Site Servicing and Stormwater Management Report
166 Boyd Street, Carleton Place, ON

Client:
A&B Bulat Homes Ltd.
11 Gifford Street
Ottawa, ON K2E 7S3

Submitted for:
Zoning By-law Amendment and Draft Plan of Subdivision

Project Name:
166 Boyd Street

Project Number:
OTT-00262415-A0

Prepared By:
EXP
2650 Queensview Drive
Ottawa, ON K2B 8H8
t: +1.613.688.1899
f: +1.613.225.7337

Date Submitted:
June 26, 2024

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t: +1.613.688.1899
f: +1.613.225.7337

Prepared by:

Zhidong Pan, M.Eng., P.Eng.
Senior Water Resource Engineer

Approved by:

Bruce Thomas, P.Eng.
Senior Project Manager

Date Submitted:
June 26, 2024

Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Overview

EXP Services Inc. (EXP) was retained by A&B Bulat Homes Ltd. to prepare a Site Servicing and Stormwater Management Report for the proposed redevelopment of 166 Boyd Street in support of Zoning By-law Amendment and Draft Plan of Subdivision applications.

The 2.35-hectare site is situated in the middle of Boyd Street bound by Jackson Ridge Subdivision to the south-east, residential properties on Mississippi Road to the south-west and residential apartments and parklands on Woodward Street on the north-west as illustrated in **Figure 1-1** below. The site is within the Town of Carleton Place and subject to an additional 5 m road widening along the Boyd Street. Hence, the effective area of the site is 2.27 ha. The description of the subject property is noted below:

- All of Lots 9, 11, 13, 15, & 17 on Registered Plan 7211 and, consisting of PIN 051280418, PIN 051280041, and PIN 051280042.
- Part OF Lot 7 on Part of Block 121 Registered Plan 72925 consisting of PIN 051280419

The proposed development will consist of seventy-one (71) townhome units and a dry pond block within the site. This report will discuss the adequacy of the adjacent municipal watermain, sanitary sewers and storm sewers to provide the required water supply, convey the sewage and stormwater flows that will result from the proposed development. This report provides a design brief for submission, along with the engineering drawings, for approval.

Figure 1-1: Site Location

2 Existing Conditions

The existing site contained a single home that has already been demolished. Most of the ground surface contains sparse vegetation, fill material from adjacent construction, with a small area of trees in the north-western portion of the site.

The existing site topography slopes in a northerly direction, ranging in elevation from ±146m to ±143m and having an average slope of 1.2%.

3 Existing Infrastructure

The property is currently vacant however the existing servicing stubs from the demolished home for water, storm, and sanitary shall be located before construction. The stubs found within the property shall be grouted and capped at the mains.

Along the northeast side of the property is an approximate 15.0 metre wide municipal right-of-way (Boyd Street), however the Town shall be widening this right of way into the development by 5m to expand the right-of-way to approximately 20m.

From review of the sewer and watermain mapping, and as-built drawings, the following summarizes the infrastructure within the subject property and the infrastructure on the adjacent streets along the frontage of the property and adjacent offsite infrastructure:

<u>Boyd Street</u>

- 300mm PVC watermain
- 300mm PVC storm sewer
- 200mm PVC sanitary sewer

<u>Arthur Street</u>

- 300mm PVC watermain
- 600mm Concrete storm sewer
- 200mm PVC sanitary sewer

As-built drawings obtained from the Town of Carleton Place are included in **Appendix F** for reference.

4 Pre-Consultation / Permits / Approvals

A pre-consultation meeting was held with Lanark County (County) and the Town of Carleton Place (Town) prior to design commencement. This meeting outlined the submission requirements and provided information to assist with the development proposal. The proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, therefore signoff from the MVCA will be required prior to final approval. The MVCA was contacted to confirm the stormwater management quality control requirements. A copy of the correspondence with the MVCA is attached **Appendix F**. Specific design criteria noted in the Pre-Consultation meeting is further described in the relevant sections of this report.

As requested, CLI ECA application will need to be submitted for the storm and sanitary sewer along with a form 1 for new watermain installation.

5 References

Various background reports and design manuals were referred to in preparing the current report including:

- CHI Press. November 2010. "User's Guide To SWMM 5." Guelph.

- Fire Underwriter Survey. 2021. "Water Supply for Public Fire Protection (FUS)."
- Ontario Ministry of the Environment and Climate Change. March 2003. "Stormwater Management Planning and Design Manual (SMPDM)."
- Ontario Ministry of the Environment. 2008. "Design Guidelines for Drinking-Water Systems (GSWS)."
- Ontario Ministry of the Environment. 2008. "Design Guidelines for Sewage Works."
- United States Environmental Protection Agency. January 2016. "Storm Water Management Model Reference Manual, Volume 1 - Hydrology." Cincinnati.
- United States Environmental Protection Agency. May 2017. "Storm Water Management Model Reference Manual Volume II - Hydraulics." Cincinnati.
- United States Environmental Protection Agency. July 2016. "Storm Water Management Model Reference Manual Volume III - Water Quality." Cincinnati.

In addition, for City of Ottawa Design Guidelines referred to above, additional Technical Bulletins were referenced including:

- Ottawa Sewer Design Guidelines (SDG002) Bulletins:
  - Bulletin ISDTB-2012-4 (20 June 2012)
  - Technical Bulletin ISDTB-2014-01 (05 February 2014)
  - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
  - Technical Bulletin ISDTB-2018-01 (21 March 2018)
  - Technical Bulletin ISDTB-2018-04 (27 June 2018)
- Ottawa Design Guidelines – Water Distribution (WDG001) Bulletins:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)
  - Technical Bulletin ISTB-2021-03 (18th August 2021)

6 Water Servicing

6.1 Existing Water Servicing Conditions

The site is within the Town of Carleton Place limits, south of the Mississippi River. As shown on the Jackson Ridge Subdivision - General Plan and Services (drawing # 96048-GP2), an existing 300 mm diameter watermain is on Boyd Street and is capped at approximately 35 m north of Taber Street. This 300 mm diameter water will be extended and connected to the existing 300 mm watermain at Arthur Street to provide service to the Boyd site.

6.2 Water Servicing Proposal

The proposed water supply system will consist of 250mm diameter watermain and associated appurtenances to provide water for consumption and fire protection. The site will be serviced by connecting into the existing watermain along Boyd Street at two locations to provide a looped feed through the subdivision.

Water supply for each townhome will be provided by individual water services connecting to the proposed watermain.

6.3 Water Servicing Design Criteria

The design parameters that were used to establish water and fire flow demands are summarized in the table below.

Table 6-1 : Summary of Water Supply Design Criteria

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	
Population Density – Semi-detached Home	2.7 persons/unit	
Population Density – Townhome or Terrace Flat	2.7 persons/unit	✓
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	
Population Density – Two Bedroom Apartment	2.1 persons/unit	
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	
Population Density – Three Bedroom Apartment	3.1 persons/unit	
Average Day Demands – Residential	280 L/person/day	✓
Average Day Demands – Commercial / Institutional	28,000 L/gross ha/day or 5.0 L/m2/day	
Average Day Demands – Light Industrial / Heavy Industrial	35,000 or 55,000 L/gross ha/day	
Maximum Day Peak Factor – Residential	4.54 x Average Day Demands	✓
Maximum Day Demands Peak Factor – Commercial / Institutional	1.5 x Average Day Demands	
Peak Hour Factor – Residential	6.84 x Average Day Demands	✓
Peak Hour Factor – Commercial / Institutional	2.7 x Average Day Demands	
Fire Flow Requirements Calculation	FUS	✓
Depth of Cover Required	2.4m	✓
Maximum Allowable Pressure	551.6 kPa (80 psi)	✓
Minimum Allowable Pressure	275.8 kPa (40 psi)	✓
Minimum Allowable Pressure during fire flow conditions	137.9 kPa (20 psi)	✓

6.4 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along the adjacent roadways. The required fire flows for all proposed buildings were calculated based on typical values as established by the Fire Underwriters Survey 2021 (FUS). The following equation from the Fire Underwriters document “Water Supply for Public Fire Protection”, 2021, was used for calculation of the on-site supply rates required to be supplied by the hydrants:

$F = 200 * C * \sqrt{(A)}$

where:

F	=	Required Fire flow in Litres per minute
C	=	Coefficient related to type of Construction
A	=	Total Floor Area in square metres

The proceeding **Table 6-2** summarizes the parameters used for estimating the Required Fire Flows (RFF) based on the Fire Underwriters Survey (FUS). The RFFs were estimated based on floor areas provided by the architect. The following summarizes the parameters used for the proposed townhome buildings.

Table 6-2 :Summary of FUS Method Parameters Used for Proposed Buildings

Design Parameter	Townhome
Type of Construction (Coeff, C) Wood-Framed (C=1.5), Ordinary (C=1.0), Non-Combustible (C=0.8), Fire-Resistive (C=0.6)	Wood Framed
Occupancy Type Non-combustible (-25%), Limited Combustible (-15%), Combustible (0%), Free Burning (+15%), Rapid Burning (+25%)	Limited Combustible
Sprinkler Protection Sprinkler Conforming to NFPA 13 (-30%), Standard Water Supply (-10%), Fully Supervised Sprinkler (-10%)	None

The following **Table 6-3** below summaries the individual parameters used and the resultant Required Fire Flows (RFFs) for each building block. Detailed calculations of the RFFs necessary for each building is provided in **Appendix B.**

Table 6-3 : Summary of Parameters Used and Estimation of Required Fire Flows (RFF)

Townhome Block	FUS Components						
	Construction Coefficient, C	Total Floor Area (m2)	Fire Flow prior to reduction (L/min)	Reduction Due to Occupancy	Reduction due to Sprinkler	Increase due to Exposures	Total RFF (L/min)
Block 1	1.5	1,082	11,000	-15%	0%	16%	11,000
Block 2	1.5	1,070	11,000	-15%	0%	31%	12,000
Block 3	1.5	1,070	11,000	-15%	0%	31%	12,000
Block 4	1.5	1,016	11,000	-15%	0%	31%	12,000
Block 5	1.5	712	9,000	-15%	0%	34%	10,000
Block 6	1.5	730	9,000	-15%	0%	34%	10,000
Block 7	1.5	896	10,000	-15%	0%	18%	10,000
Block 8	1.5	1,070	11,000	-15%	0%	24%	12,000

Block 9	1.5	1,060	11,000	-15%	0%	37%	13,000
Block 10	1.5	860	10,000	-15%	0%	21%	10,000
Block 11	1.5	900	10,000	-15%	0%	37%	12,000
Block 12	1.5	880	10,000	-15%	0%	50%	13,000
Block 13	1.5	880	10,000	-15%	0%	33%	11,000
Block 14	1.5	880	10,000	-15%	0%	33%	11,000
Block 15	1.5	880	10,000	-15%	0%	50%	13,000
Block 16	1.5	900	10,000	-15%	0%	37%	12,000

The estimated required fire flows (RFFs) based on the FUS Method ranges from 167 L/sec (10,000 L/min) to 217 L/sec (13,000 L/min).

6.5 Boundary Conditions

Hydraulic Grade Line (HGL) boundary conditions were obtained from the previous technical memorandum prepared by J.L. Richards & Associates Ltd in 2013. This memo report on the estimated impacts that the potential future development will have on the existing water distribution system during a maximum day demand plus the fire flow condition. The memo predicted that at the future built out stage and under the peak hour demand condition, the system pressure near the Boyd development site range from 300 kPa to 450 kPa. And available fire flows under the maximum day demand condition range from 150 L/s (9,000 L/min) to 300 L/s (18,000 L/min). A copy of the J.L. Richard's memo is included in **Appendix F.**

6.6 Estimated Water Demands

Table 6-4 below summarizes the anticipated domestic water demands for all units under average day, maximum day and peak hour conditions. Please refer to **Appendix B** for detailed calculations of the total water demands.

Table 6-4 : Total Water Demand Summary

Water Demand Conditions	Water Demands (L/sec)
Average Day	0.62
Max Day	2.82
Peak Hour	4.25

The proposed water distribution system for the Boyd site includes approximately 320 m of 250 mm diameter PVC DR18 pipeline with two connections to the existing 300 mm watermain along Boyd Street. The calculated peak hour demand for the Boyd site is 4.25 L/s. For a 250 mm diameter water pipe, the system head loss under the peak hour demand condition is negligible. The calculated maximum required fire flow is 217 L/s (13,000 L/min) for the Boyd site. The estimated system friction loss for a 217 L/s fire flow plus the maximum day demand is about 5.3 m (7.6 psi). Therefore, it is estimated that the proposed 250mm watermain connecting to 300mm watermain on the Boyd Street has sufficient capacity to service the proposed development for domestic and fire flow demands.

7 Sewage Servicing

7.1 Existing Sewage Conditions

The site is an open field with no services within the site. Any existing stub coming off the existing sanitary sewer from Boyd Street to the demolished home that occupied the property, to be capped and grouted at the property line and removed from within the property to the town's satisfaction before construction.

7.2 Proposed Sewage Conditions

As per the pre-consultation meeting, the Town of Carleton Place required Bulat Homes to extend the 200mm diameter Sanitary from the existing manhole at Boyd/Arthur Street to the existing manhole (115) at Boyd/Taber Street. The sanitary sewers were sized based on a population flow with an area-based infiltration allowance. A 200mm diameter sanitary sewer is proposed with a minimum 0.32% slope, having a capacity of 18.9 L/sec based on Manning's Equation under full flow conditions. **Table 7-1** below summarizes the design parameters used.

Table 7-1 : Summary of Wastewater Design Criteria / Parameters

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	
Population Density – Semi-detached Home	2.7 persons/unit	
Population Density – Duplex	2.3 persons/unit	
Population Density – Townhome (row)	2.7 persons/unit	✓
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	
Population Density – Two Bedroom Apartment	2.1 persons/unit	
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	
Population Density – Three Bedroom Apartment	3.1 persons/unit	
Average Daily Residential Sewage Flow	280 L/person/day	✓
Average Daily Commercial / Intuitional Flow	28,000 L/gross ha/day	
Average Light / Heavy Industrial Daily Flow	35,000 / 55,000 L/gross ha/day	
Residential Peaking Factor – Harmon Formula (Min = 2.0, Max =4.0, with K=0.8)	$M = 1 + \frac{14}{4 + P^{0.5}} * k$	✓
Commercial Peaking Factor	1.5 (when area >20%) 1.0 (when area <20%	
Institutional Peaking Factor	1.5 (when area >20%) 1.0 (when area <20%	
Industrial Peaking Factor	As per Table 4-B (SDG002)	
Unit of Peak Extraneous Flow (Dry Weather / Wet Weather)	0.05 or 0.28 L/s/gross ha	
Unit of Peak Extraneous Flow (Total I/I)	0.33 L/s/gross ha	✓

The total estimated peak sanitary flow rate from the proposed property is **2.19 L/sec** based on City Design Guidelines. Sewage rates below include a total infiltration allowance of 0.33 L/ha/sec based on the total gross site area.

Table 7-2 : Summary of Anticipated Sewage Rates

Sewage Condition	Sanitary Sewage Flow (L/sec)
Peak Residential Flow from Development Site	2.19
Infiltration Flow (at 0.33 L/ha/sec)	0.75
Design Sewage Flow	2.94

The proposed 200mm diameter sanitary sewer from the site will connect into an existing 200mm sanitary sewer along Boyd Street in two separate locations. Currently there are 4 homes along Boyd Street serviced by the 200mm sanitary sewer with a peak sanitary flow of 0.15L/sec. Therefore, the new peak sanitary flow is expected to be 2.34 L/sec and the total flow including infiltration would be 3.09 L/sec. The existing sanitary has a capacity of 18.85 L/sec and will be able to handle the revised peak sewage flows. The sanitary sewer design sheet is in **Appendix C**.

8 Storm Servicing & Stormwater Management

8.1 Background

As the proposed site is located within the Mississippi Valley Conservation Authority (MVCA) jurisdiction, the stormwater works are therefore subject to both MVCA, the County and the Town approval. There is an existing 600 mm diameter storm sewer along Arthur Street. under the existing condition, the runoff from the Boyd site flows to Boyd Street and discharges to this 600 mm storm sewer. Under the post-development conditions, the runoffs from the Boyd site will be collected by the proposed onsite storm sewer system and discharge to the existing 600 mm storm sewer with restricted rates which are up to the discharges under the existing conditions. As requested in the technical review memorandum from MVCA (Nov 18, 2022), the hydraulic capacity of the existing 600 mm storm sewer on Arthur Street will need to be reviewed.

8.2 Proposed Storm Servicing

The proposed subject property will be serviced with a conventional stormwater collection system. The storm sewer system will consist of a typical storm system including manholes and catchbasins in the roadway and catchbasins and landscape inlets in the rear yards. For the rear-yards, perforated storm sewers will be used. Due to the stormwater criteria requirements, a stormwater facility (dry pond) with an outlet control device structure is necessary.

The proposed stormwater system is designed in conformance with the latest version of the City of Ottawa Design Guidelines (October 2012). Section 5 “Storm and Combined Sewer Design” and Section 8 “Stormwater Management”. A summary of the design criteria that relates to this design report is the proceeding sections below.

8.2.1 Design Criteria & Constraints

From the pre-consultation notes the following summarizes the design criteria and constraints that will be followed:

- Criteria #1: An enhanced level of stormwater quality control is recommended per the MOE Design Manual.
- Criteria #2: Stormwater quantity should be controlled such that post-development flows equal pre-development levels.
- Criteria #3: Measures to maintain infiltration should be considered and integrated into the stormwater management design where possible.

Other design criteria were taken from MOE Design Manual which apply to the stormwater design are included.

- The storm sewer was sized based on the Rational Method and Manning’s Equation under free flow conditions for the 5-year storm using a 10-minute inlet time.
- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm.
- Calculation of the required storage volume for up to 100-year storm event has been prepared based on the Modified Rational Method.
- Overland flow routes are provided.
- The vertical distance from the spill elevation and the ground elevation at the building is at least 150mm.
- The emergency overflow spill elevation is at least 30 cm below the lowest building opening.
- Minimum sewer slopes to be based on minimum velocities for storm sewers of 0.80 m/sec.

8.3 Stormwater Design Methodology

The methodology used for the design of the stormwater system is as follows:

- Established storm drainage area (or subcatchments) based on grading plans and roadway profiles.
- Design storm sewer system based on 5-year storm using the Rational Method. Pipes were sized based on the 5-year return period under free-flow conditions.
- Estimate the appropriate number and the location of inlets based on the developed grading plans and plan and profiles and ensure maximum permitted depth of static ponding meets City of Ottawa's guidelines of 35 cm at the edge of pavement.
- For each subcatchment restricted inflow rates to the minor system to approximately the 5-year return period storm. This is completed using standard ICD types, with an attempt to meet the 5-year rate as close as possible. All catchbasins have independent leads complete with separate ICDs.
- Developed a PCSWMM model of the storm sewer system, to calculate peak flows and runoff volumes.
- At this detailed design stage, the PCSWMM model was prepared to include the major system components (dual drainage). The model includes all subcatchments, park area, and all roadway ponding areas. Additional information on dual drainage modelling in provided later in this report.

8.4 Pre-Development Conditions

PCSWMM was used to evaluate the drainage conditions and determine the runoffs under the pre-development conditions. For this, a Digital Terrain Model (DTM) ground surface model was prepared based on elevation information collected from the topographic survey.

Figure A3 in Appendix A illustrates the results of the drainage sub-catchment delineation. Three drainage sub-catchments were defined under the pre-development conditions. Runoff generates in PER_S1 overflows towards the southwest corner of the Boyd site and drains to Mississippi Road. Runoff generates in PER_S2 overflows directly to Boyd Street and is collected by the existing catch basin on Boyd Street, south of Arthur Street. Runoff generates in PER_S3 overflows to Boyd Street and is collected by the existing CB on Boyd Street, north of Arthur Street. Generally, runoffs from the Boyd site discharge to the existing 600 mm diameter storm sewer on Arthur Street.

Subcatchment parameters under pre-development conditions were based on City of Ottawa guidelines as noted in **Table 8-4**. Levels of subcatchment imperviousness was based on existing 2018 site conditions. Subcatchment slopes were established in PCSWMM using average slopes of overland flow paths. The following table summarizes the peak flows at each outfall under pre-development conditions.

Table 8-1 : Summary of Pre-Development Peak Flows

Storm Event	Outfall_EX_ST_MH		Outfall_Mississippi Road	
	Peak Flow (L/sec)	Volume (m3)	Peak Flow (L/sec)	Volume (m3)
Chicago_3h_2yr	20.1	29	5.3	7
Chicago_3h_5yr	39.5	74.8	16.4	23.4
Chicago_12h_100yr	177.2	542	90.6	144.4

8.5 Runoff Coefficients

Average runoff coefficients for all subcatchments were calculated using PCSWMM's area weighting routine. This modelling software has a GIS engine which allows for catchment (or polygon) definition including attributes. The runoff coefficients for all catchments were area weighted to derive at average runoff coefficients based on hard surfaces (concrete or asphalt) having an imperviousness of 100%, soft surfaces (landscaping surfaces) having a percent imperviousness of 5%. The conversion from an imperviousness percent to a runoff coefficient was taken as C = (IMP*0.70) / 100 + 0.20, with the imperviousness (IMP) as a percentage.

Since the site plan included building footprints, driveways, roads, and sidewalks, etc., the estimation of the actual level of imperviousness and runoff coefficients was completed. For this detailed design stage imperviousness levels and corresponding runoff coefficients were based on the actual building footprints. This applies to the site plan areas and townhomes as the building layouts are finalized with the developer. This way when area weighting was applied the more conservative percentage was used.

Area weighting was again used to apply imperviousness and average runoff coefficients for all lot types (singles, townhomes, 18m rights-of-way, 22m right of ways, park, walkway blocks, and site plans, etc.). **Table 8-2** below summarizes the average runoff coefficients that were calculated by area weighting.

Table 8-2 : Summary of Runoff Coefficients (Breakdown by Area Type)

Land Type	Area (m^2)	Imperviousness (%)	Runoff Coefficient C
ROOF	7440	100%	0.90
DRIVEWAY	2572	100%	0.90
ROADWAY	2874	100%	0.90
SIDEWALK	655	100%	0.90
GREEN LAND	9128	5%	0.24
DRY POND	886	5%	0.24
TOTAL	23,556	60%	0.62

The average runoff coefficient for the overall site area under post-development conditions was calculated as 0.62. The runoff coefficients for pre-development and post-development catchments are provided summarized in **Table 8-3** below. The runoff coefficients for each subcatchment were used in the storm sewer design sheet for sizing of the sewers.

Table 8-3 : Summary of Runoff Coefficients (Entire Site)

Location	Area (hectares)	Pre-Development Runoff Coefficient, CAVG	Post-Development Runoff Coefficient, CAVG Based on Site Plan
Entire Site	2.36	0.24	0.62

8.6 Storm Sewers Design

Since an end-of-pipe SWM dry pond is proposed the overall target restricted rate to match the discharges under the pre-development conditions, however for sizing of the storm sewer the 5-year capture rate was targeted to ensure no surface ponding. Target capture rates for most areas were increased to near the 5-year to account for no ponding in the 5-year event on public and private streets. The higher rate represents the approximate 5-year level of service and used to avoid surface ponding.

The target minor system rates calculated based on the average runoff coefficients were adjusted slightly, specifically for site plans, to account for anticipated future updates to these site plans as these areas are developed. It is considered appropriate as the capture rates were only used to size the required storm sewers, and to assist in the selection of the inlet control devices.

A storm drainage plan (C500) is provided in **Appendix G**. A total 24 subcatchments (or drainage areas) within the development site, and one dry pond sub-catchment are shown on this drawing with average runoff coefficients calculated for each drainage area. As noted, average runoff coefficients were calculated for all drainage areas for sizing of the storm sewers.

Design sheets for the 5-year sizing of the storm sewer system is included for reference in **Appendix D**. Under the 5-year storm event adequate capacity is provided within the storm sewer system. This subcatchment data was also used in PCSWMM for dual-drainage modelling, and for storm sewer sizing based on the Rational Method, typical with City of Ottawa guidelines.

To meet no surface ponding on pubic or private roadways during the 5-yr event, the above noted capture rates were used in conjunction with standard inlet control devices (ICDs).

8.7 Stormwater Model Development

PCSWMM was used to create a hydrologic/hydraulic model of the stormwater system. The model includes both the minor system (storm sewer), for estimating peak flows and runoff volumes and the major system (roads and swales, etc.). Calculations of runoff was completed based on the PCSWMM's EPA SWM 5 engine.

PCSWMM is an advanced software application for stormwater, wastewater, watershed, and water distribution system modelling. PCSWMM was developed by Computational Hydraulics International (CHI) https://www.chiwater.com/Home and is based on the EPA storm water management model (SWMM), which is a dynamic rainfall-runoff-routing simulation model used for single event or long-term (continuous) simulation of runoff. PCSWMM was used to determine peak runoff rates and provide hydraulic profiles of the depth of runoff during various storm events. PCSWMM calculates runoff based on the non-linear reservoir model for subcatchments. The model conceptualizes a subcatchment as a rectangular surface that has a uniform slope and a width that drains to a single outlet. The subcatchments receive inflow from precipitation and losses from evaporation and infiltration. The net excess volume ponds atop the subcatchment surface. Ponded water above the depression storage depth, can become runoff outflow. Depression storage accounts for initial rainfall abstractions such as surface ponding, interception by flat roofs and vegetation and surface wetting.

Subcatchment parameters were taken from City of Ottawa's SDG002 Design parameters. The following design parameters and assumptions are noted in **Table 8-4** below:

Table 8-4 : Subcatchment Parameters

Parameter	PCSWMM Parameter	Value
Infiltration Loss Method		Horton
Maximum Infiltration Rate	Max. Infil. Rate	76 mm/hr
Minimum Infiltration Rate	Min. Infil. Rate	13.2 mm/hr
Decay Constant (1/hr)	Decay Constant	4.14
Manning N (Impervious)	N Impev	0.013
Manning N (Pervious)	N Perv	0.25
Depression Storage – Impervious Surfaces	Dstore Imperv	1.57 mm
Depression Storage – Pervious Surfaces	Dstore Perv	4.67 mm
Zero Percent Impervious	Zero Imper	varies
Subcatchment Slopes	Slope	varies

Catchbasins were modelled in either a flow-by condition or in a ponding condition. For catchbasins in flow-by conditions inlet capture curves were developed based on the type of curbs used (mountable curbs or barrier curbs), and the inlet type (surface inlet catchbasins). Ponding areas were modelled as storage nodes with surface ponding represented by area-depth curves above the inlet control devices (ICDs) located at the outlet pipe invert.

The following design parameters and assumptions are noted as follows:

- Subcatchment areas were derived tributary to each surface inlet (catchbasin).
- Runoff coefficient for all subcatchments were determined using area weighting routine and based on actual hard and soft surface areas. Runoff coefficients were calculated from the impervious levels using the relationship C = (IMP x 0.7) + 0.20.
- Subcatchment widths are determined using PCSWMM's SET FLOW LENGTH / WIDTH routine. A Flow-Path layer was created in PCSWMW, and flow paths were created for each subcatchment. The software averages the flow path lengths to calculate the subcatchment widths. The width is equal to the subcatchment area divided by the overland flow path length.
- 5-year, 3-hour Chicago storm used to review minor system design based on Rational Method.
- 12-hr 100-year storm was used to assess the impact of major event and determine peak flows and depth of runoff.

8.8 Rainfall Data

Rainfall used for stormwater modelling and calculations were based on data provided in the City of Ottawa's Sewer Design Guidelines (SDG002). Generation of storm hyetographs for use in hydraulic/hydraulic modelling were derived from the total rainfall depths for various storm durations noted in the **Table 8-5** below.

Table 8-5 : Summary of Rainfall Data (From City of Ottawa SDG002)

Duration	Rainfall Amounts (mm) for Specified Return Period					
	2-year	5-year	10-year	25-year	50-year	100-year
5 mins	9.8	13.1	15.2	17.9	19.9	21.8
10 mins	12.1	16.2	18.7	22.1	24.5	26.9
15 mins	13.7	18.3	21.2	24.9	27.7	30.4
30 mins	16.9	22.5	26.1	30.7	34.1	37.4
1 hour	20.8	27.7	32.1	37.8	42.0	46.1
2 hours	25.6	34.2	39.6	46.6	51.8	56.8
6 hours	35.4	47.4	55.2	64.8	72.0	79.2
12 hours	44.4	58.8	68.4	80.4	85.2	97.2
24 hours	55.2	72.0	84.0	98.4	110.4	120.0

8.8.1 Storm Events Modelled

The SDG002 guidelines specify the use of the Chicago and SCS Type II distributions for generation of stormwater runoff. The 3-hr, and 6-hr Chicago (for urban), and 6-hr, 12-hr, or 24-hr SCS Type II (for rural) are generally used. For this project the 3-hr and 12-hr Chicago storms were modelled. In summary three (3) storm events were modelled including:

- 3-hour 2-year Chicago storm. (10 min timestep), with total rainfall of 31.88mm.
- 3-hour 5-year Chicago storm. (10 min timestep), with total rainfall of 42.54mm.
- 12-hour 100-year Chicago storm. (10 min timestep), with total rainfall of 97.2mm.

8.9 Model Development

The subcatchment (or storm drainage areas) were developed in Autodesk CIVIL 3D and imported into PCSWMM. PCSWMM was then used to generate impervious levels for each subcatchment with the area-weighting command. Storm sewers and manholes were imported from CIVIL 3D as GIS shape files and the node and conduit elevations, and sizes were inputted based on the preliminary sizing completed with the Rational Method analysis. Connections between the catchbasin nodes and the sewer main were converted to OUTLETS to represent the ICDs. Once all the minor system components were inputted, the major system was defined connecting inlets.

The major system was represented as irregular conduits based on a half-street cross-section. The transect editor in PCSWMM was used to establish this transect, which was applied to the majority of the major system. In addition, swale and roadway spill irregular transects were used to represent the overland flows. In flow-by conditions all subcatchments were linked to major system nodes place just upstream (u/s) of the catchbasin storage nodes. Between the u/s node and the catchbasins were represented by a PCSWMM OUTLET. These outlets were established with rating curves to represent the approach-flow and depth, and the inlet capture rate. Additional information on the rating curves under flow-by and ponding conditions is provided in proceeding sections of this report.

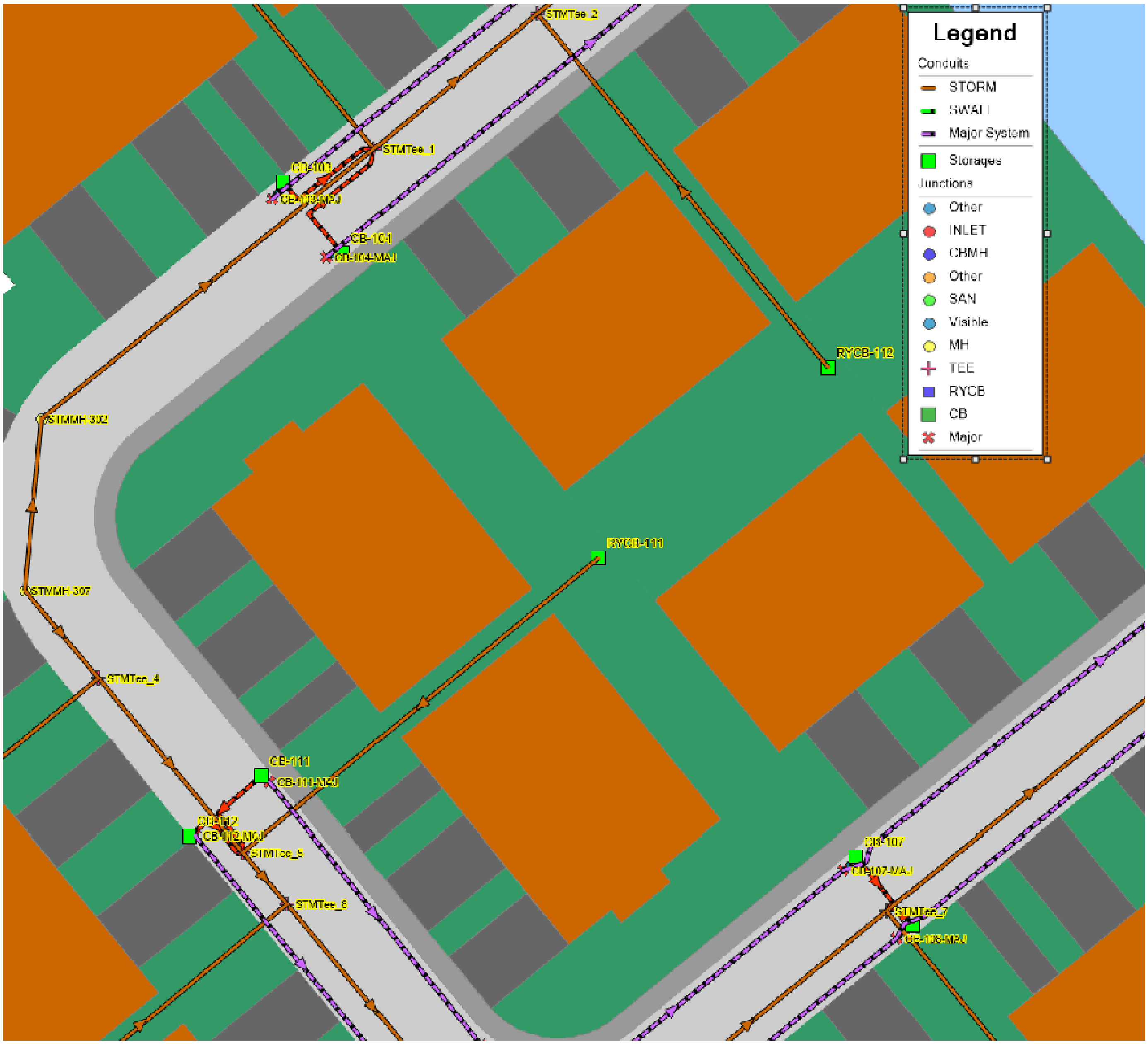


Figure 8-1: Model Schematic Showing Minor and Major System Components

Figure 8-1 above presents a portion of the PCSWMM model which demonstrates the object connectivity. The subcatchment are illustrated as white polygons, the brown lines and yellow circles represent the storm sewer system and manholes, with red dashed lines representing the OUTLET links (or ICDs). The dashed purple lines represent the major system street conduits and irregular channels. Catch basins are shown as green squares and looking closely you can see two OUTLETS connecting the CBs to the storm sewer and the major system nodes. Downstream of each CB represent the ICD, whereas upstream of the CB storage nodes the OUTLET represents the inlet capacity. At ponding locations, the storage nodes were defined based on the depth to the ICD.

8.9.1 Modelling of Catchbasins in Ponding Condition

All catchbasins will be equipped with inlet control devices (ICDs) to ensure that captured flows meet acceptable rates and no ponding occurs on road surface in the 5-year event. At low points (sag locations) the use of ICDs will result in surface ponding during large storm events. All catchbasins were established as storage nodes in PCSWMM, with these storage nodes having a volume relationship which was assigned based on the maximum depth and area of ponding. The rating curves use an area versus depth relationship starting at the invert of the inlet control device. **Figure 8-2** below illustrates a typical storage curve used at a roadway low point.

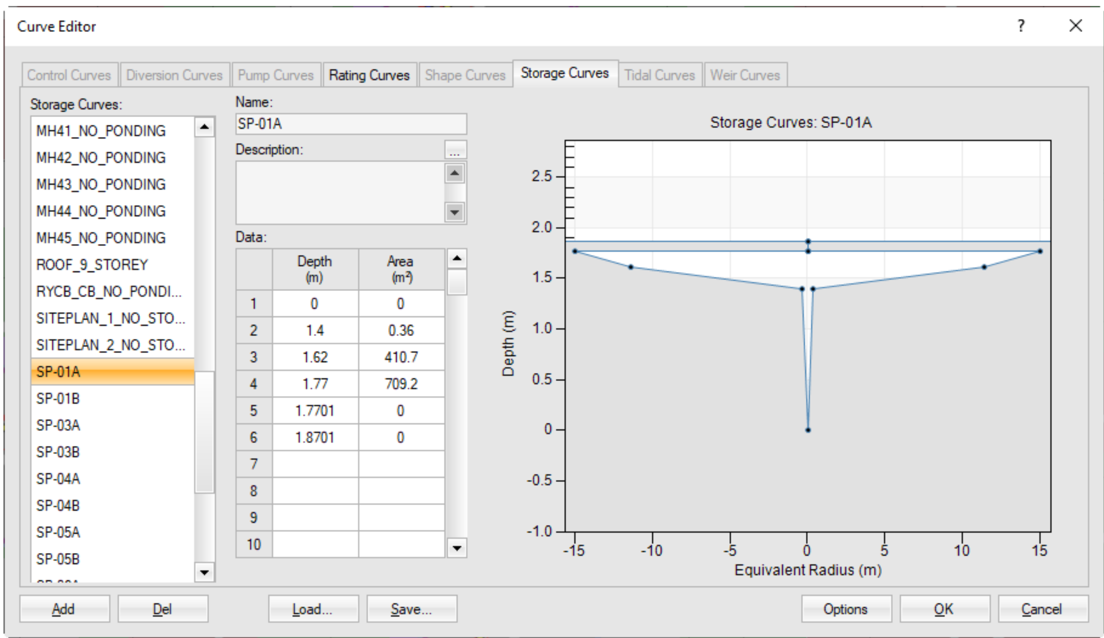


Figure 8-2: Representation of Storage Curves for Modelling of Catchbasins at Ponding Locations

The ponding areas were prepared in CIVIL 3D based on a final ground surface. This final ground surface was defined using roadway templates (or corridors) based on typical City of Ottawa roadway templates. For instance, most of the local streets in the subject site are based on an 18.0m right-of-way having 4.25m lanes (3%) with 0.35m wide mountable curbs and a 1.8m sidewalk on one side. Roadway ponding areas were defined based on the area and depth of ponding at the spill elevation (static ponding), with an additional area 150mm above this static ponding depth (dynamic ponding).

The flow control devices (or ICDs) in each catchbasin were defined as OUTLETS in PCSWMM. There are six (6) primary inlet control devices used in the City of Ottawa for the control of runoff at catchbasins. The standard ICD discharge rates at 1.2 m hydraulic head are 13.4 L/sec, 19.8 L/sec, 28.1 L/sec 36.7 L/sec, 53.2 L/sec and 70.8 L/sec for Pedro Plastics Type X, and IPEX Tempests Type A, B, C, D, and F respectively. The selection of each ICD type was based on ensuring no surface ponding in the 2-year storm event.

Table 8-6 below summarizes the discharge rates of all six (6) standard inlet control devices used. Please refer to the Storm Drainage Plan and Site Servicing Plans for the ICD types at each catchbasin.

Table 8-6 : Discharge Rates for Standard ICD Types

Head (m)	Discharge Rate (L/sec)					
	Pedro Plastics Type X	IPEX Type A	IPEX Type B	IPEX Type C	IPEX Type D	IPEX Type F
0.00	0.0	0.0	0.0	0.0	0.0	0.0
0.10	3.9	5.7	8.1	10.6	15.3	20.5
0.20	5.5	8.1	11.5	15.0	21.7	28.9
0.30	6.7	9.9	14.1	18.3	26.6	35.4
0.40	7.8	11.5	16.2	21.2	30.7	40.9
0.50	8.7	12.8	18.1	23.7	34.3	45.7
0.60	9.5	14.0	19.9	25.9	37.6	50.1
0.70	10.3	15.1	21.5	28.0	40.6	54.1
0.80	11.0	16.2	23.0	29.9	43.4	57.8
0.90	11.6	17.2	24.3	31.8	46.0	61.4
1.00	12.3	18.1	25.7	33.5	48.5	64.7
1.20	13.4	19.8	28.1	36.7	53.2	70.8
1.40	14.5	21.4	30.4	39.6	57.4	76.5
1.60	15.5	22.9	32.5	42.4	61.4	81.8
1.80	16.5	24.3	34.4	44.9	65.1	86.8
2.00	17.3	25.6	36.3	47.4	68.6	91.5
2.50	19.4	28.6	40.6	52.9	76.7	102.3
3.00	21.2	31.4	44.4	58.0	84.1	112.0

8.9.2 Modelling of Catchbasins in Flow-By Condition

Roadway catchbasins in a flow-by condition were once again modelled as STORAGE nodes in PCSWMM however no surface ponding was included in the storage curve. For the roadway catchbasins which include a single outlet to the storm sewer a standard storage definition curve was used. The standard curve was based on the typical -1.4m from the structure top of lid to the invert elevation of the ICD. The RIM elevation of the storage node (CB) was raised to allow for dynamic routing of excess runoff to downstream inlets. **Figure 8-3** below illustrates the storage curve used for typical roadway catchbasins in a flow-by condition. The rating curve shows the typical depth of 1.4m above the invert of the ICD and an additional 0.35m above the lid.

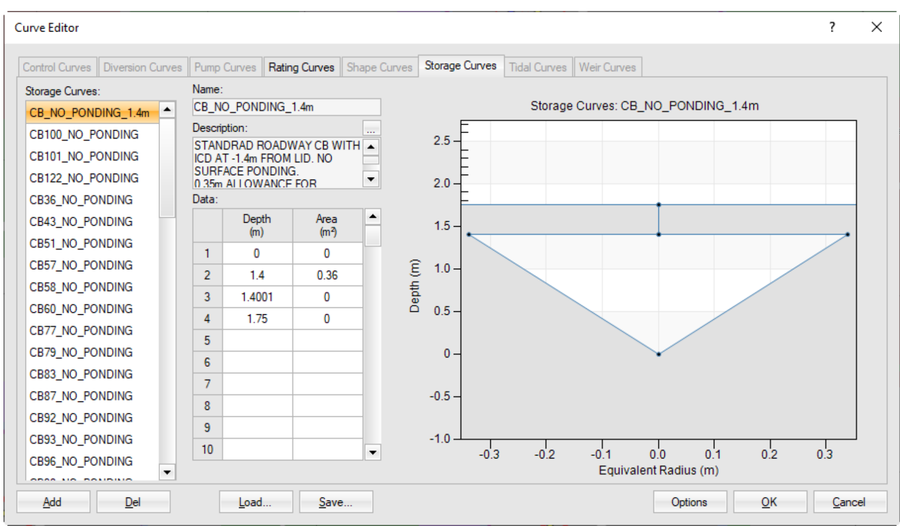


Figure 8-3: Representation of Rating Curves for Modelling of Storage at Ponding Locations

In addition to using a STORAGE node for the catchbasin an OUTLET node was connected upstream of the catchbasin node to simulate the inlet grate. The captured rate through the CB grate is based on the approach flow, depth of flow, type if inlet, roadway cross slope and gutter slope.

This flow-by capture curves are used when an inlet is not located in a ponding area. In this case only a portion of the overland flow is captured, while the remaining flow continues downstream (bypassed). Rating curves for catchbasins under flow-by conditions were modeled based on gutter flow rate curves for either barrier curbs (OPSD600.110) or mountable curb and gutter (OPSD 600.020).

The gutter flow rates are provided at longitudinal road slopes of 2%, 4%, 6%, and 8% for flow spreads ranging between 0m to 3m. Along with the gutter flow rates, the inlet capacities of the surface inlets are provided at various spreads.

The following **Table 8-7** below summarizes the rating curves used for the surface catchbasins with a curb & gutter type curb in a flow-by condition. This exercise was completed since PCSWMM does not have the ability to provide Approach Flow versus Capture Flow at flow-by conditions. PCSWMM requires a depth versus captured flow rate instead.

Table 8-7 : Rating Curves for CB in Flow-By Condition (Mountable Curb & Gutter, 3% cross fall, 2% slope)

Approach Flow (L/sec)	Total Spread, T (m)	Depth of Flow at Gutter (m)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0
5	0.716	0.009	5
10	0.933	0.017	10
50	1.715	0.053	17
100	2.226	0.068	33
125	2.420	0.074	45
150	2.592	0.079	50
200	2.887	0.088	54
250	3.140	0.096	61

8.9.3 Modelling of Dry Pond

For criteria # 2, onsite storage is required to control the post-development peak flows to the discharges under the pre-development conditions for modeled storm events as discussed in Section 8.8.1. To establish the necessary requirements, the PCSWMM model was expanded to include a storage node to represent the stormwater facility. Two (2) flow-controlled ORIFICES were added connecting the pond and the outfall. **Table 8-10** summarizes the orifices sizes and elevations that were used in the model.

Table 8-8 : Dry Pond Stage-Storage Data

Description	Elevation (m)	Total Depth (m)	Area (m2)	Total Volume (m3)
Top of pond	144.30	2.10	910.3	1132
Emergency Spill Elev	144.20	2.00	878.0	1043
Intermediate point	143.60	1.50	673.5	578
Bottom of Dry Pond	142.30	0.10	32.0	2.5
Bottom of Dry Pond (Invert)	142.20	0.00	0	0

The bottom of proposed dry pond was set an and elevation of 142.20m, and the spill elevation is 144.20m. The total available storage at the proposed dry pond is approximately 1100 m^3.

8.10 Stormwater Model Results

The peak flows and volumes in **Table 8-9** represent the peak flow results prior to stormwater detention. This was completed to determine the uncontrolled peak flows and volumes. The estimation of total peak flows and runoff volumes was completed within PCSWMM's GRAPH panel by the selection of all subcatchments to derive a total combined runoff hydrograph (lumped approach). This was completed for all storm events.

Table 8-9 : Summary of Post-Development Flows (Uncontrolled)

Storm Event	Peak Flow (L/sec)	Runoff Volume (m3)
Chicago_3h_2yr	224	250
Chicago_3h_5yr	294	367
Chicago_12h_100yr	775	705

The following orifice sizes were established to provide overall stormwater quantity control as requested.

Table 8-10 : Dry Pond Stage-Storage Data

Description	Elevation (m)	Orifice Size
Orifice 1 – upper	143.15	320mm CIRCULAR
Orifice 2 – lower	142.25	100mm CIRCULAR

8.11 Pond Results

Figure 8-4 illustrates the pond volumes and maximum water surface elevations (WSEL), whereas **Table 8-11** provides peak flows, volumes and WSEL's from the dry pond during major storm events. It also provides the depths and corresponding volumes within the pond. Two orifices were used to establish preliminary results. The volumes and depths presented below confirm that the dry pond has adequate depth and volume to contain the 100-yr storm.

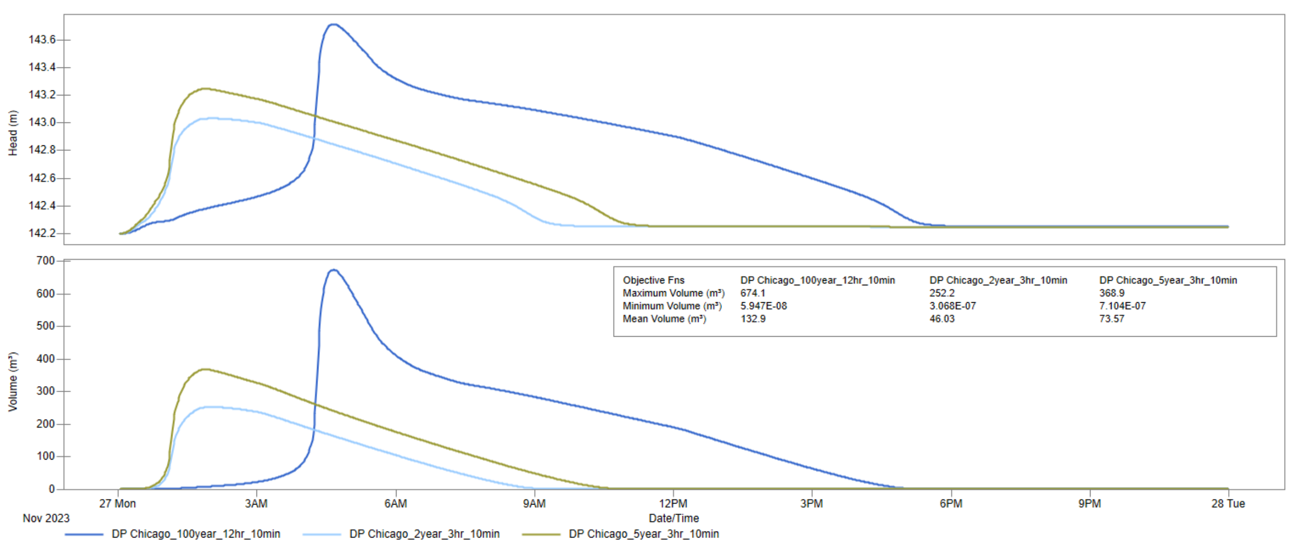


Figure 8-4 : Dry Pond Volume and Elevations for All Storm Scenarios

Table 8-11 : Dry Pond Peak Outflows, Volumes, Elevations

Storm Event	Peak Inflow from Pond (L/sec)	Peak Outflow to Exist 600 Sewer (L/sec)	Volume (m3)	Maximum Pond Stage (m)	Pond Depth During Storm Event (m)
Chicago_3h_2yr	18.2	18.3	249	143.03	0.83
Chicago_3h_5yr	35.4	36.0	363	143.25	1.05
Chicago_12h_100yr	169.5	175.5	691	143.76	1.56

1) Maximum Pond Volume of 1,132 m3 at Elev 144.30m
2) Pond Volume is 1,043 m3 at Spill Elevation of 144.20m
3) Pond bottom is 142.20m
4) Peak Outflow to Exist 600 Sewer Includes Unrestricted Overflow from the Boyd Site.

8.12 Pond Emergency Spillway

The stormwater pond will contain an emergency spillway that is oriented towards Boyd Street near the northeast corner of the proposed dry pond.

A review of the peak flows discharging through the pond's emergency spillway was completed to ensure adequate capacity during the 100-yr storm event. The following summarizes the emergency spillway parameter:

- 100-yr WSEL in dry pond 143.76 m
- Spillway invert elevation 144.20 m
- Spill Height (or top of pond) 144.30 m
- Spill dimensions (trapezoidal weir) 1.5m bottom, 3:1 side slope

8.13 Review Roadway Ponding Depths

The City of Ottawa SDG002 requires that maximum ponding depths for local roadways is 350 mm at the edge of pavement (curb line). There are twelve (12) catchbasins within the right-of-way and four (4) of them are located at ponding locations. All catchbasins used at these ponding locations have separate inlet control devices (ICDs) to control runoff. As a result, ponding will occur in storm events greater than the 5-year event. **Table 8-12** below summarizes the 100-year depths. All depths are within the allowable depth of 35cm as required in the SDG002. The depths and HGLs below are provided for the 10hr Chicago storm.

Table 8-12 : Review of Roadway Ponding Depths

Catchbasin Number	Rim Elevation (m)	100-year Ponding Elevation (m)	[1]100-year Ponding Depth (m)
CB-101	144.05	144.20	0.15
CB-102	144.05	144.19	0.14
CB-103	145.26	145.33	0.07
CB-104	145.26	145.31	0.05
CB-105	144.63	144.78	0.15
CB-106	144.63	144.79	0.16
CB-107	145.14	145.22	0.08
CB-108	145.14	145.24	0.10

CB-109	145.63	145.69	0.06
CB-110	145.63	145.70	0.07
CB-111	145.91	145.91	0.00
CB-112	145.91	145.96	0.05
Notes: *1) A negative value indicates that the water surface is below the lid*			

8.14 Storm Servicing

Due to shallow invert elevations of the storm sewer at the connection on Arthur Street and Boyd Street and 100-year water level in the dry pond, a sump-pump and backflow preventer will be required for each 100 mm diameter foundation drain discharge pipe connecting to the proposed onsite storm sewers. A detailed sump-pump system design is included in the design drawing C003.

8.15 Quality Control

For the quality control, a 2400 mm diameter EFO8 Stormceptor (or equivalent) oil grit separator has been proposed downstream of the dry pond inlet/outlet structure. The treated runoff discharges into the existing 600 mm diameter storm sewer on Aurther Street. The sizing report for EFO8 has been attached in **Appendix F**.

9 Erosion & Sediment Control

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Filter bags shall be installed between the frame and cover of all adjacent catch basins and catch basin manhole structures.
- Light duty silt fencing will be used to control runoff around the construction area. Silt fencing locations are identified on the site grading and erosion control plan.
- A mud mat will be installed at the construction entrance to help avoid mud from being transported to offsite roads.
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations.
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed.
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract.
- During the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) OPSS 805 and City of Ottawa specifications.

10 Conclusions and Recommendations

This Servicing & Stormwater Report outlines the rationale which will be used to service the proposed development. The following summarizes the servicing requirements for the site:

Water

- Estimated domestic water demands are 0.62 L/sec for ADD, 2.82 L/sec for MDD, and 4.25 L/sec for PHD.
- Required Fire Flows for all buildings based on the Fire Underwriters Survey (FUS) method are between 167 L/sec and 217 L/sec.
- A 250 mm diameter looped watermain system is proposed with two connections at the existing 300 mm watermain on Boyd Street.

Sewage

- The estimated design sewage flows from the proposed site are 2.94 L/sec, including 2.19 L/s of peak domestic sewage flow and 0.75 L/s infiltration flow. Therefore, the total sanitary flow expected from the proposed Boyd site and four (4) existing single-family homes discharge to the existing 200 mm diameter sanitary sewer on Boyd Street. The capacity of the existing 200 mm sanitary sewer is 18.85 L/sec and hence it does not identify any capacity issues to accommodate the additional sewage flow.

Stormwater

- The peak overland flows were modeled by using PCSWMM hydraulic modeling software. A split drainage was observed for the development site under the current conditions. A small portion of the onsite runoff overflows southwest to Mississippi Road. Most of the runoff from the development site overflows to Boyd Street and is collected by the existing storm sewer on Bood Street and Arthur Street. The modeled peak runoffs from the development site to Boyd Street under the current conditions are 20.1 L/s for the 2-year design rainfall, 39.5 L/s for the 5-year design rainfall, and 177.2 L/s for the 100-year design rainfall.
- Runoffs from the development site overflow to Boyd Street and are collected by the existing 600 mm diameter storm sewer on Arthur Street. as shown on the as-recorded drawing # M-037-06, the slope of the existing 600 mm diameter storm sewer is 0.50%. The estimated full hydraulic capacity of the 600 mm storm sewer @ 0.50% is 434 L/s. Hence, the existing 600 mm diameter storm sewer has sufficient capacity to accommodate the runoffs from the development site.
- The quantity control criteria require that onsite storage be provided to control peak flows from the various design rainfalls from 2-year to 100-year. The modeled peak discharges from the Boyd site to the existing 600 mm storm sewer on Arthur Stret are 18.3 L/s for the 2-year rainfall, 36.0 L/s for the 5-year rainfall, and 175.5 L/s for the 100-year rainfall. The volumes required to control to the maximum allowable discharge are 249 m3 for the 2-year rainfall, 363 m3 for the 5-year rainfall, and 692 m3 for the 100-year rainfall.
- A dry pond is proposed having a bottom elevation of 142.20m and top elevation of 144.30m. The dry ponds maximum available volume is 1,043 m3 at its emergency spill elevation of 144.20m, and 1,132 m3 at the top of pond elevation of 144.30m. An emergency spill weir (3m wide) and set at 144.0 m will ensure runoff will overflow towards the existing and adjacent walkway block. The dry pond will have 3:1 side slope and include concrete inlet and an outlet control structure. The outlet structure will contain two (2) orifices for flow control. The lower orifice is a in 100mm diameter round, which is set at invert elevation of 142.25m and an upper orifice is in 320mm diameter, which is set at invert elevation of 143.15m.
- Stormceptor EF08 or equivalent oil grit separator has been proposed for the quality control.

11 Legal Notification

This report was prepared by EXP Services Inc. for the account of A&B Bulat Homes Ltd.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Appendix A – Figures

Figure A1 – Site Location Plan

Figure A2– Site Statistics Plan

Figure A3– Pre-Development Drainage Plan

Figure A4 – Post-Development Subcatchment Plan

Figure A5 – Catchbasin Plan

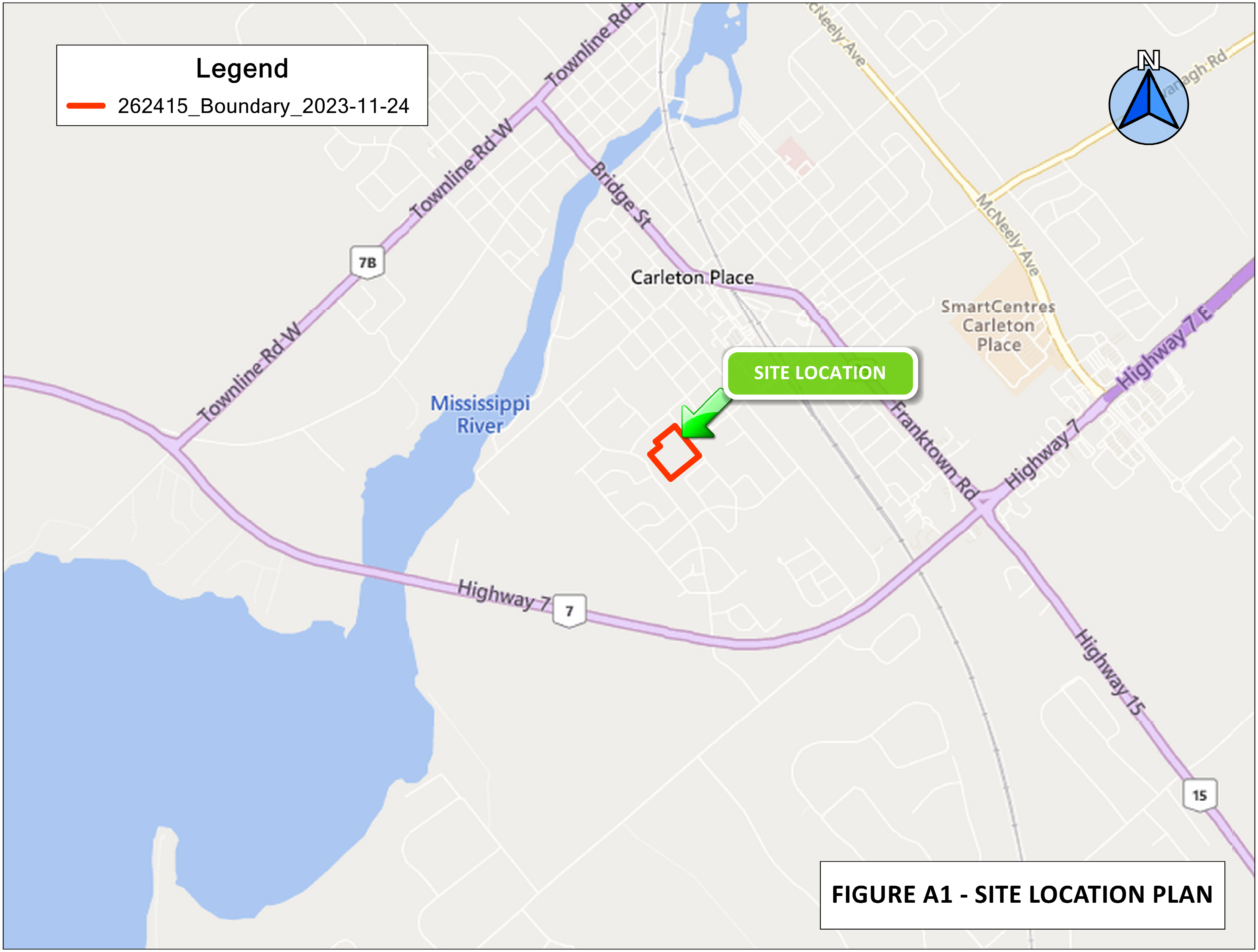


FIGURE A1 - SITE LOCATION PLAN

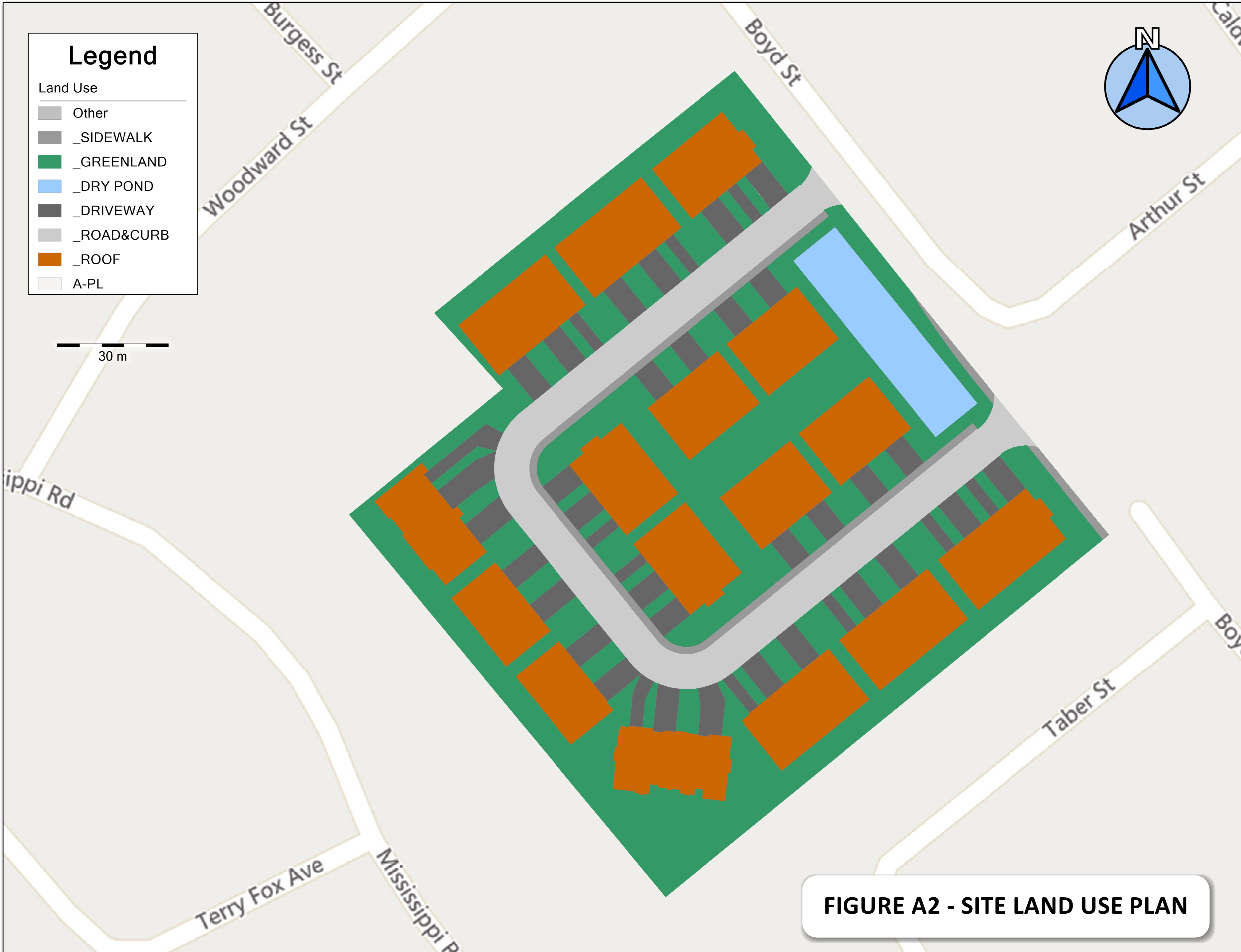


FIGURE A2 - SITE LAND USE PLAN

Figure A3 - Pre-Development Catchments

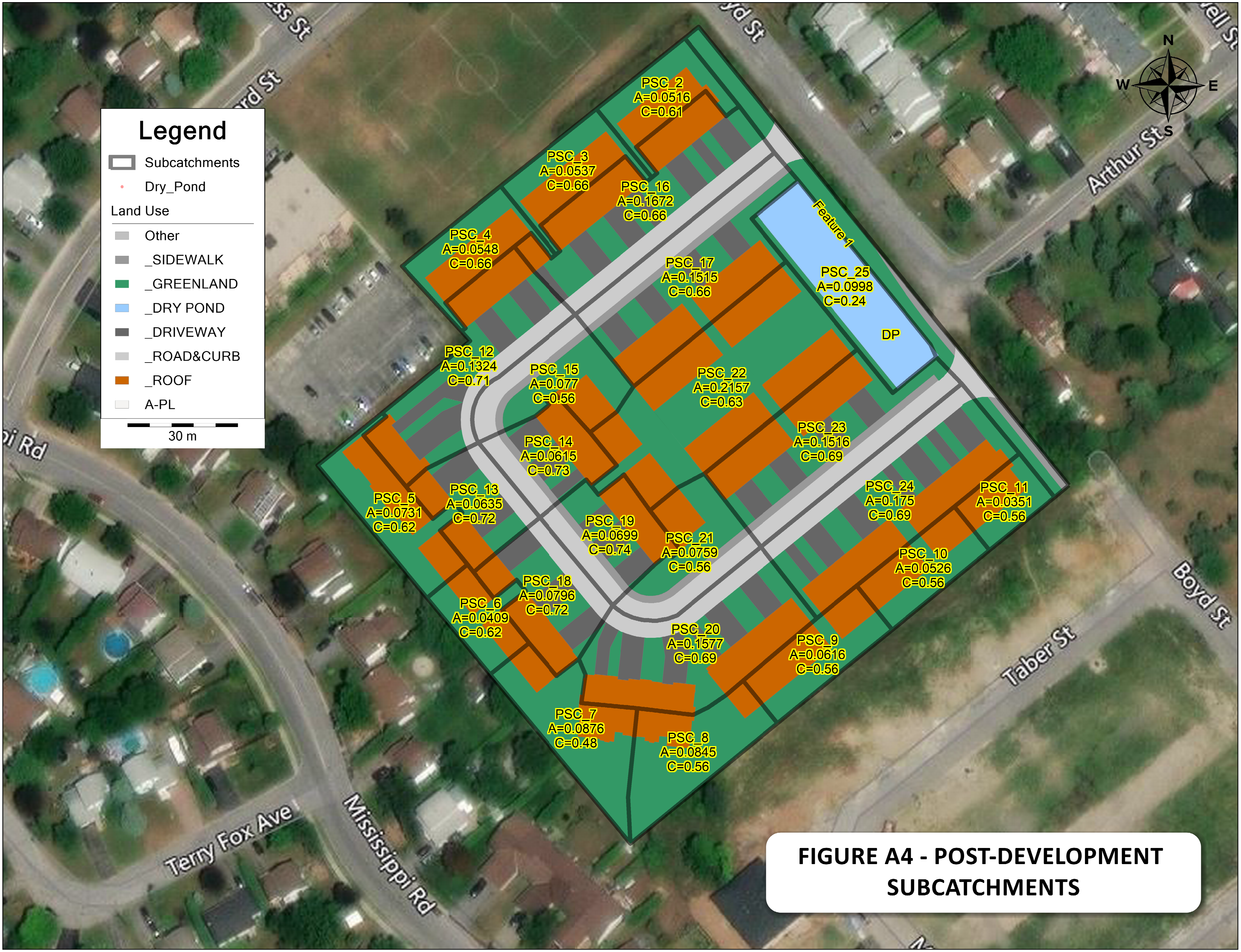


FIGURE A4 - POST-DEVELOPMENT SUBCATCHMENTS

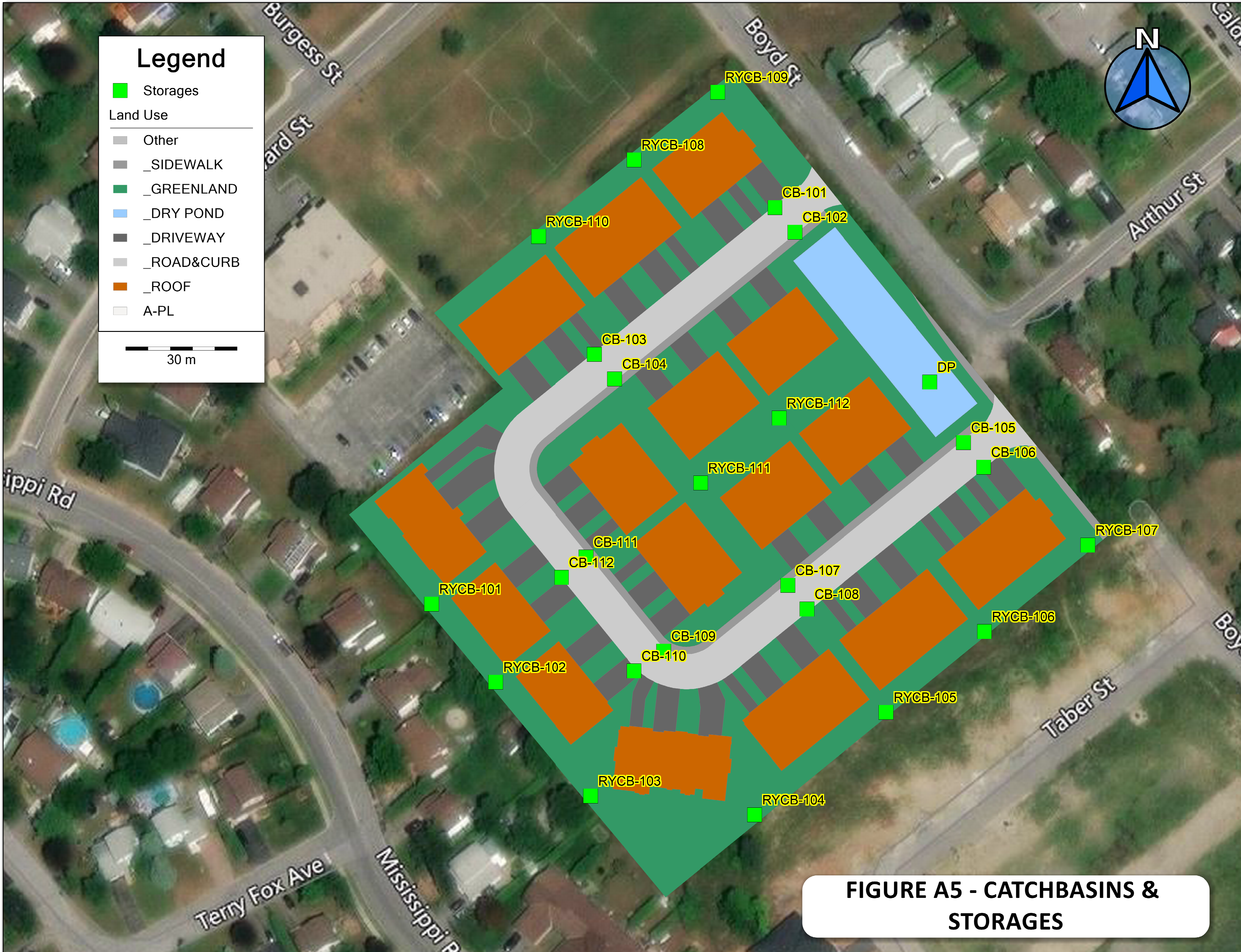


FIGURE A5 - CATCHBASINS & STORAGES

Appendix B – Water Servicing Tables

TABLE B1
WATER DEMAND CHART

Location:	166 Boyd Street
Project No:	OTT-00262415
Designed by:	Z. Pan
Checked By:	B.Thomas
Date Revised:	May 2024

Water Consumption

Residential =	**280**	L/cap/day
Commercial =	5.0	L/m^2/day

Population Densities

Single Family	3.4	person/unit
Semi-Detahced	2.7	person/unit
Duplex	2.3	person/unit
Townhome (Row)	2.7	person/unit
Bachelor Apartment	1.4	person/unit
1 Bedroom Apartment	1.4	person/unit
2 Bedroom Apartment	2.1	person/unit
3 Bedroom Apartment	3.1	person/unit
4 Bedroom Apartment	4.1	person/unit
Avg. Apartment	1.8	person/unit

Proposed Building Blocks	No. of Residential Units: Singles/Semis/Towns				No. of Residential Units: Apartments						Total Persons (pop)	Residential Demands in (L/sec)	Peaking Factors (x Avg Day)				Commercial		Peaking Factors (x Avg Day)				Total Demands (L/sec)		
	Single Family	Semi-Detached	Duplex	Townhome	Studio	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom	Avg Apt.		Avg. Day Demand (L/day)	Max Day	Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Area (m^2)	Avg Demand (L/day)	Max Day	Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Avg Day (L/s)	Max Day (L/s)	Max Hour (L/s)
Block-1				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-2				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-3				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-4				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-5				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-6				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-7				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-8				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-9				5							13.5	3,780	4.54	6.84	17,161	25,855							0.04	0.20	0.30
Block-10				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-11				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-12				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-13				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-14				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-15				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Block-16				4							10.8	3,024	4.54	6.84	13,729	20,684							0.04	0.16	0.24
Total =				**71**							**192**	**53,676**			**243,689**	**367,144**							**0.62**	**2.82**	**4.25**

PEAKING FACTORS FROM MOECC TABLE 3-3 (Peaking Factors for Water Systems Servicing Fewer Than 500 persons)

Equivalent Population	Night Minimum Hour Factor
30	0.10
150	0.10
300	0.20
450	0.30
500	0.40

Equivalent Population	Maximum Day Factor
30	9.50
150	4.90
300	3.60
450	3.00
500	2.90

Equivalent Population	Peak Hour Factor
30	14.30
150	7.40
300	5.40
450	4.50
500	4.30

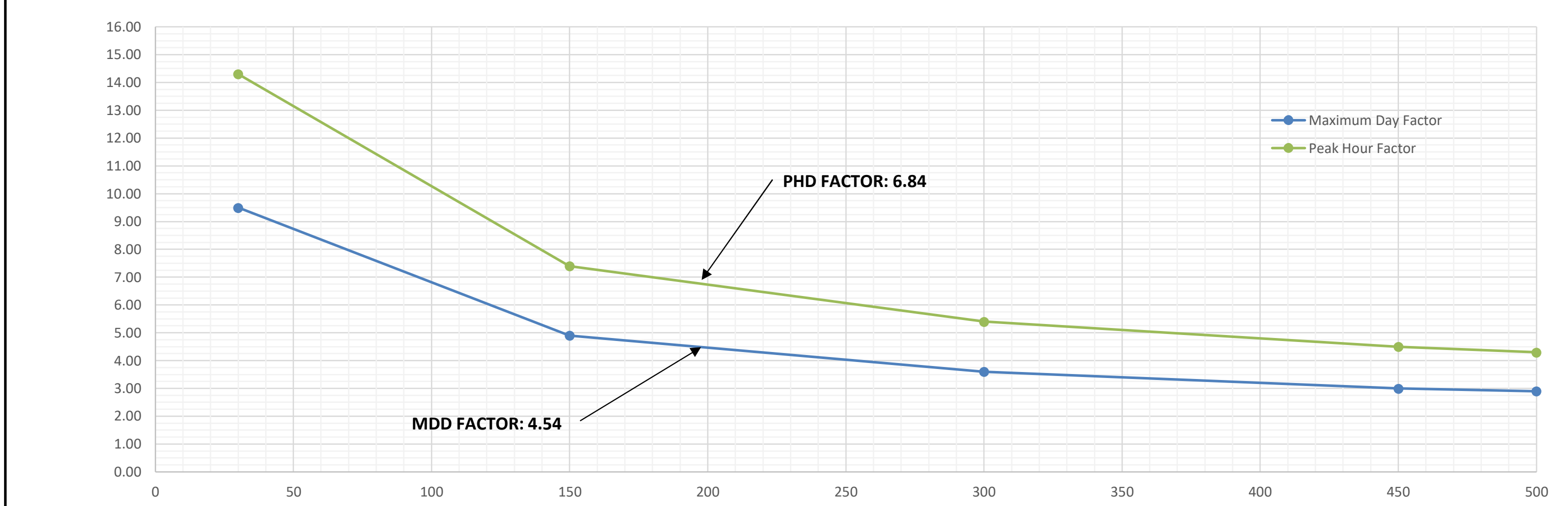


TABLE B2
Summary of Required Fire Flows (RFF) for 166 Boyd Street

Type of Resdential	Reference Table	Requried Fire Flow (L/s)
BLOCK 1 (5 Units - Townhomes)	TABLE B3	183
BLOCK 2 (5 Units - Townhomes)	TABLE B4	200
BLOCK 3 (5 Units - Townhomes)	TABLE B5	200
BLOCK 4 (5 Units - Townhomes)	TABLE B6	200
BLOCK 5 (4 Units - Townhomes)	TABLE B7	167
BLOCK 6 (4 Units - Townhomes)	TABLE B8	167
BLOCK 7 (5 Units - Townhomes)	TABLE B9	167
BLOCK 8 (5 Units - Townhomes)	TABLE B10	200
BLOCK 9 (5 Units - Townhomes)	TABLE B11	217
BLOCK 10 (4 Units - Townhomes)	TABLE B12	167
BLOCK 11 (4 Units - Townhomes)	TABLE B13	200
BLOCK 12 (4 Units - Townhomes)	TABLE B14	217
BLOCK 13 (4 Units - Townhomes)	TABLE B15	183
BLOCK 14 (4 Units - Townhomes)	TABLE B16	183
BLOCK 15 (4 Units - Townhomes)	TABLE B17	217
BLOCK 16 (4 Units - Townhomes)	TABLE B18	200

TABLE B3
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 1 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

$$F = 220 * C * SQRT(A)$$

where:
F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1082.0 m²	
	Floor 2		541	100%	541		
	Floor 1		541	100%	541		
	Basement		541	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,855
Fire Flow (F)	Rounded to nearest 1,000						**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,650	9,350
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	9,350
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	9,350
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	9,350
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	4	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	16%	1,496	10,846
	Side 2	100	5	20.1 to 30	Type V	17.4	0	0	5	0%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	100	5	20.1 to 30	Type V	30.5	0	0	5	0%			

Obtain Required Fire Flow		
	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**11,000**
	Total Required Fire Flow (RFF), L/sec =	**183**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B4
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 2 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1070.0 m²	
	Floor 2		535	100%	535		
	Floor 1		535	100%	535		
	Basement		535	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,795
Fire Flow (F)	Rounded to nearest 1,000						**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,650	9,350
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	9,350
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	9,350
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	9,350
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	4	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	31%	2,899	12,249
	Side 2	3.7	2	3.1 to 10	Type V	17.4	0	0	2A	15%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	100	5	20.1 to 30	Type V	30.5	0	0	5	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**12,000**
	Total Required Fire Flow (RFF), L/sec =												**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	**Condition**
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B5
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 3 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1074.0 m²	
	Floor 2		537	100%	537		
	Floor 1		537	100%	537		
	Basement		537	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,815
Fire Flow (F)	Rounded to nearest 1,000						**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input						Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible						-15%	-1,650	9,350
	Limited Combustible	-15%									
	Combustible	0%									
	Free Burning	15%									
	Rapid Burning	25%									
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler						0%	0	9,350
	No Sprinkler	0%									
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable						0%	0	9,350
	Not Standard Water Supply or Unavailable	0%									
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A						0%	0	9,350
	Not Fully Supervised or N/A	0%									

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	4	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	31%	2,899	12,249
	Side 2	4.5	2	3.1 to 10	Type V	17.4	0	0	2A	15%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	100	5	20.1 to 30	Type V	30.5	0	0	5	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**12,000**
	Total Required Fire Flow (RFF), L/sec =												**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	**Condition**
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B6
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 4 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1016.0 m²	
	Floor 2		508	100%	508		
	Floor 1		508	100%	508		
	Basement		508	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,519
Fire Flow (F)	Rounded to nearest 1,000						**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier		Input						Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%		Limited Combustible						-15%	-1,650	9,350
	Limited Combustible	-15%										
	Combustible	0%										
	Free Burning	15%										
	Rapid Burning	25%										
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%		No Sprinkler						0%	0	9,350
	No Sprinkler	0%										
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%		Not Standard Water Supply or Unavailable						0%	0	9,350
	Not Standard Water Supply or Unavailable	0%										
	Fully Supervised Sprinkler System	-10%		Not Fully Supervised or N/A						0%	0	9,350
	Not Fully Supervised or N/A	0%										
Choose Structure Exposure Distance					Exposed Wall Length							
	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)
	Side 1	5	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	31%	2,899	12,249
	Side 2	4.5	2	3.1 to 10	Type V	17.4	0	0	2A	15%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	100	5	20.1 to 30	Type V	30.5	0	0	5	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =											**12,000**
	Total Required Fire Flow (RFF), L/sec =											**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B7
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 5 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	711.6 m²	
	Floor 2		355.8	100%	355.8		
	Floor 1		355.8	100%	355.8		
	Basement		355.8	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						8,803
Fire Flow (F)	Rounded to nearest 1,000						**9,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	5	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	34%	2,601	10,251
	Side 2	3.6	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	27	4	20.1 to 30	Type V	30.5	1	30.5	4B	2%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**10,000**
	Total Required Fire Flow (RFF), L/sec =												**167**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B8
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 6 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	730.0 m²	
	Floor 2		365	100%	365		
	Floor 1		365	100%	365		
	Basement		365	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						8,916
Fire Flow (F)	Rounded to nearest 1,000						9,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,350	7,650
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	7,650
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	7,650
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	4	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	34%	2,601	10,251
	Side 2	3.6	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	27	4	20.1 to 30	Type V	30.5	1	30.5	4B	2%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**10,000**
	Total Required Fire Flow (RFF), L/sec =												**167**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B9
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 7 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options		Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame		1.5	Wood Frame			1.5	
	Ordinary Construction		1					
	Non-combustible Construction		0.8					
	Fire Resistive Construction		0.6					
Input Building Floor Areas (A)				Area	% Used	Area Used	896.6 m²	
	Floor 2			448.3	100%	448.3		
	Floor 1			448.3	100%	448.3		
	Basement			448.3	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)							9,881
Fire Flow (F)	Rounded to nearest 1,000							**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	4	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%	18%	1,530	10,030
	Side 2	42	5	20.1 to 30	Type V	17.4	4	69.6	5	0%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	27	4	20.1 to 30	Type V	30.5	1	30.5	4B	2%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**10,000**
	Total Required Fire Flow (RFF), L/sec =												**167**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	**Condition**
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B10
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 8 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1060.0 m²	
	Floor 2		530	100%	530		
	Floor 1		530	100%	530		
	Basement		530	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,744
Fire Flow (F)	Rounded to nearest 1,000						**11,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,650	9,350
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	9,350
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	9,350
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	9,350
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	17.4	2	34.8	1B	21%	24%	2,244	11,594
	Side 2	31.3	5	20.1 to 30	Type V	17.4	2	34.8	5	0%			
	Front	30.5	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	27	4	20.1 to 30	Type III	30.5	4	122	4F	3%			

Obtain Required Fire Flow		
	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**12,000**
	Total Required Fire Flow (RFF), L/sec =	**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B11
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 9 (5 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	1060.0 m²	
	Floor 2		530	100%	530		
	Floor 1		530	100%	530		
	Basement		530	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						10,744
Fire Flow (F)	Rounded to nearest 1,000						11,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,650	9,350
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	9,350
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	9,350
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	9,350
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	17.4	2	34.8	1B	21%	37%	3,460	12,810
	Side 2	3.6	2	3.1 to 10	Type V	17.4	2	34.8	2B	16%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	100	5	20.1 to 30	Type V	30.5	2	61	5	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**13,000**
	Total Required Fire Flow (RFF), L/sec =												**217**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B12
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 10 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	860.0 m²	
	Floor 2		430	100%	430		
	Floor 1		430	100%	430		
	Basement		430	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,677
Fire Flow (F)	Rounded to nearest 1,000						**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	17.4	2	34.8	1B	21%	21%	1,785	10,285
	Side 2	35	5	20.1 to 30	Type V	17.4	2	34.8	5	0%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	100	5	20.1 to 30	Type V	30.5	2	61	5	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**10,000**
	Total Required Fire Flow (RFF), L/sec =												**167**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B13
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 11 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	900.0 m²	
	Floor 2		450	100%	450		
	Floor 1		450	100%	450		
	Basement		450	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,900
Fire Flow (F)	Rounded to nearest 1,000						**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	17.4	2	34.8	1B	21%	37%	3,145	11,645
	Side 2	32	5	20.1 to 30	Type V	17.4	2	34.8	5	0%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	8	2	3.1 to 10	Type V	18	2	36	2B	16%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**12,000**
	Total Required Fire Flow (RFF), L/sec =												**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B14

FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020

Building # / Type: BLOCK 12 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute

A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)

C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	880.0 m²	
	Floor 2		440	100%	440		
	Floor 1		440	100%	440		
	Basement		440	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,789
Fire Flow (F)	Rounded to nearest 1,000						10,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance						Exposed Wall Length							
	Side 1	3	1	0 to 3	Type V	18	2	36	1B	21%	50%	4,250	12,750
	Side 2	8	2	3.1 to 10	Type V	24.5	2	49	2C	17%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	13	3	10.1 to 20	Type V	24.5	2	49	3C	12%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**13,000**
	Total Required Fire Flow (RFF), L/sec =												**217**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B15
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 13 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	880.0 m²	
	Floor 2		440	100%	440		
	Floor 1		440	100%	440		
	Basement		440	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,789
Fire Flow (F)	Rounded to nearest 1,000						**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	18	2	36	1B	21%	33%	2,805	11,305
	Side 2	100	5	20.1 to 30	Type V	24.5	2	49	5	0%			
	Front	32	5	20.1 to 30	Type V	30.5	2	61	5	0%			
	Back	13	3	10.1 to 20	Type V	24.5	2	49	3C	12%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**11,000**
	Total Required Fire Flow (RFF), L/sec =												**183**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B16
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 14 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options		Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame		1.5	Wood Frame			1.5	
	Ordinary Construction		1					
	Non-combustible Construction		0.8					
	Fire Resistive Construction		0.6					
Input Building Floor Areas (A)				Area	% Used	Area Used	880.0 m²	
	Floor 2			440	100%	440		
	Floor 1			440	100%	440		
	Basement			440	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)							9,789
Fire Flow (F)	Rounded to nearest 1,000							**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	18	2	36	1B	21%	33%	2,805	11,305
	Side 2	100	5	20.1 to 30	Type V	18	2	36	5	0%			
	Front	32	5	20.1 to 30	Type V	30.2	2	60.4	5	0%			
	Back	13	3	10.1 to 20	Type V	24.5	2	49	3C	12%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**11,000**
	Total Required Fire Flow (RFF), L/sec =												**183**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	**Condition**
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B17
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 15 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	880.0 m²	
	Floor 2		440	100%	440		
	Floor 1		440	100%	440		
	Basement		440	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,789
Fire Flow (F)	Rounded to nearest 1,000						**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	18	2	36	1B	21%	50%	4,250	12,750
	Side 2	8	2	3.1 to 10	Type V	24.5	2	49	2C	17%			
	Front	32	5	20.1 to 30	Type V	30.2	2	60.4	5	0%			
	Back	13	3	10.1 to 20	Type V	24.5	2	49	3C	12%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**13,000**
	Total Required Fire Flow (RFF), L/sec =												**217**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B18
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
Building # / Type: BLOCK 16 (4 Units - Townhomes)

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input			Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Wood Frame			1.5	
	Ordinary Construction	1					
	Non-combustible Construction	0.8					
	Fire Resistive Construction	0.6					
Input Building Floor Areas (A)			Area	% Used	Area Used	900.0 m²	
	Floor 2		450	100%	450		
	Floor 1		450	100%	450		
	Basement		450	0%	0		
Fire Flow (F)	F = 220 * C * SQRT(A)						9,900
Fire Flow (F)	Rounded to nearest 1,000						**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	No Sprinkler	0%	0	8,500
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Not Standard Water Supply or Unavailable	0%	0	8,500
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,500
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposing Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	3	1	0 to 3	Type V	18	2	36	1B	21%	37%	3,145	11,645
	Side 2	30.5	5	20.1 to 30	Type V	30.2	2	60.4	5	0%			
	Front	32	5	20.1 to 30	Type V	23.7	2	47.4	5	0%			
	Back	8	2	3.1 to 10	Type V	18	2	36	2B	16%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**12,000**
	Total Required Fire Flow (RFF), L/sec =												**200**

Exposure Charges for Exposing Walls of Wood Frame Construction (from Table G5)

Type V	Wood-Frame
Type IV	Mass Timber
Type III	Ordinary or joisted masonry
Type II	Non-combustible
Type I	Fire-resistive

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

Appendix C – Sanitary Servicing Table

Table C1 – Sanitary Sewer Design Sheet

TABLE C1: SANITARY SEWER CALCULATION SHEET

LOCATION				RESIDENTIAL AREAS AND POPULATIONS												COMMERCIAL			INDUSTRIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
					NUMBER OF UNITS							POPULATION				AREA (ha)			AREA (ha)					AREA (ha)										
Street	U/S MH	D/S MH	Area Number	Area (ha)	Singles	Semis	Towns	Batch or 1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	Total Units	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor (per MOE)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
166 Boyd	SANMH 04	SANMH 03	1	0.4500			17				17	45.9	45.9	3.66	0.54									0.4500	0.45	0.15	0.69	200	201.2	0.65	63.1	26.87	0.03	0.84
	SANMH 03	SANMH 02					4				4	10.8	56.7	3.64	0.67												0.69	200	201.2	0.30	10.4	18.25	0.04	0.57
	SANMH 02	SANMH 01	2	0.8900			23				23	62.1	118.8	3.58	1.38									0.8900	1.3400	0.44	1.82	200	201.2	0.30	118.3	18.25	0.10	0.57
	SANMH04	SANMH 05	3	0.9300			4				4	10.8	10.8	3.73	0.13									0.9300	0.9300	0.31	0.44	200	201.2	2.61	14.6	53.84	0.01	1.68
	SANMH 05	SANMH 06					23				23	62.1	72.9	3.62	0.86												0.86	200	201.2	0.30	115.9	18.25	0.05	0.57
Existing					4						4	13.6	205.3	3.52	2.34																			
200mm Sanitary on Boyd													205.3	3.52	**2.34**										2.2700	0.75	**3.09**	200	201.2	0.32	102.4	18.85	0.16	0.59
				2.2700	**4**		**71**				**75**	**205.3**												**2.2700**							**424.7**			

Residential Avg. Daily Flow, q (L/p/day) = 280
Commercial Avg. Daily Flow (L/gross ha/day) = 28,000
or L/gross ha/sec = 0.324
Institutianal Avg. Daily Flow (L/day/ha) = 28,000
or L/gross ha/day = 0.324
Light Industrial Flow (L/gross ha/day) = 35,000
or L/gross ha/sec = 0.40509
Light Industrial Flow (L/gross ha/day) = 55,000
or L/gross ha/sec = 0.637

Commercial Peak Factor = 1.5 (when area >20%)
1.0 (when area <20%)
Institutional Peak Factor = 1.5 (when area >20%)
1.0 (when area <20%)
Residential Correction Factor, K = 0.80
Manning N = 0.013
Peak extraneous flow, I (L/s/ha) = 0.33 (Total I/I)

Peak Population Flow, (L/sec) = P*q*M/86.4
Peak Extraneous Flow, (L/sec) = I*Ac
Residential Peaking Factor, M = 1 + (14/(4+P^0.5)) * K
A_c = Cumulative Area (hectares)
P = Population (thousands)
Sewer Capacity, Qcap (L/sec) = 1/N $S^{1/2}$ $R^{2/3}$ A_c
(Manning's Equation)

Unit Type	Persons/Unit
Singles	3.4
Semi-Detached	2.7
Townhomes	2.7
Batchelor or 1-bed Apt. Unit	1.4
2-bed Apt. Unit	2.1
3-bed Apt. Unit	3.1
4-bed Apt. Unit	3.8

Designed:	Project:
Z. Pan	166 Boyd Street
Checked:	Location:
T. Bruce	Ottawa, Ontario
File Reference:	Page No:
262415 Sanitary - Sewer Design Sheet_May 2024.xlsx	1 of 1

Appendix D – Stormwater Tables

Table D1 - Storm Sewer Calculation Sheet. 5-Year.

Table D2 – Stage-Storage Table of Dry Pond

Table D3 – Major System (Street Segment) Characteristics. Barrier Curb at 2% Longitudinal Slope.

Table D4 – Major System (Street Segment) Characteristics. Barrier Curb at 3% Longitudinal Slope.

Table D5 – Major System (Street Segment) Characteristics. Mountable Curb at 1% Longitudinal Slope.

Table D6 – Major System (Street Segment) Characteristics. Mountable Curb at 2% Longitudinal Slope.

Table D7 – Major System (Street Segment) Characteristics. Mountable Curb at 3% Longitudinal Slope.

TABLE D-1: 5-YEAR STORM SEWER CALCULATION SHEET

Return Period Storm =	**5-year**	(2-year, 5-year, 100-year)
Default Inlet Time=	10	(minutes)
Manning Coefficient =	0.013	(dimensionless)

From Node	To Node	Street	AREA INFO				FLOW (UNRESTRICTED)							INDIV CAP FLOW (L/s)	CUMUL CAP FLOW (L/s)	SEWER DATA										
			Area No.	Area (ha)	∑ Area (ha)	Average R	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)			Dia (mm) Actual	Dia (mm) Nominal	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Velocity (m/s) Vf	Velocity (m/s) Va	Time in Pipe, Tt (min)	Hydraulic Ratios Q/Q_{CAP}	Hydraulic Ratios Va/Vf
STMMH 307	STMMH 302	UNNAMED	PSC12&15	0.209	0.209	0.65	0.381	0.381	10.00	104.19	39.7	5-year	39.7			251.5	250	PVC	1.71	15.8	78.98	1.58	1.12	0.24	0.50	0.71
STMMH 302	STMMH 303	UNNAMED	PSC3,4,&22	0.328	0.537	0.64	0.583	0.965	10.24	102.97	60.1	5-year	99.3			447.9	450	PVC	0.30	102.2	154.20	0.98	0.90	1.89	0.64	0.92
STMMH 303	STMMH Dry_Pond_Outlet	UNNAMED	PSC2,16 &17	0.370	0.908	0.65	0.672	1.637	12.12	94.18	63.3	5-year	154.2			610.0	600	PVC	0.20	60.1	286.97	0.97	0.69	1.46	0.54	0.71
STMMH 307	STMMH 306	UNNAMED	PSC5,6,13&14	0.241	0.241	0.68	0.452	0.452	10.00	104.19	47.1	5-year	47.1			447.9	450	PVC	0.30	64.4	154.20	0.98	0.69	1.56	0.31	0.70
STMMH 306	STMMH 305	UNNAMED	PSC7,18&19	0.237	0.478	0.64	0.420	0.872	11.56	96.61	40.6	5-year	84.2			447.9	450	PVC	0.30	11.6	154.20	0.98	0.69	0.28	0.55	0.71
STMMH 305	STMMH 308	UNNAMED	PSC8,9,10,20&21	0.432	0.910	0.61	0.730	1.602	11.84	95.38	69.6	5-year	152.8			447.9	450	PVC	0.30	104.7	154.20	0.98	1.02	1.71	0.99	1.04
STMMH 308	STMMH Dry_Pond_Outlet	UNNAMED	PSC11,23&24	0.362	1.272	0.67	0.677	2.279	13.55	88.56	60.0	5-year	201.8			610.0	600	PVC	0.21	24.1	294.06	1.00	0.94	0.43	0.69	0.94
STMMH Dry_Pond_Outlet	DRY POND	UNNAMED			2.179			2.279	13.55	88.56		5-year	201.8			610.0	600	PVC	0.75	6.5	555.71	1.88	1.33	0.08	0.36	0.71
DRY POND	STORM MAIN	BOYD STREET	PSC25	0.100	2.279	0.20	0.056	2.335	13.63	88.26	4.9	5-year	206.1	35.3	35.3	610.0	600	PVC	0.16	12.4	256.67	0.87	0.50	0.41	0.14	0.58
TOTALS =				**2.28**			**3.972**																			

Definitions:
Q = 2.78*AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Watershed Area (hectares)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficients (dimensionless)

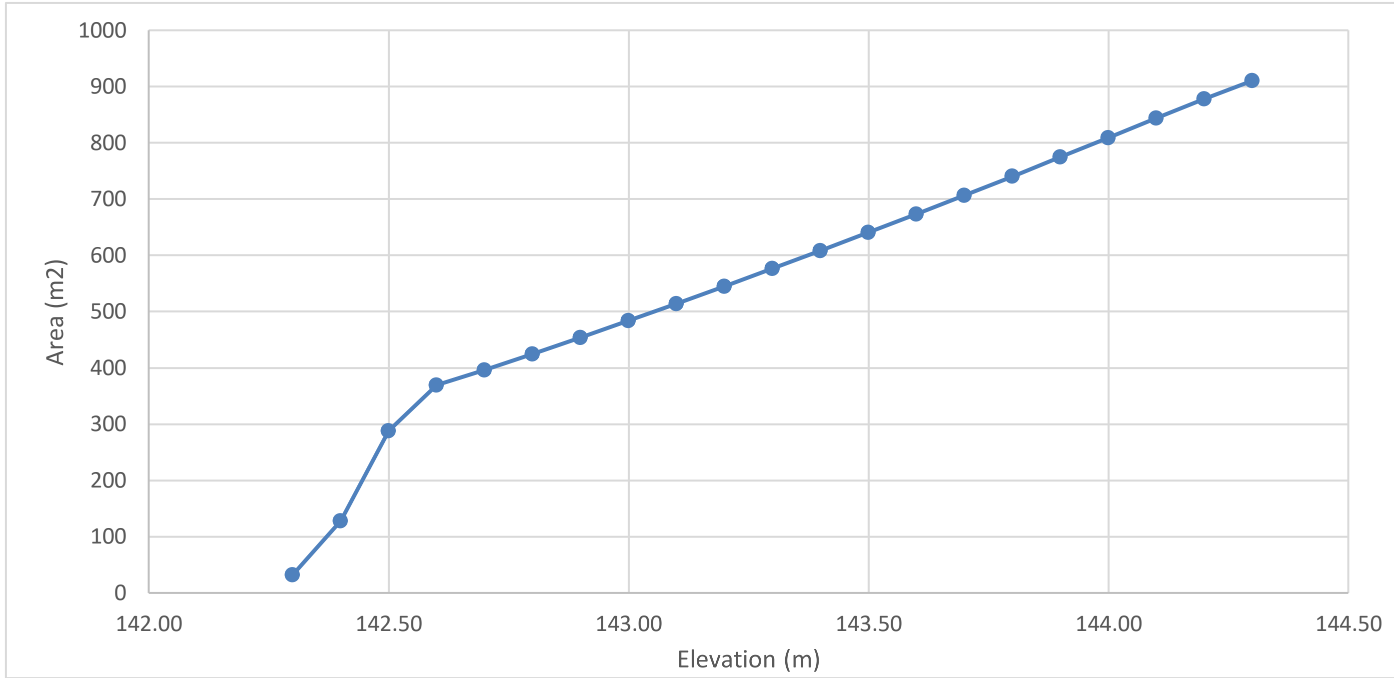
Ottawa Rainfall Intensity Values from Sewer Design Guidelines, SDG002

	a	b	c
2-year	732.951	6.199	0.810
5-year	998.071	6.053	0.814
100-year	1735.688	6.014	0.820

Designed:	Project:	
Zhidong Pan, P.Eng.	166 Boyd Street	
Checked:	Location:	
Bruce Thomas, P.Eng.	166 Boyd Street	
Dwg Reference:	File Ref:	Sheet No:
C100 - Site Servicing Plan	**262415 Storm Design Sheets_May 2024.xlsx**	1 of 1

Table D-2: Stage Area Table of Dry Pond

Dry_Pond_Bottom_Elevation (m)		142.2
Stage Elevation (m)	Level (m)	Area (m2)
142.30	0.10	32.05
142.40	0.20	128.19
142.50	0.30	288.44
142.60	0.40	369.59
142.70	0.50	395.99
142.80	0.60	424.89
142.90	0.70	454.26
143.00	0.80	484.12
143.10	0.90	514.47
143.20	1.00	545.30
143.30	1.10	576.61
143.40	1.20	608.40
143.50	1.30	640.68
143.60	1.40	673.45
143.70	1.50	706.69
143.80	1.60	740.42
143.90	1.70	774.64
144.00	1.80	809.34
144.10	1.90	844.28
144.20	2.00	878.02
144.30	2.10	910.31



Stage Storage

Stage Storage Table Details

Report Title:

Boyd Site Dry Pond Stage Storage Curve

Project Name:

166 Boyd Street

Basin Description:

Volume Calculation Method

- ○ Average End Area
- ○ Conic Approximation
- ● Both

Basin Definition Options

- ● Define Basin from Entity
- ○ Use Manual Contour Data Entry

Define Basin

Stage Storage Volume Table

Contour El...	Contour Ar...	Incremetal Dep...	Avg. End Area I...	Avg. End Area ...	Conic Increment...	Conic Cumulati...
142.300	32.05	N/A	N/A	0.00	N/A	0.00
142.400	128.19	0.100	8.01	8.01	7.48	7.48
142.500	288.44	0.100	20.83	28.84	20.30	27.78
142.600	367.59	0.100	32.80	61.65	32.72	60.50
142.700	395.99	0.100	38.18	99.82	38.17	98.67
142.800	424.89	0.100	41.04	140.87	41.04	139.70
142.900	454.26	0.100	43.96	184.83	43.95	183.65
143.000	484.12	0.100	46.92	231.75	46.91	230.56
143.100	514.47	0.100	49.93	281.67	49.92	280.49
143.200	545.30	0.100	52.99	334.66	52.98	333.47
143.300	576.61	0.100	56.10	390.76	56.09	389.55
143.400	608.40	0.100	59.25	450.01	59.24	448.80
143.500	640.68	0.100	62.45	512.46	62.45	511.25
143.600	673.45	0.100	65.71	578.17	65.70	576.94
143.700	706.69	0.100	69.01	647.18	69.00	645.95
143.800	740.42	0.100	72.36	719.53	72.35	718.29
143.900	774.64	0.100	75.75	795.29	75.75	794.04
144.000	809.34	0.100	79.20	874.48	79.19	873.23
144.100	844.28	0.100	82.68	957.17	82.67	955.91
144.200	878.02	0.100	86.11	1043.28	86.11	1042.02
144.300	910.31	0.100	89.42	1132.70	89.41	1131.43
144.400	741.86	0.100	82.61	1215.30	82.47	1213.89
144.500	567.28	0.100	65.46	1280.76	65.26	1279.16
144.600	431.76	0.100	49.95	1330.71	49.80	1328.95
144.700	261.96	0.100	34.69	1365.40	34.33	1363.29
144.800	6.08	0.100	13.40	1378.80	10.26	1373.55

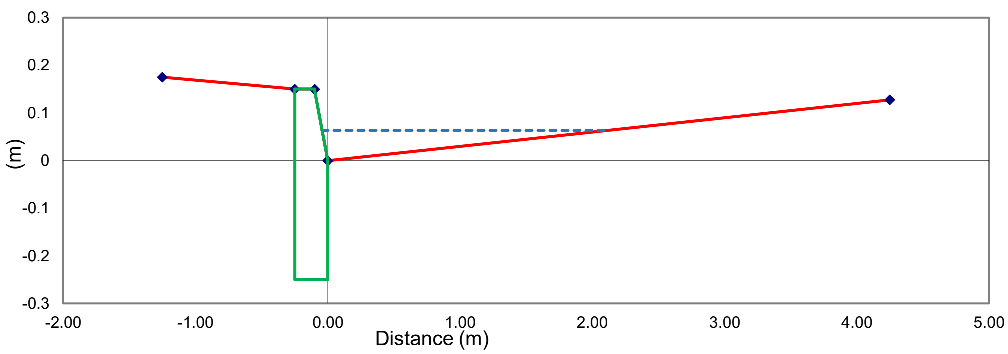
Load Table | Save Table | Create Report | Insert

Open Export Folder | Cancel | Help

TABLE D3: MAJOR SYSTEM CHARACTERISTICS

ROAD AND CURB DATA (For Barrier Curb at 2% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.250	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.020	*2.0%*
Curb Type =	SC1.1	*Mountable Curb and Gutter*
Inlet Type =	S19	*Curb inlet CB*
Curb height, H_C (m) =	0.150	
Total curb height, H_T (m) =	0.400	
Curb top width, W_C (m) =	0.150	
Curb bottom width, W (m) =	0.250	
Gutter width, W_G (m) =	0.000	
Gutter slope, S_G (m/m) =	0.000	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.000	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.125	*Max Permitted Spread = 1/2 Asphalt width, W_A + W_G*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.064	*$D_{MAX} = D_{SMAX} + D_G$*



Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.725	0.725	0.022	0.022	0.0000	0.0000	0.0000	0.0050	5.00
10	0.940	0.940	0.028	0.028	0.0000	0.0000	0.0000	0.0100	10.00
50	1.718	1.718	0.052	0.052	0.0000	0.0000	0.0000	0.0500	50.00
100	2.228	2.228	0.067	0.067	0.0000	0.0000	0.0000	0.1000	100.00
125	2.423	2.423	0.073	0.073	0.0000	0.0000	0.0000	0.1250	125.00
150	2.594	2.594	0.078	0.078	0.0000	0.0000	0.0000	0.1500	150.00
200	2.890	2.890	0.087	0.087	0.0000	0.0000	0.0000	0.2000	200.00
250	3.142	3.142	0.094	0.094	0.0000	0.0000	0.0000	0.2500	250.00

**Note: Re-iterate to get Steeet Flow Equal to Q_{A+B} (use Goal Seak Function)*

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.020 m/m

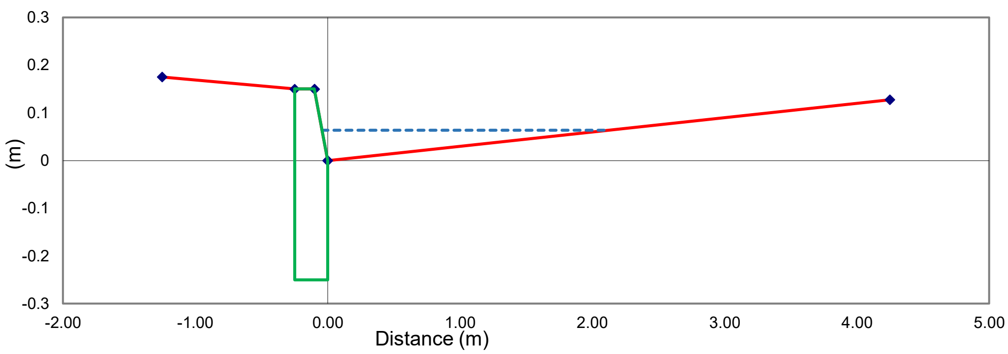
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.725	0.725	0.022	0.013	13
10	0.940	0.940	0.028	0.017	17
50	1.718	1.718	0.052	0.033	33
100	2.228	2.228	0.067	0.045	45
125	2.423	2.423	0.073	0.050	50
150	2.594	2.594	0.078	0.054	54
200	2.890	2.890	0.087	0.061	61
250	3.142	3.142	0.094	0.000	61

Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE D4: MAJOR SYSTEM CHARACTERISTICS

ROAD AND CURB DATA (For Barrier Curb at 3% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.250	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.030	*3.0%*
Curb Type =	SC1.1	*Mountable Curb and Gutter*
Inlet Type =	S19	*Curb inlet CB*
Curb height, H_C (m) =	0.150	
Total curb height, H_T (m) =	0.400	
Curb top width, W_C (m) =	0.150	
Curb bottom width, W (m) =	0.250	
Gutter width, W_G (m) =	0.000	
Gutter slope, S_G (m/m) =	0.000	*$S_G = D_G / W_G$*
Gutter depth, D_G (m) =	0.000	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.125	*Max Permitted Spread = 1/2 Asphalt width, W_A + W_G*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.064	*$D_{MAX} = D_{SMAX} + D_G$*



Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.672	0.672	0.020	0.020	0.0000	0.0000	0.0000	0.0050	5.00
10	0.871	0.871	0.026	0.026	0.0000	0.0000	0.0000	0.0100	10.00
50	1.593	1.593	0.048	0.048	0.0000	0.0000	0.0000	0.0500	50.00
100	2.065	2.065	0.062	0.062	0.0000	0.0000	0.0000	0.1000	100.00
125	2.245	2.245	0.067	0.067	0.0000	0.0000	0.0000	0.1250	125.00
150	2.404	2.404	0.072	0.072	0.0000	0.0000	0.0000	0.1500	150.00
200	2.678	2.678	0.080	0.080	0.0000	0.0000	0.0000	0.2000	200.00
250	2.912	2.912	0.087	0.087	0.0000	0.0000	0.0000	0.2500	250.00

**Note: Re-iterate to get Steeet Flow Equal to Q_{A+B} (use Goal Seak Function)*

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.030 m/m

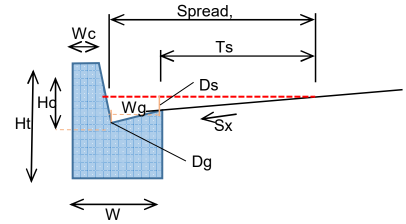
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.672	0.672	0.020	0.016	16
10	0.871	0.871	0.026	0.019	19
50	1.593	1.593	0.048	0.036	36
100	2.065	2.065	0.062	0.048	48
125	2.245	2.245	0.067	0.052	52
150	2.404	2.404	0.072	0.055	55
200	2.678	2.678	0.080	0.062	62
250	2.912	2.912	0.087	0.000	62

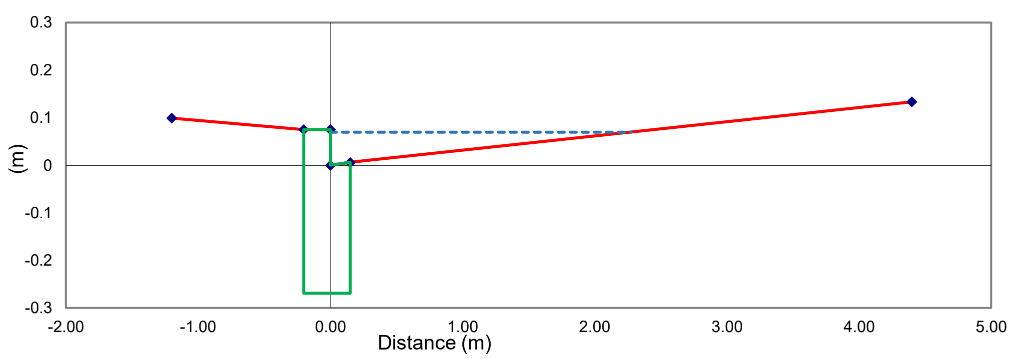
Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE D5: MAJOR SYSTEM CHARACTERISTICS

ROAD AND CURB DATA (For Mountable Curb at 1% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.400	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.010	*1.0%*
Curb Type =	SC1.3	*Mountable Curb and Gutter*
Inlet Type =	S19	*Surface inlet CB*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	$S_G = D_G / W_G$
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.275	*Max Permitted Spread = 1/2 Asphalt width,* $W_A + W_G$ *(minor storm)*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.070	$D_{MAX} = D_{SMAX} + D_G$





Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.818	0.668	0.020	0.026	0.0043	0.0021	0.0022	0.0028	5.00
10	1.064	0.914	0.027	0.033	0.0084	0.0049	0.0034	0.0066	10.00
50	1.954	1.804	0.054	0.060	0.0399	0.0302	0.0098	0.0402	50.00
100	2.535	2.385	0.072	0.078	0.0788	0.0636	0.0152	0.0848	100.00
125	2.757	2.607	0.078	0.084	0.0981	0.0806	0.0176	0.1074	125.00
150	2.952	2.802	0.084	0.090	0.1174	0.0977	0.0197	0.1303	150.00
200	3.289	3.139	0.094	0.100	0.1559	0.1322	0.0237	0.1763	200.00
250	3.576	3.426	0.103	0.109	0.1943	0.1670	0.0273	0.2227	250.00

**Note: Re-iterate to get Steeet Flow Equal to* Q_{A+B} *(use Goal Seak Function)*

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.010 m/m

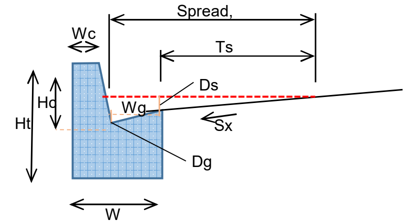
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.818	0.668	0.009	0.007	5
10	1.064	0.914	0.017	0.011	10
50	1.954	1.804	0.060	0.013	13
100	2.535	2.385	0.078	0.028	28
125	2.757	2.607	0.084	0.040	40
150	2.952	2.802	0.090	0.044	44
200	3.289	3.139	0.100	0.048	48
250	3.576	3.426	0.109	0.055	55

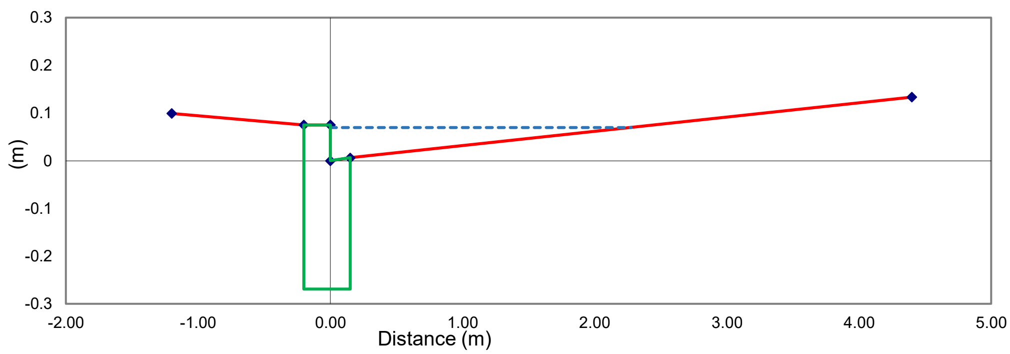
Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE D6: MAJOR SYSTEM CHARACTERISTICS

ROAD AND CURB DATA (For Mountable Curb at 2% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.400	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.020	*2.0%*
Curb Type =	SC1.3	*Mountable Curb and Gutter*
Inlet Type =	S19	*Surface inlet CB*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	$S_G = D_G / W_G$
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.275	*Max Permitted Spread = 1/2 Asphalt width,* $W_A + W_G$ *(minor storm)*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.070	$D_{MAX} = D_{SMAX} + D_G$





Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.716	0.566	0.017	0.023	0.0044	0.0019	0.0024	0.0026	5.00
10	0.933	0.783	0.023	0.029	0.0085	0.0046	0.0038	0.0062	10.00
50	1.715	1.565	0.047	0.053	0.0403	0.0292	0.0110	0.0390	50.00
100	2.226	2.076	0.062	0.068	0.0793	0.0621	0.0173	0.0827	100.00
125	2.420	2.270	0.068	0.074	0.0987	0.0788	0.0199	0.1051	125.00
150	2.592	2.442	0.073	0.079	0.1181	0.0957	0.0224	0.1276	150.00
200	2.887	2.737	0.082	0.088	0.1567	0.1298	0.0269	0.1731	200.00
250	3.140	2.990	0.090	0.096	0.1952	0.1643	0.0310	0.2190	250.00

**Note: Re-iterate to get Steeet Flow Equal to* Q_{A+B} *(use Goal Seak Function)*

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.020 m/m

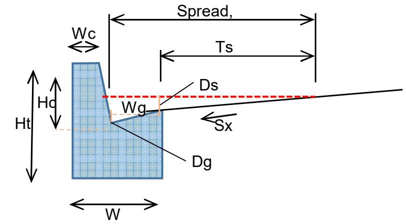
Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.716	0.566	0.009	0.010	5
10	0.933	0.783	0.017	0.013	10
50	1.715	1.565	0.053	0.017	17
100	2.226	2.076	0.068	0.033	33
125	2.420	2.270	0.074	0.045	45
150	2.592	2.442	0.079	0.050	50
200	2.887	2.737	0.088	0.054	54
250	3.140	2.990	0.096	0.061	61

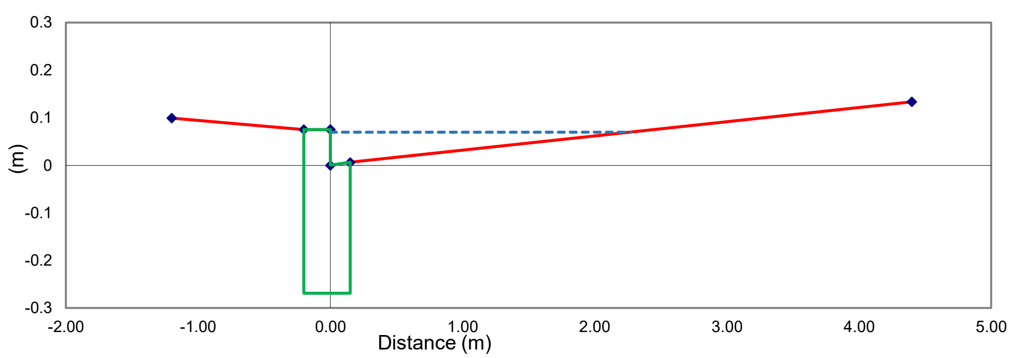
Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

TABLE D7: MAJOR SYSTEM CHARACTERISTICS

ROAD AND CURB DATA (For Mountable Curb at 3% Longitudinal Slope)

Asphalt width, W_A (m) =	4.250	*From EOP to CL*
Total Road Width, W_R (m) =	4.400	*Includes gutter*
Lane crossfall, S_X (m/m) =	0.030	*3.0%*
Gutter Grade, S_O (m/m)	0.030	*3.0%*
Curb Type =	SC1.3	*Mountable Curb and Gutter*
Inlet Type =	S19	*Surface inlet CB*
Curb height, H_C (m) =	0.075	
Total curb height, H_T (m) =	0.350	
Curb top width, W_C (m) =	0.200	
Curb bottom width, W (m) =	0.350	
Gutter width, W_G (m) =	0.150	
Gutter slope, S_G (m/m) =	0.040	$S_G = D_G / W_G$
Gutter depth, D_G (m) =	0.006	
Mannings, N =	0.013	
Max Spread, T_{MAX} (m) =	2.275	*Max Permitted Spread = 1/2 Asphalt width,* $W_A + W_G$ *(minor storm)*
Max Spread on Asphalt, T_{SMAX} (m) =	2.125	*Max Permitted Spread Over Asphalt =1/2 Asphalt width*
Max Depth at EOP, D_{SMAX}(m) =	0.064	*Based on 1/2 Lane Width*
Max depth over gutter, D_{MAX} (m) =	0.070	$D_{MAX} = D_{SMAX} + D_G$





Overland Gutter and Roadway Flow Based on Road & Curb Type

Street Flow, (L/sec)	Assumed Spread (T)	Spread on Asphalt, Ts=T-Wg	Ds=Ts*Sx	D=Ds+Dg	Road and Gutter Flows (m^3/sec)				
					$Q_{(A+C)}$	$Q_{(C)}$	Gutter Flow, $Q_{(A)}$	Road Flow, $Q_{(B)}$	$Q_{(A+B)}$
0	0.000	0.000	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.00
5	0.663	0.513	0.015	0.021	0.0044	0.0018	0.0026	0.0024	5.00
10	0.864	0.714	0.021	0.027	0.0085	0.0044	0.0041	0.0059	10.00
50	1.589	1.439	0.043	0.049	0.0405	0.0286	0.0119	0.0381	50.00
100	2.062	1.912	0.057	0.063	0.0796	0.0611	0.0186	0.0814	100.00
125	2.243	2.093	0.063	0.069	0.0991	0.0777	0.0214	0.1036	125.00
150	2.402	2.252	0.068	0.074	0.1185	0.0945	0.0241	0.1259	150.00
200	2.676	2.526	0.076	0.082	0.1572	0.1283	0.0289	0.1711	200.00
250	2.910	2.760	0.083	0.089	0.1958	0.1625	0.0333	0.2167	250.00

**Note: Re-iterate to get Steeet Flow Equal to* Q_{A+B} *(use Goal Seak Function)*

INLET CAPACITY, APPROACH FLOW & SPREAD BASED ON

Lane Crossfall = 0.030 m/m

Gutter Grade = 0.030 m/m

Street Flow (L/sec)	Total Spread, T (m)	Spread on Asphalt, T_S (metres)	Depth of Flow at Gutter (m)	Inlet Capture Rate (m3/sec)	Inlet Capture Rate (L/sec)
0	0.000	0.000	0.000	0.000	0
5	0.663	0.513	0.009	0.011	5
10	0.864	0.714	0.017	0.016	10
50	1.589	1.439	0.049	0.019	19
100	2.062	1.912	0.063	0.036	36
125	2.243	2.093	0.069	0.048	48
150	2.402	2.252	0.074	0.052	52
200	2.676	2.526	0.082	0.055	55
250	2.910	2.760	0.089	0.055	55

Note: The Total Spread (T), includes Gutter width, (Wg) plus spread on lane, (Ts) for curb & gutter type curbs

Appendix E – PCSWMM Information

Appendix F – Background Documents

F1 – Pre-Consultation Checklist

F2 – Pre-Consultation Meeting Notes

F3 – Pre-Consultation Comments 2020.10

F4 – Existing 600 Storm Sewer on Arthur Street

F5 – Existing Servicing As-Recorded Drawing

F6 – JLR Water Memo

F7 – Updated Site Plan

F8 – Legal Survey and Registered Plan 7211

F9 – Stormceptor EFP Sizing Report

PCSWMM Report

Rev6_Results_100yr

Model 262415_166_Boyd_Rev6_Post.inp

exp Services Inc.

June 26, 2024

Table of Contents

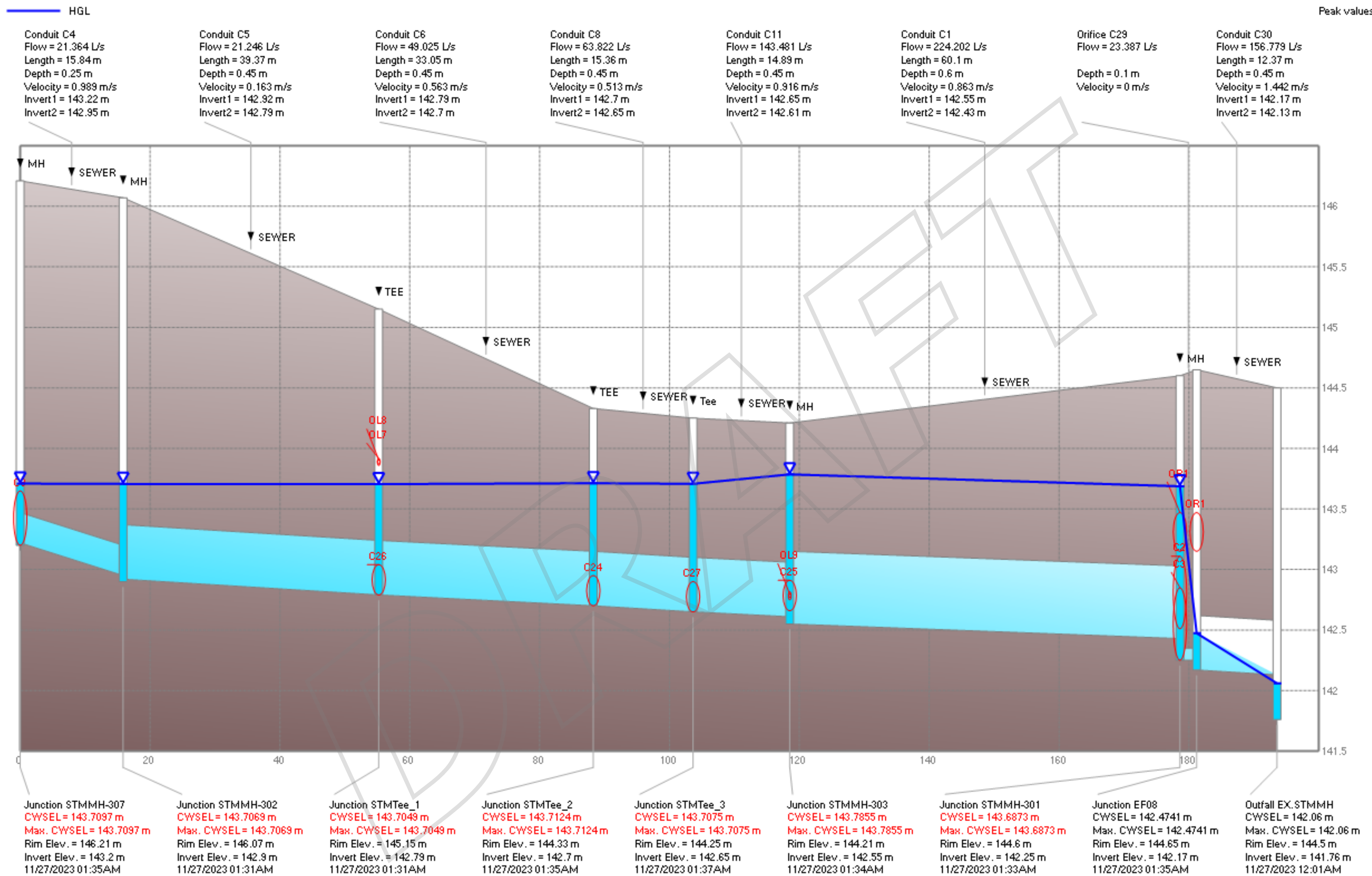


Figure 1: Node STMMH-307 to Node EX.STMMH (North Leg)

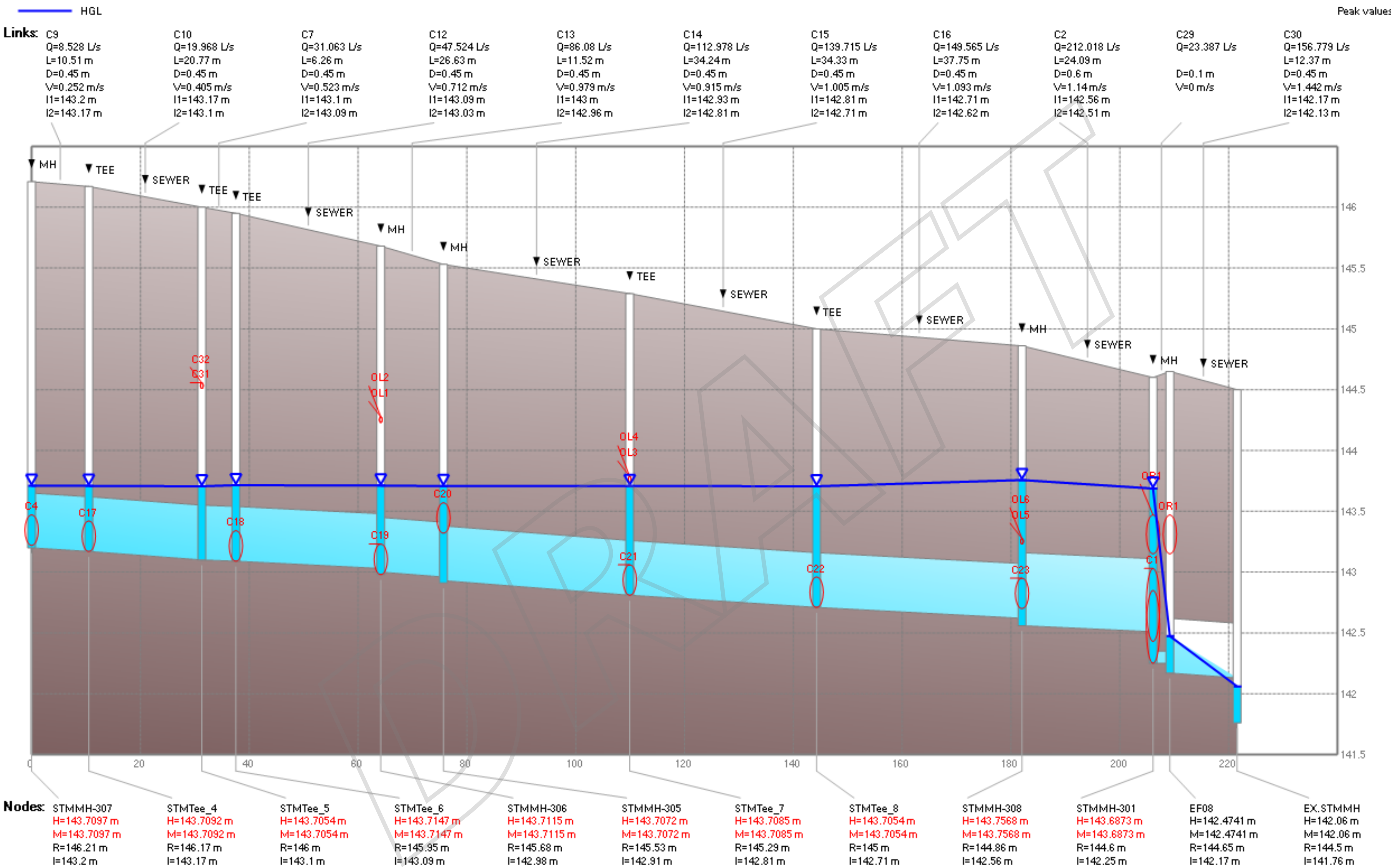


Figure 2: Node STMMH-307 to Node EX.STMMH (South Leg)

Table 1: Table 1 - Storages

Name	Tag	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Storage Curve	Curve Name
CB-101	CB	142.75	144.3	1.55	TABULAR	CB-101
CB-102	CB	142.77	144.3	1.53	TABULAR	CB-102
CB-103	CB	143.87	145.42	1.55	TABULAR	CB-103
CB-104	CB	143.86	145.41	1.55	TABULAR	CB-104
CB-105	CB	143.23	144.9	1.67	TABULAR	CB-105
CB-106	CB	143.23	144.9	1.67	TABULAR	CB-106
CB-107	CB	143.74	145.29	1.55	TABULAR	CB-107
CB-108	CB	143.74	145.29	1.55	TABULAR	CB-108
CB-109	CB	144.23	145.78	1.55	TABULAR	CB-109
CB-110	CB	144.23	145.78	1.55	TABULAR	CB-110
CB-111	CB	144.51	146.06	1.55	TABULAR	CB-111
CB-112	CB	144.51	146.06	1.55	TABULAR	CB-112
DP		142.2	144.3	2.1	TABULAR	DP
RYCB-101	RYCB	143.46	145.43	1.97	TABULAR	RYCB-101
RYCB-102	RYCB	143.37	145.43	2.06	TABULAR	RYCB-102
RYCB-103	RYCB	143.23	145.29	2.06	TABULAR	RYCB-103
RYCB-104	RYCB	143.49	145.26	1.77	TABULAR	RYCB-104
RYCB-105	RYCB	143.25	145.2	1.95	TABULAR	RYCB-105
RYCB-106	RYCB	143.1	145.14	2.04	TABULAR	RYCB-106
RYCB-107	RYCB	142.89	145.1	2.21	TABULAR	RYCB-107
RYCB-108	RYCB	142.93	144.07	1.14	TABULAR	RYCB-108
RYCB-109	RYCB	142.84	144.07	1.23	TABULAR	RYCB-109
RYCB-110	RYCB	143.29	144.49	1.2	TABULAR	RYCB-110
RYCB-111A	RYCB	143.2	144.6	1.4	TABULAR	RYCB-111A

Table 2: Table 2 - Junctions

Name	Tag	Invert Elev. (m)	Rim Elev. (m)	Depth (m)
CB-101-MAJ	MAJ	144.05	144.35	0.3
CB-102-MAJ	MAJ	144.05	144.35	0.3
CB-103-MAJ	MAJ	145.27	145.42	0.15
CB-104-MAJ	MAJ	145.26	145.41	0.15
CB-105-MAJ	MAJ	144.63	144.93	0.3
CB-106-MAJ	MAJ	144.63	144.93	0.3
CB-107-MAJ	MAJ	145.14	145.29	0.15
CB-108-MAJ	MAJ	145.14	145.29	0.15

Table 2: Table 2 - Junctions (continued...)

Name	Tag	Invert Elev. (m)	Rim Elev. (m)	Depth (m)
CB-109-MAJ	MAJ	145.63	145.78	0.15
CB-110-MAJ	MAJ	145.63	145.78	0.15
CB-111-MAJ	MAJ	145.86	146.01	0.15
CB-112-MAJ	MAJ	145.91	146.06	0.15
EF08		142.17	144.65	2.48
RYCB-111	RYCB	143.1	144.5	1.4
STMMH-301	MH	142.25	144.6	2.35
STMMH-302	MH	142.9	146.07	3.17
STMMH-303	MH	142.55	144.21	1.66
STMMH-305	MH	142.91	145.53	2.62
STMMH-306	MH	142.98	145.68	2.7
STMMH-307	MH	143.2	146.21	3.01
STMMH-308	MH	142.56	144.86	2.3
STMTee_1	TEE	142.79	145.15	2.36
STMTee_2	TEE	142.7	144.33	1.63
STMTee_3	Tee	142.65	144.25	1.6
STMTee_4	TEE	143.17	146.17	3
STMTee_5	TEE	143.1	146	2.9
STMTee_6	TEE	143.09	145.95	2.86
STMTee_7	TEE	142.81	145.29	2.48
STMTee_8	TEE	142.71	145	2.29

Table 3: Table 3 - Conduits

Name	Inlet Node	Outlet Node	Tag	Length (m)	Roughness	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom1 (m)
C1	STMMH-303	STMMH-301	SEWER	60.1	0.013	142.55	142.43	CIRCULAR	0.6
C10	STMTee_4	STMTee_5	SEWER	20.77	0.013	143.17	143.1	CIRCULAR	0.45
C11	STMTee_3	STMMH-303	SEWER	14.89	0.013	142.65	142.61	CIRCULAR	0.45
C12	STMTee_6	STMMH-306	SEWER	26.63	0.013	143.09	143.03	CIRCULAR	0.45
C13	STMMH-306	STMMH-305	SEWER	11.52	0.013	143	142.96	CIRCULAR	0.45
C14	STMMH-305	STMTee_7	SEWER	34.24	0.013	142.93	142.81	CIRCULAR	0.45
C15	STMTee_7	STMTee_8	SEWER	34.33	0.013	142.81	142.71	CIRCULAR	0.45
C16	STMTee_8	STMMH-308	SEWER	37.75	0.013	142.71	142.62	CIRCULAR	0.45
C17	RYCB-101	STMTee_4	SEWER	34.45	0.013	143.46	143.17	CIRCULAR	0.25
C18	RYCB-102	STMTee_6	SEWER	34.49	0.01	143.37	143.09	CIRCULAR	0.25
C19	RYCB-103	STMMH-306	SEWER	38.66	0.013	143.23	142.98	CIRCULAR	0.25

Table 3: Table 3 - Conduits (continued...)

Name	Inlet Node	Outlet Node	Tag	Length (m)	Roughness	Inlet Elev. (m)	Outlet Elev. (m)	Cross-Section	Geom1 (m)
C2	STMMH-308	STMMH-301	SEWER	24.09	0.013	142.56	142.51	CIRCULAR	0.6
C20	RYCB-104	STMMH-305	SEWER	41.37	0.013	143.49	143.32	CIRCULAR	0.25
C21	RYCB-105	STMTee_7	SEWER	37.52	0.013	143.25	142.81	CIRCULAR	0.25
C22	RYCB-106	STMTee_8	SEWER	37.35	0.013	143.1	142.71	CIRCULAR	0.25
C23	RYCB-107	STMMH-308	SEWER	36.9	0.013	142.89	142.7	CIRCULAR	0.25
C24	RYCB-108	STMTee_2	SEWER	36.81	0.013	142.93	142.7	CIRCULAR	0.25
C25	RYCB-109	STMMH-303	SEWER	36.62	0.013	142.84	142.66	CIRCULAR	0.25
C26	RYCB-110	STMTee_1	SEWER	37.07	0.013	143.29	142.79	CIRCULAR	0.25
C27	RYCB-111	STMTee_3	SEWER	40.73	0.013	143.1	142.65	CIRCULAR	0.25
C3	DP	STMMH-301	SEWER	6.52	0.013	142.2	142.25	CIRCULAR	0.6
C30	EF08	EX.STMMH	SEWER	12.37	0.013	142.17	142.13	CIRCULAR	0.45
C33	CB-103-MAJ	CB-101-MAJ	MAJ	63.29	0.013	145.27	144.05	IRREGULAR	0
C34	CB-104-MAJ	CB-102-MAJ	MAJ	62.97	0.013	145.26	144.05	IRREGULAR	0
C35	CB-112-MAJ	CB-110-MAJ	MAJ	31.1	0.013	145.91	145.63	IRREGULAR	0
C36	CB-111-MAJ	CB-109-MAJ	MAJ	30.97	0.013	145.86	145.63	IRREGULAR	0
C37	CB-110-MAJ	CB-108-MAJ	MAJ	52.76	0.013	145.63	145.14	IRREGULAR	0
C38	CB-109-MAJ	CB-107-MAJ	MAJ	40.25	0.013	145.63	145.14	IRREGULAR	0
C39	CB-107-MAJ	CB-105-MAJ	MAJ	62.2	0.013	145.14	144.63	IRREGULAR	0
C4	STMMH-307	STMMH-302	SEWER	15.84	0.013	143.22	142.95	CIRCULAR	0.25
C40	CB-108-MAJ	CB-106-MAJ	MAJ	62.15	0.013	145.14	144.63	IRREGULAR	0
C5	STMMH-302	STMTee_1	SEWER	39.37	0.013	142.92	142.79	CIRCULAR	0.45
C6	STMTee_1	STMTee_2	SEWER	33.05	0.013	142.79	142.7	CIRCULAR	0.45
C7	STMTee_5	STMTee_6	SEWER	6.26	0.013	143.1	143.09	CIRCULAR	0.45
C8	STMTee_2	STMTee_3	SEWER	15.36	0.013	142.7	142.65	CIRCULAR	0.45
C9	STMMH-307	STMTee_4	SEWER	10.51	0.013	143.2	143.17	CIRCULAR	0.45

Table 4: Table 4 - Outfalls

Name	Invert Elev. (m)	Rim Elev. (m)	Tide Gate	Fixed Stage (m)
EX.STMMH	141.76	144.5	NO	142.06

Table 5: Table 5 - Orifices

Name	Inlet Node	Outlet Node	Type	Cross-Section	Height (m)	Inlet Elev. (m)	Discharge Coeff.	Flap Gate
C29	STMMH-301	EF08	SIDE	CIRCULAR	0.1	142.25	0.61	NO

Table 5: Table 5 - Orifices (continued...)

Name	Inlet Node	Outlet Node	Type	Cross-Section	Height (m)	Inlet Elev. (m)	Discharge Coeff.	Flap Gate
OR1	STMMH-301	EF08	SIDE	CIRCULAR	0.32	143.15	0.61	NO

Table 6: Table 6 - Outlets

Name	Inlet Node	Outlet Node	Tag	Inlet Elev. (m)	Rating Curve	Curve Name
C31	CB-112	STMTee_5		143.26	TABULAR/DEPTH	ICD-IPEX-LMF80
C32	CB-111	STMTee_5		144.51	TABULAR/DEPTH	ICD-IPEX-LMF80
OL1	CB-110	STMMH-306		143.16	TABULAR/DEPTH	ICD-IPEX-LMF80
OL10	CB-102	STMMH-303		142.77	TABULAR/DEPTH	ICD-IPEX-TYPE-B
OL11	CB-103-MAJ	CB-103	ICD	145.27	TABULAR/DEPTH	CB-IC
OL12	CB-101-MAJ	CB-101	ICD	144.05	TABULAR/DEPTH	CB-IC
OL13	CB-104-MAJ	CB-104	ICD	145.26	TABULAR/DEPTH	CB-IC
OL14	CB-102-MAJ	CB-102	ICD	144.05	TABULAR/DEPTH	CB-IC
OL15	CB-112-MAJ	CB-112	ICD	145.91	TABULAR/DEPTH	CB-IC
OL16	CB-110-MAJ	CB-110	ICD	145.63	TABULAR/DEPTH	CB-IC
OL17	CB-111-MAJ	CB-111	ICD	145.86	TABULAR/DEPTH	CB-IC
OL18	CB-109-MAJ	CB-109	ICD	145.63	TABULAR/DEPTH	CB-IC
OL19	CB-108-MAJ	CB-108	ICD	145.14	TABULAR/DEPTH	CB-IC
OL2	CB-109	STMMH-306		143.18	TABULAR/DEPTH	ICD-IPEX-LMF80
OL20	CB-107-MAJ	CB-107	ICD	145.14	TABULAR/DEPTH	CB-IC
OL21	CB-105-MAJ	CB-105	ICD	144.63	TABULAR/DEPTH	CB-IC
OL22	CB-106-MAJ	CB-106	ICD	144.63	TABULAR/DEPTH	CB-IC
OL23	RYCB-111A	RYCB-111		144.4	TABULAR/DEPTH	SingleCB_OPSD400.01
OL3	CB-107	STMTee_7		142.96	TABULAR/DEPTH	ICD-IPEX-LMF80
OL4	CB-108	STMTee_7		142.94	TABULAR/DEPTH	ICD-IPEX-LMF80
OL5	CB-105	STMMH-308		142.78	TABULAR/DEPTH	ICD-IPEX-TYPE-B
OL6	CB-106	STMMH-308		142.76	TABULAR/DEPTH	ICD-IPEX-TYPE-B
OL7	CB-103	STMTee_1		143.87	TABULAR/DEPTH	ICD-IPEX-LMF80
OL8	CB-104	STMTee_1		143.86	TABULAR/DEPTH	ICD-IPEX-LMF80
OL9	CB-101	STMMH-303		142.75	TABULAR/DEPTH	ICD-IPEX-TYPE-B

Table 7: Table 7 - Subcatchments

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	Subarea Routing	Percent Routed (%)	Infiltration Method	CAVG
PSC_1	EX.STMMH	0.0846	10.7	79.065	2.5	16.1	OUTLET	100	HORTON	0.31
PSC_10	RYCB-106	0.0526	19.7	26.701	4	51.1	OUTLET	100	HORTON	0.56
PSC_11	RYCB-107	0.0351	12.1	29.008	4	51.2	OUTLET	100	HORTON	0.56
PSC_12	CB-103-MAJ	0.1324	21.249	62.309	2	73.5	OUTLET	100	HORTON	0.71
PSC_13	CB-112-MAJ	0.0635	16.238	39.106	2	74.5	OUTLET	100	HORTON	0.72
PSC_14	CB-111-MAJ	0.0615	18.959	32.438	2	75.9	OUTLET	100	HORTON	0.73
PSC_15	CB-104-MAJ	0.077	26.889	28.636	2	51.6	OUTLET	100	HORTON	0.56
PSC_16	CB-101	0.1672	26.882	62.198	2	65.5	OUTLET	100	HORTON	0.66
PSC_17	CB-102	0.1515	22.3	67.937	2	65.2	OUTLET	100	HORTON	0.66
PSC_18	CB-110-MAJ	0.0796	18.712	42.54	2	74.3	OUTLET	100	HORTON	0.72
PSC_19	CB-109-MAJ	0.0699	16.372	42.695	2	76.7	OUTLET	100	HORTON	0.74
PSC_2	RYCB-109	0.0516	10.39	49.663	4	58.4	OUTLET	100	HORTON	0.61
PSC_20	CB-108-MAJ	0.1577	24.016	65.665	2	70.3	OUTLET	100	HORTON	0.69
PSC_21	CB-107-MAJ	0.0759	21.397	35.472	2	51.2	OUTLET	100	HORTON	0.56
PSC_22	RYCB-111A	0.2157	26.762	80.599	4	62	OUTLET	100	HORTON	0.63
PSC_23	CB-105-MAJ	0.1516	21.3	71.174	2	69.7	OUTLET	100	HORTON	0.69
PSC_24	CB-106-MAJ	0.175	24.5	71.429	2	69.4	OUTLET	100	HORTON	0.69
PSC_25	DP	0.0998	21.1	47.299	1	5	OUTLET	100	HORTON	0.24
PSC_3	RYCB-108	0.0537	10.194	52.678	4	65.5	OUTLET	100	HORTON	0.66
PSC_4	RYCB-110	0.0548	10.275	53.333	4	65	OUTLET	100	HORTON	0.66
PSC_5	RYCB-101	0.0731	13.85	52.78	4	59.6	OUTLET	100	HORTON	0.62
PSC_6	RYCB-102	0.0409	20.656	19.801	4	60.4	OUTLET	100	HORTON	0.62
PSC_7	RYCB-103	0.0876	24.798	35.325	4	40.2	OUTLET	100	HORTON	0.48
PSC_8	RYCB-104	0.0845	26.221	32.226	4	51.9	OUTLET	100	HORTON	0.56
PSC_9	RYCB-105	0.0616	18.7	32.941	4	51.9	OUTLET	100	HORTON	0.56

LANARK COUNTY

PLANS OF SUBDIVISION

PRE-CONSULTATION - checklist

OCTOBER 15, 2020

BULAT HOMES

Report	Comments	Required Yes/No
Planning Rationale	Include justification - Must have regard for PPS Lanark County Official Plan compatibility Local Official Plan compatibility	✓
~~Hydrogeological Study, Terrain Analysis~~ MUNICIPAL PIPED SERVICES	Availability and suitability of water and waste water MOE – D-5-4 Guidelines MOE – D-5-5 Guidelines ODWSOG Checklist Summary & Sign-off	N/A
Environment Impact Study Scoped EIS - to be confirmed by MVCA	SAR & Significant Habitat Wetlands Organic Soils Natural Heritage Features & Systems Significant Wetlands Significant Woodlands Significant Valleylands Significant Wildlife ANSI Fish Habitat	✓
Servicing ~~Options Statement~~	Guidelines – MOE D-5-3	
Stormwater Drainage /Mgmt Plan	Guidelines - MOE-2003 / MNR-2001 Checklist Summary & Sign-off - MVCA comments	✓
Grading Plan	Sloping land within lot to direct flow of surface water away from foundations & abutting properties.	

LANARK COUNTY

PLANS OF SUBDIVISION

PRE-CONSULTATION - checklist

Report	Comments	Required Yes/No
Sediment and Erosion Control Hazardous Sites	Flooding, erosion hazard Slope and Soil Stability Organic Soils Karst Topography	
Archeological Investigation	Standards & Guidelines 2011 - STAGE I - minimum	
Tree Preservation Plan or Tree Conservation Plan	Check with local municipality	
Other	• SEE BELOW & • SEE ATTACHED SUMMARY FROM TOWN OF CARLETON PLACE	
Draft Plan	To include: Planning Act 50(17) Ont. Reg. 544/06 Lot and block configuration Compatibility with adjacent uses Road access, street layout & Pedestrian amenities Parks & Open Space amenities Easement and right-of-way requirements	✓

→ TRAFFIC STUDY
 – justification for why density is appropriate for a lot proposed

→ URBAN DESIGN BRIEF

→ GEOTECHNICAL REPORT

→ PHASE I & PHASE II ENVIRONMENTAL SITE ASSESSMENT –

Pre-Consultation Meeting Notes
Virtual zoom meeting – October 15, 2020
Prepared By: Julie Stewart

In Attendance
Ankica Bulat – Bulat Homes
Bruce Thomas - exp
Tracy Zander – ZanderPlan
Niki Dwyer – Director of Development Services, Town of Carleton Place
Robin Daigle – Engineering Manager, Town of Carleton Place
Julie Stewart – County Planner, County of Lanark

The subject lands are located on Boyd Street in the Town of Carleton Place.
In 2013, a draft plan of subdivision application was filed by Devcore, for Part of Lots 3, 5, 7 and all of Lots 9, 11, 13, 15 and 17, Plan 7211, geographic Township of Beckwith, Town of Carleton Place. The block map as provided by the owner is attached.

The applicant is proposing a development consisting of 77 townhouse units. A concept plan provided by Bulat Homes is attached.

Town staff commented on the density policies of the Official Plan. Town staff noted that historically, Council has a concern with developments containing townhouses across from townhouses. Concerns are related to townhouse developments in terms of parking, on-street parking, concentration of development and neighbourhood compatibility.

The Lanark County Pre-Consultation Checklist is attached. The reports / studies / plans as noted on the attached checklist are required to be submitted at the time of application. The Town of Carleton Place provided written comments for the developers consideration in regards to the discussion of the virtual meeting. These are also attached. Additional comments are provided below.

Diane Reid – Environmental Planner, MVCA, was unable to participate in the virtual meeting, however provided preliminary information regarding stormwater management in an e-mail to the County Planner prior to the meeting. The information was read at the meeting and is included below:

- An enhanced level of stormwater quality control is recommended per the MOE Design Manual.
- Stormwater quantity should be controlled such that post-development flows equal pre-development levels.
- Measures to maintain infiltration should be considered and integrated into the stormwater management design where possible. Credit Valley Conservation has an LID Design Guide available at http://www.creditvalleyca.ca/low-impact-development/low-impact-development-support/stormwater-management-lid-guidance-documents/low-impact-development-stormwater-management-planning-and-design-guide/ that provides guidance for the infiltration of clean runoff.

Environmental Impact Study

- In regards to the requirements for an Environmental Impact Study, the County Planner has contacted MVCA and requested confirmation on what the submission requirements will be. This information will be circulated when provided.

Planning Rationale Report

- Development Permit and conformance with the Official Plan are to be addressed within. Density and bonussing should be included within the report.

Urban Design Brief

- Is required

Servicing Options Statement

- As the site is will be on public services, a Conceptual Servicing Report shall be submitted with the application.

Stormwater Drainage Plan

- See MVCA comments above
- See Town's comments attached

Archaeological

- A minimum Stage 1 Archaeological Assessment is required to be submitted

OTHER

Traffic Study

- The Town advised this will be required and should justify why the density is appropriate

Geotechnical Report

-is required to be submitted

Environmental Site Assessment

- A Phase 1 Environmental Site Assessment and a Phase 2 Environmental Site Assessment were submitted with the 2013 draft plan of subdivision. Confirmation on the status of these reports should be provided with the submission, or new / updated reports should be provided with the submission. The owner / agent shall consult with the Ministry of the Environment, Conservation and Parks directly in regards to the ESA.

Corporation of the Town of Carleton Place

175 Bridge Street, Carleton Place, ON K7C 2V8 Phone: (613) 257-6200 Fax: (613) 257-8170

October 30, 2020

Julie Stewart, RPP MCIP
County Planner
Lanark County
(jstewart@lanarkcountry.ca)

Re: Boyd Street Infill Subdivision (Bulat Homes)

Ms Stewart,

Further to the virtual meeting you hosted on October 15th, 2020 respecting the proposed infill subdivision by Bulat Homes at the intersection of Boyd Street and Arthur Street, the Town of Carleton Place offers the following comments for the developers consideration prior to further consultation:

Density

- While the Official Plan does not prescribe an upper limit of density for infill developments of less than 3 ha, it is the principal of the general provisions of both the Official Plan and Development Permit Bylaw to see a mix of housing types that create visual interest on the streetscape and provide a range of housing options. Specifically, the developer shall have regard for the policies found in Section 2.0 of the Official Plan and Section 14.3.2 of the Development Permit Bylaw in considering a design of the subdivision.
- Any development in excess of 35 units per ha will be reviewed in accordance with the Town's policies for density bonusing located in Section 3.5.5 of the Official Plan.

Parkland Development

- The context of the neighbourhood and the development lands have been reviewed and discussed with the Manager of Recreation and it is recommended that in this case the development contribute cash in lieu of parkland due to the size of the land area of a possible contribution. Cash in lieu of parkland is to be provided in accordance with the Municipality's bylaw, a copy of which is enclosed herein.

Road Upgrades and Geometry

- The Town would like to see the development integrated within the existing street alignment. Opportunities for connectivity to Arthur Street should be explored as an option.
- The developer will be required to complete the connection of Boyd Street to the completed connection in the Jackson Ridge subdivision the design of which will include asphalt and curbing.
- Boyd Street presently exhibits of width of approximately 12m. A road widening on the western edge of the existing allowance of approximately 5m will be required to be dedicated to the Municipality.

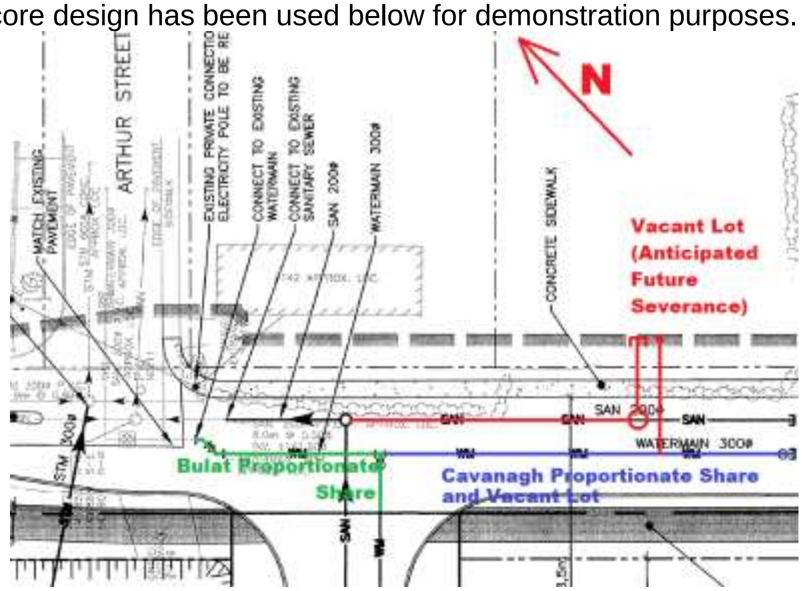
Corporation of the Town of Carleton Place
175 Bridge Street, Carleton Place, ON K7C 2V8   Phone: (613) 257-6200   Fax: (613) 257-8170

- The developer will be required to construct the continuous pathway from Jackson Ridge subdivision to the parkland at the corner of Woodward and Boyd Streets.   This construction will be considered part of the roadway cross-section and will not contributed to "parkland" dedications.
- Internal roadway cross-sections shall have a minimum right of way width of 20m unless expressly justified for a reduction to no less than 18m.

Servicing

Water Service

- Cavanagh Developments is required (as Part of the Bodnar Subdivision) to extend a watermain from the Jackson Ridge Subdivision to the cap at Arthur Street; this project will need to be coordinated with the developer. Preliminary thoughts are as follows:
  - That the developer be responsible for the portion of watermain from Arthur Street to their own site entrance and Cavanagh would be responsible for the remainder to the Jackson Ridge Subdivision; see below sketch for reference.
  - As the developer is responsible for the road, the design for the watermain should be included in the Boyd Street Subdivision design scope.
  - Should timing require Cavanagh to construct the watermain before the Boyd Street Subdivision proceeds, Cavanagh will be required to make provisions for the Boyd Street Subdivision (i.e install a watermain service stub) and the developer will be required to pay their proportionate share for this project.
  - Should the developer require the connection first, the developer will be required to install the watermain and make the connection to the Jackson Ridge Subdivision, the Town would in turn require Cavanagh to reimburse the developer Cavanagh's proportionate share.
  - The Devcore design has been used below for demonstration purposes.



- The site has access to a 300mm diameter watermain. No capacity constraints are anticipated. This will need to be confirmed within the developer servicing report.
- Town can provide system modelling results and have our water modelling consultant provide boundary conditions if necessary at the developer's expense.

Sanitary

- Town will require the Boyd Street sanitary extension as shown above in red. The Town would then charge the vacant lot 50% of the cost of the road along the frontage of a severed lot + the cost to install the sanitary main and lateral and water service prior to Building permit issuance for this lot.
- The Town does not anticipate that sanitary sewer constraints will impede the development, however the developer will need to verify this fact within the Servicing Report.

Cost-Sharing Contributions

- The properties are presently subject to two Cost-sharing bylaws the details of which are as follows:
  - By-law 06-2017/59-2018
    - $31,400.00 Enbridge Works + CPI (January 2017 to Present – Adjusted Annually) + HST as Per By-Law 2018-59.
  - By-Law 26-1994
    - $122,678.27 ("Ritchie" Parcels) + CPI (December 1994 to Present – Adjusted Annually) + HST
    - $5,627.44 ("Blackburn" Parcel) + CPI (December 1994 to Present – Adjusted Annually) + HST
    - Note the By-law applies a 9.25% annual interest rate however Staff would commit to having this amended to CPI subject to Council Approval.

Stormwater

- The developer is expected to match post development run-off rates with pre-development rates for storms up to the 100 yr event. Storm sewers are to be sized to a 5 yr minimum design storm. Water quality shall meet a normal treatment level unless higher levels are required by outside agencies (I.e MVCA).
- A wet pond is likely not a desirable option given the size of this site. A combination of oil/grit separators and a dry pond will likely be the preferred option of the Town. As discussed underground storage options can be considered.

Application Submission Requirements

- The Town will require the following minimum submission documents for consideration of the application:
  - Traffic Impact Assessment (to include an on-street parking plan)
  - Urban Design Brief
  - Planning Rational (to include preferred scenarios for density bonusing)

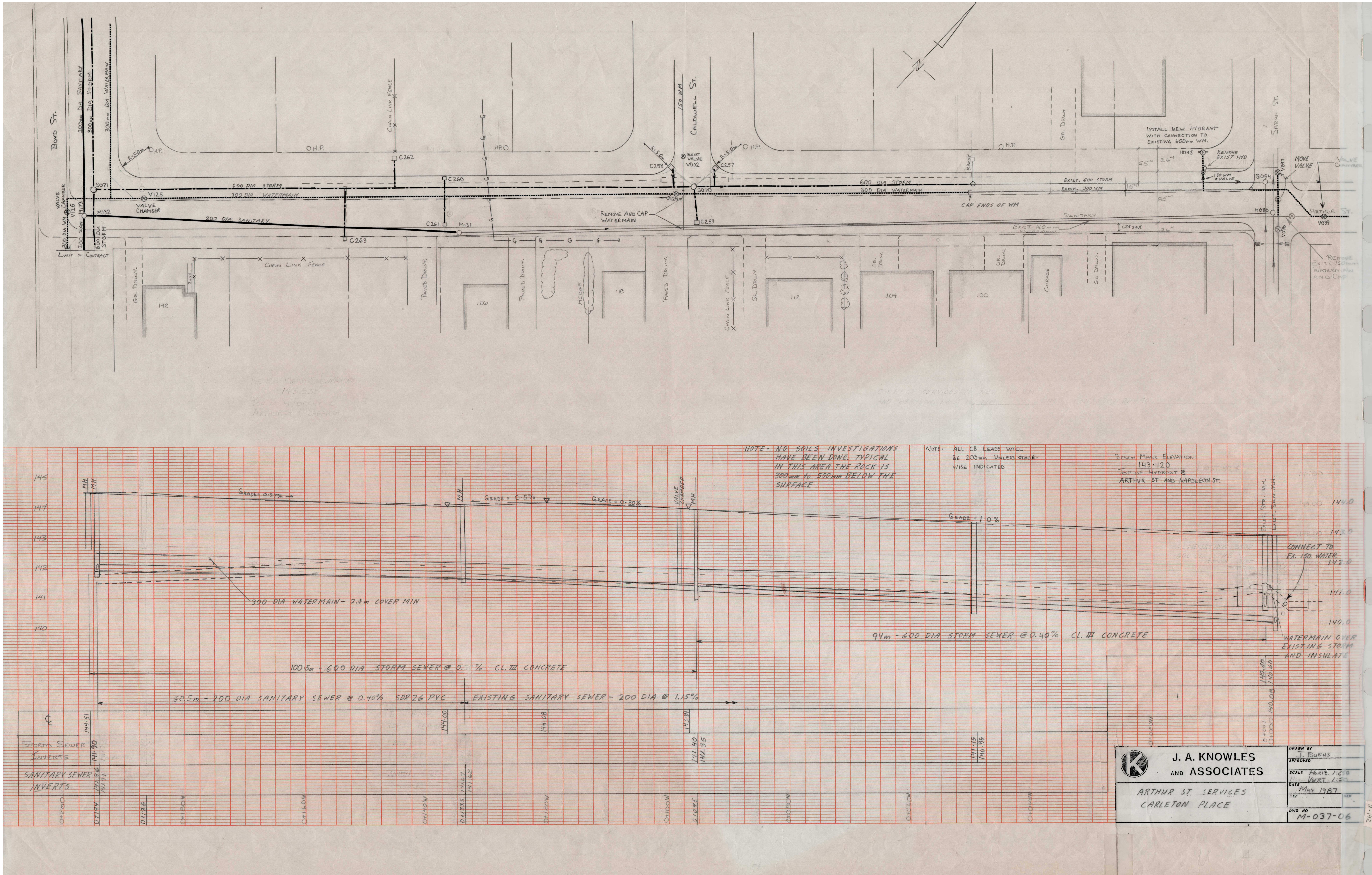
- Stormwater Management Report
- Servicing Report
- Geotechnical Report
- Scoped Environmental Impact Study (to be confirmed by MVCA)

The Town looks forward to receiving an additional conceptual proposal for review and further comment prior to final submission of a subdivision application.

Kindest Regards,

Niki Dwyer, RPP MCIP
Director of Development Services
Town of Carleton Place
ndwyer@carletonplace.ca

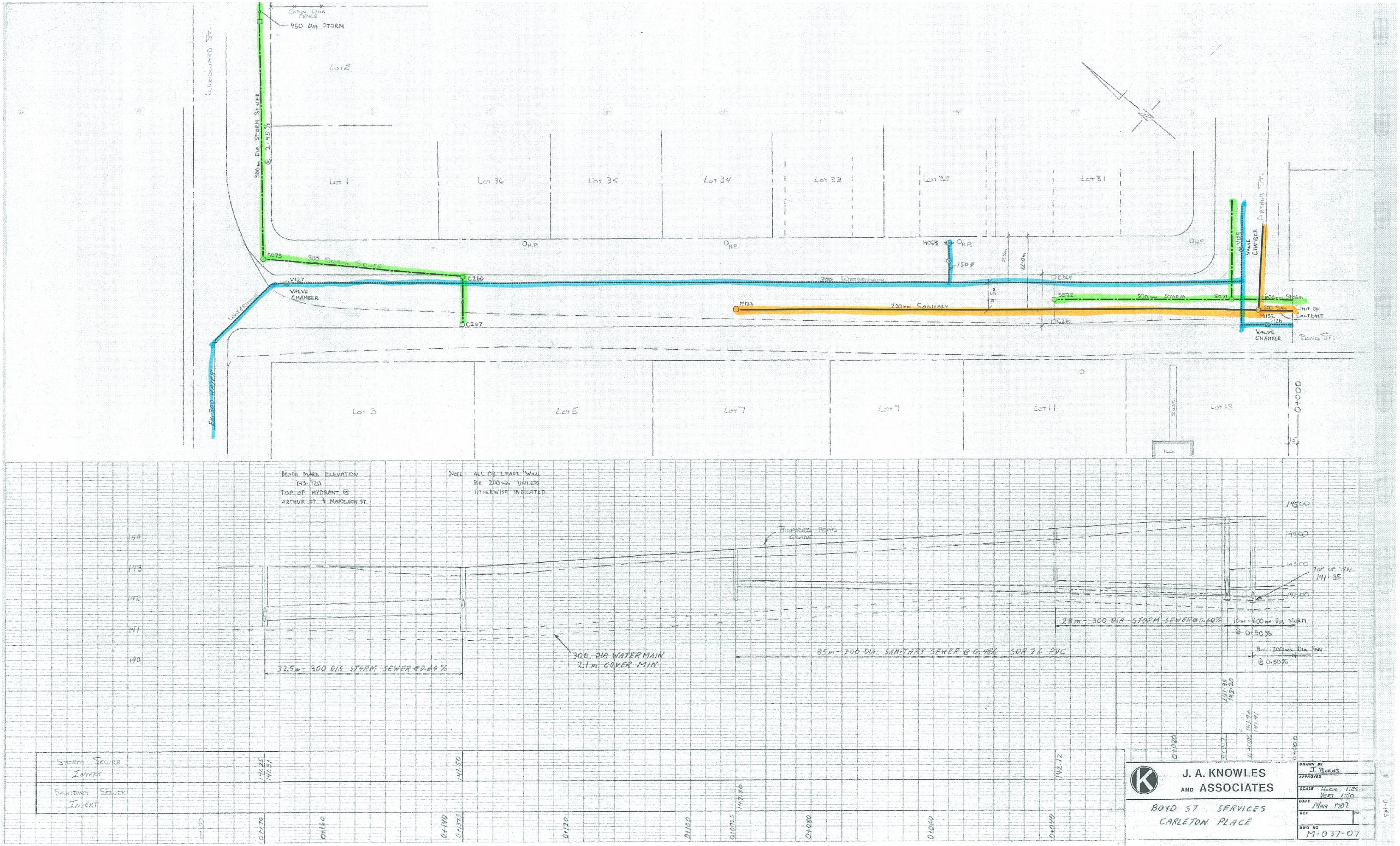
cc: Robin Daigle, Engineering Manager (rdaigle@carletonplace.ca)

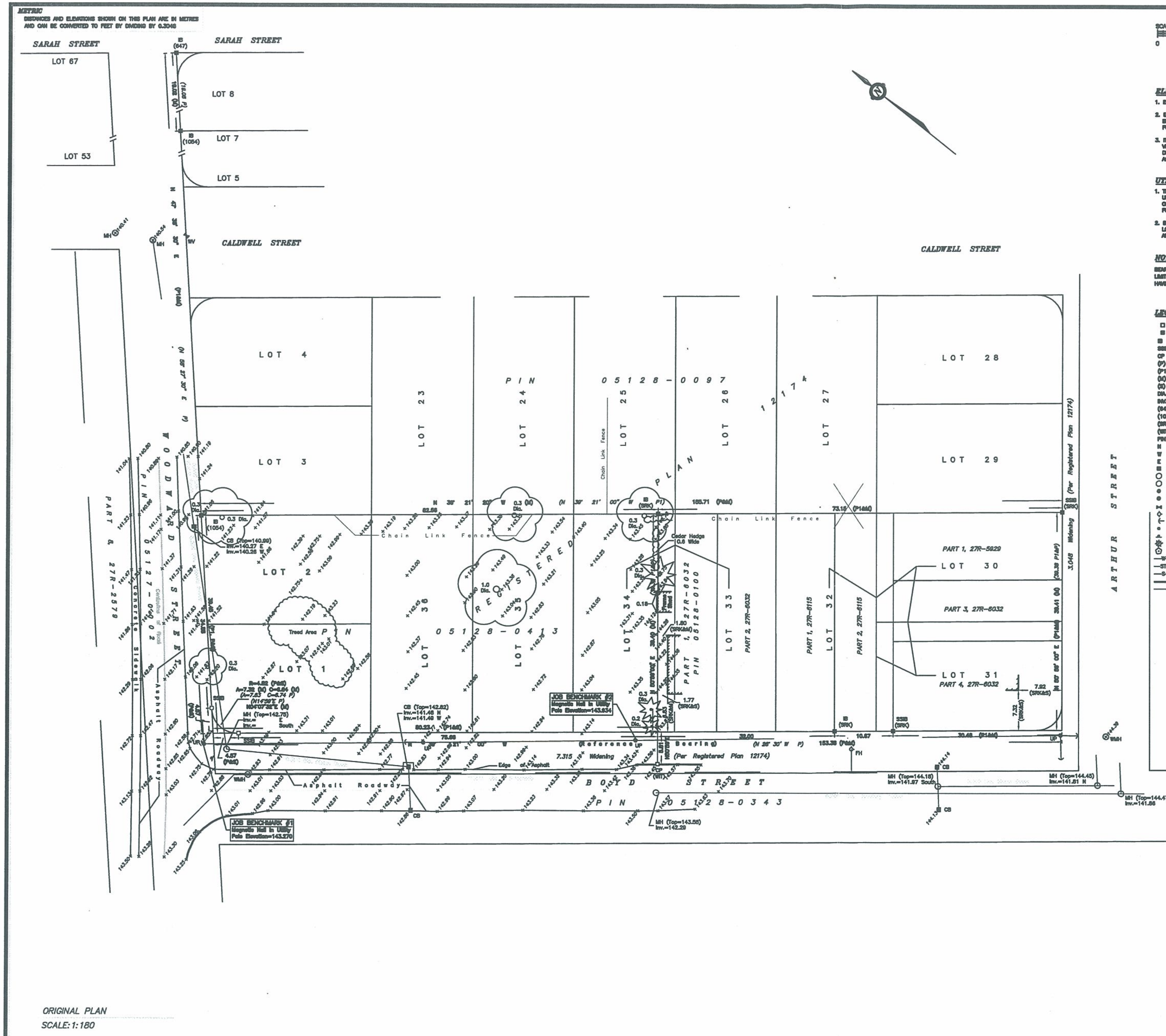


J. A. KNOWLES AND ASSOCIATES

DRAWN BY	J. BURNS
APPROVED	
SCALE	HORIZ. 1:2?0 VERT. 1:??
DATE	MAY 1987
DWG NO	M-037-06

ARTHUR ST SERVICES
CARLETON PLACE


450 DIA STORM
LOT 2
LOT 1
LOT 36
LOT 35
LOT 34
LOT 33
LOT 32
LOT 31
ARTHUR ST.
VALVE CHAMBER
200 WATERMAIN
200mm SANITARY
LIMIT OF CONTRACT
BOYD ST.
LOT 3
LOT 5
LOT 7
LOT 9
LOT 11
LOT 13
BENCH MARK ELEVATION
143.120
TOP OF HYDRANT @
ARTHUR ST & NAPOLEON ST.
NOTE: ALL CB LEADS WILL
BE 200mm UNLESS
OTHERWISE INDICATED
PROPOSED ROAD GRADE
300 DIA WATERMAIN
2.1m COVER MIN
32.5m - 300 DIA STORM SEWER @ 0.60%
28m - 300 DIA STORM SEWER @ 0.60%
10m - 600mm DIA STORM
@ 0.50%
85m - 200 DIA SANITARY SEWER @ 0.48% SDR 26 PVC
8m - 200mm DIA SAN
@ 0.50%
TOP OF WM
141.35
STORM SEWER
INVERT
SANITARY SEWER
INVERT
J. A. KNOWLES AND ASSOCIATES
BOYD ST SERVICES
CARLETON PLACE
DATE
MAY 1987
DWG NO
M-037-07



SCALE 1 : 300

0 5 10 20 30 metres

ELEVATION NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM.
2. ELEVATIONS FOR MANHOLE COVERS AND CATCH BASINS HAVE TO BE INDEPENDENTLY CONFIRMED BEFORE THEY CAN BE ACCEPTED FOR FINAL DESIGN OR CONSTRUCTION PURPOSES.
3. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THEIR RELATIVE ELEVATION AND DESCRIPTION AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

UTILITY NOTES

1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ANY UNDERGROUND UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. BEFORE ANY WORK INVOLVING PROBING, EXCAVATING, ETC., A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY.

NOTES

BEARINGS HEREON ARE ASTRONOMIC AND ARE REFERRED TO THE EASTERLY LIMIT OF BOYD STREET (AS WIDENED) AS SHOWN ON PLAN 27R-5929, HAVING A BEARING OF N 38° 21' 00" W.

LEGEND

◻	– SURVEY MONUMENT SET
■	– SURVEY MONUMENT FOUND
IB	– IRON BAR
SSIB	– SHORT STANDARD IRON BAR
CP	– CONCRETE PIN
(P)	– PLAN REGISTERED PLAN 12174
(P1)	– PLAN 27R-5929
(M)	– MEASURED
(S)	– SET
DIA.	– DIAMETER
INV.	– INVERT
(647)	– H. R. FARLEY, O.L.S.
(1054)	– GEO W. BRACKEN, O.L.S. (REF. 3301)
(SRK)	– SURY, ROWE & KASPRZAK LTD., O.L.S. (REF. C-059-94)
(WIT)	– WITNESS
PIN	– PROPERTY IDENTIFIER NUMBER
N	– NORTH
W	– WEST
E	– EAST
CB	– CATCH BASIN
MH	– MANHOLE
WMH	– WATER MANHOLE
LS	– LAMP STANDARD
UP	– UTILITY POLE
WV	– WATER VALVE
FH	– FIRE HYDRANT
	– GUY WIRE AND ANCHOR
	– BOLLARD
	– SIGN
	– CONIFEROUS TREE
	– DECIDUOUS TREE
—W—	– WATERMAIN
—ST—	– STORM SEWER
—S—	– SANITARY SEWER
	– CURB
	– OVERHEAD UTILITY WIRES

Pierre J. Tabet *architecte*

167 Rue De Roquebrune, Gatineau Qc J8T 7Y6
Tel. :819-568-3994/ 613-797-5375 Fax : 819-246 4312
E-Mail : pierre.tabet@hotmail.com

LEGENDE

NOTES

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Issue	Par	Appr.	YY.MM.DD

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	E.L.	P.T.	P.T.	11/MM/JJ

Sceau

Projet

CARLETON PLACE PROJECT
WOODWARD/BOYD, OTTAWA, ON

Titre

ORIGINAL PLAN

Projet No.	Echelle	Date
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Révision	Page	Dessin No.
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J.L. Richards
ENGINEERS · ARCHITECTS · PLANNERS
J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

MEMORANDUM

TO: Paul Knowles, P.Eng.
Chief Administrative Officer
Town of Carleton Place

DATE: September 16, 2013

JOB NO.: 25819-01

FROM: Mark Buchanan, P.Eng

CC: Dave Young, Director of Public Works
Town of Carleton Place
Brian Hein, P.Eng.
J.L. Richards & Associates Limited

RE: Town of Carleton Place – Hydraulic Water Model Investigation
Future Development

INTRODUCTION

The Town of Carleton Place (Town) has identified numerous potential future development areas located within and outside of the current Town limits (refer to the attached Drawing). The purpose of this Memorandum is to report on the estimated impacts that the potential future development will have on the existing water distribution network during a maximum day demand plus coincidental fire flow (i.e. considered the worst case conditions). The Town's existing hydraulic water model (previously updated in 2010) was updated based on recent watermain replacements and was used to evaluate the impact of the potential future development.

METHODOLOGY

Based on the scope of the possible future development (refer to the attached Drawing) and discussions with the Town, the following seven (7) scenarios were developed and analyzed in the hydraulic water model:

1) Existing Water Distribution System;
2) Build-out of future development within the existing Town Limits;
3) Future development north of the Mississippi River (within the Town Limits);
4) Future development south of the Mississippi River (within the Town Limits);
5) Existing plus future development outside of the Town Limits (excluding development within Town Limits);
6) Build-out of all proposed future development; and
7) Build-out of all proposed future development under peak hour demand.

This analysis was conducted in accordance with MOE Water Distribution Design Guidelines that recommend systems meet the following criteria:

1) Maximum day plus coincidental fire flow at a minimum 140 kPa (20 psi) system pressure throughout; and
2) Minimum peak hour system pressure of 275 kPa (40 psi) throughout.

Typically, watermain sizing is dictated by the maximum day plus coincidental fire flow conditions since this demand condition generates the highest flow rates through watermains resulting in higher frictional losses. All scenarios were evaluated under this demand condition. As an additional check of the water distribution system a peak hour demand condition was simulated under the build-out of all potential future development. New watermains added to the model ranged in diameters from 150 mm to 300 mm. It should be noted that while 200 mm diameter watermains were modelled south of Highway No. 7 and east of McNeely Avenue, it is recommended that 300 mm diameter trunk watermains be constructed in these areas since the actual extent of development is unknown at this time. The installation of 300 mm diameter trunk watermains would be consistent with previous Town development.

It is understood that water plant upgrades (including high lift pump upgrades) and additional water storage would be required to support the proposed future development. The water distribution network is the focus of this investigation.

WATER DEMANDS

Anticipated land use in the future development areas consists of residential, commercial and light industrial. Water demands and residential peaking factors were estimated based on the consumption rates recommended in MOE Design Guidelines. The peaking factors for commercial and light industrial development were obtained from the City of Ottawa Design Guidelines. For residential development, a unit density of 2.5 people/unit was applied. The following Table summarizes the water demand parameters applied to future development areas (refer to the attached tables for detailed water demands applied under each scenario).

Table 1: Future Development Water Demand Parameters

Land Use	Average Day	Maximum Day	Peak Hour
Residential	350 L/cap/day	2.0 x Average Day	3.0 x Average Day
Commercial	28,000 L/ha/day	1.5 x Average Day	2.7 x Average Day
Light Industrial	35,000 L/ha/day	1.5 x Average Day	2.7 x Average Day

BOUNDARY CONDITIONS

Maximum day plus fire flow simulations were carried out using HLPs No. 1 and No. 4 and an Elevated Storage Tank (EST) level of 181.1 m. This scenario was modelled assuming a minimum pressure of 140 kPa (20 psi) at any junction or hydrant within that zone. Based on revised high lift pump curves, the model extrapolated flows to the 140 kPa (20 psi) level because the pumps run-out point is anywhere between 440 kPa (63.8 psi) and 410 kPa (59.4 psi).

The peak hour demand condition was simulated using HLPs No. 1 and No. 3 and EST level of 181.1 m. The resulting system pressures were compared to the minimum operating pressure of 275 kPa (40 psi) recommended in the MOE Guidelines.

MODEL RESULTS AND OBSERVATIONS

The following Table presents a summary of the fire flows estimated that can be delivered to the various junctions in the system under the simulated scenarios. The simulation results are expressed in terms of a percentage of total system junctions that are capable of delivering the fire flow listed under the column heading.

Table 2: Maximum Day + Fire Flow Junction Performance Summary

Scenario	Water Demand (L/s)	Percentage (%) of Junctions Capable of Meeting the Fire Flow Indicated				
		Fire Flow				
		50 L/s	75 L/s	100 L/s	150 L/s	300 L/s
Existing	86	97	85	73	51	21
Town Limits (T.L.)	197	99	90	79	52	18
North of River (T.L.)	112	96	86	73	50	20
South of River (T.L.)	172	99	90	79	56	29
Outside (T.L.)	192	99	90	76	49	16
Build-out	302	99	86	75	48	14

The potential build-out future development condition represents a 216 L/s or 250% increase in the maximum day demand from existing conditions. Given this significant growth, the model results indicate that overall the water distribution system provides a relatively consistent level of service from existing conditions. This is indicative of a well planned watermain network capable of supporting ample future development (refer to the attached WaterCAD results).

The junction performance summary indicates improved fire flows South of the River within the Town Limits scenario. Available fire flows increased when compared to existing conditions in the southwest quadrant of the Town. This improvement is attributed to potential watermain looping and redundancy created by connecting Morris Street, extending the existing 300 mm watermain along Boyd Street and future connections on the west side of Dunham Street.

In the northeast quadrant of the Town, existing fire flows are below 50 L/s and up to 75 L/s in the commercial/industrial area. The model results of future development in this area indicate that similar levels of services can be expected under build-out conditions. Additional investigation will likely be required to determine if these are acceptable levels of service for future commercial and industrial development. Relatively higher ground elevations and small watermain diameter (150 mm) are identified as constraints to this future development.

Build-out - Peak Hour Demand

As a conservative check, a peak hour scenario was simulated under the projected build-out condition. This scenario peaked domestic water demands at 445 L/s, an increase of 305 L/s or 218% from the existing peak hour demand of 140 L/s. The results of this investigation indicate that the minimum peak hour pressure requirement of 275 kPa (40 psi) is achieved across the majority of the water distribution system, with noted deficiencies at the periphery of the system on the north side of the Mississippi River. The deficient pressures range between 235 kPa to 273 kPa and are located in the future commercial/industrial development and the existing Moffat, Thomas and Bridge Street areas. Watermain upgrades and/or booster stations may be required to adequately service these areas in the future. Once the timing and scope of future development areas are defined, it is recommended that a specific hydraulic investigation be undertaken for the new development as a final check that adequate water servicing can be delivered by the existing water distribution network.

CONCLUSION AND RECOMMENDATIONS

The results of the foregoing hydraulic investigation indicate that the majority of the existing water distribution system can accommodate significant levels of future development. The level of service provided under existing maximum day demand plus coincidental fire flow is maintained following build-out of the proposed future development areas. It is recommended that watermain looping be constructed when developing new areas, particularly in the southwest quadrant of the Town. It should be noted that while 200 mm diameter watermains were simulated in the south east quadrant it is recommended that 300 mm diameter trunk feedermains be installed in this area since the precise scope of future development is unknown at this time. The installation of 300 mm diameter trunk watermains would be consistent with the previous Town development. Once the timing and scope of future development areas are defined, it is recommended that a specific hydraulic investigation be undertaken for the new development as a final check that adequate water servicing can be delivered by the existing water distribution network.

Should you have any questions, please do not hesitate to contact the undersigned at your convenience.

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED

Mark Buchanan

Mark Buchanan, P.Eng.

MB:jd
Attach.

ATTACHMENT NO. 1

Future Development Drawing

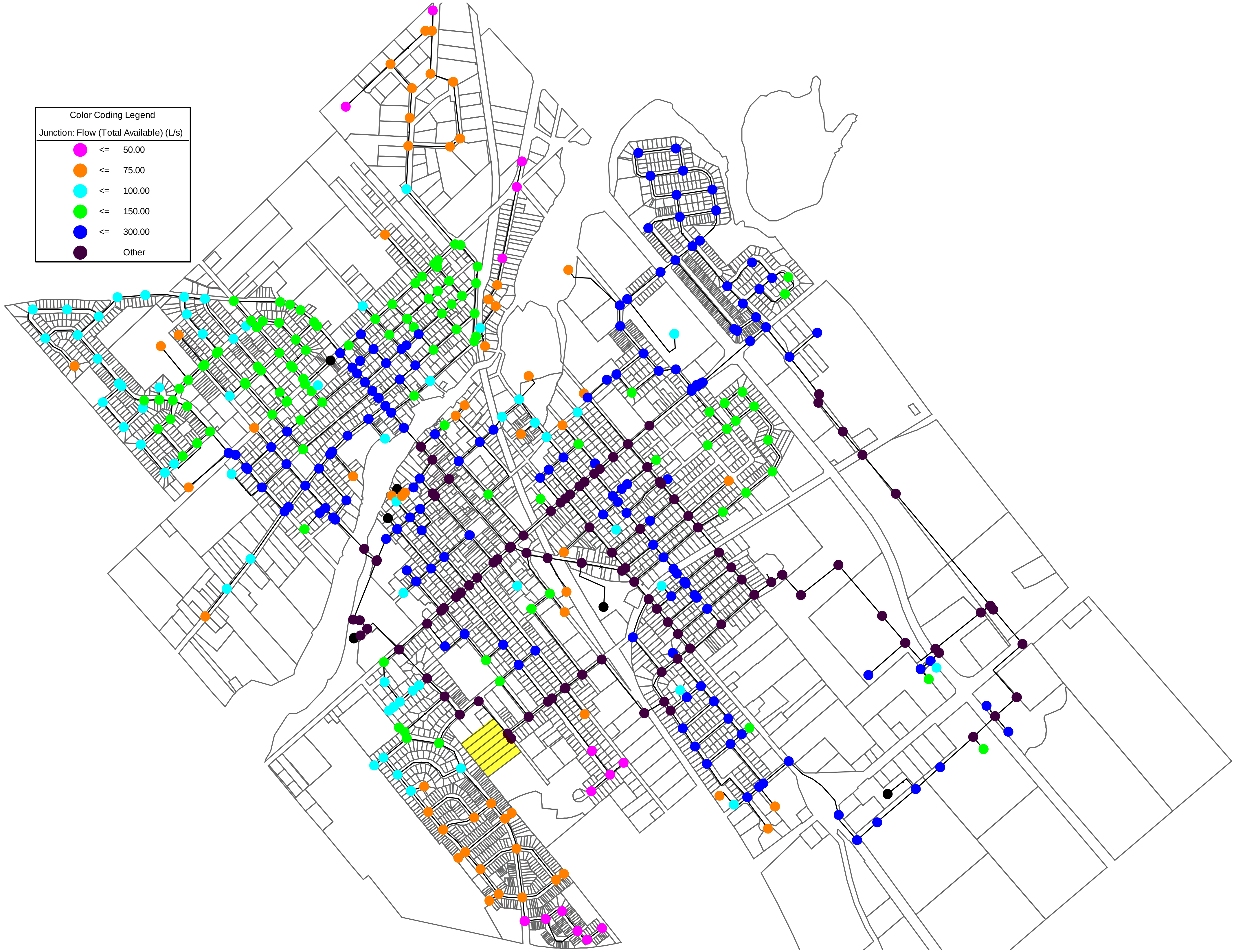
TOWN OF CARLETON PLACE WATER DISTRIBUTION SYSTEM FUTURE DEVELOPMENT

File Location: P:\25000\25819-01 Carleton Place - Water Model\ULR DWG\Civil\Xref Civil\WATERSYS MODEL 2013.dwg

ATTACHMENT NO. 2

Water Demands and WaterCAD Results

Active Scenario: Max Day plus Fire Flow Demand

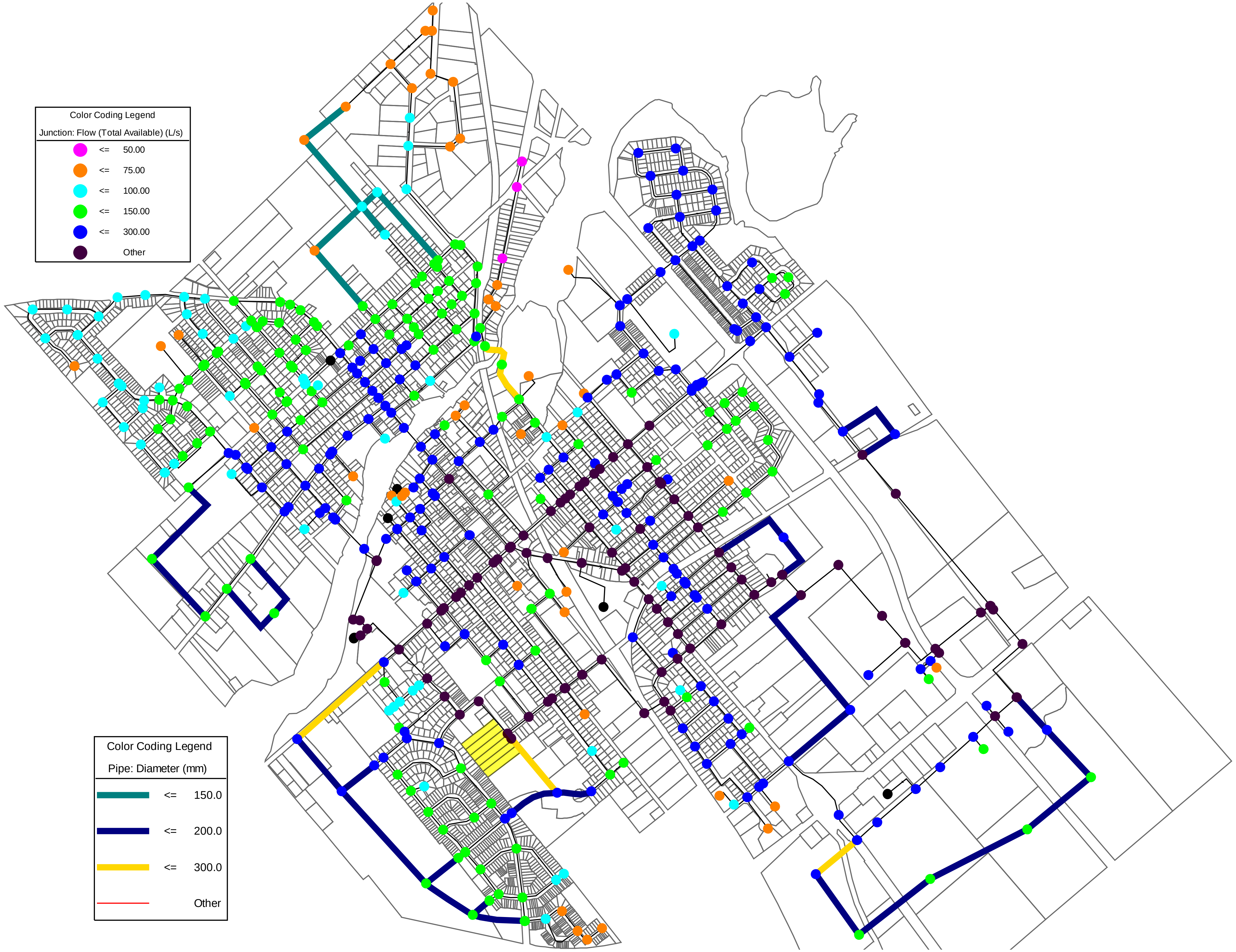


Town of Carleton Place
Future Development within Town Limits
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)	
			Average Day	Maximum Day
181	Res	300	3.04	6.08
895	Comm	6.07	1.97	2.95
904	Res	0	0.00	0.00
905	Res	300	3.04	6.08
906	Res	300	3.04	6.08
907	Res	0	0.00	0.00
908	Res	350	3.54	7.09
909	Res	200	2.03	4.05
910	Res	150	1.52	3.04
911	Res	0	0.00	0.00
912	Res	94	0.95	1.90
913	Res	225	2.28	4.56
914	Res	225	2.28	4.56
915	Res	0	0.00	0.00
916	Res	0	0.00	0.00
917	Res	200	2.03	4.05
918	Res	0	0.00	0.00
919	Indust.	12.14	4.92	7.38
920	Res	0	0.00	0.00
921	Res	320	3.24	6.48
921	Comm	8.09	2.62	3.93
922	Res	260	2.63	5.27
922	Comm	8.09	2.62	3.93
923	Res	350	3.54	7.09
924	Res	400	4.05	8.10
925	Res	300	3.04	6.08
926	Comm	6.07	1.97	2.95
927	Res	0	0.00	0.00
928	Indust.	6.07	2.46	3.69
936	Indust.	8.5	3.44	5.16
	Total		**60.24**	**110.49**

Parameters		
Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire within Town Limits

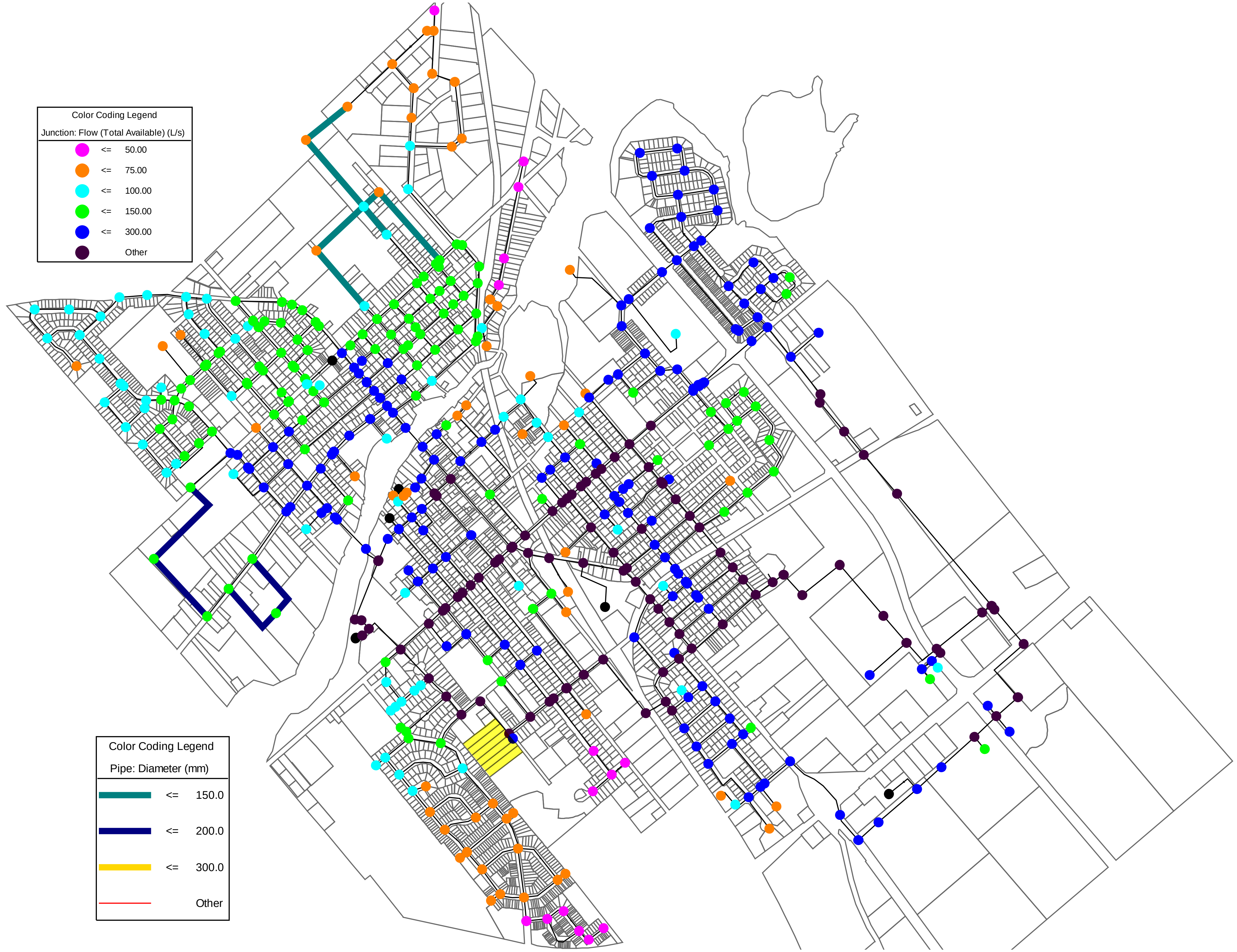


Town of Carleton Place
Future Development
North of Mississippi River (within Town Limit)
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)		
			Average Day	Maximum Day	
181	Res	300	3.04	6.08	
910	Res	150	1.52	3.04	
911	Res	0	0.00	0.00	
912	Res	94	0.95	1.90	
913	Res	225	2.28	4.56	
914	Res	225	2.28	4.56	
915	Res	0	0.00	0.00	
916	Res	0	0.00	0.00	
936	Indust.	8.5	3.44	5.16	20.13
	Total		**13.51**	**25.30**	

Parameters		
Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire within Town Limits (North of River)



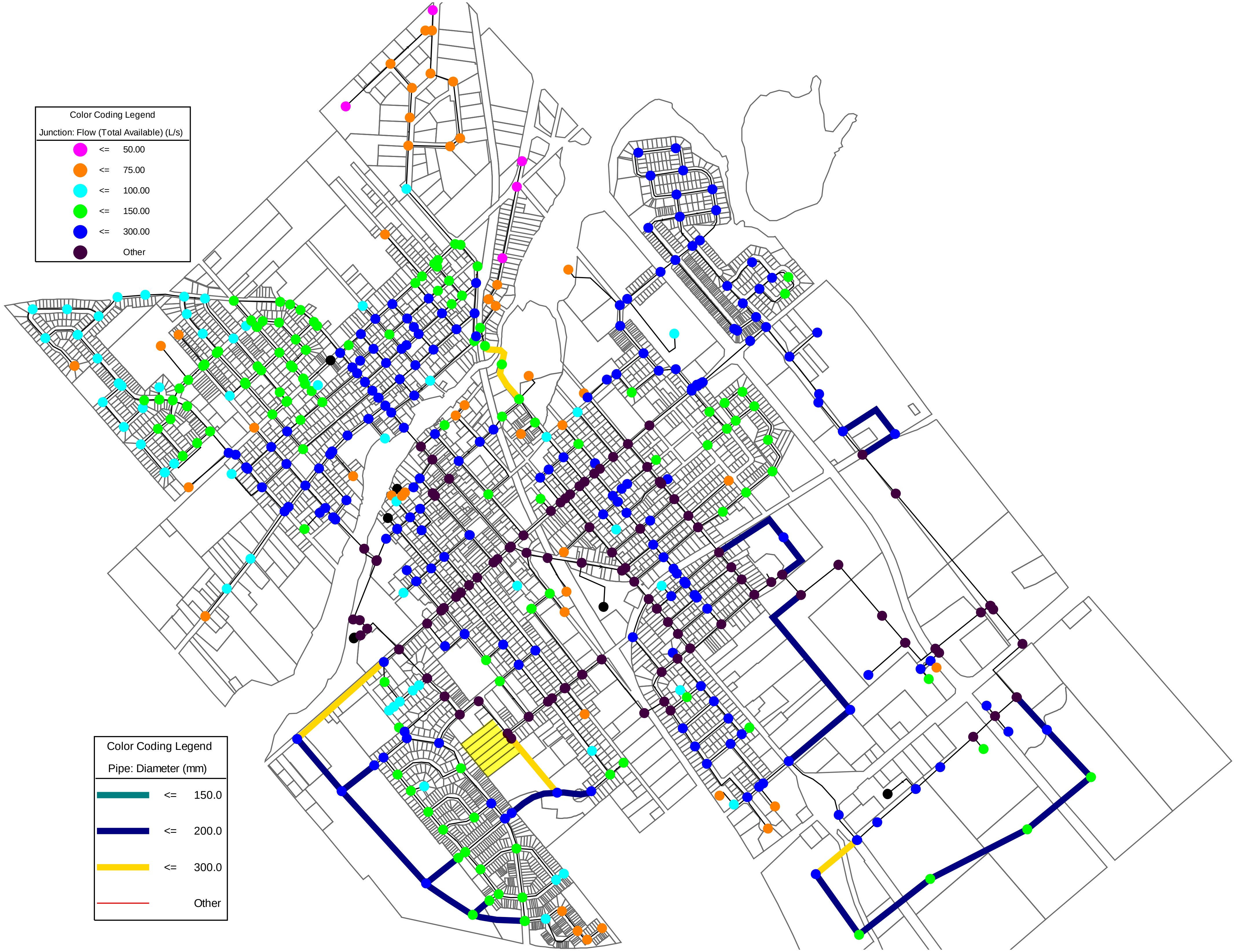
Town of Carleton Place
Future Development within Town Limits
South of Mississippi River (within Town Limit)
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)	
			Average Day	Maximum Day
895	Comm	6.07	1.97	2.95
904	Res	0	0.00	0.00
905	Res	300	3.04	6.08
906	Res	300	3.04	6.08
907	Res	0	0.00	0.00
908	Res	350	3.54	7.09
909	Res	200	2.03	4.05
917	Res	200	2.03	4.05
918	Res	0	0.00	0.00
919	Indust.	12.14	4.92	7.38
920	Res	0	0.00	0.00
921	Res	320	3.24	6.48
921	Comm	8.09	2.62	3.93
922	Res	260	2.63	5.27
922	Comm	8.09	2.62	3.93
923	Res	350	3.54	7.09
924	Res	400	4.05	8.10
925	Res	300	3.04	6.08
926	Comm	6.07	1.97	2.95
927	Res	0	0.00	0.00
928	Indust.	6.07	2.46	3.69
	Total		**46.73**	**85.19**

Parameters

Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire within Town Limits (South of River)



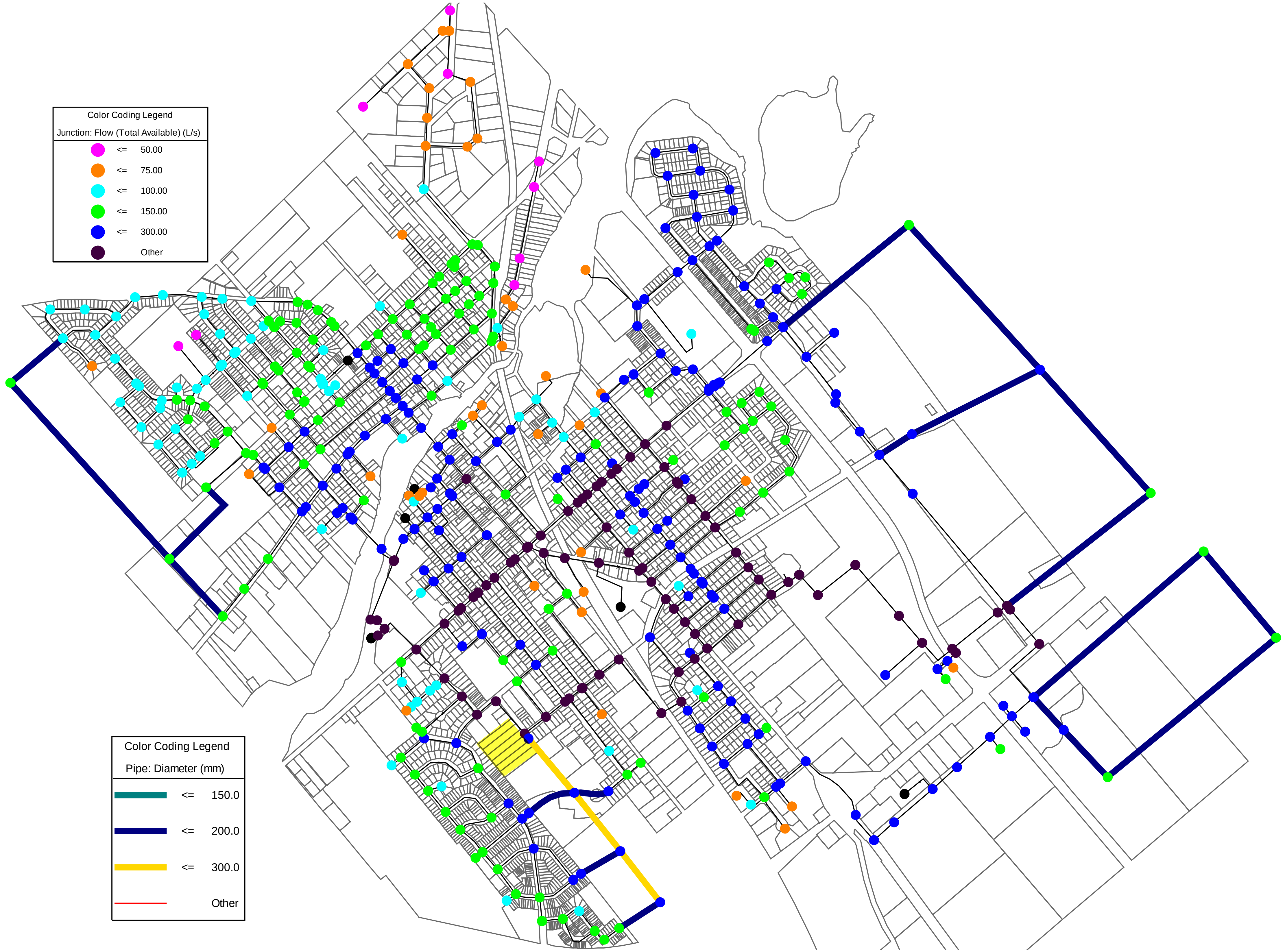
Town of Carleton Place
Future Development Outside Town Limits
Water Demands

Node	Zoning	Units or Area (ha)	Demand (L/s)	
			Average Day	Maximum Day
930	Res	800	8.10	16.20
931	Res	750	7.60	15.19
932	Res	1250	12.66	25.32
933	Res	500	5.06	10.13
934	Res	200	2.03	4.05
935	Res	200	2.03	4.05
937	Res	1500	15.19	30.38
	Total		**52.66**	**105.32**

Parameters

Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg

Active Scenario: Max Day + Fire outside Town Limits

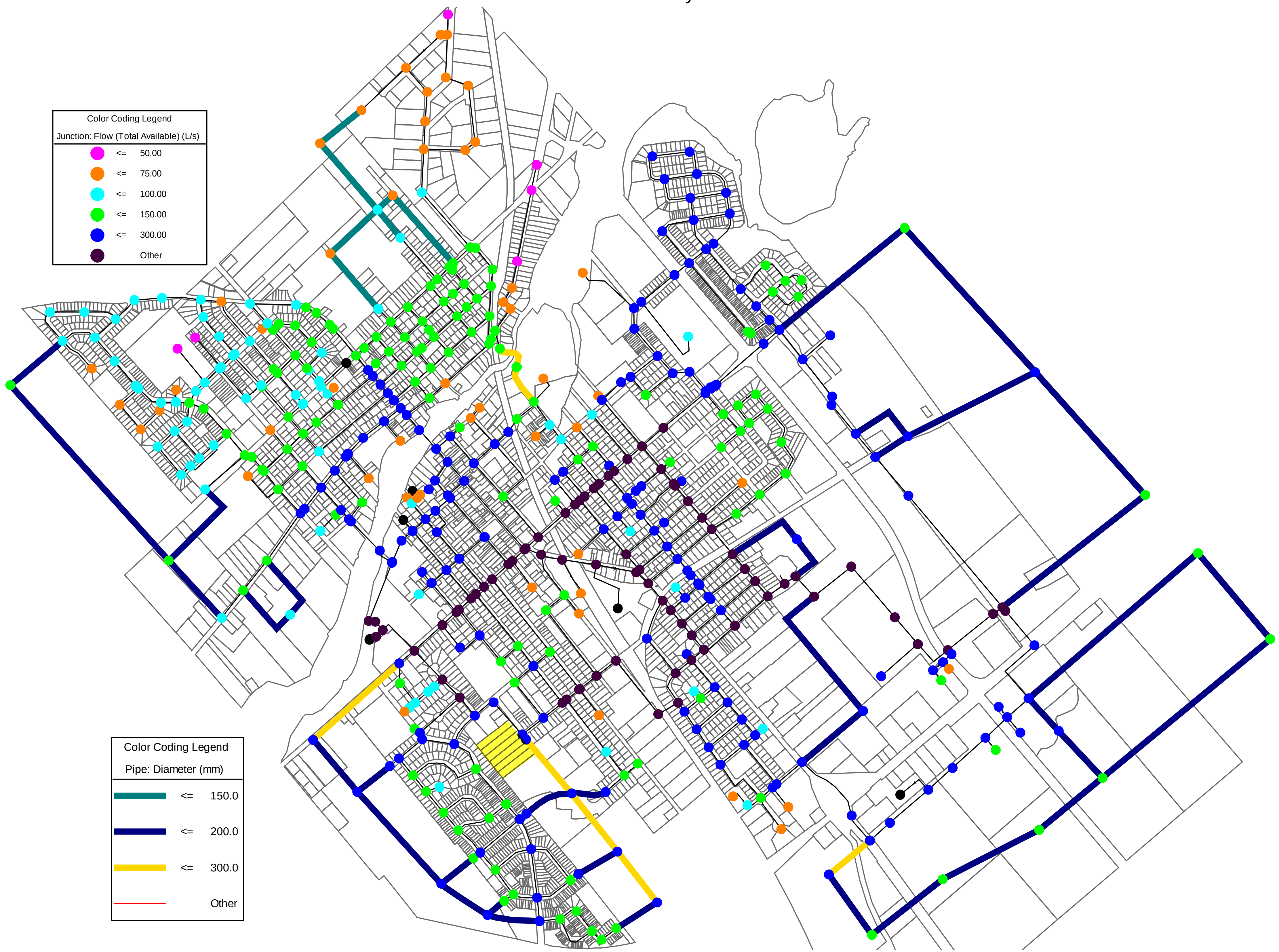


Town of Carleton Place
Future Development Build-out
Water Demands

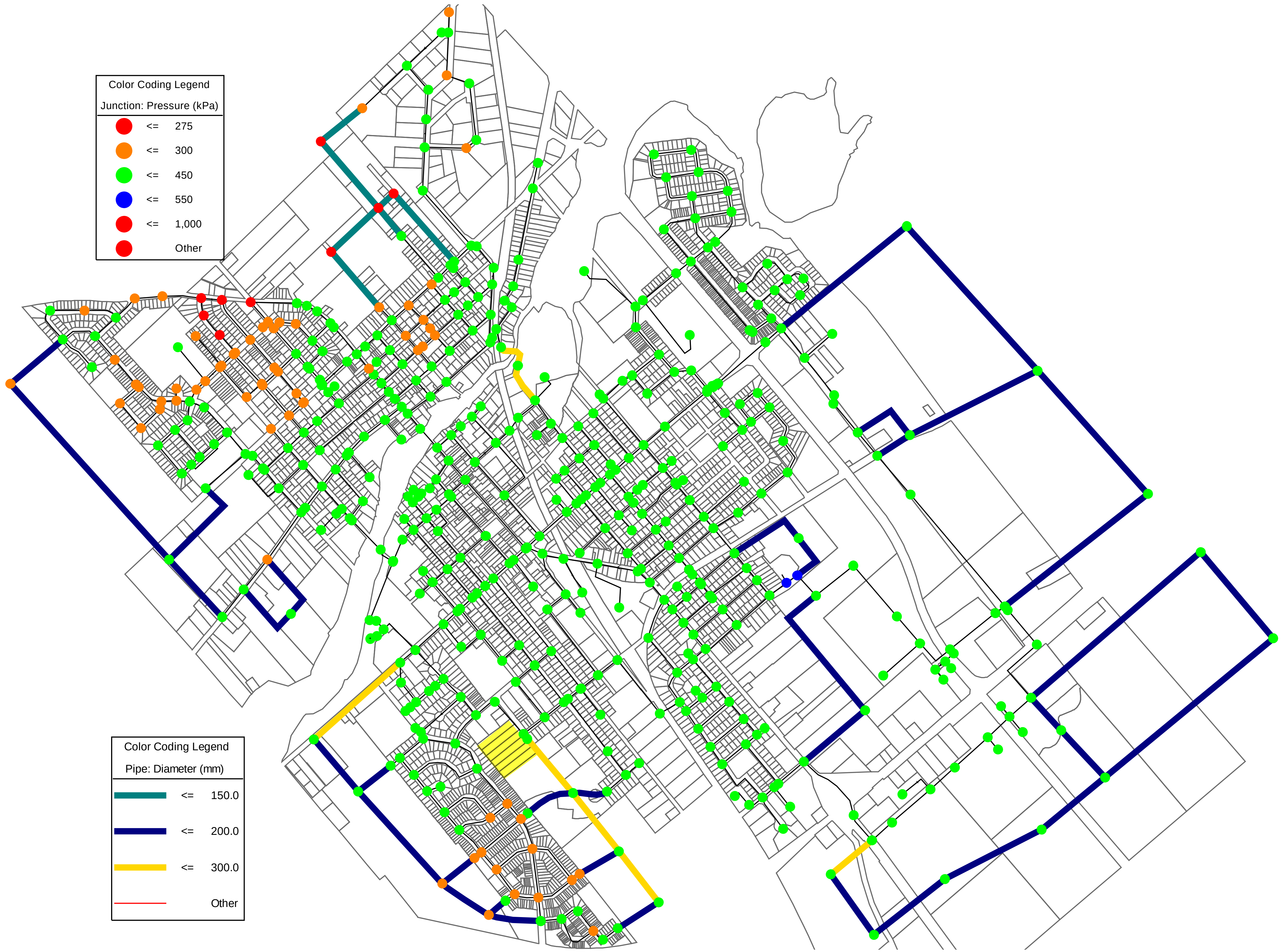
Node	Zoning	Units or Area (ha)	Demand (L/s)		
			Average Day	Maximum Day	Peak Hour
181	Res	300	3.04	6.08	8.20
895	Comm	6.07	1.97	2.95	5.31
904	Res	0	0.00	0.00	0.00
905	Res	300	3.04	6.08	8.20
906	Res	300	3.04	6.08	8.20
907	Res	0	0.00	0.00	0.00
908	Res	350	3.54	7.09	9.57
909	Res	200	2.03	4.05	5.47
910	Res	150	1.52	3.04	4.10
911	Res	0	0.00	0.00	0.00
912	Res	94	0.95	1.90	2.57
913	Res	225	2.28	4.56	6.15
914	Res	225	2.28	4.56	6.15
915	Res	0	0.00	0.00	0.00
916	Res	0	0.00	0.00	0.00
917	Res	200	2.03	4.05	5.47
918	Res	0	0.00	0.00	0.00
919	Indust.	12.14	4.92	7.38	13.28
920	Res	0	0.00	0.00	0.00
921	Res	320	3.24	6.48	8.75
921	Comm	8.09	2.62	3.93	7.08
922	Res	260	2.63	5.27	7.11
922	Comm	8.09	2.62	3.93	7.08
923	Res	350	3.54	7.09	9.57
924	Res	400	4.05	8.10	10.94
925	Res	300	3.04	6.08	8.20
926	Comm	6.07	1.97	2.95	5.31
927	Res	0	0.00	0.00	0.00
928	Indust.	6.07	2.46	3.69	6.64
929	Res	0	0.00	0.00	0.00
930	Res	800	8.10	16.20	21.88
931	Res	750	7.60	15.19	20.51
932	Res	1250	12.66	25.32	34.18
933	Res	500	5.06	10.13	13.67
934	Res	200	2.03	4.05	5.47
935	Res	200	2.03	4.05	5.47
936	Indust.	8.5	3.44	5.16	9.30
937	Res	1500	15.19	30.38	41.02
	Total		**112.91**	**215.81**	**304.85**

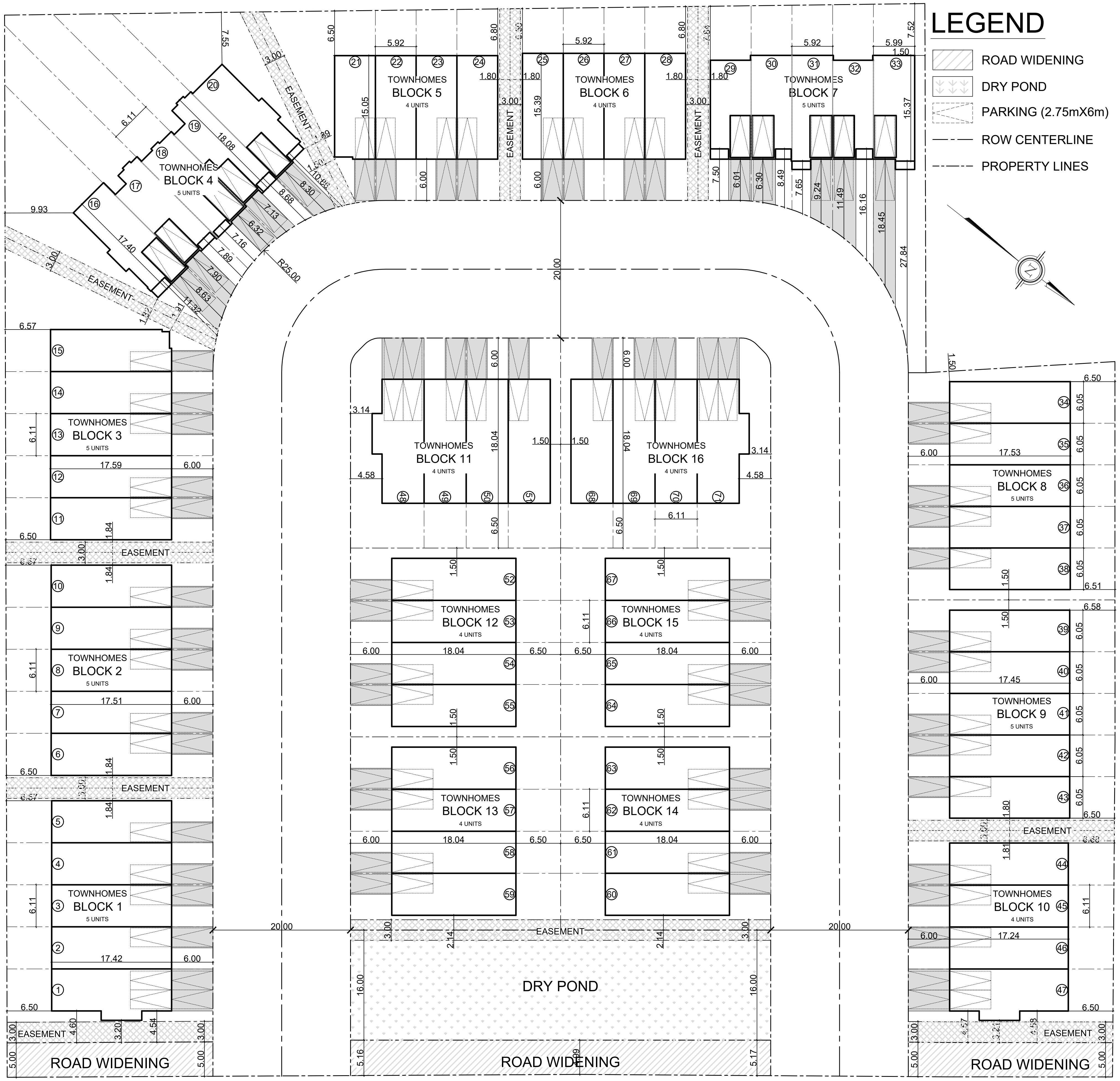
Parameters		
Unit Density	2.5	people/unit
Average Day	350	L/cap/day
Maximum Day Peaking Factor	2.0	x Avg
Peak Hour Peaking Factor	3.0	x Avg
Light Industrial Avg Day Demand	35000	L/ha/day
Commercial Average Day Demand	28000	L/ha/day
Max Day Peaking Factor	1.5	x Avg
Peak Hour Peaking Factor	2.7	x Avg

Active Scenario: Max Day + Fire - Build-out



Active Scenario: Peak Hour - Build-out





SITE INFORMATION

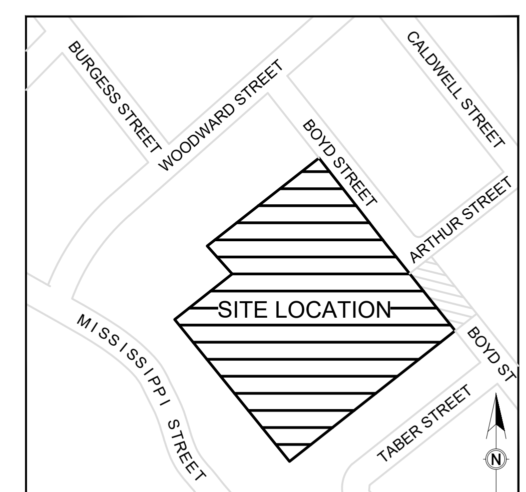
TOTAL SITE AREA	5.82 ac
TOTAL BUILDING AREA	xx
SITE COVERAGE	%
DEVELOPPED AREA	3.93 ac
ROAD AREA	1.50 ac
ROAD WIDENING AREA	0.15 ac
DRY POND AREA	0.24 ac
TOTAL NUMBER OF UNITS	71
EXISTING DISTRICT	RESIDENTIAL

BLOCK COVERAGE INFORMATION

BLOCK NO.	AREA (m²)	COVERAGE (m²)	COVERAGE (%)	NO. OF DWELLINGS
1	xx	xx	xx	xx
2	xx	xx	xx	xx
3	xx	xx	xx	xx
4	xx	xx	xx	xx
5	xx	xx	xx	xx
6	xx	xx	xx	xx
7	xx	xx	xx	xx
8	xx	xx	xx	xx
9	xx	xx	xx	xx
10	xx	xx	xx	xx
11	xx	xx	xx	xx
12	xx	xx	xx	xx
13	xx	xx	xx	xx
14	xx	xx	xx	xx
15	xx	xx	xx	xx
16	xx	xx	xx	xx

DEVELOPMENT STANDARDS - TOWNHOME DWELLINGS

SITE PROVISIONS	REQUIREMENTS	PROVIDED
LOT AREA (MIN)	NIL	
LOT COVERAGE (MAX)	60%	
LOT FRONTAGE (MIN)	5.5 M (18.04 FT)	
FRONT YARD BUILD WITHIN AREA	4.5 M, MIN (14.7 FT) 7.5 M, MAX (24.6 FT)	
EXTERIOR SIDE YARD BUILD WITHIN AREA	4.5 M, MIN (14.7 FT) 7.5 M, MAX (24.6 FT)	
INTERIOR SIDE YARD (MIN)	1.5 M (4.9 FT)	
REAR YARD DEPTH (MIN)	6.5 M (21.3 FT)	
USABLE LANDSCAPED OPEN SPACE IN THE REAR YARD (MIN)	30 SQM (538 SQFT)	
BUILDING HEIGHT (MAX)	11 M (36 FT)	
DWELLING UNIT AREA (MIN)	83.1 SQM (900 SQFT)	
NO ENCROACHMENT AREA FROM FRONT OR EXTERIOR SIDE LOT LINE	2.5 M (8.2 FT)	
PARKING SPACES	2 SPACES / DWELLING UNIT, ONE OF WHICH MAY BE PROVIDED WITH GARAGE	
GARAGE WIDTH	70% OVERALL LOT FRONTAGE (MAX)	
MAIN GARAGE FOUNDATION	SET BACK 6 M FROM FRONT OR EXT SIDE LOT (MIN)	



KEY PLAN

202 - 11 GIFFORD STREET
NEPEAN, ONTARIO K2E 7S3
TEL: 723-1008 FAX: 727-0209

I HAVE REVIEWED THE PLANS AND ACCEPT RESPONSIBILTY FOR THE DESIGN.

INDIVIDUAL BCIN: 100692

X

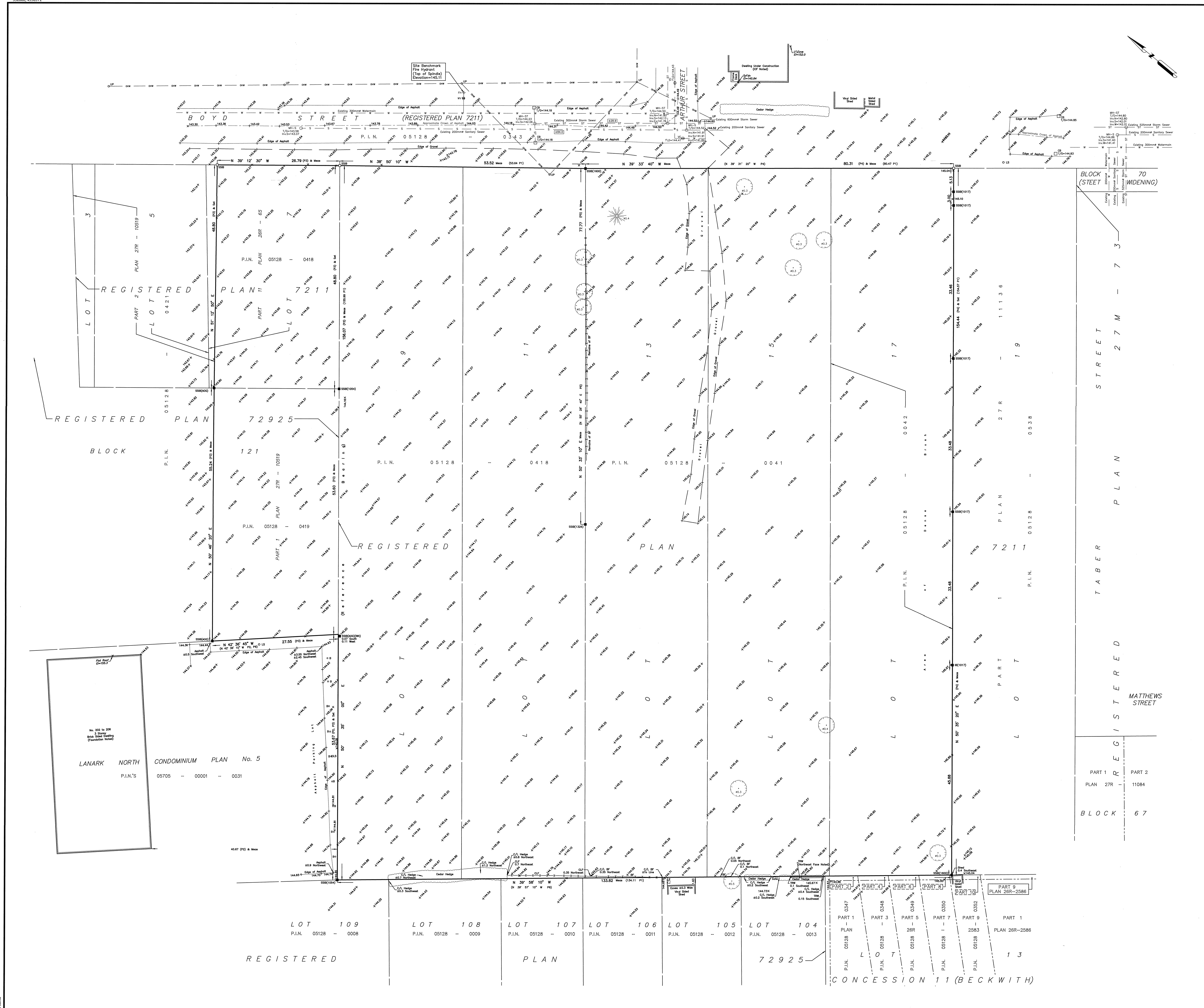
REVISIONS

PROJECT NAME:
XX
AREA: N/A SQFT APPROX

LOCATION:
BOYD STREET
CARLETON PLACE

SHEET TITLE:
SITE PLAN

SCALE: 3/16" = 1'-0"	DWG. NO.
DRAWN: R LAROCQUE	S1.0
DATE: 25/09/2020	
PRINT DATE: 17/08/2023 - 8:25am	



TOPOGRAPHIC PLAN OF SURVEY OF

ALL OF LOTS 9, 11, 13, 15 & 17 AND PART OF LOT 7 REGISTERED PLAN 7211 AND PART OF BLOCK 121 REGISTERED PLAN 72925

TOWN OF CARLETON PLACE

COUNTY OF LANARK

FARLEY, SMITH & DENIS SURVEYING LTD. 2020

Scale 1: 250

0 2.5 5 7.5 10 12.5 15 20 25 metres

Metric Note

Distances and coordinates on this plan are in metres and can be converted to feet by dividing by 0.3048.

Distance Note

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.99989.

Bearing Note

Bearings hereon are grid, referred to the northerly limit of Lot 9 on Registered Plan 7211 having a bearing of N50°35'00"E as shown on Plan 27R-10519 and are referred to the Central Meridian of MTM Zone 9 (76°30' West Longitude) Nad-83 CSRS (2010).

For bearing comparisons, a rotation of 0°21'40" counter-clockwise was applied to bearings on P2 and P6.
For bearing comparisons, a rotation of 0°29'00" counter-clockwise was applied to bearings on P5.

Elevation Notes

1. Elevations shown are geodetic and are referred to the Town of Carleton Place Benchmark List Benchmark No. 28 the top of spindle of a fire hydrant at the intersection of Woodward Street and Burgess Street having a published elevation of 144.076 metres.
2. Elevations shown are geodetic and are referred to Geodetic Datum CGVD-1928 :1978.
3. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

Utility Notes

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. Underground utility data compiled from Municipal utility sheet reference: Drawing No. 96048-P1 & M-037-07.
4. Sanitary and storm sewer grades and inverts were derived from: Field measurement .
5. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

Notes & Legend

	Denotes	
—□—	"	Survey Monument Planted
—■—	"	Survey Monument Found
SIB	"	Standard Iron Bar
SSIB	"	Short Standard Iron Bar
(Wit)	"	Witness
Meas	"	Measured
(P1)	"	Registered Plan 7211
(P2)	"	Lanark North Condominium Plan No. 5
(P3)	"	Plan 27R-10519
(P4)	"	Plan 27R-11136
(P5)	"	Plan 27R-6955
(P6)	"	Registered Plan 72925
○ MH–ST	"	Maintenance Hole (Storm)
○ MH–S	"	Maintenance Hole (Sanitary)
VC	"	Valve Chamber (Watermain)
—— ST ——	"	Underground Storm Sewer
—— S ——	"	Underground Sanitary Sewer
—— W ——	"	Underground Water
—— OHW ——	"	Overhead Wires
o UP	"	Utility Pole
o LS	"	Light Standard
□ CB	"	Catch Basin
FH	"	Fire Hydrant
WV	"	Water Valve
o B	"	Bollard
	"	Gate
Ø	"	Diameter
CLF	"	Chain Link Fence
BF	"	Board Fence
TRW	"	Timber Retaining Wall
Inv.	"	Invert
T/G	"	Top of Grate
U/Eave	"	Underside of Eave
TpFdn	"	Top of Foundation
C/L	"	Centreline
+65.00	"	Location of Elevations
+65.00	"	Top of Concrete Curb Elevation
———	"	Property Line
	"	Deciduous Tree
	"	Coniferous Tree

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2139120

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR
In accordance with Regulation 1026, Section 29 (3).

Surveyor's Certificate

I certify that :

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Regulations made under them.
2. The survey was completed on the 29th day of October, 2020.

Nov.12/20
Date

Daniel Robinson
Ontario Land Surveyor

FARLEY, SMITH & DENIS SURVEYING LTD.

ONTARIO LAND SURVEYORS
CANADA LAND SURVEYORS

190 COLONNADE ROAD, OTTAWA, ONTARIO K2E 7J5
TEL. (613) 727-8226 FAX. (613) 727-1826

FILE No. : 492-20

J:\2020\492-20_166 Boyd St_CP_Topo\Final\492-20 166 Boyd Str_LT3,5,7,9,11,13,15,17 RP7211_BL121 RP72925_Topo_F.dwg

Stormceptor EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

06/25/2024

Province:	Ontario
City:	Carleton Place
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	
Drainage Area (ha):	2.36
% Imperviousness:	60.00

Project Name:	Boyd Avenue
Project Number:	262415
Designer Name:	jason fitzpatrick
Designer Company:	Exp Services
Designer Email:	jason.fitzpatrick@exp.com
Designer Phone:	613-688-1899
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	50.27
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	1657
Estimated Average Annual Sediment Volume (L/yr):	1347

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	63
EFO6	78
EFO8	86
EFO10	91
EFO12	94

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 86

Water Quality Runoff Volume Capture (%): > 90

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 waterways.

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.

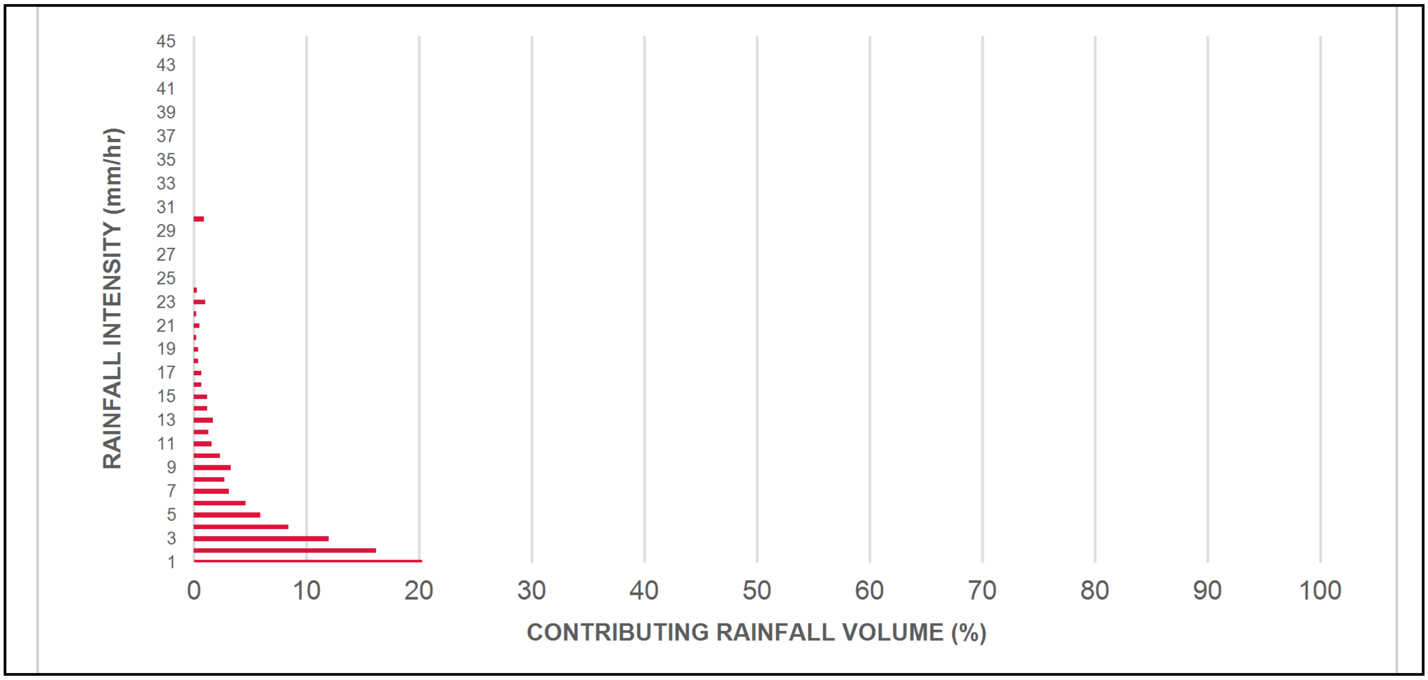
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

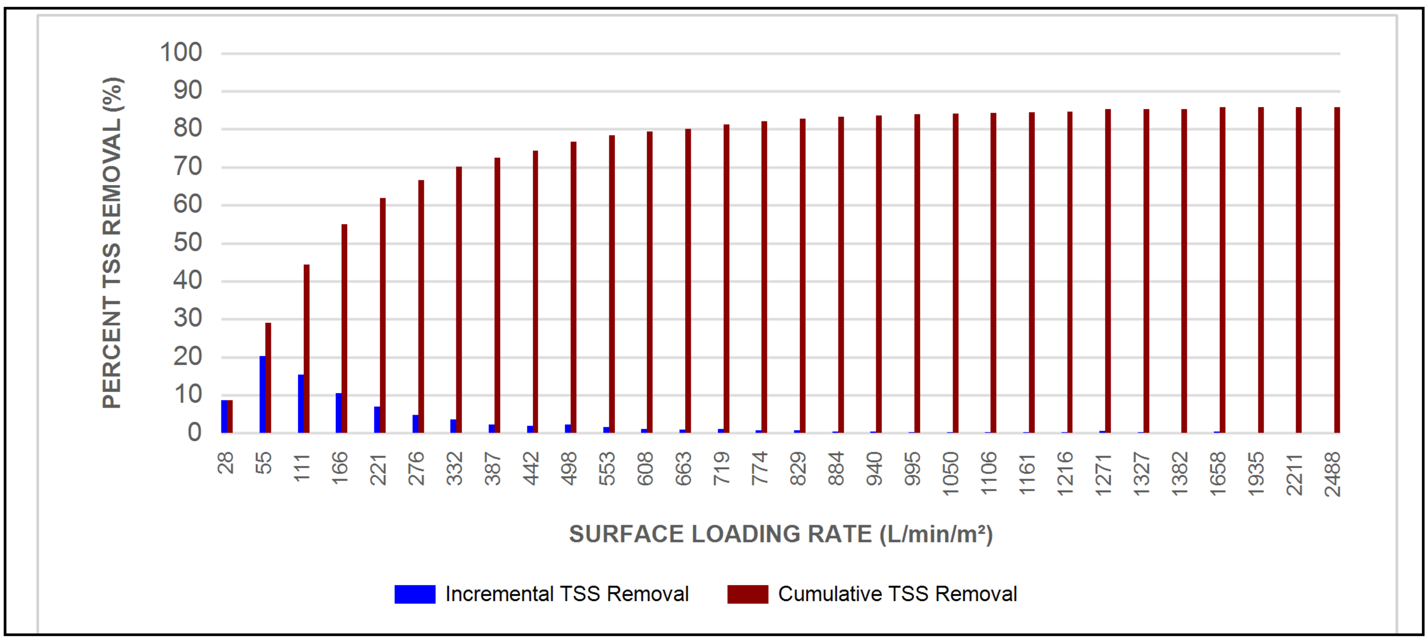
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	2.17	130.0	28.0	100	8.6	8.6
1.00	20.3	29.0	4.33	260.0	55.0	100	20.3	29.0
2.00	16.2	45.2	8.66	520.0	111.0	95	15.3	44.3
3.00	12.0	57.2	12.99	779.0	166.0	88	10.6	54.9
4.00	8.4	65.6	17.32	1039.0	221.0	82	6.9	61.8
5.00	5.9	71.6	21.65	1299.0	276.0	80	4.7	66.6
6.00	4.6	76.2	25.98	1559.0	332.0	77	3.6	70.1
7.00	3.1	79.3	30.31	1819.0	387.0	75	2.3	72.4
8.00	2.7	82.0	34.64	2078.0	442.0	72	2.0	74.4
9.00	3.3	85.3	38.97	2338.0	498.0	70	2.3	76.7
10.00	2.3	87.6	43.30	2598.0	553.0	67	1.5	78.3
11.00	1.6	89.2	47.63	2858.0	608.0	65	1.0	79.3
12.00	1.3	90.5	51.96	3118.0	663.0	64	0.8	80.1
13.00	1.7	92.2	56.29	3377.0	719.0	64	1.1	81.2
14.00	1.2	93.5	60.62	3637.0	774.0	63	0.8	82.0
15.00	1.2	94.6	64.95	3897.0	829.0	63	0.7	82.7
16.00	0.7	95.3	69.28	4157.0	884.0	62	0.4	83.2
17.00	0.7	96.1	73.61	4417.0	940.0	62	0.5	83.6
18.00	0.4	96.5	77.94	4677.0	995.0	62	0.2	83.9
19.00	0.4	96.9	82.27	4936.0	1050.0	60	0.2	84.1
20.00	0.2	97.1	86.60	5196.0	1106.0	59	0.1	84.2
21.00	0.5	97.5	90.93	5456.0	1161.0	58	0.3	84.5
22.00	0.2	97.8	95.26	5716.0	1216.0	57	0.1	84.6
23.00	1.0	98.8	99.59	5976.0	1271.0	55	0.6	85.2
24.00	0.3	99.1	103.92	6235.0	1327.0	54	0.1	85.3
25.00	0.0	99.1	108.25	6495.0	1382.0	53	0.0	85.3
30.00	0.9	100.0	129.90	7794.0	1658.0	44	0.4	85.8
35.00	0.0	100.0	151.55	9093.0	1935.0	38	0.0	85.8
40.00	0.0	100.0	173.21	10392.0	2211.0	33	0.0	85.8
45.00	0.0	100.0	194.86	11691.0	2488.0	30	0.0	85.8
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



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Stormceptor® EF Sizing Report

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

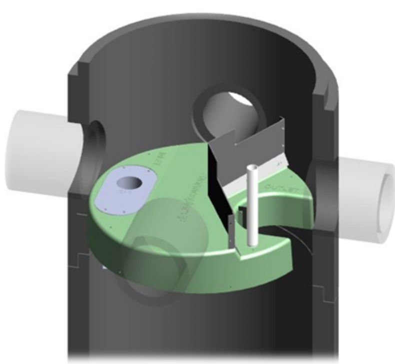
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

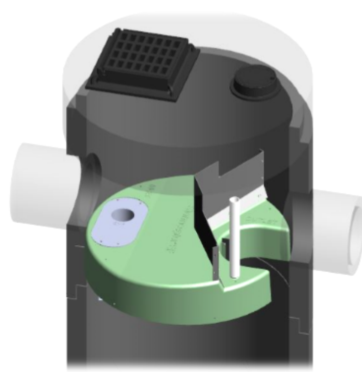
DESIGN FLEXIBILITY

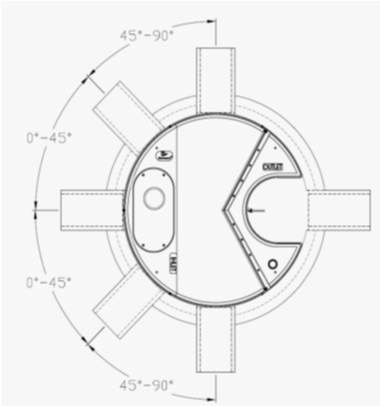
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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)	(ft³)	(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/ft³)

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 of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

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/m^2 to 2600 L/min/m^2) 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.

Appendix G – Drawings

Engineering Drawings (provided separately)

- Cover Sheet
- C001 – Existing Conditions and Removal Plan
- C002 – Notes and Legend Sheet
- C003 – Detail Sheet
- C100 – Site Servicing Plan
- C101 – Plan & Profile
- C200 – Site Grading Plan
- C201 – Dry Pond Details
- C300 – Erosion and Sediment Control Plan
- C400 – Pre Development Storm Catchments
- C500 – Post Development Storm Catchments
- C600 – Sanitary Drainage Area Plan