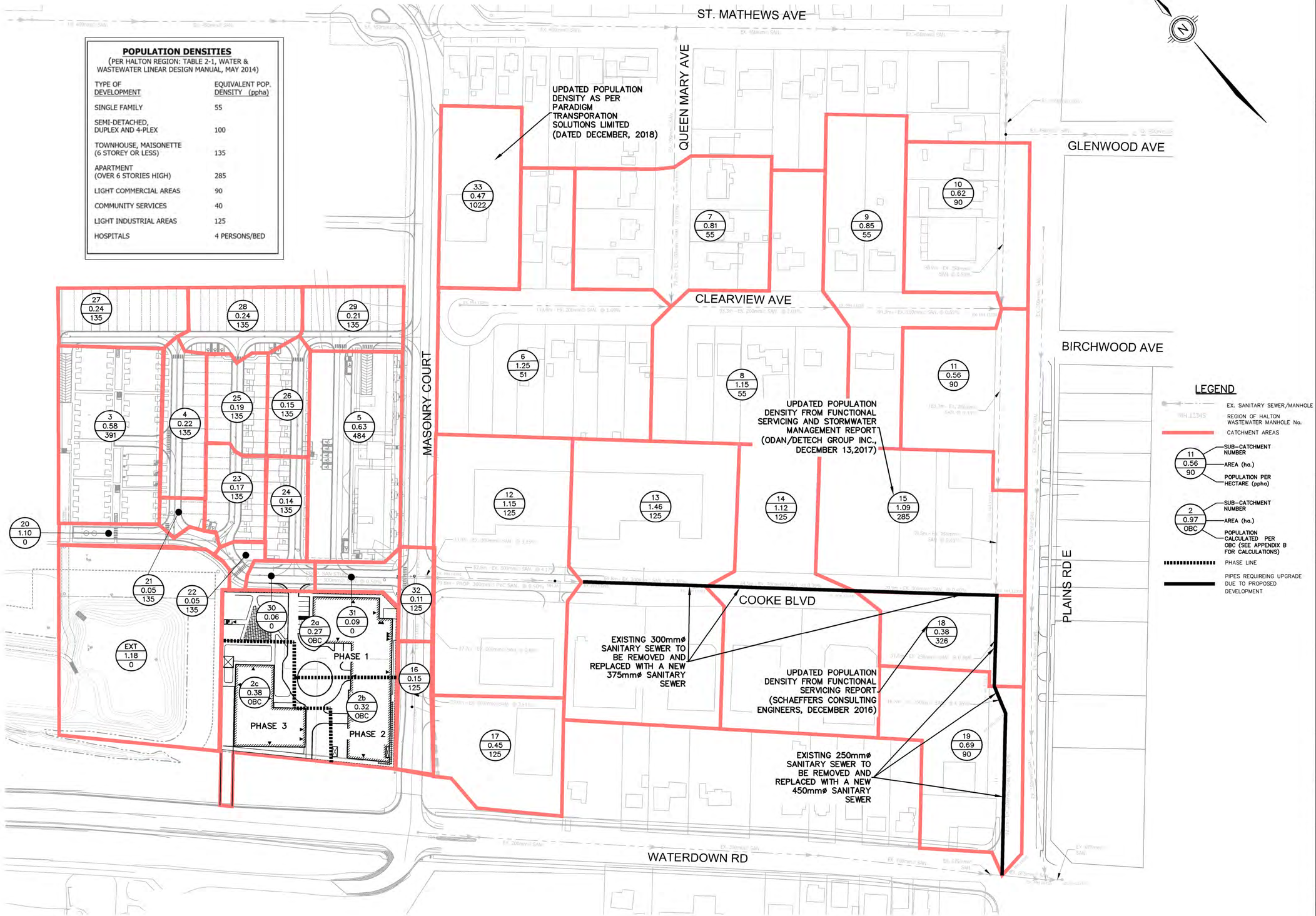
Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
																Proposed Sewer Design					Actual	%	
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Velocity m/s	Pipe Full	Remarks
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	0.71		125.00		89	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
	Masonry Ct.	EX. MH 1403	EX. MH1A		0.71				0	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
12	Cooke Blvd.	EX. MH1A	EX. MH 3A	1.15	1.86		125.00		144	233	0.5	4.12	0.74	3.1	3.6	300	PVC	0.50%	58.92	0.8372	0.4616	6%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.93		125.00		0	1261.6	1.7	3.73	4.02	15.0	16.7	300	PVC	4.20%	170.78	2.4264	1.5386	10%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.42	7.35		125.00		178	1439.6	2.1	3.69	4.58	16.9	19.0	300	PVC	0.38%	51.37	0.7298	0.6751	37%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.47		125.00		140	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.39%	52.04	0.7394	0.6982	40%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.47				0	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.40%	52.70	0.7488	0.7047	40%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.72	1.72		51.00		88	88	0.5	4.26	0.28	1.2	1.7	200	PVC	1.70%	37.64	1.1843	0.5956	4%	
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	197	1.1	4.15	0.63	2.6	3.7	200	PVC	2.00%	40.82	1.2845	0.7948	9%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	244	1.3	4.12	0.78	3.2	4.5	200	PVC	0.50%	20.41	0.6423	0.5149	22%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	295	1.5	4.08	0.94	3.8	5.3	250	PVC	0.43%	34.32	0.6912	0.5005	15%	
15	Plains Road	EX. MH 13327	EX. MH 13319	0.91	6.00		125.00		114	409	1.7	4.02	1.30	5.2	6.9	250	PVC	0.43%	34.32	0.6912	0.5412	20%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	14.85		90.00		35	2023.5	4.2	3.58	6.44	23.1	27.3	250	PVC	0.46%	35.50	0.7149	0.7884	77%	
	Plains Road	EX. MH 13317	EX. MH 13314		14.85					2023.5	4.2	3.58	6.44	23.1	27.3	250	PVC	0.76%	45.63	0.9189	0.9598	60%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.68	15.53		90.00		62	2085.5	4.4	3.57	6.64	23.7	28.1	250	PVC	0.47%	35.89	0.7226	0.7998	78%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.53					2085.5	4.4	3.57	6.64	23.7	28.1	675	PVC	0.70%	687.89	1.9545	0.9559	4%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.53					2085.5	4.4	3.57	6.64	23.7	28.1	675	PVC	0.260%	419.23	1.1912	0.6774	7%	
		Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)																					

MTE FILE PATH: P:\P\48247\100\48247-100-SA1

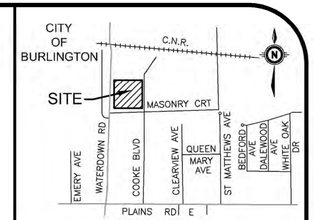
POPULATION DENSITIES
(PER HALTON REGION: TABLE 2-1, WATER & WASTEWATER LINEAR DESIGN MANUAL, MAY 2014)

TYPE OF DEVELOPMENT	EQUIVALENT POP. DENSITY (ppha)
SINGLE FAMILY	55
SEMI-DETACHED, DUPLEX AND 4-PLEX	100
TOWNHOUSE, MAISONETTE (6 STOREY OR LESS)	135
APARTMENT (OVER 6 STORIES HIGH)	285
LIGHT COMMERCIAL AREAS	90
COMMUNITY SERVICES	40
LIGHT INDUSTRIAL AREAS	125
HOSPITALS	4 PERSONS/BED



LEGEND

- EX. SANITARY SEWER/MANHOLE
- REGION OF HALTON WASTEWATER MANHOLE No.
- CATCHMENT AREAS
- SUB-CATCHMENT NUMBER / AREA (ha.) / POPULATION PER HECTARE (ppha)
- SUB-CATCHMENT NUMBER / AREA (ha.) / POPULATION CALCULATED PER OBC (SEE APPENDIX B FOR CALCULATIONS)
- PHASE LINE
- PIPES REQUIREING UPGRADE DUE TO PROPOSED DEVELOPMENT



KEY PLAN N.T.S.

GEODETIC BM ELEV. = 100.718m
ELEVATIONS ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK NO. 0011922u2445.

SITE BENCHMARK ELEV. = m

NOTE TO CONTRACTOR :

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

No.	REVISION	BY	YYYY-MM-DD
1.	ISSUED FOR ZBA	GPB	2021-07-21
2.			
3.			
4.			
5.			
6.			
7.			
8.			

MTE
Engineers, Scientists, Surveyors
905-639-2552

NOT FOR CONSTRUCTION

CLIENT
ADI DEVELOPMENT (MASONRY INC)
1100 BURLOAK DR SUITE 700 BURLINGTON, ON

PROJECT
101 COOKE BLVD
THREE MULTI-STOREY BUILDING
101 MASONRY COURT BURLINGTON, ON

DRAWING
EXTERNAL SANITARY SEWER CATCHMENT - AREA SERVICING PLAN

Project Manager G. BERENYI	Project No. 48247-100
Design By EXK	Checked By GPB
Drawn By LXQ/DXC	Checked By GPB
Surveyed By OTHERS	Drawing No. SA1
Date Apr.19/21	
Scale 1:1000	Sheet 2 of 4

July 21, 2021 - 5:11:29 PM - Plotted By: Alla X. Gulkin

Station West- Phase 2 - Existing conditions with Approved Developments

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275 L/c/d
Infiltration Factor:	0.286 L/s/ha
Mannings n:	0.015 dia < 600mm
	0.013 dia ≥ 600mm
Min Velocity:	0.6 m/s
Max Velocoty:	3 m/s

Peaking Factor

Harmon Formula

$$M = K_{ext} \times \left(1 + \frac{14}{4 + \sqrt{P + P_r}}\right)$$

$$K_{ext} = \frac{A_R + 0.80 \times (A_I + A_{IC})}{A_R + A_I + A_{IC}}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.40					453	0.7	4.00	1.44	5.8	6.4	250	PVC	0.69%	43.48	0.8755	0.6270	15%	
2	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY)	EX. MH3A	0.95	0.95		285.00		271	271	0.27	4.10	0.86	3.5	3.8	200	PVC	1.00%	28.87	0.9083	0.6288	13%	Approved as per Phase 1 of the development
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. EX. MH1A		4.07					1029	1.2	3.79	3.27	12.4	13.6	300	PVC	1.04%	84.98	1.2074	0.8838	16%	

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: July 6, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{av} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{av} = \frac{A_R + 0.80 \times (A_I + A_C)}{A_R + A_I + A_C}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL							DESIGN												
Area No.	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	0.71		125.00		89	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
	Masonry Ct.	EX. MH 1403	EX. MH1A		0.71				0	89	0.2	4.26	0.28	1.2	1.4	300	PVC	3.80%	162.44	2.3079	0.6975	1%	
12	Cooke Blvd.	EX. MH1A	EX. MH 3A	1.15	1.86		125.00		144	233	0.5	4.12	0.74	3.1	3.6	300	PVC	0.50%	58.92	0.8372	0.4616	6%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.93		125.00		0	1261.6	1.7	3.73	4.02	15.0	16.7	300	PVC	4.20%	170.78	2.4264	1.5386	10%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.42	7.35		125.00		178	1439.6	2.1	3.69	4.58	16.9	19.0	300	PVC	0.38%	51.37	0.7298	0.6751	37%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.47		125.00		140	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.39%	52.04	0.7394	0.6982	40%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.47				0	1579.6	2.4	3.66	5.03	18.4	20.8	300	PVC	0.40%	52.70	0.7488	0.7047	40%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.25	1.25		51.00		64	64	0.4	4.29	0.20	0.9	1.2	200	PVC	1.70%	37.64	1.1843	0.5433	3%	
33	Clearview Ave.	EX. MH. 13299	EX. MH 13316	0.47	0.47		1022		481	481	0.1	3.98	1.53	6.1	6.2	200	PVC	1.70%	37.64	1.1843	0.8762	17%	160 units proposed. Assumed 3 persons per unit.
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	654	1.1	3.91	2.08	8.1	9.2	200	PVC	2.00%	40.82	1.2845	1.0368	23%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	701	1.3	3.89	2.23	8.7	10.0	200	PVC	0.50%	20.41	0.6423	0.6386	49%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	752	1.5	3.88	2.39	9.3	10.7	250	PVC	0.43%	34.32	0.6912	0.6108	31%	
15	Plains Road	EX. MH 13327	EX. MH 13319	1.09	6.18		285.00		311	1063	1.8	3.78	3.38	12.8	14.6	250	PVC	0.43%	34.32	0.6912	0.6627	42%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	15.03		326.00		124	2766.6	4.3	3.47	8.81	30.6	34.9	250	PVC	0.46%	35.50	0.7149	0.8148	98%	
	Plains Road	EX. MH 13317	EX. MH 13314		15.03					2766.6	4.3	3.47	8.81	30.6	34.9	250	PVC	0.76%	45.63	0.9189	1.0120	76%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.68	15.71		90.00		62	2828.6	4.5	3.46	9.00	31.2	35.7	250	PVC	0.47%	35.89	0.7226	0.8236	99%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.71					2828.6	4.5	3.46	9.00	31.2	35.7	675	PVC	0.70%	687.89	1.9545	1.0280	5%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.71					2828.6	4.5	3.46	9.00	31.2	35.7	675	PVC	0.260%	419.23	1.1912	0.7260	9%	
		Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)											Updated per current development projects underway as found on City of Burlington website and by BA Group's research for traffic impacts in the area.										

Station West- Phase 2 - Proposed Phase 2 Demands- No pipe upgrades

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{pf} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{pf} = \frac{A_p + 0.80 \times (A_i + A_c)}{A_p + A_i + A_c}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN													
																Proposed Sewer Design								
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
2C	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 3	EX. MH 4A	0.38	0.38				1242	1242	0.1	3.74	3.95	14.8	14.9	200	PVC	2.00%	40.82	1.2845	1.1832	36%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.78					1695	0.8	3.64	5.39	19.6	20.4	250	PVC	0.69%	43.48	0.8755	0.8618	47%	
2A	Masonry Ct.	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 1	EX. MH 14204	0.27	0.27				921	921	0.08	3.82	2.93	11.2	11.3	200	PVC	2.00%	40.82	1.2845	1.0974	28%	
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. MH1A		3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
2B	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 2	EX. MH3A	0.32	0.32				1189	1199	0.1	3.75	3.82	14.3	14.4	200	PVC	2.00%	40.82	1.2845	1.1726	35%	Population increased to account for commercial area. Refer to SAN calculations for detailed demand calculations.

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{ex} \times \left(1 + \frac{14}{4 + \sqrt{P + P_i}}\right)$$

$$K_{ex} = \frac{A_r + 0.80 \times (A_i + A_c)}{A_r + A_i + A_c}$$

Max Peaking factor 5
Min Peaking Factor 2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN												
																Proposed Sewer Design							
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	1.03		125.00		89	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
	Masonry Ct.	EX. MH 1403	EX. MH 14202		1.03				0	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
12	Cooke Blvd.	EX. MH 14202	EX. MH 3A	1.15	2.18		125.00		144	1432	0.6	3.69	4.56	16.8	17.5	300	PVC	0.50%	58.92	0.8372	0.7292	30%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.95		125.00		0	4352.8	1.7	3.30	13.85	45.7	47.4	300	PVC	4.20%	170.78	2.4264	2.0755	28%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.46	7.41		125.00		183	4535.8	2.1	3.28	14.44	47.4	49.5	300	PVC	0.38%	51.37	0.7298	0.8312	96%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.53		125.00		140	4675.8	2.4	3.27	14.88	48.7	51.1	300	PVC	0.39%	52.04	0.7394	0.8427	98%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.53				0	4675.8	2.4	3.27	14.88	48.7	51.1	300	PVC	0.40%	52.70	0.7488	0.8531	97%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.25	1.25		51.00		64	64	0.4	4.29	0.20	0.9	1.2	200	PVC	1.70%	37.64	1.1843	0.5433	3%	
33	Clearview Ave.	EX. MH. 13299	EX. MH 13316	0.47	0.47		1022		481	481	0.1	3.98	1.53	6.1	6.2	200	PVC	1.70%	37.64	1.1843	0.8762	17%	160 units proposed. Assumed 3 persons per unit.
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	654	1.1	3.91	2.08	8.1	9.2	200	PVC	2.00%	40.82	1.2845	1.0368	23%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	701	1.3	3.89	2.23	8.7	10.0	200	PVC	0.50%	20.41	0.6423	0.6386	49%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	752	1.5	3.88	2.39	9.3	10.7	250	PVC	0.43%	34.32	0.6912	0.6108	31%	
15	Plains Road	EX. MH 13327	EX. MH 13319	1.09	6.18		285.00		311	1063	1.8	3.78	3.38	12.8	14.6	250	PVC	0.43%	34.32	0.6912	0.6627	42%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	15.09		326.00		124	5862.8	4.3	3.18	18.66	59.3	63.7	250	PVC	0.46%	35.50	0.7149	ERROR!	179%	
	Plains Road	EX. MH 13317	EX. MH 13314		15.09					5862.8	4.3	3.18	18.66	59.3	63.7	250	PVC	0.76%	45.63	0.9189	ERROR!	140%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.69	15.78		90.00		63	5925.8	4.5	3.18	18.86	59.9	64.4	250	PVC	0.47%	35.89	0.7226	ERROR!	179%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.70%	687.89	1.9545	1.2245	9%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.260%	419.23	1.1912	0.8619	15%	
		Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)											Updated per current development projects underway as found on City of Burlington website and by BA Group's research for traffic impacts in the area.										

Station West- Phase 2 - Proposed Phase 2 Demands- Upgrading d/s Pipes

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
Checked By: GPB
File: Q:\48247\100\SAN\48247-100 Sanitary Sewer Design Sheet.xls

DESIGN PARAMETERS

Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{pf} \times \left(1 + \frac{14}{4 + \sqrt{P + P_c}}\right)$$

$$K_{pf} = \frac{A_p + 0.80 \times (A_i + A_c)}{A_p + A_i + A_c}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN													
																Proposed Sewer Design								
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s	Actual Velocity m/s	% Pipe Full	Remarks
27	Private Site	EX. MH 10A	EX. MH 9A	0.24	0.24		135.00		33	33	0.1	4.35	0.11	0.5	0.5	200	PVC	0.50%	20.41	0.6423	0.2728	3%	
24	Private Site	EX. MH 14A	EX. MH 13A	0.14	0.14		135.00		19	19	0.0	4.38	0.06	0.3	0.3	200	PVC	0.50%	20.41	0.6423	0.2307	1%	
26	Private Site	EX. MH 13A	EX. MH 11A	0.15	0.29		135.00		20	39	0.1	4.34	0.12	0.5	0.6	200	PVC	0.50%	20.41	0.6423	0.2875	3%	
29	Private Site	EX. MH 12A	EX. MH 11A	0.21	0.21		135.00		29	29	0.1	4.36	0.09	0.4	0.5	200	PVC	0.50%	20.41	0.6423	0.2632	2%	
28	Private Site	EX. MH 11A	EX. MH 9A	0.24	0.74		135.00		32	100	0.2	4.24	0.32	1.3	1.6	200	PVC	0.50%	20.41	0.6423	0.3816	8%	
4	Private Site	EX. MH 9A	EX. MH 8A	0.22	1.20		135.00		30	163	0.3	4.18	0.52	2.2	2.5	200	PVC	0.50%	20.41	0.6423	0.4357	12%	
3	Private Site	EX. SAN STUB 2 (PH1 STACKED)	EX. MH 8A	0.58	0.58	140.00		2	227	227	0.2	4.13	0.72	3.0	3.1	200	PVC	1.00%	28.87	0.9083	0.5953	11%	
21	Private Site	EX. MH 8A	EX. MH 7A	0.05	1.83		135.00		7	397	0.5	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5477	27%	
20	Private Site	EX. MH 7A	EX. MH 6A	0.10	1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
	Private Site	EX. MH 6A	EX. MH 5A		1.93					397	0.6	4.02	1.26	5.1	5.6	200	PVC	0.50%	20.41	0.6423	0.5485	28%	
25	Private Site	EX. MH 17A	EX. MH16A	0.19	0.19		135.00		26	26	0.1	4.36	0.08	0.4	0.4	200	PVC	0.50%	20.41	0.6423	0.2553	2%	
23	Private Site	EX. MH 16A	EX. MH 15A	0.17	0.36		135.00		23	49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
	Cooke Blvd. (New ROW)	EX. MH 15A	EX. MH 5A		0.36					49	0.1	4.32	0.16	0.7	0.8	200	PVC	0.50%	20.41	0.6423	0.3074	4%	
22	Cooke Blvd. (New ROW)	EX. MH 5A	EX. MH 4A	0.05	2.34		135.00		7	453	0.7	4.00	1.44	5.8	6.4	200	PVC	0.57%	21.79	0.6858	0.5966	29%	
2C	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 3	EX. MH 4A	0.38	0.38				1242	1242	0.1	3.74	3.95	14.8	14.9	200	PVC	2.00%	40.82	1.2845	1.1832	36%	
30	Cooke Blvd. (New ROW)	EX. MH 4A	EX. MH 3A	0.06	2.78					1695	0.8	3.64	5.39	19.6	20.4	250	PVC	0.69%	43.48	0.8755	0.8618	47%	
2A	Masonry Ct.	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 1	EX. MH 14204	0.27	0.27				921	921	0.08	3.82	2.93	11.2	11.3	200	PVC	2.00%	40.82	1.2845	1.0974	28%	Population increased to account for commercial area. Refer to SAN calculations for detailed demand calculations.
5	Cooke Blvd. (New ROW)	EX. SAN C -MH 1 (PH1- MID RISE)	EX. MH 3A	0.63	0.63	188.00		1.62	305	305	0.2	4.08	0.97	4.0	4.1	200	PVC	1.56%	36.05	1.1345	0.7546	11%	
31	Cooke Blvd. (New ROW)	EX. MH 3A	EX. SAN STUB 4	0.09	3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
	Cooke Blvd. (New ROW)	EX. SAN STUB 4	EX. MH1A		3.77					2921	1.1	3.45	9.30	32.1	33.2	300	PVC	1.04%	84.98	1.2074	1.1325	39%	
2B	Cooke Blvd. (New ROW)	SAN STUB 3 (PH2- HIGH DENSITY) - PHASE 2	EX. MH3A	0.32	0.32				1189	1199	0.1	3.75	3.82	14.3	14.4	200	PVC	2.00%	40.82	1.2845	1.1726	35%	Population increased to account for commercial area. Refer to SAN calculations for detailed demand calculations.

CITY OF BURLINGTON

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

Project No. 48247-100
Date: August 12, 2021
Designed By: EXK
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Design Flow

Design flow factor	275	L/c/d
Infiltration Factor:	0.286	L/s/ha
Mannings n:	0.015	dia < 600mm
	0.013	dia ≥ 600mm
Min Velocity:	0.6	m/s
Max Velocoty:	3	m/s

Peaking Factor

Harmon Formula

$$M = K_{adj} \times \left(1 + \frac{14}{4 + \sqrt{P + P_i}}\right)$$

$$K_{adj} = \frac{A_r + 0.80 \times (A_i + A_c)}{A_r + A_i + A_c}$$

Max Peaking factor	5
Min Peaking Factor	2

LOCATION				RESIDENTIAL / COMMERCIAL							DESIGN												
Area No. (Reg. drawing SA1)	Street Name	From MH	To MH	Incremental Area [ha]	Cumulative Area [ha]	Units (#)	Density (P/ha)	Density (P/ unit)	Population	Accum. Res. Population	Infil-tration l/s	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Total Flow l/s	Proposed Sewer Design					Actual Velocity m/s	% Pipe Full	Remarks
																Diameter [mm]	Material n=0.015	Grade %	Capacity l/s	Velocity m/s			
16, 17, 32	Masonry Ct.	EX. MH 1404	EX. MH 14203	0.71	1.03		125.00		89	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
	Masonry Ct.	EX. MH 1403	EX. MH 14202		1.03				0	1288	0.3	3.73	4.10	15.3	15.6	300	PVC	3.80%	162.44	2.3079	1.4556	10%	
12	Cooke Blvd.	EX. MH 14202	EX. MH 3A	1.15	2.18		125.00		144	1432	0.6	3.69	4.56	16.8	17.5	300	PVC	0.50%	58.92	0.8372	0.7292	30%	
	Cooke Blvd.	EX. MH 3A	EX. MH 13295		5.95		125.00		0	4352.8	1.7	3.30	13.85	45.7	47.4	300	PVC	4.20%	170.78	2.4264	2.0755	28%	
13	Cooke Blvd.	EX. MH 13295	EX. MH 13301	1.46	7.41		125.00		183	4535.8	2.1	3.28	14.44	47.4	49.5	**375**	PVC	0.38%	88.06	0.8351	0.8594	56%	
14	Cooke Blvd.	EX. MH 13301	EX. MH 13310	1.12	8.53		125.00		140	4675.8	2.4	3.27	14.88	48.7	51.1	**375**	PVC	0.39%	89.21	0.8460	0.8746	57%	
	Cooke Blvd.	EX. MH 13310	EX. MH 13319		8.53				0	4675.8	2.4	3.27	14.88	48.7	51.1	**375**	PVC	0.40%	90.35	0.8568	0.8831	57%	
6	Clearview Ave.	EX. MH. 13299	EX. MH 13316	1.25	1.25		51.00		64	64	0.4	4.29	0.20	0.9	1.2	200	PVC	1.70%	37.64	1.1843	0.5433	3%	
33	Clearview Ave.	EX. MH. 13299	EX. MH 13316	0.47	0.47		1022		481	481	0.1	3.98	1.53	6.1	6.2	200	PVC	1.70%	37.64	1.1843	0.8762	17%	160 units proposed. Assumed 3 persons per unit.
7	Queen Mary Ave.	EX. MH 13322	EX. MH 13316	0.81	0.81		55.00		45	45	0.2	4.32	0.14	0.6	0.9	200	PVC	0.70%	24.15	0.7599	0.3561	4%	
8	Clearview Ave.	EX. MH 13316	EX. MH 13326	1.15	3.68		55.00		64	654	1.1	3.91	2.08	8.1	9.2	200	PVC	2.00%	40.82	1.2845	1.0368	23%	
9	Clearview Ave.	EX. MH 13326	EX. MH 13339	0.85	4.53		55.00		47	701	1.3	3.89	2.23	8.7	10.0	200	PVC	0.50%	20.41	0.6423	0.6386	49%	
10				0.62			90.00		56														
11	Plains Road	EX. MH 13339	EX. MH 13327	0.56	5.09		90.00		51	752	1.5	3.88	2.39	9.3	10.7	250	PVC	0.43%	34.32	0.6912	0.6108	31%	
15	Plains Road	EX. MH 13327	EX. MH 13319	1.09	6.18		285.00		311	1063	1.8	3.78	3.38	12.8	14.6	250	PVC	0.43%	34.32	0.6912	0.6627	42%	
18	Plains Road	EX. MH 13319	EX. MH 13317	0.38	15.09		326.00		124	5862.8	4.3	3.18	18.66	59.3	63.7	**450**	PVC	0.46%	165.48	1.0504	0.9815	38%	
	Plains Road	EX. MH 13317	EX. MH 13314		15.09					5862.8	4.3	3.18	18.66	59.3	63.7	**450**	PVC	0.76%	212.70	1.3501	1.1794	30%	
19	Plains Road	EX. MH 13314	EX. MH 19205	0.69	15.78		90.00		63	5925.8	4.5	3.18	18.86	59.9	64.4	**450**	PVC	0.47%	167.27	1.0617	0.9924	39%	
	Waterdown Road	EX. MH 19205	EX. MH 19736		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.70%	687.89	1.9545	1.2245	9%	
	Waterdown Road	EX. MH 19736	EX. MH 19737		15.78					5925.8	4.5	3.18	18.86	59.9	64.4	675	PVC	0.260%	419.23	1.1912	0.8619	15%	

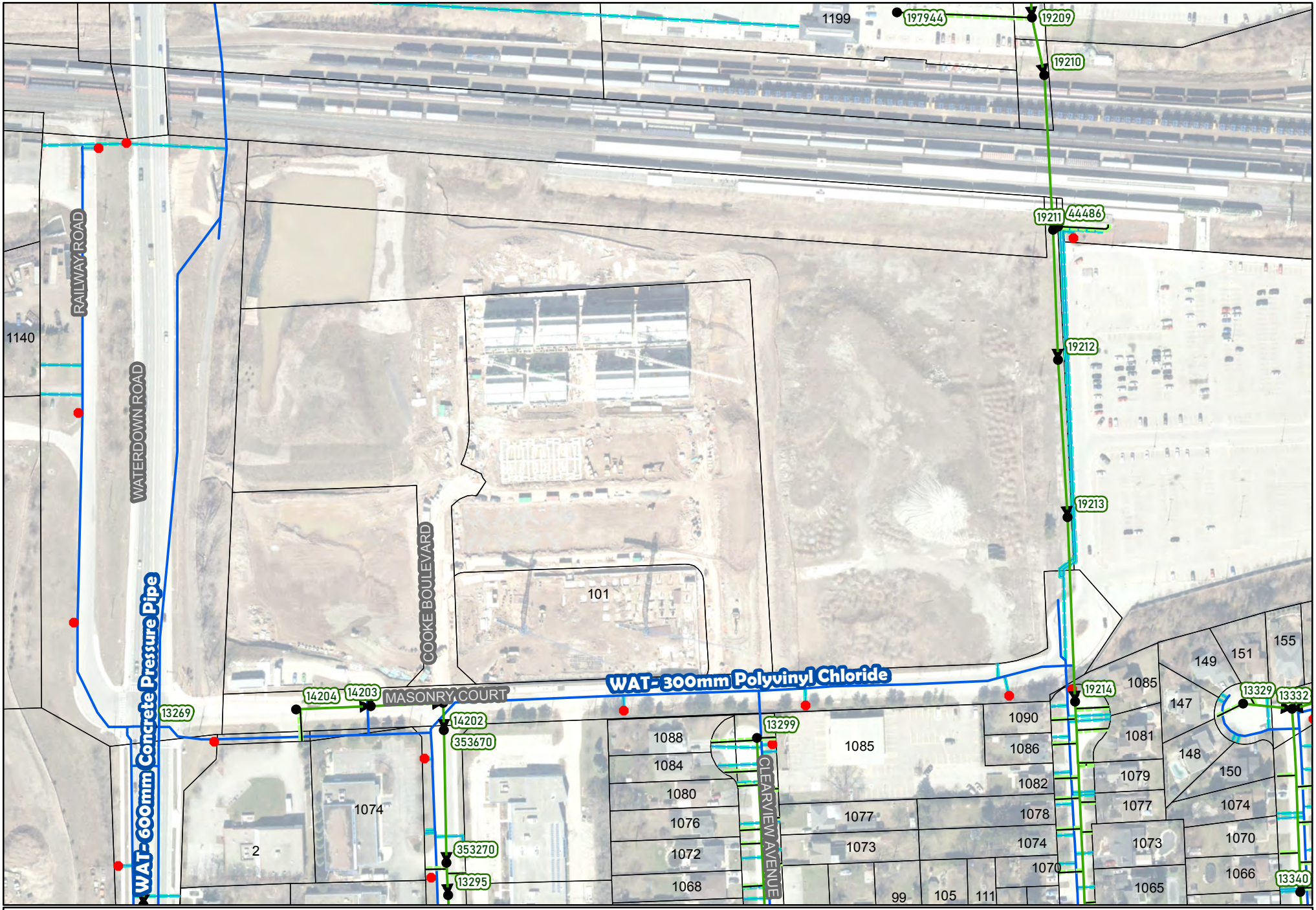
Indicates that the sewer requires replacement based off Halton Region Design Guidelines (sewers under 450mm diam. should be designed to no more than 60% full, and triggered for upsizing if it reaches 70% full)

Proposed Pipes to be upgraded part of this development

Updated per current development projects underway as found on City of Burlington website and by BA Group's research for traffic impacts in the area.

Appendix C

Water Demand Calculations & Analysis



Halton REGION

- MaintenanceHole
- Hydrant
- SewerMain
- Watermain
- ServiceLateral
- ServiceLead

0 25 50 Meters

REGIONAL MUNICIPALITY OF HALTON, ITS EMPLOYEES, OFFICERS AND AGENTS ARE NOT RESPONSIBLE FOR ANY ERRORS, OMISSIONS OR INACCURACIES, WHETHER DUE TO THEIR NEGLIGENCE OR OTHERWISE. ALL INFORMATION SHOULD BE VERIFIED

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2017 Orthophoto
Created: April 2020
Public Works Information

Station West
101 Masonry Court
MTE Project #: 48247-100
Date: June 2021

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Gross floor area in square metres

Adjustments to the calculated fire flow can be made based on occupancy, sprinkler protection and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

			(1)		(2)		(3)		(4)		**Final Adjusted**		
Phase	Area "A" [A]	C [B]	Fire Flow "F"		Occupancy		Sprinkler		Exposure		**Fire Flow**		
	(m^2)		(l/min)	(l/s)	%	Adjusted Fire Flow (L/min)	%	Adjustment (L/min)	%	Adjustment (L/min)	**(L/min)**	**Rounded(L/min)**	**(L/s)**
Phase 1 - Building B	6,933.71	0.6	11,000	183.3	-15	9,350	-40	-3,740	20	1,870	7,480	7,000	**117**
Phase 2- Building C	4,130.20	0.6	8,000	133.3	-15	6,800	-40	-2,720	25	1,700	5,780	6,000	**100**
Phase 3- Building A	5,024.60	0.6	9,000	150.0	-15	7,650	-40	-3,060	15	1,148	5,738	6,000	**100**
												Max required:	**117**

Note [A]: Area "A" represents the Gross Floor Area as indicated on the unit matrix.
Note [B]: Construction type confirmed by the Architect
Note: Fire wall between Building B and C

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

40% credit for adequately designed system per NFPA 13. Additional 10% if water supply standard for both the system and fire department hose lines.

(4) Exposure

0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
30.1 to 45m	5%	exceed 75%

Phase 1- Building B

N	> 45m	0
S	> 45m	0
E	28m	10
W	Fire wall	10
	TOTAL	20

Note: 10% exposure for fire wall.

Phase 2- Building C

N	16m	15
S	> 45m	0
E	Fire wall	10
W	> 45m	0
	TOTAL	25

Phase 3 - Building A

N	> 45m	0
S	16m	15
E	> 45m	0
W	> 45m	0
	TOTAL	15

Station West
101 Masonry Court
MTE Project #: 48247-100
Date: October 2021

Residential Peaking Factors[1]:		Commercial Peaking Factors[1]:	
Avg. Day	1.0	Avg. Day	1.0
Max. Day	2.25	Max. Day	2.25
Peak Hour	4.0	Peak Hour	2.25

Water Demand Calculations

	Residential				Commerical		Final Demand		
Location	Site Area (ha)	Population Density (ppha)	Population[3] (persons)	Demand (L/s)	Floor Area (ha)	Demand[3] (L/s)	Avg Day Demand Qavg (L/s)	Max Day Demand Qmax.day (L/s)	Peak Hour Demand Qpeak (L/s)
Designed Per Phase 1									
Entire Site	0.95	285	271	0.86			0.86	1.94	3.45
Total Designed for Phase 1	0.95		271	0.86			0.86	1.94	3.45
Proposed Phase 2									
Phase 1			905	2.880			2.880	6.480	11.520
Phase 2			1183	3.765			3.765	8.471	15.060
Phase 2- Commercial					0.0231	0.0066	0.0070	0.016	0.016
Phase 3			1211	3.854			3.854	8.672	15.416
Total	0.95		3299	10.500	0.0231	0.0066	**10.506**	**23.639**	**42.01**

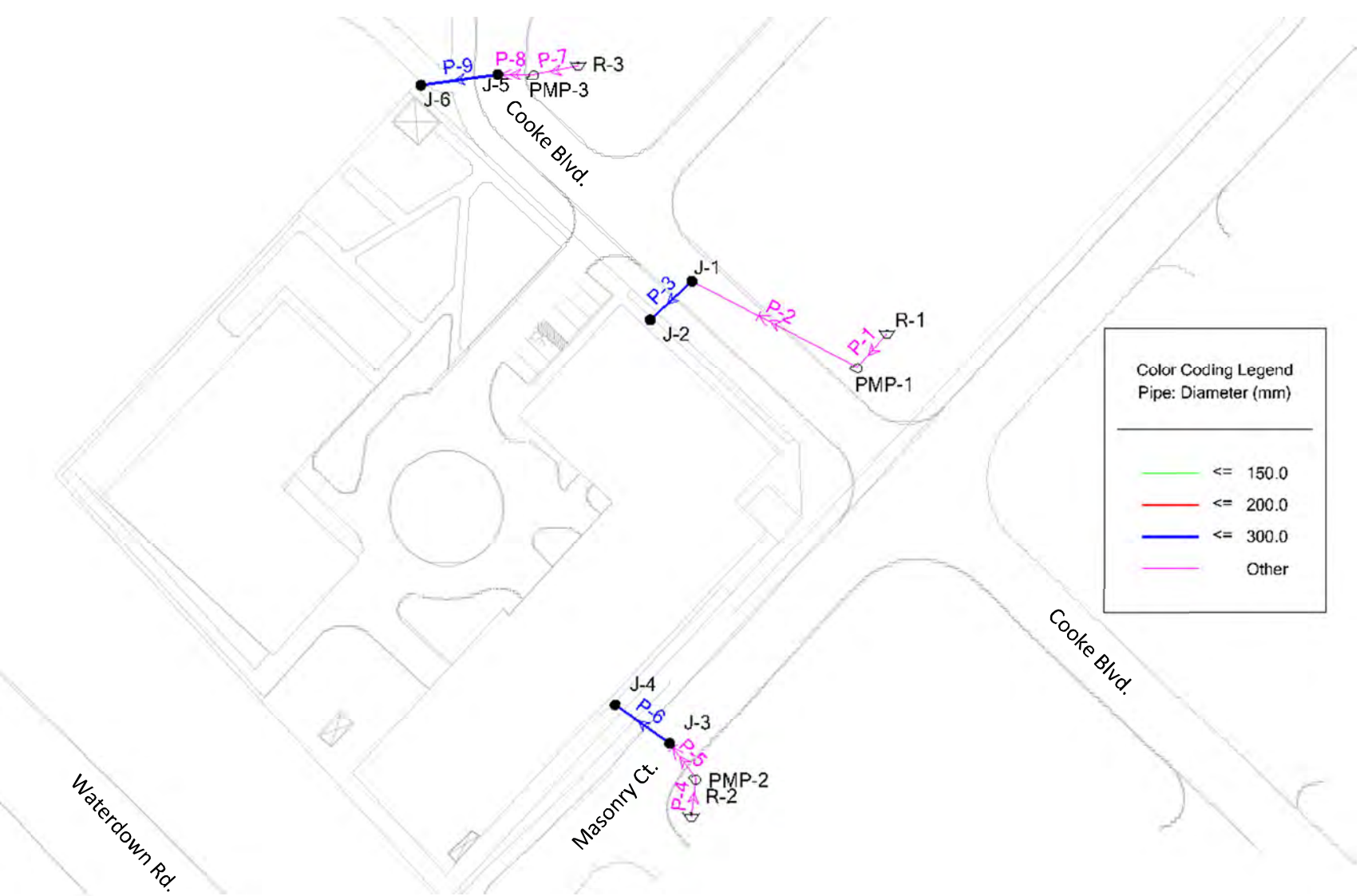
Water Demand[4]		
Average Residential Daily Demands	275	L/d/person
	0.0032	L/s/person
Average Commercial Daily Demands	24.75	m^3/d/ha
	0.29	L/s/ha

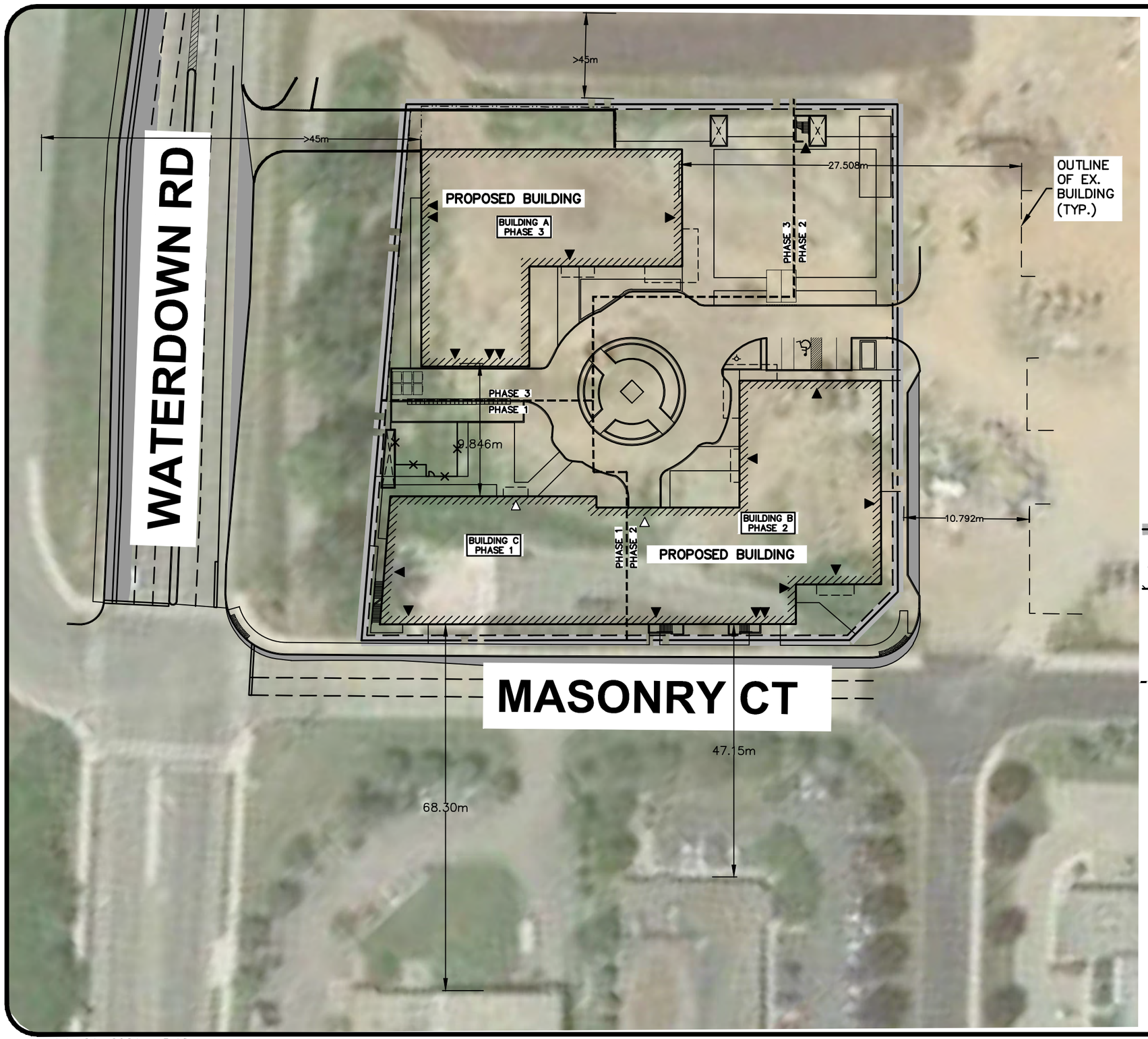
Fire Flow[5]		
Fire Flow- Phase 1	117	L/s
Fire Flow- Phase 2	100	L/s
Fire Flow- Phase 3	100	L/s

Max Day + Fire Flow Demand		
Qmax.day+fire- Phase 1	123.15	L/s
Qmax.day+fire- Phase 2	108.49	L/s
Qmax.day+fire- Phase 3	108.67	L/s

Note 1: Peaking factors based on Halton Region Design Guidelines
Note 2: Residential Population Density based on OBC 3.1.17.1.1(c)(i)
Note 3: Refer to Sanitary in Appendix B for population calcualtions.
Note 4: Water Demands based on Halton Region Design Guidelines
Note 5: Fire flows calculated using FUS (1999) guidelines - See attached worksheet, maximum fire flow demand of the three phases used

Water Distribution Network





N

LEGEND

- SITE BOUNDARY
- PROPOSED BUILDING
- BUILDING EXPOSURE DISTANCE (47.15m)
- PHASING LINE

Figure 2

Date: JUL.21/21
Scale: 1:750

BUILDING EXPOSURE LAYOUT FOR FIRE FLOW CALCULATIONS

MTE
Engineers, Scientists, Surveyors

Project No.: 48247-100

July 21, 2021 — 5:18 p.m. — Plotted By: AGutkin

P:\P\48247\100\48247-100-F3.dwg

Hydrant Flow Test Report

SITE NAME:

SITE ADDRESS / MUNICIPALITY: 101Masonry Court in Burlington, ON

TEST HYDRANT LOCATION : 1st Fire Hydrant Northwest off Masonry Court on Cooke Blvd

BASE HYDRANT LOCATION: 1st Fire Hydrant NorthEast off Masonry Court on Cooke Blvd

TEST BY: Luzia Wood

TEST DATE: June,07,2021

TEST TIME: 9:24am

TEST DATA

FLOW HYDRANT Pipe Diam. (in / mm)

	PITOT 1	PITOT 2
SIZE OPENING (inches):	2.5	2.5
COEFFICIENT (**note 1**):	0.90	0.90
PITOT READING (psi):	35	22 / 22
FLOW (usgpm):	**993**	**1574**

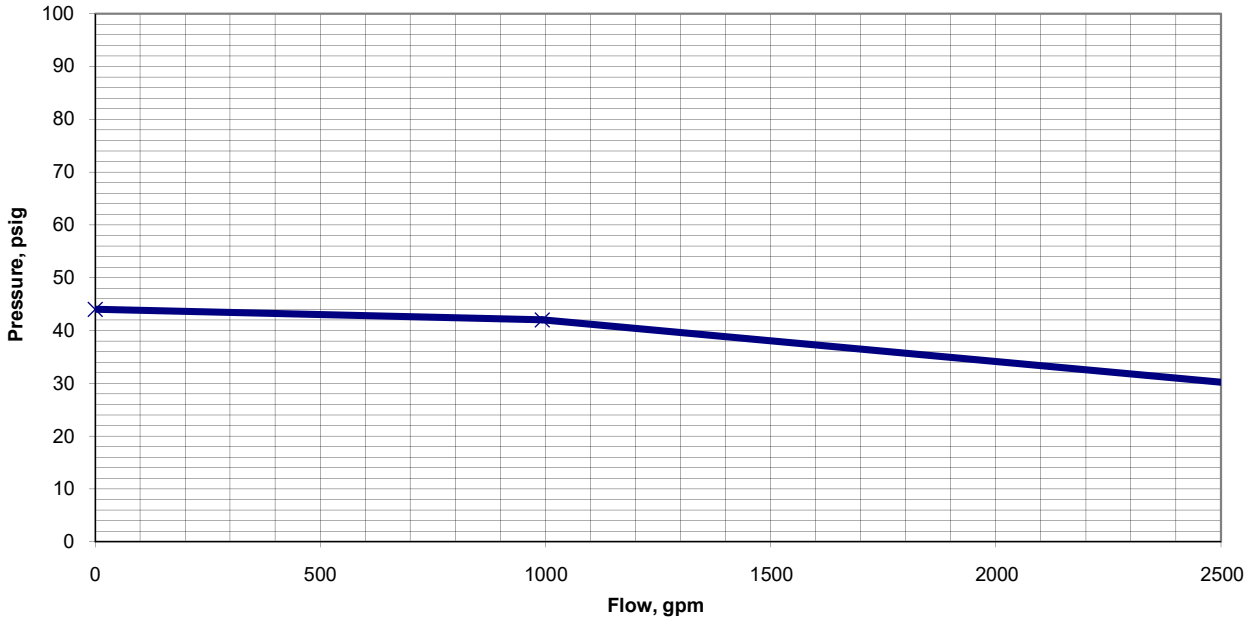
THEORETICAL FLOW @ 20 PSI 3798

BASE HYDRANT Pipe Diam. (in / mm)

STATIC READING (psi): 44 RESIDUAL 1 (psi): 42 RESIDUAL 2 (psi): 40

REMARKS: We had the Region Trun off the Pumps befor we started the 2 flow tests.

NOTE 1: Conversion factor of .90 used for flow calculation based on rounded and flush internal nozzle configuration. No appreciable difference in pipe invert between flow and base hydrants.



491 Port Maitland Rd

Hydrant Flow Test Report

SITE NAME:

SITE ADDRESS / MUNICIPALITY: 101Masonry Court in Burlington, ON

TEST HYDRANT LOCATION : Front of # 2 Masonry Court

BASE HYDRANT LOCATION: 1st Fire Hydrant East of Cooke Blvd on Masonry Court

TEST BY: Luzia Wood

TEST DATE: June,07,2021

TEST TIME: 8:57am

TEST DATA

FLOW HYDRANT — Pipe Diam. (in / mm): 300mm P.V.C.

	PITOT 1	PITOT 2
SIZE OPENING (inches):	2.5	2.5
COEFFICIENT (**note 1**):	0.90	0.90
PITOT READING (psi):	37	24 / 24
FLOW (usgpm):	**1021**	**1644**

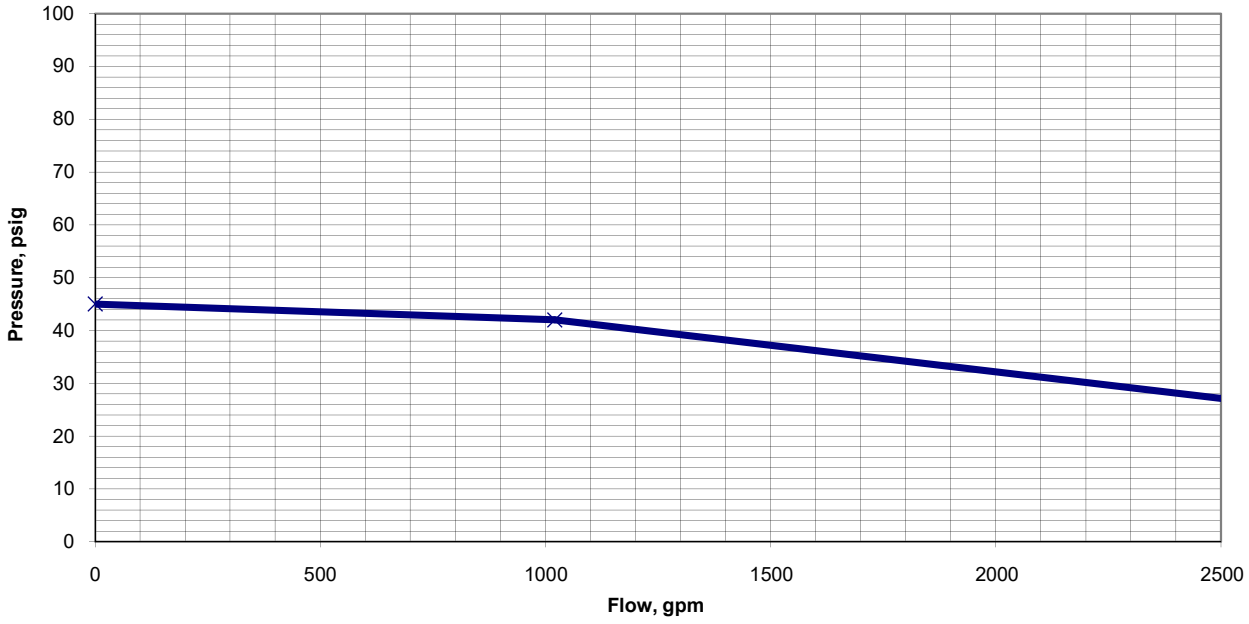
THEORETICAL FLOW @ 20 PSI 3207

BASE HYDRANT — Pipe Diam. (in / mm): 300mm, P.V.C.

STATIC READING (psi): 45 RESIDUAL 1 (psi): 42 RESIDUAL 2 (psi): 40

REMARKS: We had the Region Trun off the Pumps befor we started the 2 flow tests. Hydrants are on the Southsaide of Masonry Court.

NOTE 1: Conversion factor of .90 used for flow calculation based on rounded and flush internal nozzle configuration. No appreciable difference in pipe invert between flow and base hydrants.



491 Port Maitland Rd

Fire Flow Node FlexTable: Fire Flow

Active Scenario: Max Day + Fire Report

Label	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Available) (L/s)	Flow (Total Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Calculated Residual) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Velocity of Maximum Pipe (m/s)	Pipe w/ Maximum Velocity
J-1	2	True	200.00	117.00	200.00	189.38	187.40	0.27	P-2
J-2	2	True	150.00	108.53	158.53	237.30	243.68	2.24	P-3
J-3	6	True	195.92	117.00	195.92	141.28	140.00	0.26	P-5
J-4	5	True	193.57	123.60	200.17	139.99	147.77	2.83	P-6
J-5	2	True	200.00	117.00	200.00	188.89	185.74	0.27	P-8
J-6	2	True	150.00	108.89	158.89	235.21	243.38	2.25	P-9

Active Scenario: Average Day

FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	104.76	0.00	134.66	292.60
J-2	104.96	3.79	134.66	290.64
J-3	106.87	0.00	136.57	290.62
J-4	107.00	2.93	136.56	289.35
J-5	104.68	0.00	134.58	292.60
J-6	105.00	3.95	134.58	289.47

Active Scenario: Peak Hour FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	104.76	0.00	134.65	292.52
J-2	104.96	15.15	134.64	290.52
J-3	106.87	0.00	136.56	290.62
J-4	107.00	11.72	136.56	289.32
J-5	104.68	0.00	134.57	292.51
J-6	105.00	15.81	134.56	289.32

Active Scenario: Max Day FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	104.76	0.00	134.66	292.59
J-2	104.96	8.53	134.65	290.61
J-3	106.87	0.00	136.57	290.62
J-4	107.00	6.60	136.56	289.34
J-5	104.68	0.00	134.58	292.59
J-6	105.00	8.89	134.57	289.43

Appendix D

Reference Material

Conservation
Halton

905.336.1158
Fax: 905.336.7014
2596 Britannia Road West
Burlington, Ontario L7P 0G3
conservationhalton.ca

Protecting the Natural Environment from Lake to Escarpment

March 14, 2017

Mr. Tariq Adi
Adi Development (Masonry) Inc.
1100 Burloak Drive, Suite 402
Burlington, ON
L7L 6B2

Dear Mr. Adi:

Re: Proposed installation of a relief culvert under Waterdown Road and floodplain management within the regulated area associated with Grindstone Creek
Adi Developments
101 Masonry Court
City of Burlington
CH File: A/15/B/99, A/17/B/27 and A/17/B/28

Proposals

Please find enclosed **Permit No. 5524** issued in accordance with Ontario Regulation 162/06, for the above noted proposal.

Staff have reviewed the following files regarding the above noted proposal:

- *Set of 18 drawings in support of Waterdown Road Culvert Improvments & Floodplain Management Adi Development (Masonry) Inc.* , Prepared by Urbantech West, Marked DWG No. C-GN1, C-EX1, C-SG1, C-SG2, C-SG3, C-SS1, C-XS1, C-XS2, C-XS3, C-ST1, C-ST2, C-ST3, C-ST4, C-ST-5, C-ST6, C-ST7, C-D1 and C-D2, Dated March 9, 2017, Stamped Received March 9, 2017, Stamped Approved March 14, 2017;
- *Set of 5 drawings in support of 101 Masonry Court Adi Development (Masonry) Inc. – Headwall,* Prepared by G.D. Jewell Engineering Inc., Marked DWG No. S1 to S5, Dated March 9, 2017, Stamped Received March 9, 2017, Stamped Approved March 14, 2017;
- *Set of 2 drawings in support of 101 Masonry Court Adi Development (Masonry) Inc. – Grindstone Creek Outfall Design,* Prepared by GeoMorphix, Marked DWG No. GEO-1 and DET-1, Dated March 9, 2017, Stamped Received March 9, 2017, Stamped Approved March 14, 2017;
- *Set of 4 drawings in support of 101 Masonry Court – Tree Management and Planting Plan,* Prepared by Adesso Design Inc., Marked DWG No. L-1 to L-4, Dated March 8, 2017, Stamped Received March 9, 2017, Redline Revised and Stamped Approved March 14, 2017.

The proposed installation of a relief culvert under Waterdown Road and floodplain management within the regulated area associated with Grindstone Creek. Please note that after staff reviewed the proposed development; it meets Policy 3.19 of Conservation Halton's *Policies and Guidelines for the*

Administration of Ontario Regulation 162/06 and Land Use Planning Document, Revised August 11, 2011.

Based on the above, this permit is approved with the following conditions:

a. **All disturbed areas be stabilized immediately following the completion of construction to the satisfaction of Conservation Halton.**
b. **That excess fill (soil or otherwise) generated from this development shall not be stockpiled and/or disposed of within any area regulated by Conservation Halton (on or off-site), pursuant to Ontario Regulation 162/06.**
c. **That effective sediment and erosion control measures be installed prior to starting work, maintained during construction and fully removed once all disturbed areas have been stabilized. That site conditions be monitored and that the sediment and erosion control measures be modified if site conditions warrant it. That any breaches of sediment and erosion control measures be reported to Conservation Halton staff immediately.**
d. **That bi-weekly (i.e. every 2 weeks) construction updates and photos detailing the construction progress and construction schedule, and the condition/effectiveness of sediment and erosion controls be submitted to Conservation Halton upon initiation of construction and until site stabilization.**
e. **That within 30 days of completion of all works, the following information be provided to the satisfaction of Conservation Halton staff demonstrating that the works have been completed in accordance with the approved drawings: as-built drawings for the approved development and that all required flood storage has been provided; updated georeferenced hydraulic model and floodplain mapping based on as-built conditions; a P.Eng. certification letter and a P.Geo. certification letter.**
f. **That the digital copy of the floodplain and meander belt delineations include all relevant topographical and structural information. HEC-RAS River Stations and predicted Regional Storm flood elevations should also be provided. GIS data and mapping should be submitted in an acceptable ESRI format and be properly georeferenced to real world coordinates (i.e., NAD83, UTM, Zone 17). It is highly desirable that mapping related data be submitted in ArcGIS Geodatabase format, containing all spatial, attribute, metadata and spatial joins/data rules. ESRI shape file format is an acceptable alternative. Alternatively, the drawing may be provided in the most recent version of AutoCAD and properly georeferenced to real world coordinates (i.e. NAD83, UTM, Zone 17). File formats in order of preference are dgn, dwg, and dxf.**

Please be sure that you read and understand all conditions listed on the enclosed Permit (and included below). Please also note that contravention of a Permit, or the terms and conditions of a Permit, is considered an offence under Section 28(16) of the *Conservation Authorities Act.* It is your responsibility to ensure that any person working under the authority of this Permit is familiar, and complies with, the terms and conditions.

Conservation Halton must be contacted a minimum of 48 hours prior to commencement of construction. This Permit or a copy thereof as well as all approved drawings must be available at the site. Any changes to the approved design or installation methods must be reviewed and approved by Conservation Halton staff prior to their implementation. This Permit is valid two years from the dated it is issued.

Please be advised that should you have any objection to any of the conditions of the permit, you are entitled to request a hearing before the Authority, in accordance with Section 28(12) of the Conservation Authorities Act. A written notice of your request for a hearing must be received by staff within 30 days

of the date of this letter. Please note that if a hearing has been requested, this permit approval is withdrawn until such time as the hearing results have been finalized and commencement of any site alteration must not occur until the results of the Hearing are determined.

We trust the above is of assistance in this matter. Should you require further information, please contact staff at extension 2278.

Yours truly,

Ben Davis, CAN-CISEC
Regulations Officer

BD/

Encl. 1

Cc: Building Department – City of Burlington (Permit and Drawings)
Cc: Peter Horn c/o Urbantech, 2030 Bristol Circle, Suite 201, Oakville, ON, L6H 0H2 (Permit and Drawings) (phorn@urbantech.com – By Email)
Cc: Scott Hamilton c/o City of Burlington, 426 Brant Street, P.O. Box 5013, Burlington, ON, L7R 3Z6 (Permit and Drawings) (scott.hamilton@burlington.ca)
Cc: Peter Rozanski c/o Metrolinx, 20 Bay Street, Toronto, ON, M5J 2W3 (Permit and Drawings) (peter.rozanski@metrolinx.com)
Cc: Shane Cooney – shane@adidevelopments.com (By Email)
Cc: Katie Jane Harris – Conservation Halton (By Email)

Conservation Halton
2596 Britannia Road West
Burlington, ON L7P 0G3
Telephone: 905 336-1158 Fax: 905 336-6684

PERMIT #: 5524

FILE #: A/15/B/99
A/17/B/27
A/17/B/28

PERMIT

IN ACCORDANCE WITH SECTION 3 OF REGULATION 162/06, PERMISSION HAS BEEN GRANTED TO:

A/15/B/99

Owner's Name: ADI Development (Masonry) Inc. Phone: 905-592-1140
Mailing Address: 200-4190 South Service Road, Burlington ON L7L 4X5

A/17/B/27

Owner's Name: Metrolinx (Captial) Phone: 905-901-9669
Mailing Address: 20 Bay Street, Toronto ON M5J 2W3

A/17/B/28

Owner's Name: City of Burlington Phone: 905-335-7600
Mailing Address: 426 Brant Street, Burlington ON L7R 3Z6

Agent/Contractor: Urbantech West Phone: 905-829-8818
2030 Bristol Circle, Oakville ON L6H 0H2

Property Location: 101 Masonry Court
in the (City, Town, Township) of: Burlington (Region/County) of: Halton

This permit is for the purpose of the proposed installation of a relief culvert under Waterdown Road and floodplain management within the Regulated Area associated with Grindstone Creek.

This permit is issued on this **15th day of March, 2017** Expires: **15th day of March, 2019**
And is subject to the following conditions:

1. That the work to be carried out in accordance with plans submitted on March 9th, 2017 and stamped APPROVED by: Ben Davis, Regulations Officer

2. see reverse

3. **Conservation Halton is to be notified of the date of the commencement of construction. This permit (including drawings stamped approved by Conservation Halton) or a copy thereof, must be posted on the site and be available for inspection.**

Your privacy is important to us. If you have questions regarding our Privacy Policy, please visit our website at www.conservationhalton.ca/privacy or ask a staff member

Conservation Halton may, at any time, withdraw any permission given under this regulation if, in the opinion of the Conservation Authority, the conditions of the permit are not complied with.

Authorized representatives of Conservation Halton may, at any time, enter lands and buildings, to make any surveys, examinations, investigations, and inspections to ensure that the works authorized by this Permit are being carried out in accordance with the terms of this Permit.

This permit does not preclude any approvals required by any other existing law and regulations.

Authorized by: Barbara Veale on the 15th day of March 2017.
Barbara Veale, Director, Planning and Regulations

2.)

a. All disturbed areas be stabilized immediately following the completion of construction to the satisfaction of Conservation Halton;

b. That excess fill (soil or otherwise) generated from this development shall not be stockpiled and/or disposed of within any area regulated by Conservation Halton (on or off-site), pursuant to Ontario Regulation 162/06;

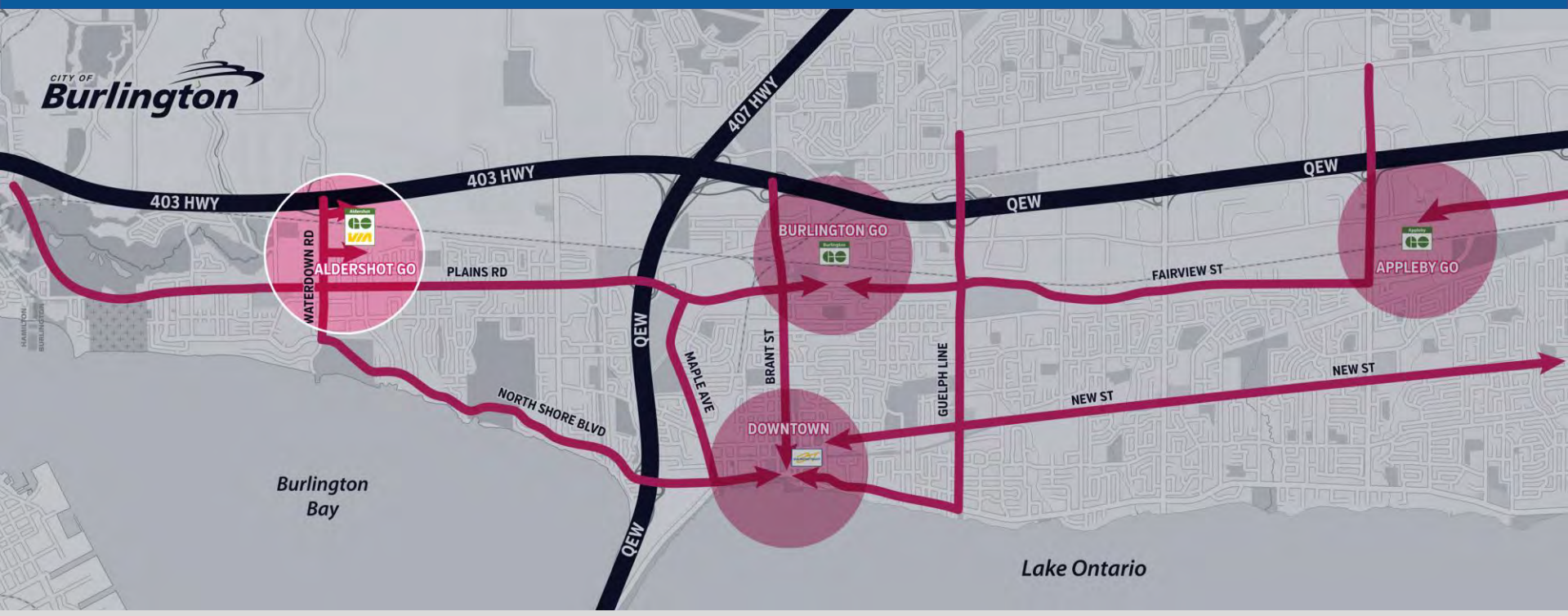
c. That effective sediment and erosion control measures be installed prior to starting work, maintained during construction and fully removed once all disturbed areas have been stabilized. That site conditions be monitored and that the sediment and erosion control measures be modified if site conditions warrant it. That any breaches of sediment and erosion control measures be reported to Conservation Halton staff immediately;

d. That bi-weekly (i.e. every 2 weeks) construction updates and photos detailing the construction progress and construction schedule, and the condition/effectiveness of sediment and erosion controls be submitted to Conservation Halton upon initiation of construction and until site stabilization;

e. That within 30 days of completion of all works, the following information be provided to the satisfaction of Conservation Halton staff demonstrating that the works have been completed in accordance with the approved drawings: as-built drawings for the approved development and that all required flood storage has been provided; updated georeferenced hydraulic model and floodplain mapping based on as-built conditions; a P.Eng. certification letter and a P.Geo. certification letter; and

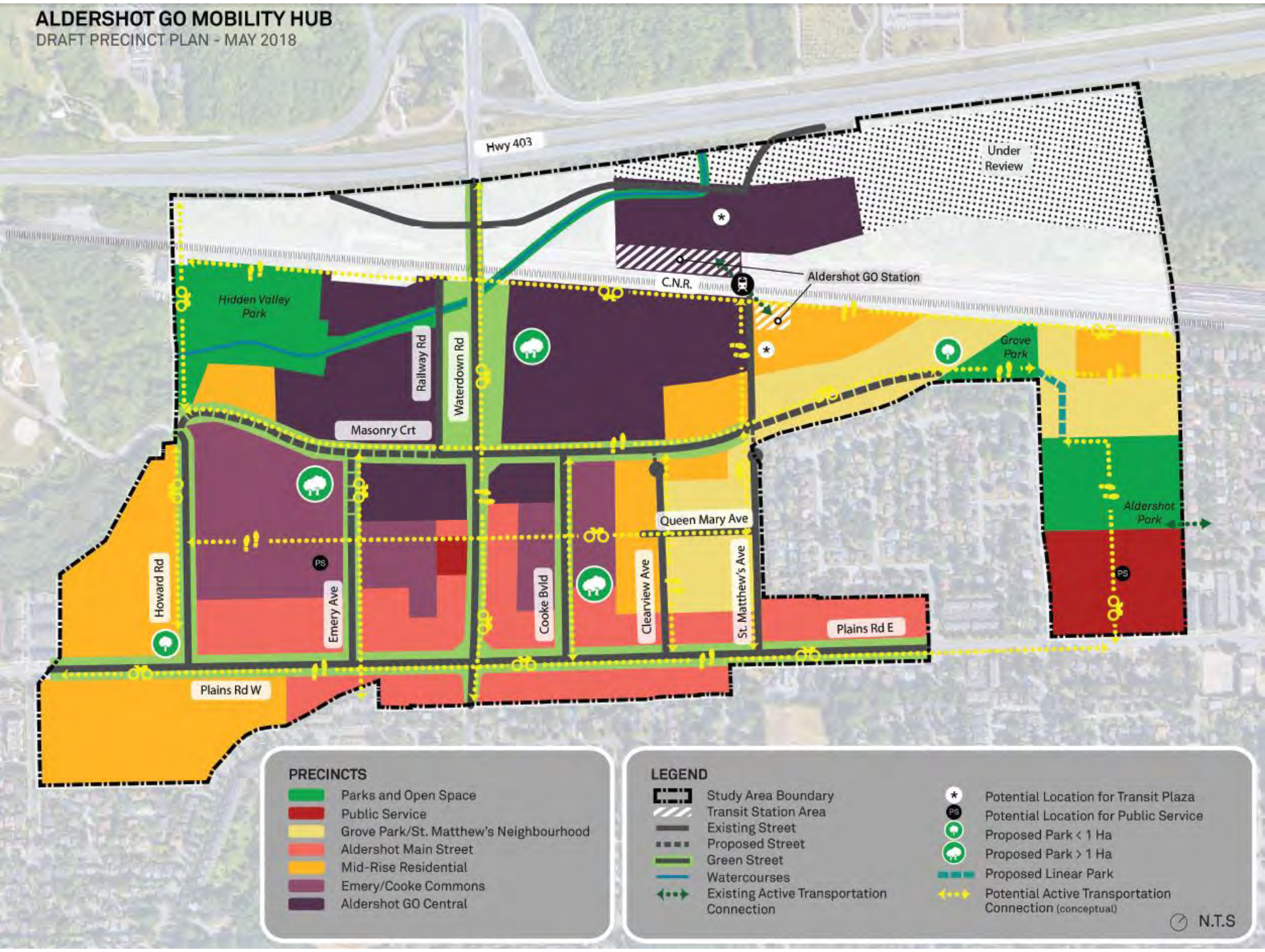
f. That the digital copy of the floodplain and meander belt delineations include all relevant topographical and structural information. HEC-RAS River Stations and predicted Regional Storm flood elevations should also be provided. GIS data and mapping should be submitted in an acceptable ESRI format and be properly georeferenced to real world coordinates (i.e., NAD83, UTM, Zone 17). It is highly desirable that mapping related data be submitted in ArcGIS Geodatabase format, containing all spatial, attribute, metadata and spatial joins/data rules. ESRI shape file format is an acceptable alternative. Alternatively, the drawing may be provided in the most recent version of AutoCAD and properly georeferenced to real world coordinates (i.e. NAD83, UTM, Zone 17). File formats in order of preference are dgn, dwg, and dxf.

ALDERSHOT GO MOBILITY HUB



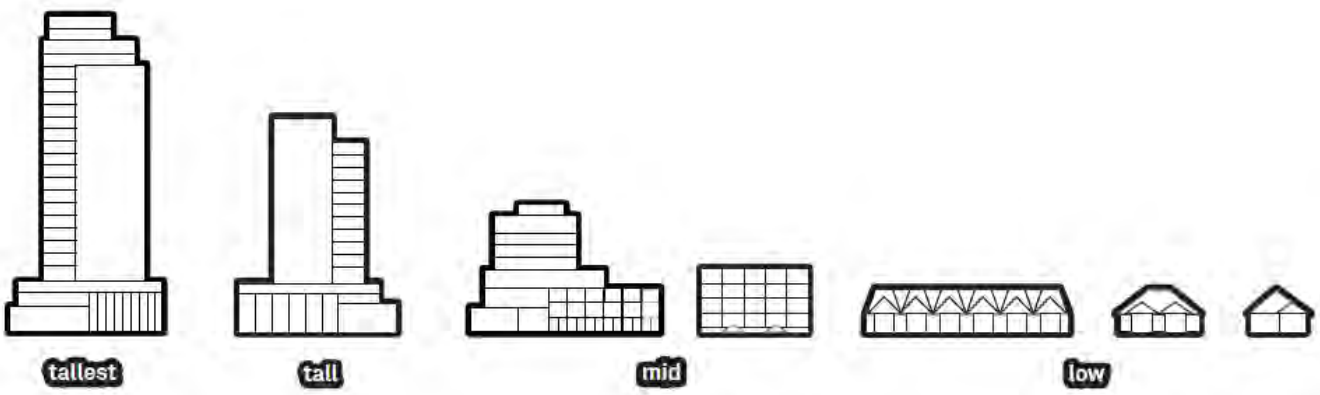
APPENDIX A PACKAGE

DRAFT ALDERSHOT GO PRECINCTS



PROPOSED FUTURE BUILDING TYPES WITHIN THIS HUB

The draft precinct plan for the Aldershot GO Mobility Hub includes the following building types:



Please note that the draft precinct plan, precinct boundaries, associated intention statements and key directions are preliminary and subject to change as a result of on-going technical studies and community and stakeholder feedback.

CITY OF Burlington

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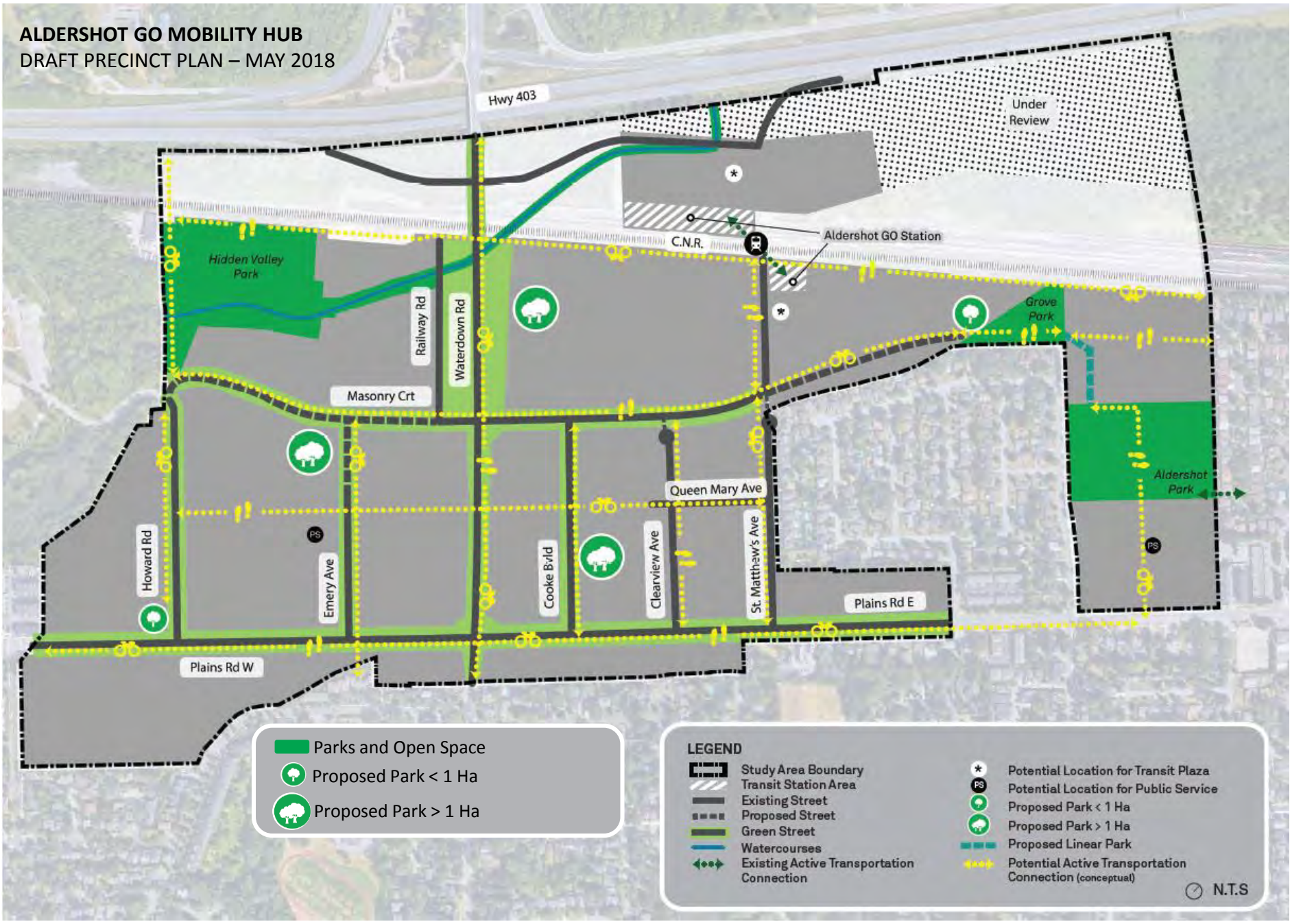
PARKS AND OPEN SPACE PRECINCT

INTENTION STATEMENT

The Mobility Hub **Parks and Open Space Precinct** will create a parks and open space network consisting of current and future parks, open spaces and key linkages within the mobility hub to serve the residents and employees of the mobility hub and the surrounding area. In addition, the precinct will recognize the need to maintain and enhance public access to parks and open spaces and identify key linkages to ensure pedestrian and cycling access within, to and from the Mobility Hub and the adjacent areas.

KEY DIRECTIONS

- Recognize and preserve the Hidden Valley, Aldershot and Grove Parks.
- Identify new public parks and gathering spaces throughout the hub to serve current and future residents and employees of the hub and the surrounding neighbourhoods.
- Provide a range and variety of parks and open spaces, which may include privately-owned publicly accessible spaces, to serve the amenity needs of the hubs including:
    - Expanding Grove Park and providing a linear connection to Aldershot Park;
    - Establishing two new major urban parks on the east and west side of Waterdown Road to serve as central community gathering spaces.



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PUBLIC SERVICE PRECINCT

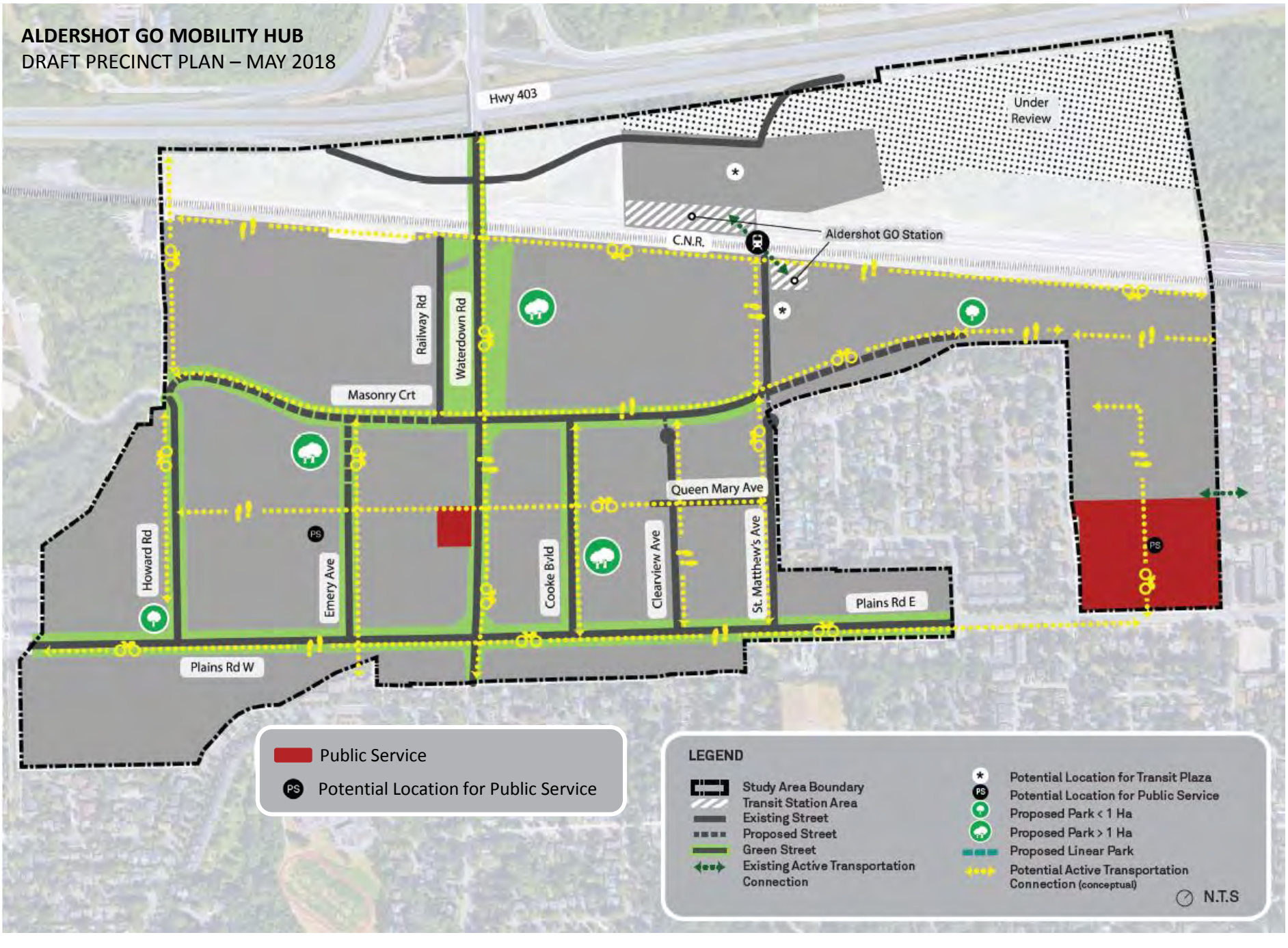
INTENTION STATEMENT

The Mobility Hub **Public Service Precinct** will accommodate current and future public services within the Mobility Hub including healthcare, education, emergency and protective services, cultural activities and civic administration, among others. Lands identified as public service may accommodate such uses either wholly or in part as part of a public-private partnership.

KEY DIRECTIONS

- Include within the precinct existing public services located in the Aldershot GO Mobility Hub including:
  - Holy Rosary Catholic Elementary School; and
  - Fire Station #3.
- Identify additional lands within the Aldershot GO Mobility Hub which may be required to accommodate future public services in anticipation of future population and employment growth.
- Permit the opportunity for public services to be located within private developments through joint Public-Private Partnerships.
- Require the provision of Transportation Demand Management (TDM) and traffic mitigation measures within developments, such as car-share, transit passes, shared parking facilities, etc.

ALDERSHOT GO MOBILITY HUB
DRAFT PRECINCT PLAN – MAY 2018



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CITY OF Burlington GROW BOLD

GROVE PARK / ST. MATTHEW'S NEIGHBOURHOOD PRECINCT

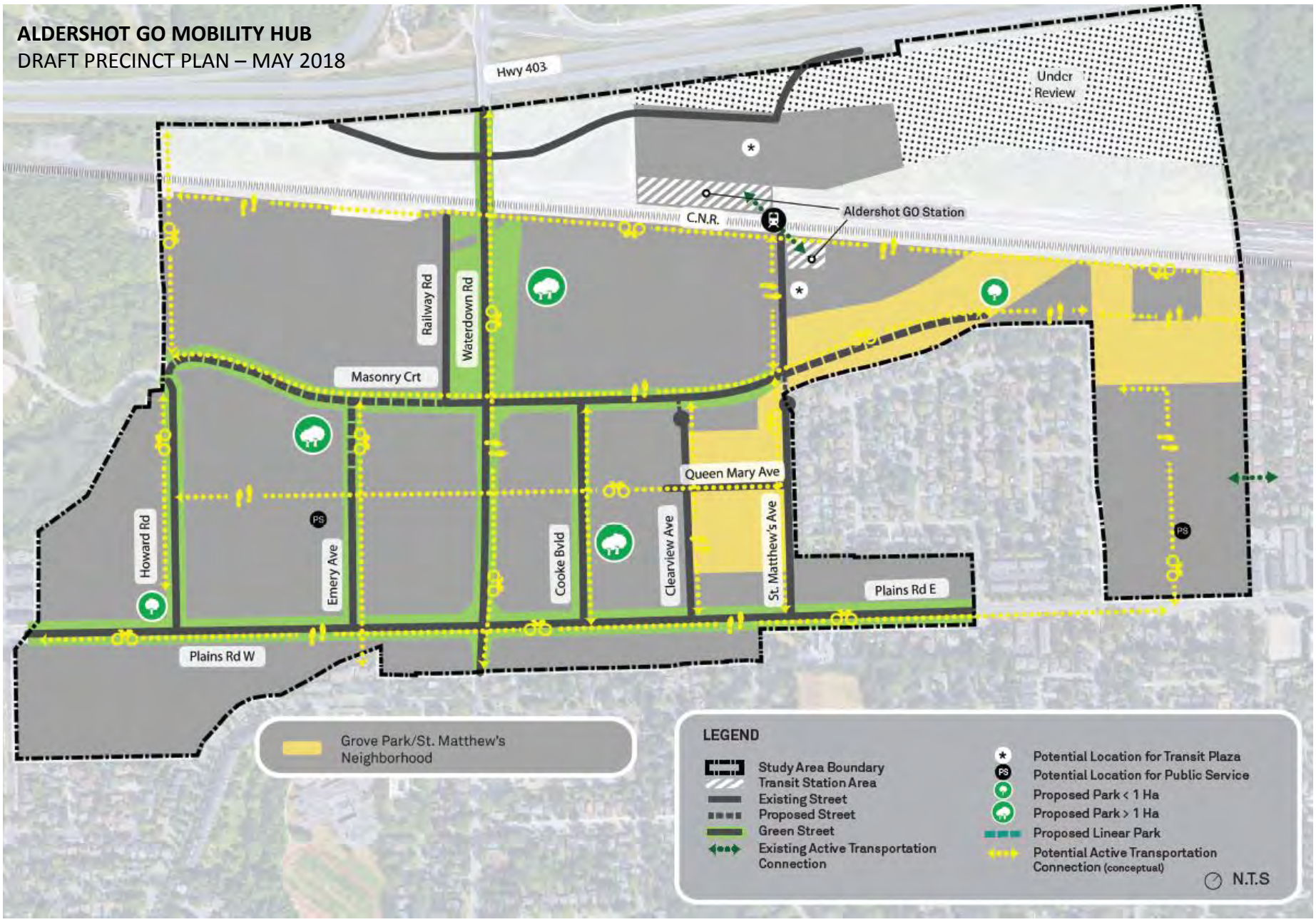
INTENTION STATEMENT

The **Grove Park/St. Matthew's Neighbourhood Precinct** will maintain the low-rise residential and neighbourhood character of the area and provide an effective and compatible transition to established neighbourhoods outside of the mobility hub. Limited development opportunities may exist within the precinct given the neighbourhood's close proximity and existing linear public access to the Aldershot GO station. Development will be in the form of low-rise residential, including **single and semi-detached houses as well as street-oriented townhouses** which will be compatible with the existing neighbourhood. New and/or enhanced multi-modal connections to the Aldershot GO station will be established using existing streets.

KEY DIRECTIONS

- Provide for **street-oriented townhouses** with the exception of stacked and back-to-back forms of townhouses.
- Enhance existing streets to provide a high degree of permeability to the Aldershot GO station and accommodate active transportation and transit.
- Prohibit closures of existing public streets.
- Achievement of complete streets.
- Require built form and design measures to achieve effective transitions and a high degree of compatibility with adjacent neighbourhoods/ areas.

ALDERSHOT GO MOBILITY HUB
DRAFT PRECINCT PLAN – MAY 2018



PROPOSED BUILDING TYPES



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CITY OF Burlington

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ALDERSHOT MAIN STREET PRECINCT

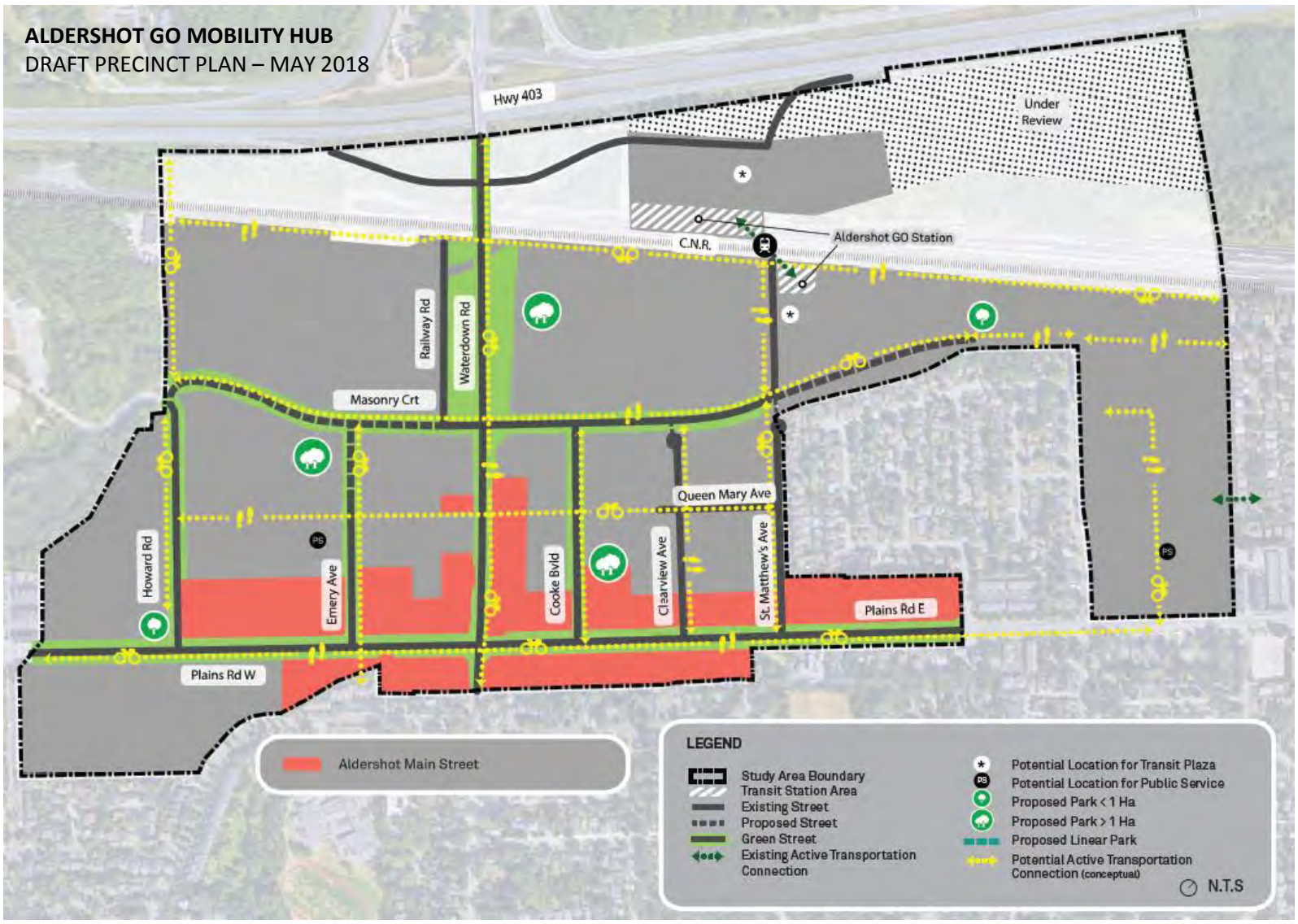
INTENTION STATEMENT

The **Aldershot Main Street Precinct** advances the Plains Road Village Vision and will establish a unique community destination within the Aldershot GO Mobility Hub focused on creating a continuous retail frontage with a main-street pedestrian experience along a planned frequent transit corridor.

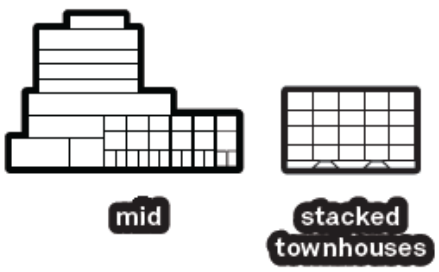
KEY DIRECTIONS

- Developments will be in a **mid-rise form** and continue to establish a traditional main-street character along Plains Road generally between Howard Street and White Oak Drive. Development will incorporate a low-rise podium with building heights that respond to adjacent neighbourhoods.
- Establish a **maximum building height of 6 storeys on the north side of Plains Road** adjacent to low-density residential areas and **up to a maximum of 11 storeys in a mid-rise form** where properties are not adjacent to low-rise residential uses. On **the south side of Plains Road, establish a maximum building height of 6 storeys** with compatibility criteria to adjacent low-density residential uses.
- Establish a continuous building frontage along Plains Road to provide a predicable rhythm along Plains Road.
- High degree of public realm and building design that support a main-street character.
- Preferred location for public art.
- Achievement of complete streets.
- Requirement for retail and/or service commercial uses to be located at street level on Plains Road.
- Establish a minimum floor height for the ground floor of buildings containing retail / commercial uses.
- Investigate minimum retail unit sizes.
- Introduce a requirement for buildings to incorporate a podium element to create a pedestrian scaled environment at street level along Plains Road.
- Require developments to achieve a minimum of two uses within a building.
- Require the provision of Transportation Demand Management (TDM) and traffic mitigation measures within developments, such as car-share, transit passes, shared parking facilities, etc.

ALDERSHOT GO MOBILITY HUB
DRAFT PRECINCT PLAN – MAY 2018



PROPOSED BUILDING TYPES



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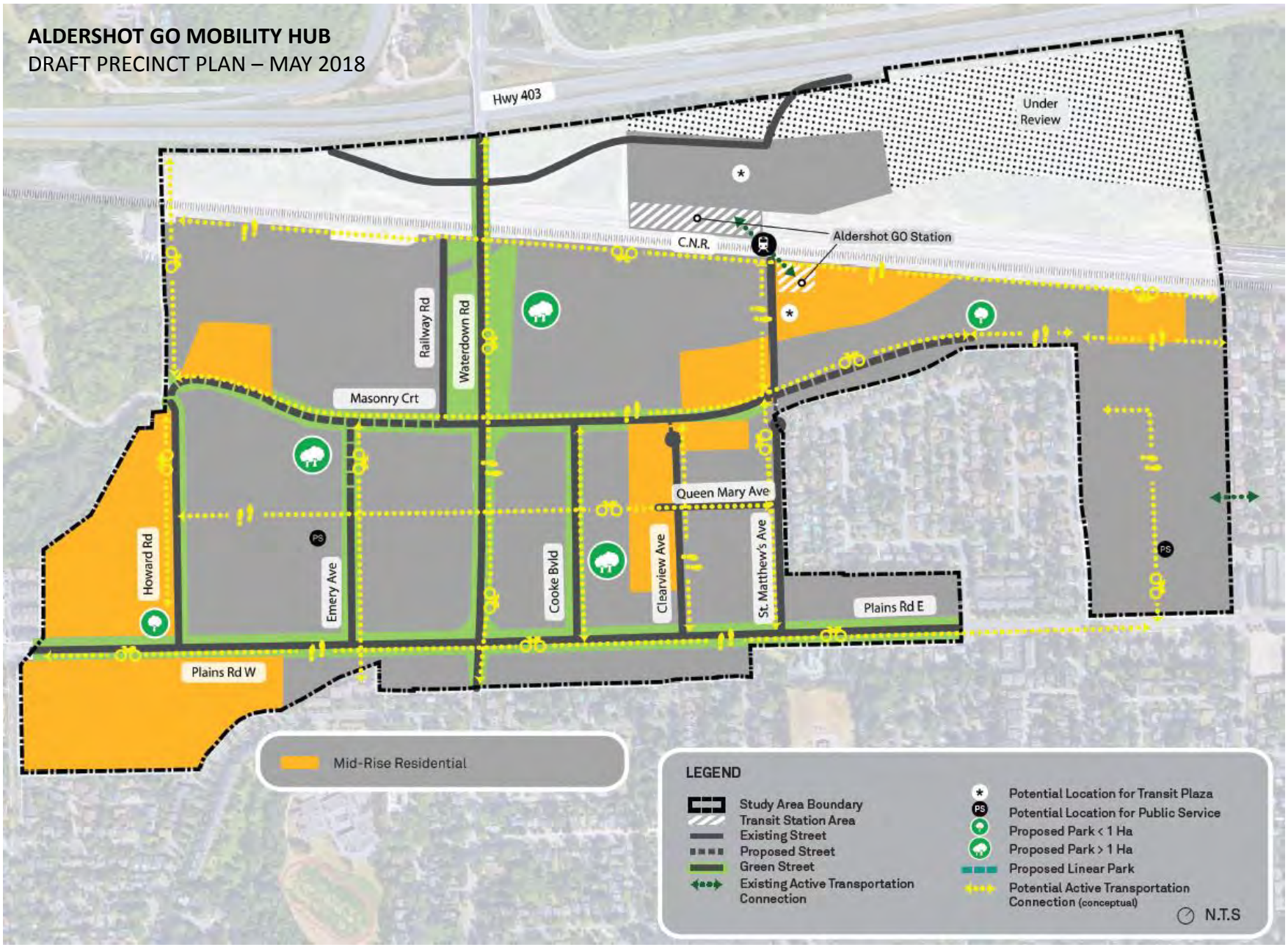
MID-RISE RESIDENTIAL PRECINCT

INTENTION STATEMENT

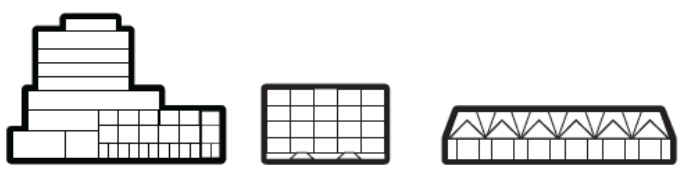
The Mobility Hub **Mid-Rise Residential Precinct** will support the development of compact urban residential communities within the mobility hub. This precinct will provide a variety of housing forms at a lower scale and intensity not otherwise provided for in the mobility hub and which will accommodate a wide range of demographics through the development of family-oriented housing, ground-oriented housing, associated supporting amenities and other community features. Development will be in the form of **low and/or mid-rise building forms** consisting of 11 storeys or less and may serve as a transition to adjacent precincts and/or areas.

KEY DIRECTIONS

- Establish a **maximum building height of 11 storeys in a mid-rise or low-rise form.**
- Provide opportunities for a range of low-rise and mid-rise building types including new ground-oriented housing formats (such as townhomes).
- Permit opportunities for commercial activities at street level on strategic streets.
- Require the provision of Transportation Demand Management (TDM) and traffic mitigation measures within developments, such as car-share, transit passes, shared parking facilities, etc.
- Provide for a range of units types and sizes (i.e. "Missing Middle").



PROPOSED BUILDING TYPES



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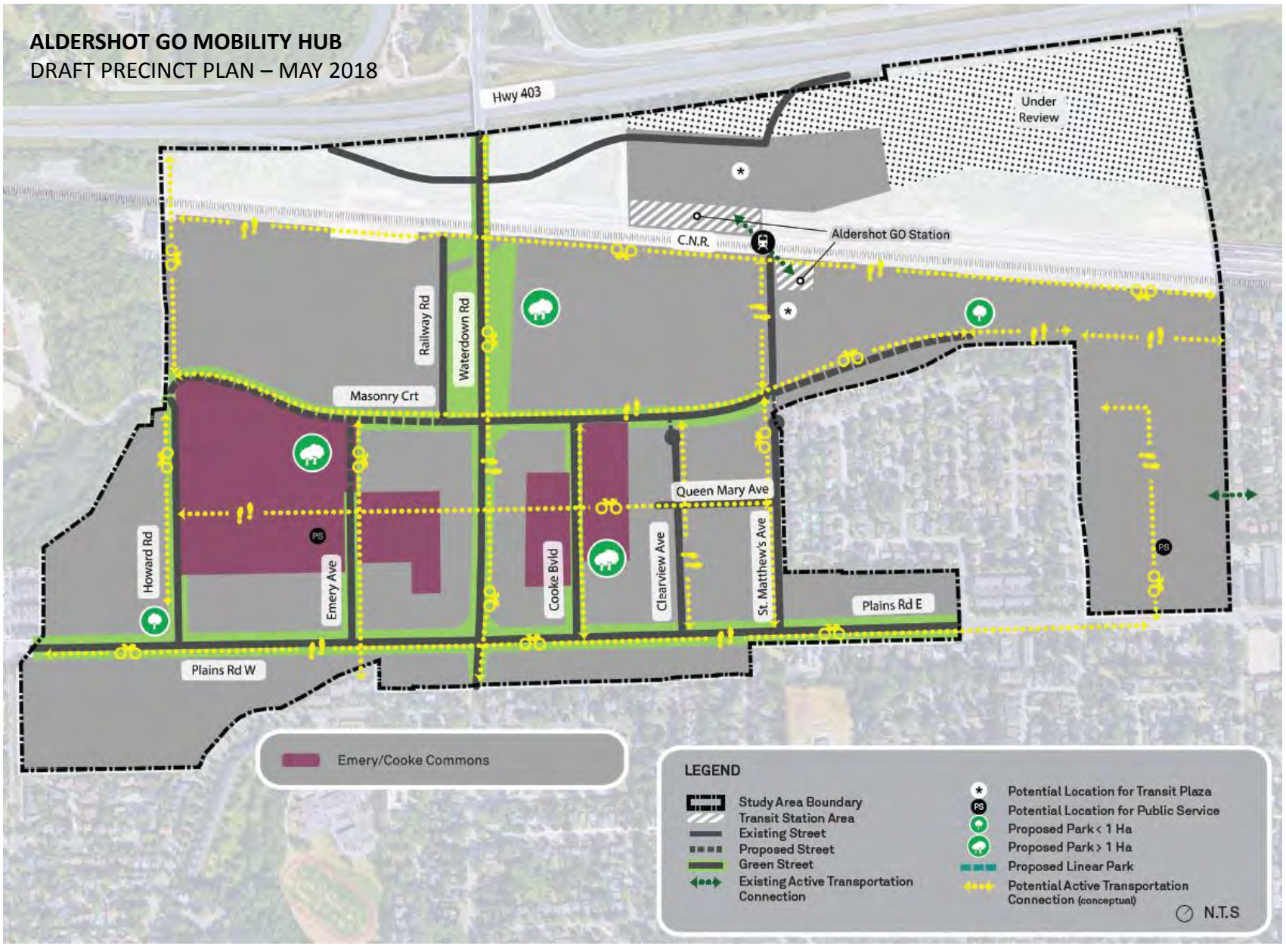
EMERY/COOKE COMMONS PRECINCT

INTENTION STATEMENT

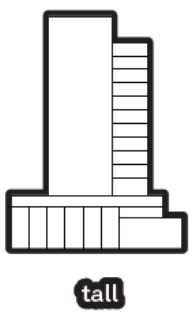
The **Emery/Cooke Commons Precinct** will accommodate a significant concentration of residential, retail and commercial uses which are located in close proximity to, and oriented around, planned major public parks. Developments will also support the frequent transit corridor within the hub along Plains Road. Development will be in the form of **tall mixed-use buildings** and contribute towards the creation of a lively, vibrant and people-oriented place.

KEY DIRECTIONS

- Establish a **maximum building height of 19 storeys.**
- Introduce a requirement for buildings to incorporate a podium element to create a pedestrian scaled environment at street level and provide an appropriate interface to public parks, where applicable.
- Ensure new development is permeable to provide active transportation linkages to and from the frequent transit corridor.
- Introduce new building setback requirements from the sidewalk at street level to allow for potential patio spaces, greenery and/or other elements that will enhance the public realm and pedestrian experience and enjoyment.
- Require developments to achieve a minimum of two uses within a building.
- Require the provision of Transportation Demand Management (TDM) and traffic mitigation measures within developments, such as car-share, transit passes, shared parking facilities, etc.



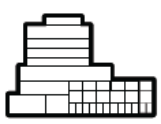
PROPOSED BUILDING TYPES



May be in combination with:



Stacked townhouses



Mid-rise

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CITY OF Burlington

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ALDERSHOT GO CENTRAL PRECINCT

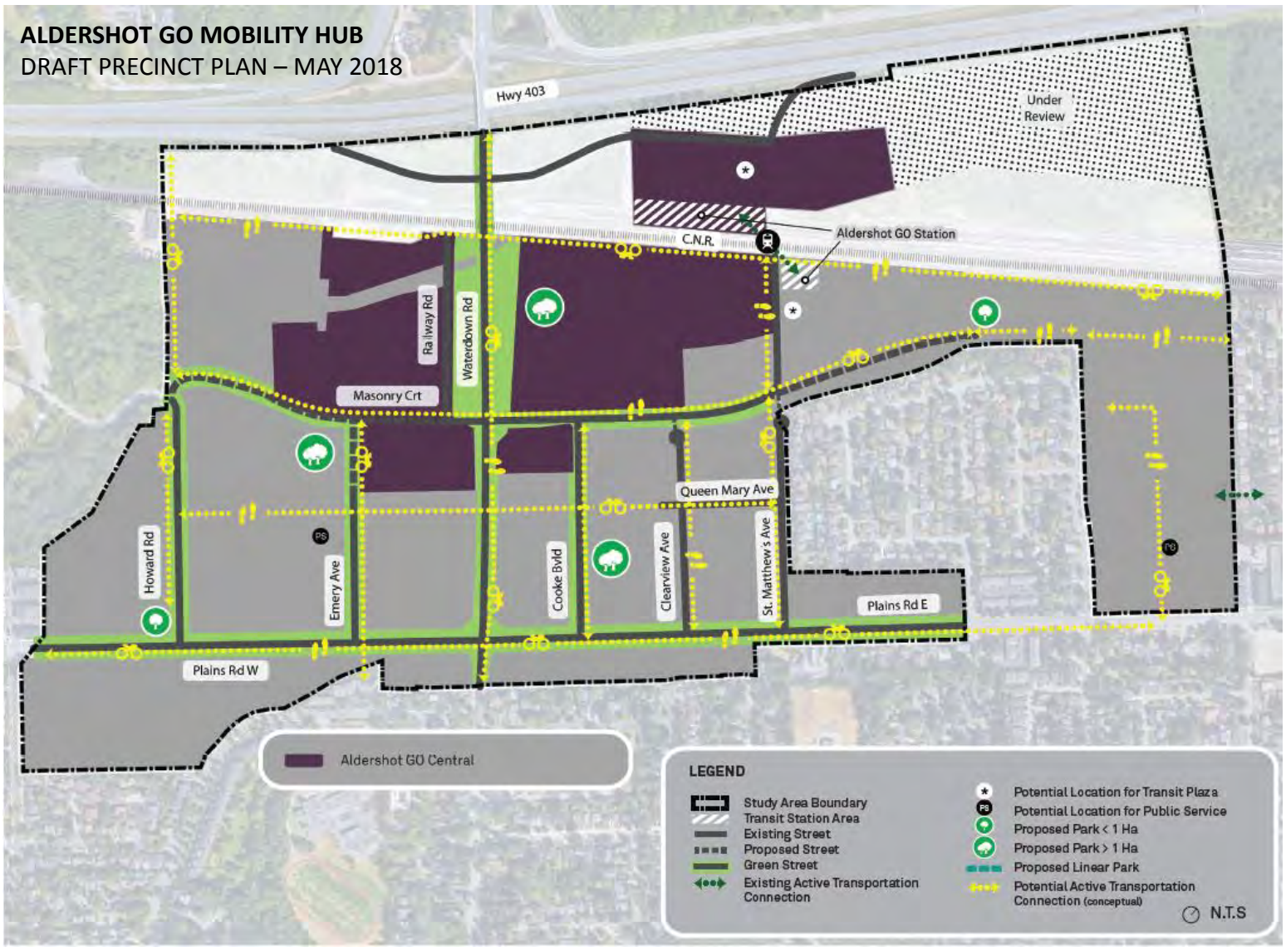
INTENTION STATEMENT

The **Aldershot GO Central Precinct** will establish a height peak within the Mobility Hub in close proximity to the rail corridor and GO station. The precinct will accommodate the most significant concentration of residential, retail and commercial uses and be the preeminent destination for office, affordable housing and urban format retail. Development will significantly contribute towards the creation of a complete transit-oriented community and achieve a high degree of compatibility with adjacent land uses and transportation infrastructure.

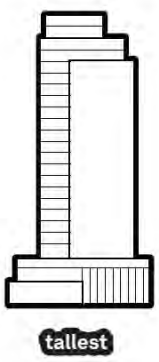
KEY DIRECTIONS

- Establish a **maximum building height of 30 storeys**, where appropriate and compatible.
- Require developments to achieve a high standard of architectural and urban design excellence to create a distinct and identifiable landmark area within each hub.
- Introduce a requirement for buildings to incorporate a podium element to create a pedestrian scaled environment at street level.
- Provide residential developments that achieve a level of affordability and mix of unit sizes and bedrooms to attract people from a range of income and demographics to the areas in close proximity to the GO station.
- Require retail, office and/or other service commercial uses at street level within buildings.
- Introduce new building setback requirements from the sidewalk at street level to allow for potential patio spaces, greenery and/or other elements that will enhance the public realm and pedestrian experience and enjoyment.
- Incorporate a significant employment function within mixed use developments.
- Require developments to achieve a minimum of two uses within a building.
- Require the provision of Transportation Demand Management (TDM) and traffic mitigation measures within developments, such as car-share, transit passes, shared parking facilities, etc.

ALDERSHOT GO MOBILITY HUB
DRAFT PRECINCT PLAN – MAY 2018

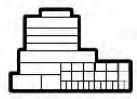


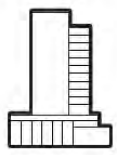
PROPOSED BUILDING TYPES



May be in combination with:


Stacked townhouses


Mid-rise


Tall

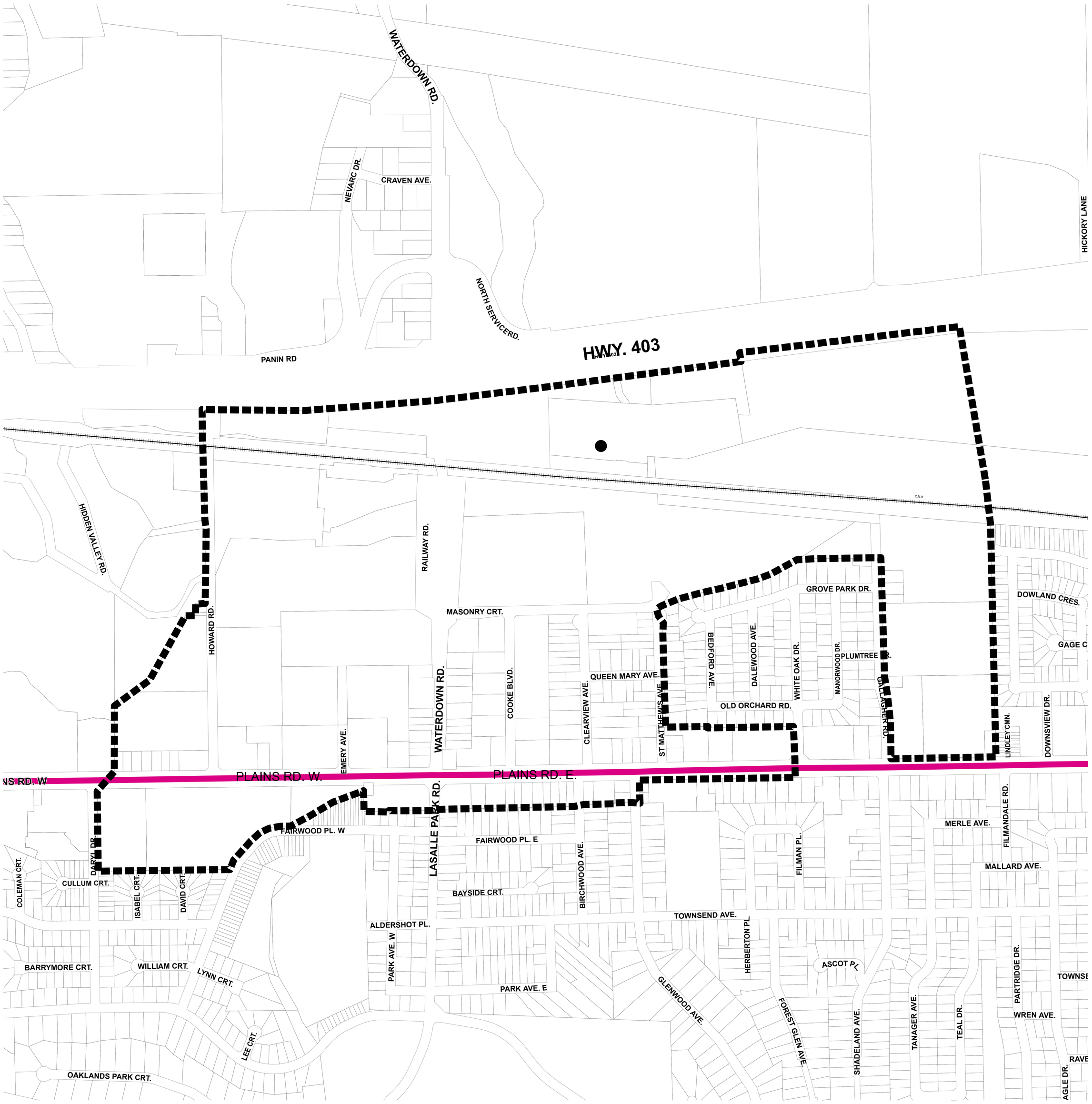
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CITY OF Burlington

GROW BOLD

Aldershot Mobility Hub Study Area

City of Burlington



Legend

- Mobility Hub
- Mobility Hub Primary Connector
- Railway
- Major Transit Station

0 0.25 0.5 1 Kilometers

TERANET City of Burlington