Functional Site Servicing and Stormwater Management Report 1009 Trim Road, Ottawa, ON

Client:
9378-0633 Quebec Inc.
7 de Tellier
Gatineau, QC J8T 8C2

Submitted for:
Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBL)

Project Name:
1009 Trim Road

Project Number:
OTT-00259629-A0

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

Date Submitted:
September 14, 2020

Functional Site Servicing and Stormwater Management Report 1009 Trim Road, Ottawa, ON

Client:
9378-0633 Quebec Inc.
7 de Tellier
Gatineau, QC J8T 8C2

Submitted for:
Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBL)

Project Name:
1009 Trim Road

Project Number:
OTT-00259629-A0

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

Prepared by:

LICENSED PROFESSIONAL ENGINEER
J.L. FITZPATRICK
2020-09-14
PROVINCE OF ONTARIO

Jason Fitzpatrick, P.Eng.
Project Engineer

Approved by:

Bruce Thomas, P.Eng.
Senior Project Manager

Date Submitted:
September 14, 2020

Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Overview

EXP Services Inc. (EXP) was retained by 9378-0633 Quebec Inc. to prepare a Functional Site Servicing and Stormwater Management Report for the proposed development of 1009 Trim Road in support of an Official Plan Amendment (OPA) and Zoning By-Law Amendment (ZBL).

The site is situated at the north-east corner of Trim Road and Jeanne D'Arc Boulevard North and as illustrated in **Figure 1-1** below. The site is within the City of Ottawa urban boundary and situated in Orleans Ward (Ward 1).

Figure 1-1 - Site Location

The development proposed will consist of two phases. The first phase will be composed of two high-rise buildings (Tower B1, 28-storeys and Tower B2, 32-storeys) with a multi-storey podium (Podium B1-B2, 4-storeys) connecting them, constructed above underground parking. The first phase of this development will include ±460 residential units and ±490 square meters of ground-level retail space housed within the two towers and podium.

The Second Phase of development, once it is confirmed that additional lands can be available to accommodate the second phase, is comprised of one high-rise building (Tower B3, 30-storeys) with a multi-storey podium (Podium B2-B3, 4-storeys) connecting Tower B3 to Tower B2, constructed above underground parking. The second phase of this development will include ±265 residential units and ±510 square meters of ground-level retail space housed within the tower and podium. 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.

2 Existing Conditions

2.1 Site Topography

The site is currently undeveloped. The site is bounded to the west by Trim Road, to the south by Jeanne-D'Arc Boulevard North (formerly Inlet Private), to the east by undeveloped land, and to the north by the Ottawa River. **Figure 2-1** below illustrates the topography of the site which slopes in a northerly direction towards the Ottawa River.

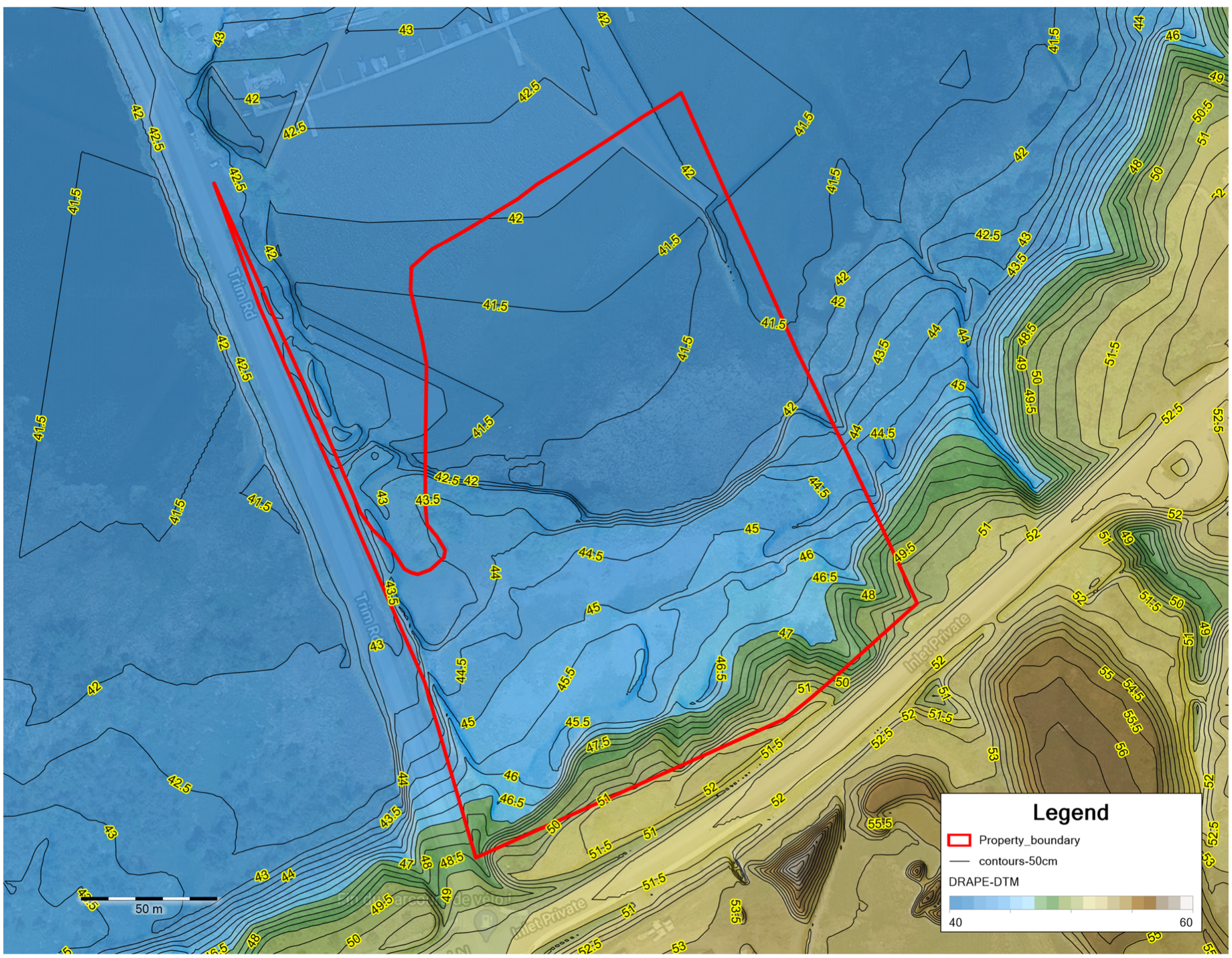


Figure 2-1 - Site Topography

Within the site the topography ranges from ±52m down to ±42m. A digital terrain model (DTM), was derived from the 2014 Digital Raster Acquisition Project of Eastern Ontario (DRAPE) and is shown in **Figure 2-1**. The normal water surface elevation within the adjacent Ottawa River is approximately ±42.0m, with a 100-year flood elevation being 45.0m.

3 Existing Infrastructure

From review of the sewer and watermain mapping, as-built drawings and the City's GeoOttawa mapping, the following summarizes the onsite and adjacent offsite infrastructure:

Within property

- Subject property is currently undeveloped with no services or utilities

Within Jeanne-D'Arc Boulevard North, opposite the site

- 406 mm watermain and fire hydrants
- 300mm sanitary sewer
- Open drainage ditches on east side of Trim Road and along the north side of Jeanne D'Arc Boulevard North
- Enbridge Consumers Gas
- Overhead hydro lines and communication cables

4 Pre-Consultation / Permits / Approvals

A pre-consultation meeting was held with the City prior to design commencement. This meeting, held June 1, 2020, outlined the submission requirements and provided information to assist with the development proposal.

The proposed site is located within the Rideau Valley Conservation Authority (RVCA) jurisdiction, therefore signoff from the RVCA will be required. From previous development consultation on the property, the RVCA has noted that enhanced protection (80% TSS removal) is required. The RVCA has been contacted to confirm the stormwater management quality control requirements.

Stormwater management quantity control will not be required for the portion of the development that will be discharging directly to the Ottawa River. Additional information on this will be provided in proceeding sections.

Generally, an Environmental Compliance Approval (ECA) would be obtained from the Ministry of Environment, Conservation and Parks (MECP), formerly the Ministry of the Environment and Climate Change (MOECC), for any onsite private sewage works. The onsite sewage works would generally include the onsite stormwater works such as flow controls, associated stormwater detention, and treatment works. An Approval Exemption under Ontario Regulation 525/98 may sometimes be applied. Under Section 3 of O'Reg 525/98, Section 53 (1) and (3) do not apply to the alteration, extension, replacement or a change to a stormwater management facility that 1) is designed to service one lot or parcel of land, b) discharges into a storm sewer that is not a combined sewer, c) does not service industrial land or a structure located on industrial land, and finally d) is not located on industrial land. However, the Exception to obtaining an ECA does not apply to sewage works that drain directly to a watercourse. As it is currently proposed to discharge storm runoff to the Ottawa River directly, an ECA for the onsite stormwater works discharging to the Ottawa River will be necessary. Prior to City signoff, a pre-consultation will be held with the local MECP, to confirm submission requirements.

4.1 Design Guidelines

Various design guidelines were referred to in preparing the current report including:

- 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, July 2010 (WDG001), including:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).
- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 1999.
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing.

5 Development Proposal

It is proposed to develop the site in two phases. Phase 1 will consist of Towers B1 & B2 and an adjoining podium. Underground parking levels will be located beneath much of the phase 1 boundary. A third tower (Tower B3) and 4-storey podium link is proposed as a possible future phase.

Vehicular entrances are proposed off of Jeanne D'Arc Boulevard North, with sidewalk connections along the frontage of the property linking Trim Road (to the west) and the future realigned Trim Road to the east.

6 Water Servicing

6.1 Water Servicing Design Criteria

Table 6-1 below summarizes the Design Criteria that was used to establish the water demands and the required fire flows, based on the proposed building uses. The design parameters that apply to this project and used for calculations are identified 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	1.8 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	350 L/person/day	✓
Average Day Demands – Commercial / Institutional	5 L/m^2 floor area/day	✓
Average Day Demands – Light Industrial / Heavy Industrial	35,000 or 55,000 L/gross ha/day	
Maximum Day Demands – Residential	2.5 x Average Day Demands	✓
Maximum Day Demands – Commercial / Institutional	1.5 x Average Day Demands	✓
Peak Hour Demands – Residential	5.5 x Average Day Demands	✓
Peak Hour Demands – 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)	✓

6.2 Water Servicing Proposal

The first phase of the proposed development will include ±530 residential units and ±490 square meters of ground-level retail space housed within the two towers and podium. The second phase of the proposed development will include ±265 residential units and ±510 square meters of ground-level retail space, within a future tower and podium, should it be confirmed that lands can be made available for the second phase.

Architectural plans and rendering of the proposed building along with building statistics are provided in **Appendix E.**

Water supply for the site will be provided by twin 200mm watermains supplied from the existing 406mm watermain on Jeanne D'Arc Boulevard North. The development will require independent and twin watermain, which is the result of the average day water demands exceeding 50 m^3/day. The watermain feeds from the underground parking level will connect directly to the existing 460mm watermain on Jeanne D'Arc Boulevard and will have an isolation valve between them, consistent with City of Ottawa Water Design Guidelines. **Figure A1** in **Appendix A** illustrates the conceptual water servicing of the property.

The buildings will be protected by an automatic sprinkler system. A fire department connection (or siamese) will be located within 45 metres of an adjacent municipally owned fire hydrant. In order to achieve this, it is proposed that a new hydrant will be installed off the existing 406mm watermain within the Jeanne D'Arc Boulevard right-of-way.

6.3 Estimated Water Demands

The following **Table 6-2** below summarizes the anticipated water demands for the proposed development based on following:

- Phase 1 having 530 units and 490 m^2 of retail space. Estimated residential population of 927 persons.
- Phase 2 having 265 units and 510 m^2 of retail space. Estimated residential population of 464 persons.

Table 6-2 : Water Demand Summary

Water Demand Conditions	Phase 1 Water Demands (L/sec)	Phase 2 Water Demands (L/sec)	Total Water Demands (L/sec)
Average Day	3.78	1.91	5.69
Max Day	9.43	4.74	14.17
Peak Hour	20.73	10.42	31.15

6.4 Boundary Conditions

Hydraulic Grade Line (HGL) boundary conditions were obtained from the City for design purposes. A copy of the correspondence received from the City is provided in **Appendix D**.

The following hydraulic grade line (HGL) boundary conditions were provided:

- Maximum HGL = 113.6 m
- Peak Hour HGL = 106.7 m
- Max Day Plus Fire Flow 1 = 112.0 m (100 L/sec)
- Max Day Plus Fire Flow 2 = 102.9 m (167 L/sec)

The provided HGL ranges of 106.7 m – 113.6 m were used to estimate pressures at the building. Under Max Day Plus fire flow conditions, the lower HGL of 102.9 m was used, whereas for Peak Hour conditions the HGL of 106.7 m was used.

6.5 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along on Jeanne D'Arc Boulevard. The required fire flows for the proposed buildings were calculated based on typical values as established by the Fire Underwriters Survey 1999 (FUS).

The following equation from the Fire Underwriters document "Water Supply for Public Fire Protection", 1991, 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 6-3** summarizes the parameters used for estimating the Required Fire Flows (RFF) based on the Fire Underwriters Survey (FUS) and the latest City of Ottawa Technical Bulletins. The RFFs were estimated in accordance with ISTB-2018-02, and based on floor areas provided by the architect, which are illustrates in **Appendix E.** The following summarizes the parameters used for all buildings.

Table 6-3 - Summary of Design Parameters Used in Calculating Required Fire Flows (RFF) Using FUS

Design Parameter	Value
Coefficient Related to type of Construction C	0.80 (Tower B1, Podium B1-B2, Tower B2, future Podium B2-B3, future Tower B3)
Total Floor Area (m2)	4,512 (Tower B1) 1,470 (Podium B1-B2) 4,512 (Tower B2) 1,530 (future Podium B2-B3) 4,512 (future Tower B3)
Fire Flow. Prior to rounding to closest 1,000 (L/min),	11,822 (Tower B1) 6,748 (Podium B1-B2) 11,822 (Tower B2) 6,844 (future Podium B2-B3) 11,822 (future Tower B3)
Fire Flow. Rounded to closest 1,000 (L/min),	12,000 (Tower B1) 7,000 (Podium B1-B2) 12,000 (Tower B2) 7,000 (future Podium B2-B3) 12,000 (future Tower B3)
Reduction Due to Occupancy Non-combustible (-25%), Limited Combustible (-15%), Combustible (0%), Free Burning (+15%), Rapid Burning (+25%)	-15% (Tower B1, Podium B1-B2, Tower B2, future Podium B2-B3, future Tower B3)
Reduction due to Sprinkler (Max 50%)	-50% (Tower B1, Podium B1-B2, Tower B2,

Sprinkler Conforming to NFPA 13 (-30%), Standard Water Supply (-10%), Fully Supervised Sprinkler (-10%)	future Podium B2-B3, future Tower B3)
Exposures	+25% (Tower B1) +46% (Podium B1-B2) +46% Tower B2) +46% (future Podium B2-B3) +25% (future Tower B3)
Required Fire Flow, RFF, before rounded to closest 1,000 (L/min)	7,650 (Tower B1) 5,712 (Podium B1-B2) 9,792 (Tower B2) 5,712 (future Podium B2-B3) 7,650 (future Tower B3)

The estimated required fire flows (RFF) rounded to the closest 1,000, based on the FUS methods is: 10,000 (or 167 L/sec) for Phase 1, and 8,000 (or 133 L/sec) for future Phase 2.

6.6 Review of Hydrant Spacing

A review of the hydrant spacing was completed to ensure compliance with Appendix I of Technical Bulletin ISTB-2018-02. As per Section 3 of Appendix I all hydrants within 150 metres were reviewed to assess the total possible available flow from these contributing hydrants. For each hydrant the distance to the proposed building was determined to arrive at the contribution of fire flow from each. All hydrants are expected to be of Class AA as per Section 5.1 of Appendix I. For each hydrant the straight-line distance, distance measured along a fire route or roadway, whether its location is accessible, and its contribution to the required fire flow.

Figure 6-1 below illustrates all the hydrants that are within the 75 metre and 150 metre offsets from the subject property. Fire hydrants that are denoted with a number having a HP versus H represents a PRIVATE hydrant rather than a CITY owner hydrant. All hydrants where reviewed to determine if they were accessible or non-accessible. For example, a hydrant would not be accessible if they were located on the opposite side of a median, limiting fire truck access. A summary table of the total fire flows available versus the required fire flows (RFFs) is presented in Error! Reference source not found. below.

Table 6-4 –Fire Flows Based on Hydrant Spacing

Building	Required Fire Flow (L/min)	Available Fireflow Based on Hydrant Spacing as per ISTB-2018-02 (L/min)
Tower B1	8,000 (or 133 L/sec)	13,300
Podium B1 / B2	6,000 (or 100 L/sec)	13,300
Tower B2	10,000 (or 167 L/sec)	13,300
Future Podium B2 / B3	6,000 (or 100 L/sec)	9,500
Future Tower B3	8,000 (or 133 L/sec)	13,300

Detailed calculations of the available fire flows based on hydrant spacing is provided in Error! Reference source not found. in **Appendix B.** Therefore, the available flows from hydrants exceed each building's fire flow requirements as identified in Appendix I of Technical Bulletin ISTB-2018-02.

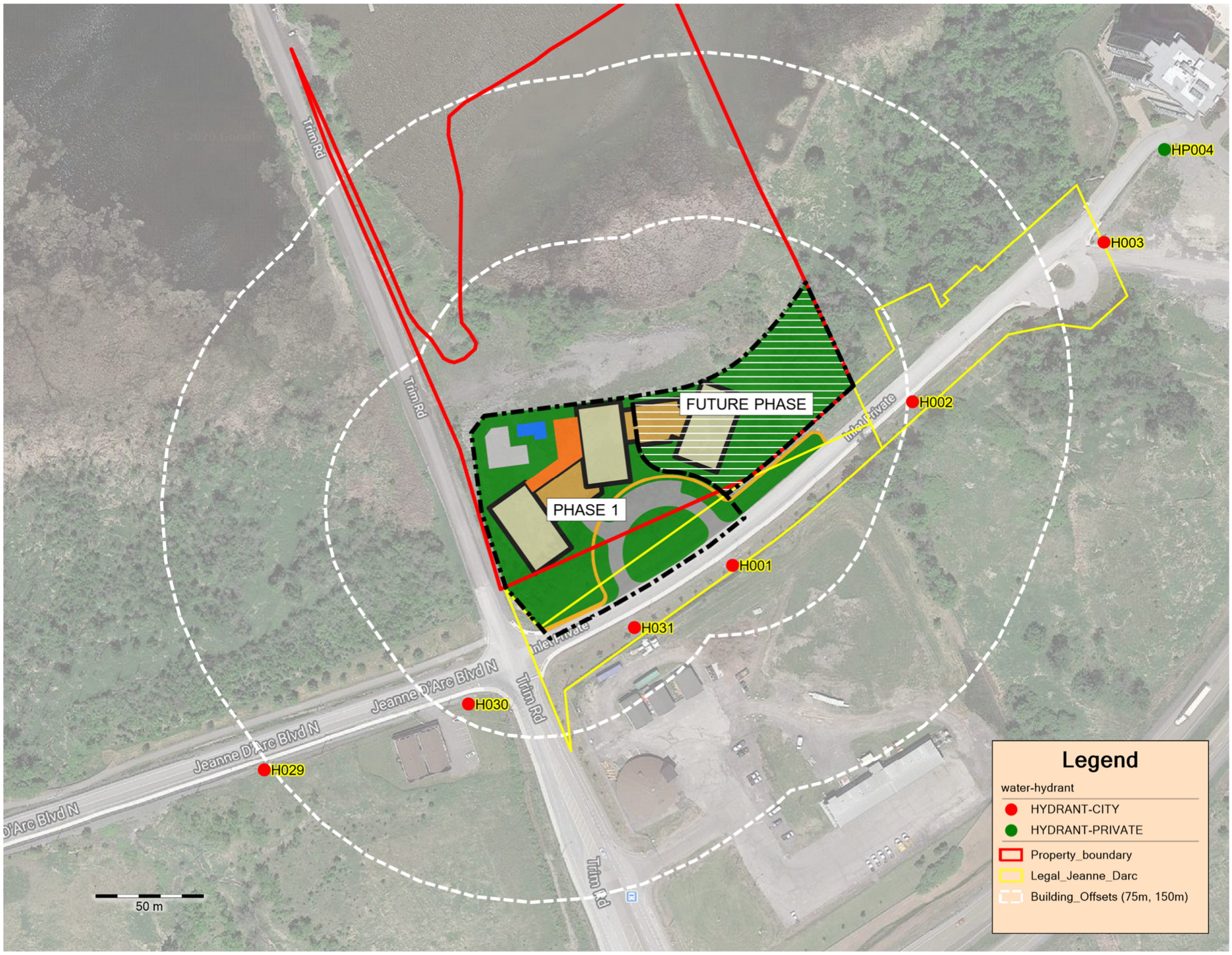


Figure 6-1 – Review of Hydrant Spacing

6.7 Water Servicing Design

The water servicing requirements for the proposed building is designed in accordance with the City Design Guidelines (July 2010). The following steps indicate the basic methodology that was used in our analysis:

- Estimated water demands under average day, maximum day and peak hour conditions. As the total population estimate is greater than 500, standard residential peaking factors were used
- Estimated the required fire flow (RFF) based on the Fire Underwriters Survey (FUS).
- Reviewed the available flows from hydrants within 150m of the buildings, based on the City's WDG002 and compared to the required fire flows (RFFs) based on the Fire Underwriters Survey (FUS).
- Obtained hydraulic boundary conditions (HGL) from the City, based on the above water demands and required fire flows.
- Boundary condition data and water demands were used to estimate the pressure at the proposed building, and this was compared to the City's design criteria.

Since the average day demand exceed 50 m^3 per day, two watermain feeds for the development will be necessary as per Section 4.31 of the WDG001. Please refer to **Table B1** in **Appendix B** for detailed calculations of the total water demands.

A review of the estimated watermain pressure at the building connection, based on the boundary conditions provided, was completed based on using two watermains. **Table B8** in **Appendix B** provides a comparison of anticipated pressures at the building connection based on using a single or double watermain feed. A single watermain analysis was completed to determined if the water pressure still met the City requirement during either the maximum day plus fire flow or peak hour condition, if one of the laterals was out of service.

Based on the hydraulic grade line (HGL) provided from the City it is evident that high pressures exist in the water distribution system at the property. Static pressures of ± 70 psi – 90 psi are typically available. This is due to the lower elevation relative to the reservoir. Due of the relatively short distance that would be necessary between the buildings and the watermain connection, minimal pressure loss is anticipated. The pressure available at the building connection would be within ±4.5 psi of the pressure in the city main based on a 200mm supply. If only one of the two mains were in operation, the pressure at the building would be ±13.5 psi of the pressure in the city main, under maximum day plus fire flow conditions.

Under peak hour conditions, there is little difference if either one or two 200mm watermains are in use, with anticipated pressure at the building of ±1.5 psi of the city's distribution main pressure.

During the detailed design stage of the project the final selection of the watermain diameter required for each building will be coordinated with the mechanical consultant.

Based on the results, the installation of two 200mm watermains with a shut-off valve between them is proposed. As the maximum hydraulic grade line (HGL) provided by the City indicates pressures greater than 80 psi, (pressure reducing measures will be required.0

7 Sanitary Sewage Servicing

Sanitary Sewage Design Criteria

The sanitary sewer system is designed based on a population flow and an area-based infiltration allowance. The flows were calculated using City sewer design guidelines (SDG002). **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	✓
Institutional Peaking Factor	1.5	
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	✓

7.1 Proposed Sewage Conditions

It is proposed that the mechanical piping from each building to a sanitary manhole onsite, which will then discharge to the existing sanitary sewer on Jeanne-D'Arc Boulevard. This manhole will be installed near the property line and be used as a monitoring manhole. .

A 250mm diameter sanitary sewer is proposed with a minimum 2% slope, having a capacity of 68 L/sec based on Manning's Equation under full flow conditions. The estimated peak sanitary flow rate from the proposed property is **±17.4 L/sec** based on City Design Guidelines. Sewage rates include a total infiltration allowance of 0.33 L/ha/sec based on the total gross site area. **Table 7-2** below summarizes the sewage anticipated peak sewage flows for the proposed site.

Table 7-2 – Summary of Anticipated Sewage Rates

Sewage Condition	Sanitary Sewage Flow (L/sec)
Peak Residential Flow (for 1,391 persons)	14.2
Peak Commercial Flow (for 1,000 m2)	2.1
Infiltration Flow (for 3.45 ha)	1.14
Peak Design Flow	17.44

7.2 Offsite Sanitary Sewer Review

The sanitary sewer run on Jeanne D'Arc Boulevard North (from Trim Road easterly to municipal limits) was designed and constructed to allow for the development of Phase I (Tower 1) of Brigil's Petrie's Landing II to proceed. Approximately 320 metres of sanitary sewer was extended from the Trim Road intersection easterly to service Petrie's Landing II. A review of previous reports by David MacManus (DME) for Phase 1, and EXP Services (EXP) for Phase 2, confirmed that the sanitary sewer system on Jeanne D'Arc Boulevard North was sized, not only for the 3.9-hectare Petrie's Landing development site, but also for an additional 9.9 hectares of commercial development along Jeanne D'Arc Boulevard North. The commercial flow allowance established was 50,000 L/ha/day and included an additional infiltration allowance at 0.28 L/ha/sec.

As taken from the DME report, the total peak sanitary flows from both Petrie's Landing development (all 5 phases) and the additional 9.9 hectares was 34.7 L/sec, which included ±23.4 L/sec from Petrie's Landing and ±11.4 L/sec from the additional area along Jeanne D'Arc Boulevard North. At the time of the design of Tower 1 by DME, this was based on a residential population of 1512 persons.

In 2016, during the design of Tower 2 by EXP Services Inc (EXP), further refinement of the sanitary sewage flows from the Petrie's II Landing development was completed, based on number of proposed residential units. A revised population of 1822 persons was used and included the same offsite commercial flow allowance for the 9.9-hectares along Jeanne D'Arc Boulevard North. The peak flow was updated to 39.2 L/sec with 27.8 L/sec from Petrie's Landing development and 11.4 L/sec from the offsite areas.

Now in 2020, the review of all sanitary sewer runs on Jean D'Arc Boulevard North were completed based on the most up to date information. A sanitary sewer design sheet was compiled based on data from the Petrie's Landing II project and based on the City's most recent Technical Bulletins. It should be noted that March 2018, revisions to the City's SDG002, were made to residential flow allowances as noted in Technical Bulletin ISTB-2018-01. The pre capita flow allowance was lowered from 350 L/p/day to 280 L/person/day, along with the addition of the correction factors of 0.8 to the Harmon Formula Peaking Factors. These revised allowances were used to review sanitary sewer capacities.

Table B11 in **Appendix B** summarizes the anticipated peak sewage flows in all sanitary sewers runs up to the Trim Road intersection, whereas **Figure A2** illustrates the sanitary drainage areas tributary to this sewer run.

The total peak flow is estimated at 38.6 L/sec, with includes peak flows of:

- ±20.1 L/sec from the 3.91-hectare Petrie's Landing (all phase), based on population of 1874.4 persons and 1,500m^2 commercial space
- An additional ±5.1 L/sec from 6.17 hectares along Jeanne D'Arc Boulevard North, based on 50,000 L/gross ha of commercial flow

- An additional 13.4 L/sec from proposed site at 1009 Trim Road, based on 1,391 persons and 1,000m^2 commercial space.

It should be noted that the difference in peak flows from Table 7-2 and the above noted is based on the accumulation of population and the resultant lowering of the peaking factor. Based on the total estimated peak flows there is adequate capacity in all pipe runs, with the most downstream run at 91% capacity.

For the site at 1009 Trim Road, a single 250mm diameter PVC sewer lateral having a slope of 2.0% is proposed to service the entire development. The estimated capacity of a 250mm pipe at 2% is ±88 L/sec. A lateral at this slope would permit 4,500 fixture units as per OBC. Further detail will be advanced as the project progresses.

8 Storm Servicing & Stormwater Management

8.1 Design Criteria

The subject property is located within the Rideau Valley subwatershed; therefore, stormwater works are subject to both the Rideau Valley Conservation Authority (RVCA) and City of Ottawa (COO) approval.

The RVCA has noted that (80% TSS removal) quality control requirements for the site will be required.

Also clarified during the pre-consultation meeting, the requirements related to stormwater quantity control are noted as follows:

- *No quantity control is required for this development ONLY if it is discharging to the river.*
- *Please contact the City if this development will require municipal stormwater servicing.*

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.

8.1.1 Minor System Design Criteria

- The storm sewer sizing will be based on the Rational Method and Manning’s Equation under free flow conditions for the 2-year storm using a 10-minute inlet time.
- Minimum sewer slopes to be based on minimum velocities for storm sewers of 0.80 m/sec.

8.1.2 Major System Design Criteria

- On-site storage is calculated based on the 100-year design storm. The on-site detention storage requirements will be determined during the Site Plan submission stage. It is proposed that roof top storage be incorporated were possible.
- Overland flow routes will be reviewed during the Site Plan submission stage.
- The vertical distance from the spill elevation on the street and the ground elevation at the buildings is at least 150mm.
- The emergency overflow spill elevation is at least 30 cm below the lowest building opening.

8.2 Runoff Coefficients

Runoff coefficients used for were based on actual areas taken from CAD. Runoff coefficients for impervious surfaces (roofs, asphalt, and concrete) were taken as 0.90, whereas those for pervious surfaces (grass/landscaping) were taken as 0.20. Average runoff coefficients were calculated for catchments (or drainage areas) using the area-weighting routine in PCSWMM. The runoff coefficients for all post-development catchments are provided in **Table B13.**

8.3 Allowable Release Rate

Rather than meeting pre-development released rates, the City of Ottawa allowed for “NO” quantity control of runoff due to the sites proximity to the Ottawa River.

The majority of storm runoff occurring on the site will discharge to roof drains or area drains, which will permit for stormwater storage, simply by using flow-controlled drains. For this reason, an allowable discharge rate based on a runoff coefficient of C=0.50 was established. Peak flows for all storm events were established based on this runoff coefficient.

The 2-yr, 5-yr and 100-yr allowable release rates from the proposed site was estimated at 103.8 L/sec, 141.0 L/sec, 241.3 L/sec, respectively. **Table B12** in **Appendix B** provides detailed calculations on the total allowable peak flow.

Table 8-1 – Summary of Stormwater Peak Flows

Phase	Discharge Rates (L/sec)		
	2-year	5-year	100-year
Phase 1	49.1	66.7	114.2
Future Phase 2	54.7	74.3	127.2
Totals	103.8	141.0	241.3

8.4 Proposed Stormwater System

Stormwater runoff from the proposed site will drain from a combination of controlled and uncontrolled areas. A storm drainage plan is illustrated on **Figure A3**. A total five (5) subcatchments (or drainage areas) within Phase 1 and four (4) subcatchments are shown for future phase 2 on this drawing with average runoff coefficients calculated for each drainage area. The stormwater works shall consist of the following elements:

- For Phase 1, Flow-control roof drains for Towers B1, B2, and connecting podium B1/B2.
- Runoff from surface areas in Phase 1 will be collected by area drains and discharge to internal drainage piping in the underground parking structures. This in turn discharges to one of the directly to an oil-grit separator manhole, prior to discharging to the Ottawa River
- For Phase 2, Flow-control roof drains for Towers B3, and connecting podium B2/B3.
- For Phase 2, similar to Phase 1, runoff from surface areas will be collected by area drains and discharge to internal drainage piping in the underground parking structures. This in turn will discharge to the previously noted oil/grit separator manhole.

All roof area will utilize flow-controlled weirs and based on the roof areas an estimate of the number of roof drains was completed. WATTS ACCUTROL weirs were used to determine the total discharge rates from the roof areas based on the estimated number of drains. In addition, the total cumulative prism volumes on the roofs were calculated at a maximum permitted depth of 150mm. Information on the estimated 100-year volumes on each roof is provided in Table B21 – Estimation of Roof Storage and Outflow - Tower B1**Table B21** to **Table B25** in **Appendix B.**

8.5 Flow Attenuation & Storage

The attenuation of stormwater will be achieved by utilizing roof storage. Using the release rates estimated on the roofs, the Modified Rational Method was used to determine the 2-year, 5-year, and 100-year volumes that will occur for corresponding release rates.

Table B16 through **Table B20**, provide the storage volumes necessary on the roof to attenuate the controlled release rates. **Table B14** summarizes the combined controlled and uncontrolled flows leaving the subject site. A summary of release rates, storage volume requirements, and provided storage volumes are identified in **Table 8-2** below.

Table 8-2 – Summary of Post-Development Storage

Area	Location	Release Rate (L/s)			Storage Required (m^3)			Storage Provided (m^3)		Control Method
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Roof	Surface	
S01	Tower B1	5.9	8.0	15.1	5.2	7.1	13.4	30.0		Flow Controlled Roof Drains
S02	Podium B1 / B2	4.4	6.0	11.4	2.7	3.6	6.9	18.4		Flow Controlled Roof Drains
S03	Tower B2	5.9	8.0	15.1	5.2	7.1	13.4	30.0		Flow Controlled Roof Drains
S04	Surface over deck	10.5	14.2	30.4						none
S05	Surface over deck	10.9	14.8	31.7						none
Total (Phase 1)		37.5	50.8	103.7	13.1	17.8	33.8	78.4		
S06	Podium B1 / B2	4.4	6.0	11.4	3.3	4.4	8.4	20.4		Flow Controlled Roof Drains
S07	Tower B3	5.9	8.0	15.1	5.2	7.1	13.4	30.0		Flow Controlled Roof Drains
S08	front/side area to ravine	19.6	26.7	57.1				15.1		none
S09	over deck	1.1	3.2	3.2				57.1		none
Total (Future)		31.0	43.8	86.8	8.5	11.5	21.8	122.6		
Total (All)		68.5	94.6	190.5	21.6	29.2	55.6	201.0		

8.6 Quality Control

As a total suspended solids (TSS) removal efficiency of 80% is required, it is proposed to provide an oil grit separator for quality control. The following summarizes the design parameters used in the sizing of the Stormceptor manhole.

Table 8-3 – Design Parameters Used for Oil Grit Separator Sizing

Parameter	Value Used
Drainage Area	0.97 hectares
Imperviousness	43 %
TSS Removal Requirements	80 %
Runoff Volume Capture	85 %
Flow attenuation upstream of OG separator (taken as 100-yr discharge & storage upstream of OG)	none
Particle distribution	fine

Output from the PCSWMM for Stormceptor program is provided in Appendix E for reference. A Stormceptor model EF06 is necessary to meet the required TSS removal of 80%. The EF06 will provide an approximate TSS removal of 83%.

9 Erosion & Sediment Control

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

- Filter cloth shall be installed between the frame and cover of all adjacent catch basins and catch basin manhole structures.
- Heavy 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 Functional 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

- Two parallel 200mm watermains are proposed to service the development, as the average day demands exceed 50 m^3 per day, which is mandatory as per Section 4.31 of the WDG001.
- The Required Fire Flows (RFFs) were estimated at **8,000 L/min** (133 L/sec) for Tower B1, **6,000 L/min** (100 L/sec) for Podium B1-B2, **10,000 L/min** (167 L/sec) for Tower B2, **6,000 L/min** (100 L/sec) for Podium B2-B3 and **8,000 L/min** (167 L/sec) for Tower B3. The total minimum available flows for firefighting purposes, based on the contribution from hydrants, was estimated at **13,300 L/min, 13,300 L/min, 13,300 L/min, 9,500 L/min** and **13,300 L/min** for each building, respectively.
- Based on hydraulic boundary conditions (HGL) provided by the City of Ottawa, a system pressure of **±77.2 psi** under peak hourly demands is anticipated at the proposed building. This exceeds the City's guideline of 40 psi.

Sewage

- Estimated peak sewage flows of **17.4 L/sec** are anticipated. A review of the sanitary sewers on Jeanne D'Arc Boulevard was completed. It was determined that adequate capacity in the existing system is available.

Stormwater

- For the stormwater system, the total discharge rate from the entire site was calculated based on a runoff coefficient of 0.50 and a time of concentration of 10 minutes. The City did not impose onsite quantity control due to the proximity to the Ottawa River. This is contingent on using a direct connection to the River rather than discharging to a storm sewer.
- The release rate for the entire site was calculated to be using a C_{AVG} of 0.50 for all storms up to the 100-year event. Although runoff does not need to be detained onsite, stormwater on the roof of the proposed building will occur.
- Runoff on the building roofs will be controlled using flow-controlled roof drains. Each roof-drain is equipped with WATTS ACCUTROL weirs and set at the OPEN position and having maximum discharge rate of 30 gpm at 150mm depth. An estimate of the number of roof drains, based on roof areas was completed, resulting in maximum 100-year discharge rates of **41.6 L/sec** (Tower B1, Podium B1/B2, Tower B2 in Phase 1) and **26.5 L/sec** (future Podium B2/B3 and Tower B3).
- The remaining areas will not have flow controls with 100-yr anticipated peak flows of **122.3 L/sec.** A total 100yr peak flow of **190.5 L/sec** is estimated.
- Based on the discharge rates from the flat roofs a total retention volume of **± 55.6 m^3** metres is required. This includes approximately 33.8 m^3 for the roofs in Phase 1 and 21.8 m^3 for the roofs in future Phase 2. These volumes are based on the above release rates, using the Modified Rational Method.
- The volumes available on the roofs are ±**128.8 m^3**, or **78.4 m^3** (Tower B1, Podium B1/B2, Tower B2 in Phase 1) and **50.4 m^3** (future Podium B2/B3 and Tower B3), based on a maximum 150mm ponding depth.
- Runoff from the surface areas above the parking structure will not be controlled.
- An oil-grit separator (OG) is required to meet the TSS removal efficiency of 80%. A Stormceptor Model EF06 was selected which is estimated to have a removal efficiency of **83%.**

11 Legal Notification

This report was prepared by EXP Services Inc. for the account of 9378-0633 Quebec Inc.

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 – Conceptual Servicing Plan

Figure A2 – Sanitary Drainage Plan

Figure A3 – Storm Drainage Plan

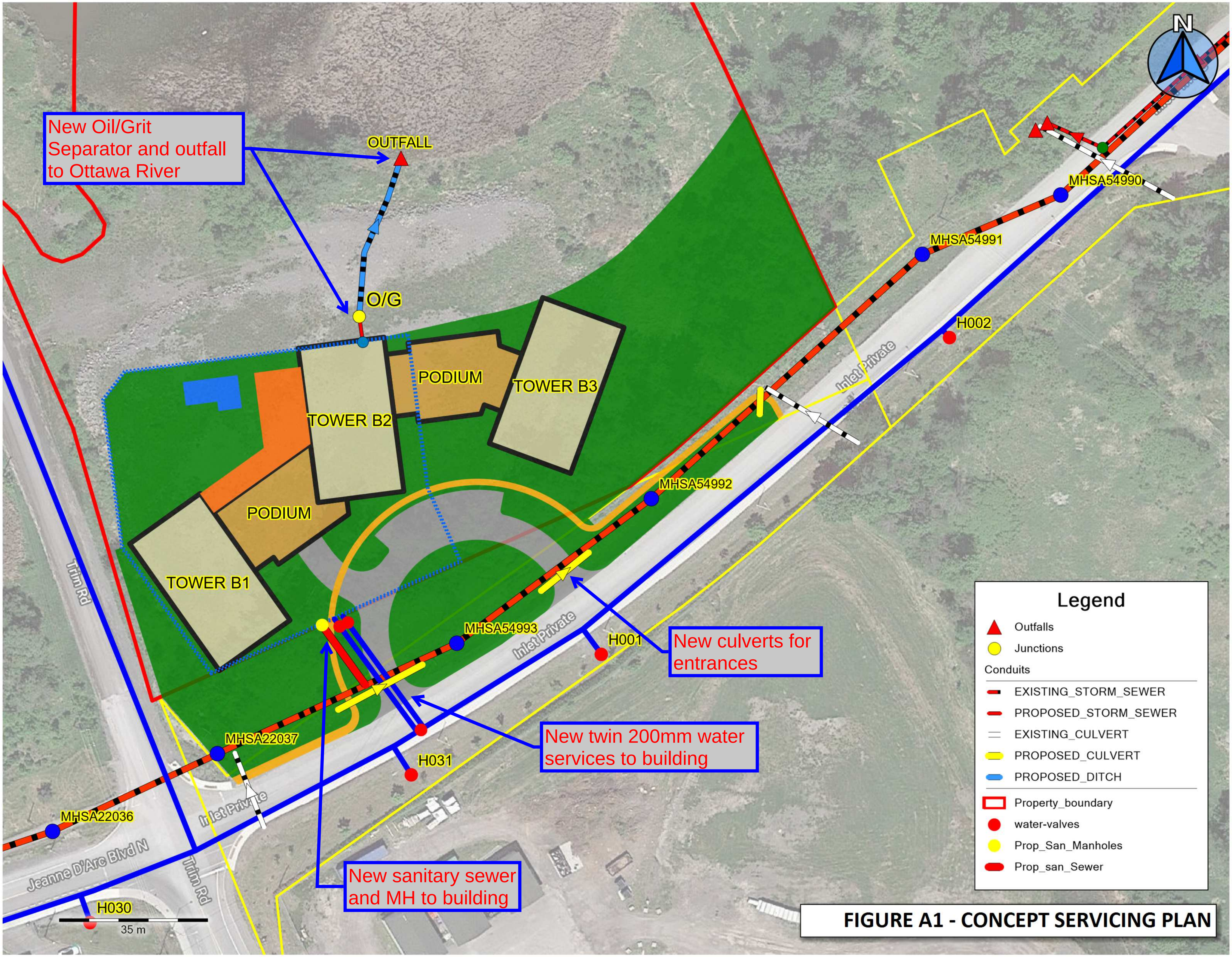


FIGURE A1 - CONCEPT SERVICING PLAN

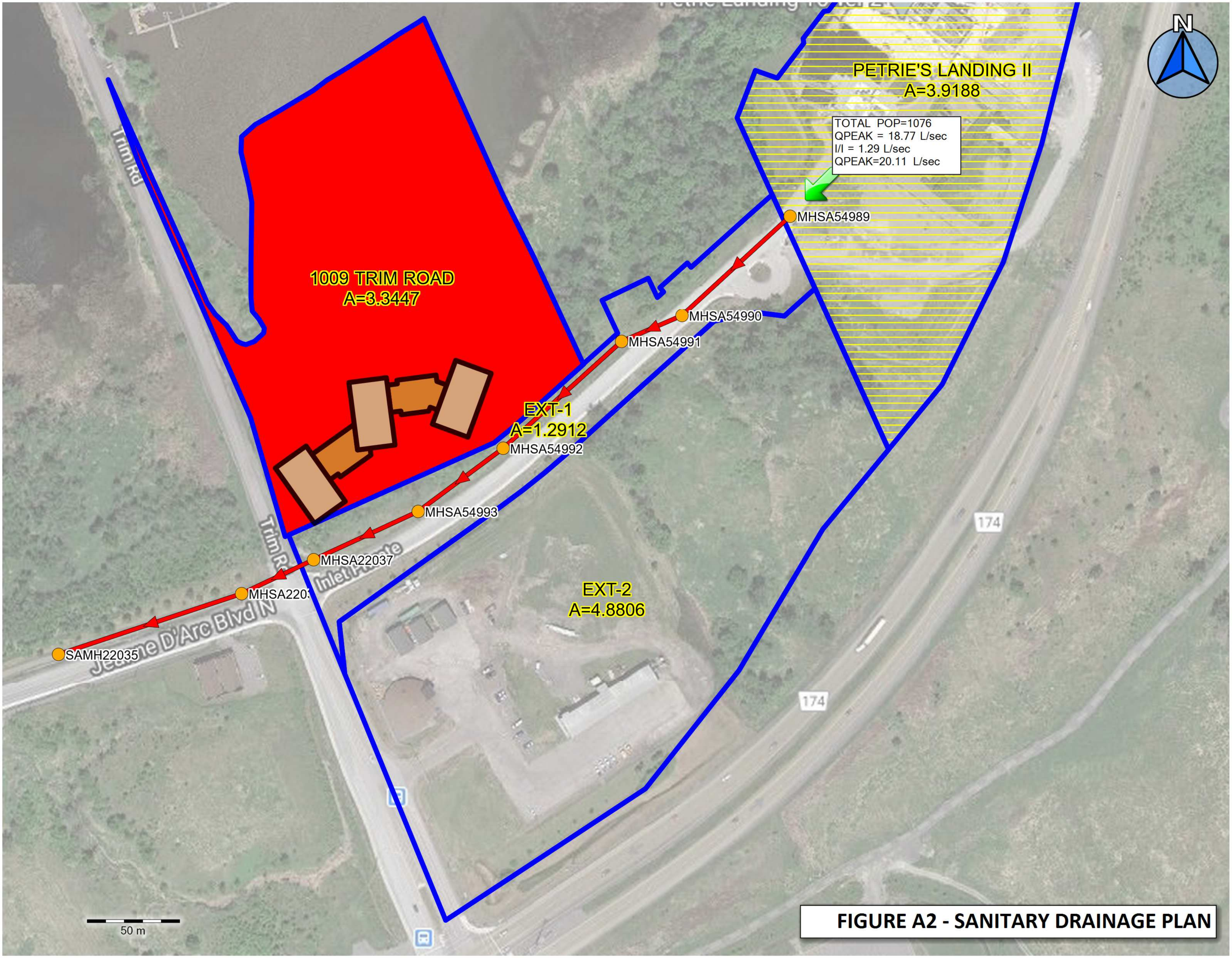


FIGURE A2 - SANITARY DRAINAGE PLAN

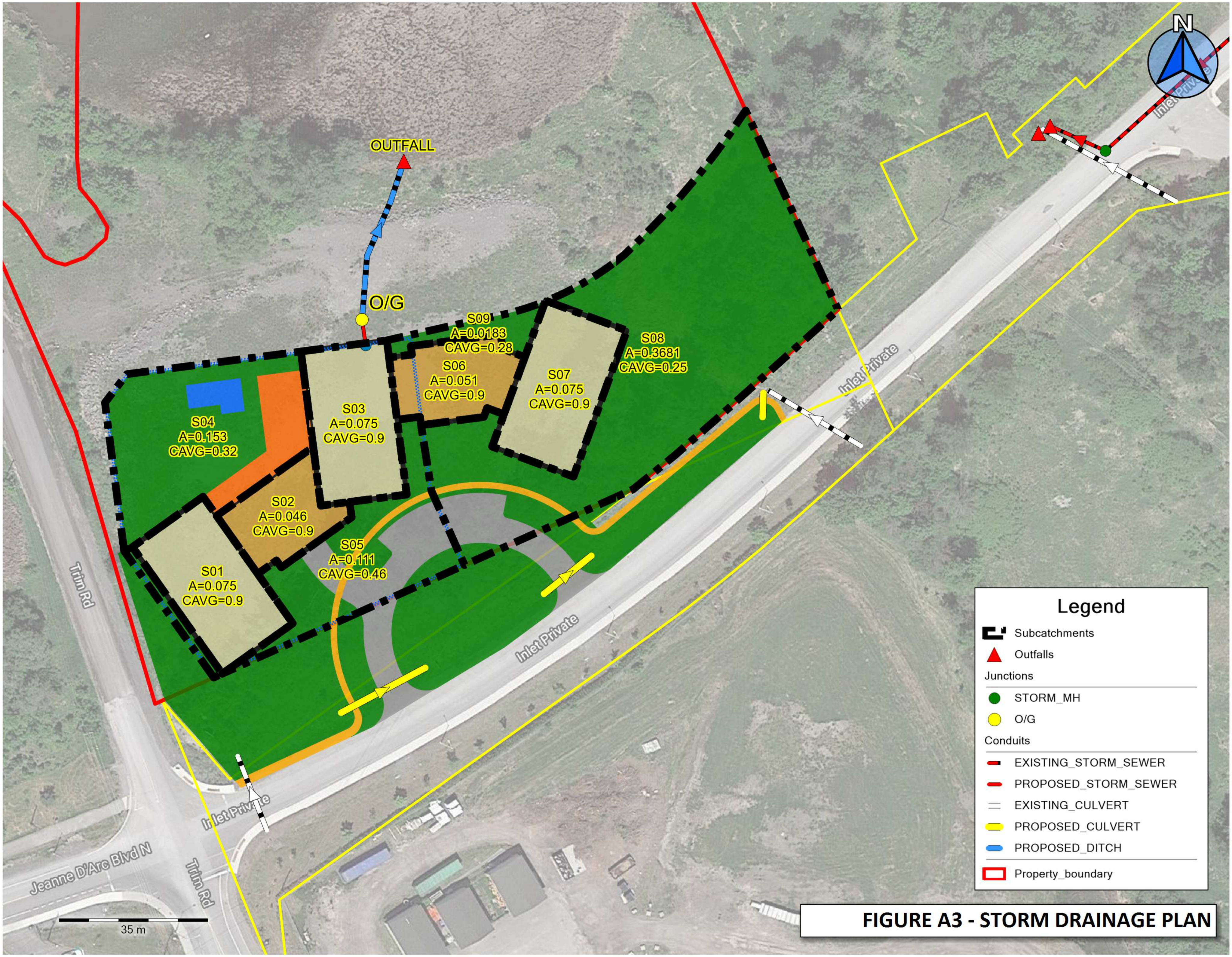


FIGURE A3 - STORM DRAINAGE PLAN

Appendix B – Design Tables

Table B1 – Water Demand Chart

Table B2 – Summary of Required Fire Flows (RFFs)

Table B3 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower B1

Table B4 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower 2

Table B5 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower B2

Table B6 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower 2

Table B7 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower B3

Table B8 – Estimated Water Pressure at Proposed Building

Table B9 – Fire Flow Requirements Based on Hydrant Spacing

Table B10 – Estimated Water Pressure at Proposed Building

Table B11 – Sanitary Sewer Design Sheet

Table B12 – Estimation of Allowable Peak Flows (Based on Max C=0.50 with Tc=10mins)

Table B13 – Average Runoff Coefficients for Post-Development

Table B14 – Summary of Post-Development Peak Flows (Uncontrolled and Controlled)

Table B15 – Summary of Storage

Table B16 – Storage Volumes for 2-year, 5-year and 100-Year Storms (MRM) Tower B1

Table B17 – Storage Volumes for 2-year, 5-year and 100-Year Storms (MRM) Podium B1/B2

Table B18 – Storage Volumes for 2-year, 5-year and 100-Year Storms (MRM) Tower B2

Table B19 – Storage Volumes for 2-year, 5-year and 100-Year Storms (MRM) Future Podium B2/B3

Table B20 – Storage Volumes for 2-year, 5-year and 100-Year Storms (MRM) Future Tower B3

Table B21 – Estimation of Roof Storage and Outflow - Tower B1

Table B22 – Estimation of Roof Storage and Outflow - Podium B1/B2

Table B23 – Estimation of Roof Storage and Outflow - Tower B2

Table B24 – Estimation of Roof Storage and Outflow – Future Podium B1/B3

Table B25 – Estimation of Roof Storage and Outflow – Future Tower B3

TABLE B1

Water Demand Chart

Junction Number (Building)	No. of Units										Total Pop	Residential Demands					Commercial						Totla Demands in (L/sec)		
	Singles/Semis/Towns				Apartments														Peaking Factors (x Avg Day)						
	Single Familty	Semi	Duplex	Townhome	Bachelor	1-Bed Apt	1-Bed +Den Apt	2 Bed Apt	3 Bed Apt	Avg Apt.		Avg Day Demand (L/day)	Max Day Peaking Factor	Max Hour Peaking Factor	Max Day Demand (L/day)	Peak Hourly 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)	Peak Hour (L/s)
Phase 1																									
Tower B1 (Trim Rd)						62	62	123			431.9	151,165	2.5	5.5	377,913	831,408							1.75	4.37	9.62
Tower B2 (Trim Rd)						71	71	141			494.9	173,215	2.5	5.5	433,038	952,683							2.00	5.01	11.03
Podium B1-B2																	490	2,450	1.5	2.7	3675.0	6615.0	0.03	0.04	0.08
Phase 2																									
Tower B3 (Trim Rd)						66	66	133			464.1	162,435	2.5	5.5	406,088	893,393							1.88	4.70	10.34
Podium B2-B3																	510	2,550	1.5	2.7	3825.0	6885.0	0.03	0.04	0.08
Totals =						199	199	397			1390.9	486,815			1,217,038	2,677,483					7,500	13,500	5.69	14.17	31.15

Unit Densities	Persons/Unit
Singles	3.4
Semi-Detached	2.7
Duplex	2.3
Townhome	2.7
Bachelor Apt Unit	1.4
1-Bed Apt Unit	1.4
1-Bed + Den Apt Unit	1.4
2-Bed Apt Unit	2.1
3-Bed Apt Unit	3.1
Avg. Apt Unit	1.8

Residential

Residential Consumption (L/pers/day) =	350
Max Day Peaking Factor (* avg day) =	2.5
Peak Hour Factor (* avg day) =	5.5

Industrrial/Commercial/Institutional Water Consumption

Light Industrial (L/gross ha/day) =	35,000
Heavy Industrial (L/gross ha/day) =	55,000
Commer/Instit (L/m^2 floor/day) =	5
Max Day Peaking Factor (* avg day) =	1.5
Peak Hour Factor (* avg day) =	2.7

Project:	
259629 - 1009 Trim Road	
Designed:	Location:
Terry Pascoe, B.Eng.	Ottawa, Ontario
Checked:	
Alexander O'Beirn, P.Eng.	
File Reference:	Page No:
259629 Water - Demand Chart, Sept 2020.xlsx	1 of 1

TABLE B2
SUMMARY OF REQUIRED FIREFLOWS (RFFs)

Building #	Description	[1]No of Storeys	Fire Flow, F (L/min)	[2]Type of Constr. Coeff, C	[3]Reduction Due to Occupancy (%)	[4]Reduction Due to Sprinklers (%)	Total Increase due to Exposures (%)	[6]Required Fire Flow in	
								(L/min)	(L/sec)
PROPOSED TOWER B1	high-rise condo	28	12,000	0.8	-15%	-50%	25%	8,000	133
PROPOSED PODIUM BETWEEN TOWERS B1/B2	podium	4	7,000	0.8	-15%	-50%	46%	6,000	100
PROPOSED TOWER B2	high-rise condo	32	12,000	0.8	-15%	-50%	46%	10,000	167
FUTURE PODIUM BETWEEN TOWERS B2/B3	podium	4	7,000	0.8	-15%	-50%	46%	6,000	100
FUTURE TOWER B3	high-rise condo	30	12,000	0.8	-15%	-50%	25%	8,000	133

Notes
1 - If basements are included (<50% below grade) then denoted as +.
2 -Types of constructions: 0.8 for non-combustible, 1.0 for ordinary construction,1.5 for wood frame construction.
3 - Reductions due to Occupancy are -25% for non-combustible or -15% for limited combustible.
4 - Reductions due to Sprinkler Systems
5 – Increase due to exposures were calculated based on FUS and technical bulletin ISTB-2018-02.
6 – Required Fire Flows are rounded to nearest 1,000 L/min.

TABLE B3 (Tower B1)
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR PROPOSED TOWER B1

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	Non-combustible Construction	0.8	
	Ordinary Construction	1			
	Non-combustible Construction	0.8			
	Fire Resistive Construction	0.6			

Task	Options	Area	% Used	Area Used	Comment
Input Building Floor Areas (A)	Floor 11 to 28	752	0%	0	Two largest adjoining floors+ 50% of floors above (up to eight)
	Floor 10	752	50%	376	
	Floor 9	752	50%	376	
	Floor 8	752	50%	376	
	Floor 7	752	50%	376	
	Floor 6	752	50%	376	
	Floor 5	752	50%	376	
	Floor 4	752	50%	376	
	Floor 3	752	50%	376	
	Floor 2	752	100%	752	
	Floor 1 (Ground)	752	100%	752	
	Basement (At least 50% below grade, not included)			4,512	

Task	Options	Fire Flow Total (L/min)
Fire Flow (F)	F = 220 * C * SQRT(A)	11,822
Fire Flow (F)	Rounded to nearest 1,000	**12,000**

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%	-1,800	10,200
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,060	7,140
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,020	6,120
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,020	5,100
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed 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	46	6	> 45.1	Type B	11	2	22	6	0%	25%	2,550	7,650
	Side 2	0	1	0 to 3	Type B	28	7	196	1E	25%			
	Front	46	6	> 45.1	Type B	39	9	351	6	0%			
	Back	46	6	> 45.1	Type B	18	2	30	6	0%			

Task		Value
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**8,000**
	Total Required Fire Flow, L/s =	**133**

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

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

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 to 45m	5
> 45.1m	6

TABLE B4 (Podium B1-B2)
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR PROPOSED PODIUM BETWEEN TOWERS B1/B2

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	Non-combustible Construction				0.8	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used	Comment		
	Floor 4		490	50%	245	Two largest adjoining floors+ 50% of floors above (up to eight)		
	Floor 3		490	50%	245			
	Floor 2		490	100%	490			
	Floor 1 (Ground)		490	100%	490			
	Basement (At least 50% below grade, not included)				1,470			
Fire Flow (F)	F = 220 * C * SQRT(A)							6,748
Fire Flow (F)	Rounded to nearest 1,000							7,000

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%	-1,050	5,950
	Limited Combustible	-15%											
	Combustible	0%											
	Free Burning	15%											
	Rapid Burning	25%											
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%			Adequate Sprinkler Conforms to NFPA13						-30%	-1,785	4,165
	No Sprinkler	0%											
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%			Standard Water Supply for Fire Department Hose Line and for Sprinkler System						-10%	-595	3,570
	Not Standard Water Supply or Unavailable	0%											
	Fully Supervised Sprinkler System	-10%			Fully Supervised Sprinkler System						-10%	-595	2,975
	Not Fully Supervised or N/A	0%											
Choose Structure Exposure Distance						Exposed Wall Length							
	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
	Side 1	0	1	0 to 3	Type B	11	2	22	1A	21%	46%	2,737	5,712
	Side 2	0	1	0 to 3	Type B	28	7	196	1E	25%			
	Front	46	6	> 45.1	Type B	39	9	351	6	0%			
	Back	46	6	> 45.1	Type B	18	2	30	6	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**6,000**
	Total Required Fire Flow, L/s =												**100**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)   Length-Height Factor

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

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 to 45m	5
> 45.1m	6

TABLE B5 (Tower B2)
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR PROPOSED TOWER B2

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	Non-combustible Construction				0.8	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used	Comment		
	Floor 11 to 32		752	0%	0			
	Floor 10		752	50%	376			
	Floor 9		752	50%	376			
	Floor 8		752	50%	376			
	Floor 7		752	50%	376			
	Floor 6		752	50%	376			
	Floor 5		752	50%	376			
	Floor 4		752	50%	376			
	Floor 3		752	50%	376			
	Floor 2		752	100%	752			
	Floor 1 (Ground)		752	100%	752			
	Basement (At least 50% below grade, not included)				4,512			
Fire Flow (F)	F = 220 * C * SQRT(A)							11,822
Fire Flow (F)	Rounded to nearest 1,000							12,000

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%	-1,800	10,200
	Limited Combustible	-15%											
	Combustible	0%											
	Free Burning	15%											
	Rapid Burning	25%											
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%			Adequate Sprinkler Conforms to NFPA13						-30%	-3,060	7,140
	No Sprinkler	0%											
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%			Standard Water Supply for Fire Department Hose Line and for Sprinkler System						-10%	-1,020	6,120
	Not Standard Water Supply or Unavailable	0%											
	Fully Supervised Sprinkler System	-10%			Fully Supervised Sprinkler System						-10%	-1,020	5,100
	Not Fully Supervised or N/A	0%											
Choose Structure Exposure Distance						Exposed Wall Length							
	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Length (m)	No of Storeys	Length-Height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
	Side 1	0	1	0 to 3	Type B	28	7	196	1E	25%	46%	4,692	9,792
	Side 2	0	1	0 to 3	Type B	2	2	4	1A	21%			
	Front	46	6	> 45.1	Type B	80	2	160	6	0%			
	Back	46	6	> 45.1	Type B	19	13	30	6	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												10,000
	Total Required Fire Flow, L/s =												167

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

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

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 to 45m	5
> 45.1m	6

TABLE B6 (Podium B2-B3)
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR FUTURE PODIUM BETWEEN TOWERS B2/B3

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	Non-combustible Construction				0.8	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used	Comment		
	Floor 4		510	50%	255	Two largest adjoining floors+ 50% of floors above (up to eight)		
	Floor 3		510	50%	255			
	Floor 2		510	100%	510			
	Floor 1 (Ground)		510	100%	510			
	Basement (At least 50% below grade, not included)				1,530			
Fire Flow (F)	F = 220 * C * SQRT(A)							6,884
Fire Flow (F)	Rounded to nearest 1,000							7,000

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%	-1,050	5,950
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-1,785	4,165
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-595	3,570
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-595	2,975
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1	0	1	0 to 3	Type B	11	2	22	1A	21%	46%	2,737	5,712
	Side 2	0	1	0 to 3	Type B	28	7	196	1E	25%			
	Front	46	6	> 45.1	Type B	39	9	351	6	0%			
	Back	46	6	> 45.1	Type B	18	2	30	6	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												6,000
	Total Required Fire Flow, L/s =												100

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5) Length-Height Factor

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

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 to 45m	5
> 45.1m	6

TABLE B7 (Tower B3)

FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR FUTURE TOWER B3

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	Non-combustible Construction				0.8	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used	Comment		
	Floor 11 to 30		752	0%	0	Two largest adjoining floors+ 50% of floors above (up to eight)		
	Floor 10		752	50%	376			
	Floor 9		752	50%	376			
	Floor 8		752	50%	376			
	Floor 7		752	50%	376			
	Floor 6		752	50%	376			
	Floor 5		752	50%	376			
	Floor 4		752	50%	376			
	Floor 3		752	50%	376			
	Floor 2		752	100%	752			
	Floor 1 (Ground)		752	100%	752			
	Basement (At least 50% below grade, not included)				4,512			
Fire Flow (F)	F = 220 * C * SQRT(A)							11,822
Fire Flow (F)	Rounded to nearest 1,000							12,000

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%	-1,800	10,200
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,060	7,140
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,020	6,120
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,020	5,100
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Length (m)	No of Storeys	Length-Height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
						Exposed Wall Length							
Choose Structure Exposure Distance	Side 1	0	1	0 to 3	Type B	28	7	196	1E	25%	25%	2,550	7,650
	Side 2	46	6	> 45.1	Type B	2	2	4	6	0%			
	Front	46	6	> 45.1	Type B	80	2	160	6	0%			
	Back	46.0	6	> 45.1	Type B	19	13	30	6	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												8,000
	Total Required Fire Flow, L/s =												133

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

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

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 to 45m	5
> 45.1m	6

TABLE B9
FIRE FLOW REQUIREMENTS BASED ON HYDRANT SPACING

Hydrant #	Tower B1		Podium B1-B2		Tower B2		Podium B2-B3		Tower B3	
	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)
H029	184	0	230	0	241	0	263	0	282	0
H030	90	3,800	135	3,800	147	3,800	169	0	187	0
H031	57	5,700	63	5,700	74	5,700	97	3,800	115	3,800
H001	95	3,800	101	3,800	78	3,800	69	5,700	54	5,700
H002	196	0	191	0	169	0	160	0	144	3,800
Total (L/min)		13,300		13,300		13,300		9,500		13,300
FUS RFF in L/min or (L/sec)		8,000 (133)		6,000 (100)		10,000 (167)		6,000 (100)		8,000 (133)
Meets Requreiment (Yes/No)		Yes		Yes		Yes		Yes		Yes

Notes:

[1]Distance is measured along a road or fire route.

[2]Fire Flow Contribution for Class AA Hydrant from Table 1 of Appendix I, ISTB-2018-02

TABLE B8

ESTIMATED WATER PRESSURE AT PROPOSED BUILDING

Description	From	To	Demand (L/sec)	Pipe Length (m)	Pipe Dia (mm)	Dia (m)	Slope of HGL (m/m)	Head Loss (m)	Elev From (m)	Elev To (m)	*Elev Diff (m)	Pressure From kPa	(psi)	Pressure To kPa	(psi)	Pressure Drop (psi)
Avg Day Conditons																
Single 200mm watermain	Main	Basement	5.692	51 m	204	0.204	0.00028	0.0144	51.60	52.30	-0.7	610.2	(88.5)	603.2	(87.5)	1.0
Double 200mm watermain	Main	Basement	2.846	51 m	204	0.204	7.8E-05	0.004	51.60	52.30	-0.7	610.2	(88.5)	603.3	(87.5)	1.0
Max Day Conditons																
Single 200mm watermain	Main	Basement	14.173	51 m	204	0.204	0.00153	0.0783	51.60	52.30	-0.7	610.2	(88.5)	602.5	(87.4)	1.1
Double 200mm watermain	Main	Basement	7.086	51 m	204	0.204	0.00043	0.0217	51.60	52.30	-0.7	610.2	(88.5)	603.1	(87.5)	1.0
Peak Hour Conditons																
Single 200mm watermain	Main	Basement	31.146	51 m	204	0.204	0.0066	0.3364	51.60	52.30	-0.7	542.5	(78.7)	532.3	(77.2)	1.5
Double 200mm watermain	Main	Basement	15.573	51 m	204	0.204	0.00183	0.0932	51.60	52.30	-0.7	542.5	(78.7)	534.7	(77.6)	1.1
Max Day Plus Fireflow Conditons																
Single 200mm watermain	Main	Basement	181.2	51 m	204	0.204	0.17198	8.7707	51.60	52.30	-0.7	505.2	(73.3)	412.3	(59.8)	13.5
Double 200mm watermain	Main	Basement	90.586	51 m	204	0.204	0.04764	2.4296	51.60	52.30	-0.7	505.2	(73.3)	474.5	(68.8)	4.5
Max Day Plus Fireflow Conditons (Review of 150mm diameter)																
Single 150mm watermain	Main	Basement	181.2	51 m	150	0.150	0.76878	39.208	51.60	52.30	-0.7	505.2	(73.3)	113.7	(16.5)	56.8
Double 150mm watermain	Main	Basement	90.586	51 m	150	0.150	0.21296	10.861	51.60	52.30	-0.7	505.2	(73.3)	391.8	(56.8)	16.4

Water Demand Info

Average Demand =	5.69	L/sec
Max Day Demand =	14.17	L/sec
Peak Hr Deamand =	31.15	L/sec
Fireflow Requriement =	167	L/sec (Tower B2 highest RFF)
Max Day Plus FF Demand =	181.2	L/sec

Pipe Lengths

From watermain to building =	51 m
Hazen Williams C Factor for Friction Loss in Pipe, C=	110

Elevations

At roadway =	51.6
At building (FF) =	52.3

Boundary Conditon

	Min HGL	Max HGL	Peak Hour	Max Day Plus Fireflow	
HGL (m)	100.0	113.6	106.7	102.9	(From City of Ottawa)
Approx Ground Elev (m) =	51.4	51.4	51.4	51.4	(at connection point)
Pressure (m) =	48.6	62.2	55.3	51.5	
Pressure (Pa) =	476,766	610,182	542,493	505,215	
Pressure (psi) =	69.1	88.5	78.7	73.3	

TABLE B11

SANITARY SEWER CALCULATION SHEET

LOCATION				RESEDENTIAL AREAS AND POPULAITONS															COMMERCIAL				INDUSTRIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
						NUMBER OF UNITS									POPULATION				AREA (ha)				AREA (ha)					AREA (ha)										
Street	U/S MH	D/S MH	Desc	Area (ha)	ACCU Area (ha)	Singles	Semis	Towns	Batch Apt.	1-Bed Apt.	1-Bed + Den Apt.	2-Bed Apt.	3-Bed Apt.	Total Units	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	% of total	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)
Private	MHSA101	MHSA100	Tower 4	0.6097	0.6097				1	36	71	72	18	198	358.2	358.2	4.00	4.64										0.610	0.610	0.20	4.64							
			Tower 3	0.5676	1.1773				2	15	75	70		162	275.8	634	3.34	6.86										0.568	1.177	0.39	7.25	250	251.46	1.00	28.80	60.40	0.12	1.21
	MHSA100	MHSA71642			1.1773											634	3.34	6.86											1.177	0.39	7.25	250	251.46	0.23	34.05	29.28	0.25	0.58
	MHSA71642	MHSA70588			1.1773											634	3.34	6.86											1.177	0.39	7.25	250	251.46	0.31	22.69	33.55	0.22	0.67
	MHSA70588	MHSA70591	Ex.Tower 2	0.6852	1.8625					84		61		145	245.7	879.7	3.27	9.32										0.685	1.863	0.61	9.94	250	251.46	0.35	5.79	35.50	0.28	0.71
	MHSA70591	MHSA70589			1.8625											879.7	3.27	9.32											1.863	0.61	9.94	250	251.46	0.29	62.68	32.37	0.31	0.65
	MHSA70589	MHSA70590	Towers 5A	0.7769	2.6394					54	112	120		286	484.4	1364.1	3.17	14.01	0.04	0.04	2%	0.01						0.777	2.639	0.87	14.90	250	251.46	0.24	38.01	29.39	0.51	0.59
	MHSA70590	MHSA54986			2.6394											1364.1	3.17	14.01		0.04		0.02							2.639	0.87	14.90	250	251.46	0.54	11.04	44.53	0.33	0.89
	MHSA54986	MHSA54987	Ex.Tower 1	0.8895	3.5289					14		75		89	177.1	1541.2	3.14	15.68		0.04		0.02						0.890	3.529	1.16	16.87	250	251.46	0.51	15.66	43.17	0.39	0.86
	MHSA54987	MHSA54988			3.5289											1541.2	3.14	15.68		0.04		0.02							3.529	1.16	16.87	250	251.46	0.56	12.56	45.09	0.37	0.90
	MHSA54988	MHSA54989	Towers 5B	0.3899	3.9188					36	76	84		196	333.2	1874.4	3.09	18.77	0.11	0.15	3%	0.05						0.390	3.919	1.29	20.11	250	251.46	0.33	33.03	34.86	0.58	0.70
Jeane D'Arc Blvd North	MHSA54989	MHSA54990			3.9188											1874.4	3.09	18.77		0.15		0.07							3.919	1.29	20.14	300	299.36	0.15	79.36	37.39	0.54	0.53
	MHSA54990	MHSA54991	Ext-1, Ext-2	6.1710	10.0898											1874.4	3.09	18.77	6.171	6.321	61%	3.07						6.171	10.090	3.33	25.17	300	299.36	0.29	34.70	51.62	0.49	0.73
	MHSA54991	MHSA54992			10.0898											1874.4	3.09	18.77		6.321		3.07							10.090	3.33	25.17	300	299.36	0.16	85.00	39.02	0.65	0.55
	MHSA54992	MHSA54993	1009 TRIM	3.4500	13.5398					199	199	397		795	1390.9	3265.3	2.93	31.01	0.100	6.421	1%	2.08						3.450	13.540	4.47	37.55	300	299.36	0.24	55.13	46.69	0.80	0.66
	MHSA54993	MHSA22037			13.5398											3265.3	2.93	31.01		6.421		3.12							13.540	4.47	38.59	300	299.36	0.20	66.40	42.54	0.91	0.60
				13.540					3	438	533	879	18	1871	3265.3				6.421									13.540							584.90			

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/s/ha) = 28,000
or L/gross ha/sec = 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	5.7
Townhomes	2.7
Batch Apt. Unit	1.4
1-bed Apt. Unit	1.4
1-bed + Den Apt.	1.4
2-bed Apt. Unit	2.1
3-bed Apt. Unit	3.1

Designed:	Project:
Terry Pascoe, B.Eng.	1009 Trim Road
Checked:	Location:
J. Fitzpatrick, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
259629 Sanitary - Sewer Design Sheet, Sept 2020.xlsx	1 of 1

TABLE B12
ESTIMATION OF ALLOWABLE PEAK FLOWS (Based on Max C=0.50 & Tc=10mins)

Catchment No.	Area (ha)	Phase	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr		
				I_2 (mm/hr)	Cavg	Q_{ALLOW} (L/sec)	I_5 (mm/hr)	Cavg	Q_{ALLOW} (L/sec)	I_5 (mm/hr)	Cavg	Q_{ALLOW} (L/sec)
S01	0.0750	Phase 1										
S02	0.0460	Phase 1										
S03	0.0750	Phase 1										
S04	0.1530	Phase 1										
S05	0.1110	Phase 1										
Total (Phase 1)	**0.4600**		10	76.81	0.50	**49.1**	104.29	0.50	**66.7**	178.56	0.50	**114.2**
S06	0.0510	Future										
S07	0.0750	Future										
S08	0.3681	Future										
S09	0.0183	Future										
Total (Future)	**0.5124**		10	76.81	0.50	**54.7**	104.29	0.50	**74.3**	178.56	0.50	**127.2**
Total (All)	**0.9724**					**103.8**			**141.0**			**241.3**

Notes
1) Allowable Capture Rates are based on meeting pre-development peak flows for all storms up to 100-year event. Allowable runoff coefficent based on Cavg or C = 0.50

TABLE B13
AVERAGE RUNOFF COEFFICIENTS FOR POST-DEVELOPMENT

Runoff Coeffients $C_{ASPH/CONC}$ = 0.90 C_{ROOF} = 0.90 C_{GRASS} = 0.20

Area No.	Outlet Location	Asphalt & Conc Areas (m^2)	A * C_{ASPH}	Roof Areas (m^2)	A * C_{ROOF}	Grassed Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	C_{AVG} (see note)	Comment
S01	Roof Drains								750	0.90	Phase 1
S02	Roof Drains								460	0.90	
S03	Roof Drains								750	0.90	
S04	Area Drains								1530	0.32	
S05	Area Drains								1110	0.46	
Total (Phase 1)									4600	0.60	
S06	Area Drains								510	0.90	Future Phase
S07	Roof Drains								750	0.90	
S08	Roof Drains								3681	0.25	
S09	Direct Offsite								183	0.28	
Total (Future)									5124	0.41	
Total (All)									**9,724**		

Notes
1) Cavg derived with area-weighting command in PCSWMM

TABLE B14
SUMMARY OF POST-DEVELOPMENT PEAK FLOWS (Uncontrolled and Controlled)

Area No	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr				Storm = 5 yr				Storm = 100 yr				Outlet Location	Comments
			C_{AVG}	I_2 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_5 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_{100} (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)		
S01	0.0750	10	0.90	76.81	14.4	**(5.9)**	0.90	104.19	19.6	**(8.0)**	1.00	178.56	37.2	**(15.1)**	Roof Drains	Tower B1 roof
S02	0.0460	10	0.90	76.81	8.8	**(4.4)**	0.90	104.19	12.0	**(6.0)**	1.00	178.56	22.8	**(11.4)**	Roof Drains	Podium B1 / B2 roof
S03	0.0750	10	0.90	76.81	14.4	**(5.9)**	0.90	104.19	19.6	**(8.0)**	1.00	178.56	37.2	**(15.1)**	Roof Drains	Tower B2 roof
S04	0.1530	10	0.32	76.81	10.5	**(10.5)**	0.32	104.19	14.2	**(14.2)**	0.40	178.56	30.4	**30.4**	Area Drains	rear area over deck
S05	0.1110	10	0.46	76.81	10.9	**(10.9)**	0.46	104.19	14.8	**(14.8)**	0.58	178.56	31.7	**31.7**	Area Drains	front area over deck
Total (Phase 1)	0.4600				59.0	37.5			80.1	50.8			159.4	103.7		
S06	0.0510	10	0.90	76.81	9.8	**(4.4)**	0.90	104.19	13.3	**(6.0)**	1.00	178.56	25.3	**(11.4)**	Area Drains	Future Podium B1 / B2 roof
S07	0.0750	10	0.90	76.81	14.4	**(5.9)**	0.90	104.19	19.6	**(8.0)**	1.00	178.56	37.2	**(15.1)**	Roof Drains	Future Tower B3 roof
S08	0.3681	10	0.25	76.81	19.6	**19.6**	0.25	104.19	26.7	**26.7**	0.31	178.56	57.1	**57.1**	Roof Drains	front/side area to ravine
S09	0.0183	10	0.28	76.81	1.1	**1.1**	0.28	104.19	1.5	**3.2**	0.35	178.56	3.2	**3.2**	Direct Offsite	rear area over deck
Total (Future)	0.5124				45.0	31.0			61.0	43.8			122.8	86.8		
Total (All)	**0.9724**				**104.0**	**68.5**			**141.1**	**94.6**			**282.2**	**190.5**		

<u>*Notes*</u>
2-yr Storm Intensity, I = 732.951/(Tc+6.199)^0.810 (City of Ottawa)
5-yr Storm Intensity, I = 998.071/(Tc+6.035)^0.814 (City of Ottawa)
100-yr Storm Intensity, I = 1735.688/(Tc+6.014)&^0.820 (City of Ottawa)
Time of Concentration (min), Tc = ***10***
For Flows under column Qcap which are shown in brackets ***(0.0)*** *, denotes flows that are controlled*

TABLE B15
SUMMARY OF STORAGE

Area No	Release Rate (L/s)			Storage Required (m^3) (MRM)			Storage Provided (m^3)		Control Method	Area Desc
	2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Roof	Surface		
S01	5.9	8.0	15.1	5.2	7.1	13.4	30.0		Flow Controlled Roof Drains	Tower B1 roof
S02	4.4	6.0	11.4	2.7	3.6	6.9	18.4		Flow Controlled Roof Drains	Podium B1 / B2 roof
S03	5.9	8.0	15.1	5.2	7.1	13.4	30.0		Flow Controlled Roof Drains	Tower B2 roof
S04	10.5	14.2	30.4						none	rear area over deck
S05	10.9	14.8	31.7						none	front area over deck
Total (Phase 1)	37.5	50.8	103.7	13.1	17.8	33.8	78.4			
S06	4.4	6.0	11.4	3.3	4.4	8.4	20.4		Flow Controlled Roof Drains	Future Podium B1 / B2 roof
S07	5.9	8.0	15.1	5.2	7.1	13.4	30.0		Flow Controlled Roof Drains	Future Tower B3 roof
S08	19.6	26.7	57.1						none	front/side area to ravine
S09	1.1	3.2	3.2						none	rear area over deck
Total (Future)	31.0	43.8	86.8	8.5	11.5	21.8	50.4			
Total (All)	**68.5**	**94.6**	**190.5**	**21.6**	**29.2**	**55.6**	**128.8**			

TABLE B16

Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: TOWER B1

C_{AVG} = 0.90 (2-yr)

C_{AVG} = 0.90 (5-yr)

C_{AVG} = 1.00 (100-yr, Max 1.0)

Time Interval = 2.00 (mins)

Drainage Area = 0.0750 (hectares)

Intensity Incr (%) = 0% (Use 20% for Climate Change)

Actual Release Rate (L/sec) = 15.1

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used)

Release Rate Used for Estimation of 100-year Storage (L/sec) = 15.1

Duration (min)	Release Rate = 5.9 (L/sec); Return Period = 2.0 (years); IDF Parameters, A = 733.0, B = 0.810, C = 6.199 ($I = A/(T_c+C)$)					Release Rate = 8.0 (L/sec); Return Period = 5.0 (years); IDF Parameters, A = 998.1, B = 0.814, C = 6.053 ($I = A/(T_c+C)$)					Release Rate = 15.1 (L/sec); Return Period = 100.0 (years); IDF Parameters, A = 1735.7, B = 0.820, C = 6.014 ($I = A/(T_c+C)$)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	31.4	5.9	25.5	0.0	230.5	43.2	8.0	35.3	0.0	398.6	83.1	15.1	68.0	0.0
2	133.3	25.0	5.9	19.2	2.3	182.7	34.3	8.0	26.3	3.2	315.0	65.7	15.1	50.5	6.1
4	111.7	21.0	5.9	15.1	3.6	152.5	28.6	8.0	20.7	5.0	262.4	54.7	15.1	39.6	9.5
6	96.6	18.1	5.9	12.3	4.4	131.6	24.7	8.0	16.7	6.0	226.0	47.1	15.1	32.0	11.5
8	85.5	16.0	5.9	10.2	4.9	116.1	21.8	8.0	13.8	6.6	199.2	41.5	15.1	26.4	12.7
10	76.8	14.4	5.9	8.6	5.1	104.2	19.6	8.0	11.6	7.0	178.6	37.2	15.1	22.1	13.3
12	69.9	13.1	5.9	7.3	5.2	94.7	17.8	8.0	9.8	7.1	162.1	33.8	15.1	18.7	13.4
14	64.2	12.1	5.9	6.2	5.2	86.9	16.3	8.0	8.4	7.0	148.7	31.0	15.1	15.9	13.3
16	59.5	11.2	5.9	5.3	5.1	80.5	15.1	8.0	7.1	6.9	137.5	28.7	15.1	13.5	13.0
18	55.5	10.4	5.9	4.6	4.9	75.0	14.1	8.0	6.1	6.6	128.1	26.7	15.1	11.6	12.5
20	52.0	9.8	5.9	3.9	4.7	70.3	13.2	8.0	5.2	6.3	120.0	25.0	15.1	9.9	11.8
22	49.0	9.2	5.9	3.3	4.4	66.1	12.4	8.0	4.5	5.9	112.9	23.5	15.1	8.4	11.1
24	46.4	8.7	5.9	2.8	4.1	62.5	11.7	8.0	3.8	5.4	106.7	22.2	15.1	7.1	10.2
26	44.0	8.3	5.9	2.4	3.7	59.3	11.1	8.0	3.2	5.0	101.2	21.1	15.1	6.0	9.3
28	41.9	7.9	5.9	2.0	3.4	56.5	10.6	8.0	2.6	4.4	96.3	20.1	15.1	4.9	8.3
30	40.0	7.5	5.9	1.7	3.0	53.9	10.1	8.0	2.2	3.9	91.9	19.2	15.1	4.0	7.2
32	38.3	7.2	5.9	1.3	2.6	51.6	9.7	8.0	1.7	3.3	87.9	18.3	15.1	3.2	6.1
34	36.8	6.9	5.9	1.0	2.1	49.5	9.3	8.0	1.3	2.7	84.3	17.6	15.1	2.4	5.0
36	35.4	6.6	5.9	0.8	1.7	47.6	8.9	8.0	1.0	2.1	81.0	16.9	15.1	1.7	3.8
38	34.1	6.4	5.9	0.5	1.2	45.8	8.6	8.0	0.6	1.5	77.9	16.2	15.1	1.1	2.5
40	32.9	6.2	5.9	0.3	0.7	44.2	8.3	8.0	0.3	0.8	75.1	15.7	15.1	0.5	1.3
Max =					**5.2**					**7.1**					**13.4**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

City of Ottawa IDF Data (from SDG002)

IDF curve equations (Intensity in mm/hr)

100 year Intensity $= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$

50 year Intensity $= 1569.580 / (\text{Time in min} + 6.014)^{0.820}$

25 year Intensity $= 1402.884 / (\text{Time in min} + 6.018)^{0.819}$

10 year Intensity $= 1174.184 / (\text{Time in min} + 6.014)^{0.816}$

5 year Intensity $= 998.071 / (\text{Time in min} + 6.053)^{0.814}$

2 year Intensity $= 732.951 / (\text{Time in min} + 6.199)^{0.810}$

TABLE B17
Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: **PODIUM B1 / B2**

C_{AVG} = 0.90 (2-yr)

C_{AVG} = 0.90 (5-yr)

C_{AVG} = 1.00 (100-yr, Max 1.0)

Time Interval = 2.00 (mins)

Drainage Area = 0.0460 (hectares)

Intensity Incr (%) = 0% (Use 20% for Climate Change)

Actual Release Rate (L/sec) = 11.4

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used)

Release Rate Used for Estimation of 100-year Storage (L/sec) = 11.4

Duration (min)	Release Rate = 4.4 (L/sec); Return Period = 2.0 (years); IDF Parameters, A = 733.0, B = 0.810, C = 6.199 ($I = A/(T_c+C)$)					Release Rate = 6.0 (L/sec); Return Period = 5.0 (years); IDF Parameters, A = 998.1, B = 0.814, C = 6.053 ($I = A/(T_c+C)$)					Release Rate = 11.4 (L/sec); Return Period = 100.0 (years); IDF Parameters, A = 1735.7, B = 0.820, C = 6.014 ($I = A/(T_c+C)$)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	19.2	4.4	14.8	0.0	230.5	26.5	6.0	20.6	0.0	398.6	51.0	11.4	39.6	0.0
2	133.3	15.3	4.4	10.9	1.3	182.7	21.0	6.0	15.1	1.8	315.0	40.3	11.4	28.9	3.5
4	111.7	12.9	4.4	8.5	2.0	152.5	17.6	6.0	11.6	2.8	262.4	33.6	11.4	22.2	5.3
6	96.6	11.1	4.4	6.7	2.4	131.6	15.1	6.0	9.2	3.3	226.0	28.9	11.4	17.5	6.3
8	85.5	9.8	4.4	5.4	2.6	116.1	13.4	6.0	7.4	3.6	199.2	25.5	11.4	14.1	6.8
10	76.8	8.8	4.4	4.4	2.7	104.2	12.0	6.0	6.0	3.6	178.6	22.8	11.4	11.5	6.9
12	69.9	8.0	4.4	3.6	2.6	94.7	10.9	6.0	4.9	3.6	162.1	20.7	11.4	9.4	6.8
14	64.2	7.4	4.4	3.0	2.5	86.9	10.0	6.0	4.0	3.4	148.7	19.0	11.4	7.7	6.4
16	59.5	6.8	4.4	2.5	2.4	80.5	9.3	6.0	3.3	3.2	137.5	17.6	11.4	6.2	6.0
18	55.5	6.4	4.4	2.0	2.1	75.0	8.6	6.0	2.7	2.9	128.1	16.4	11.4	5.0	5.4
20	52.0	6.0	4.4	1.6	1.9	70.3	8.1	6.0	2.1	2.5	120.0	15.3	11.4	4.0	4.8
22	49.0	5.6	4.4	1.2	1.6	66.1	7.6	6.0	1.6	2.2	112.9	14.4	11.4	3.1	4.1
24	46.4	5.3	4.4	0.9	1.4	62.5	7.2	6.0	1.2	1.8	106.7	13.6	11.4	2.3	3.3
26	44.0	5.1	4.4	0.7	1.0	59.3	6.8	6.0	0.9	1.4	101.2	12.9	11.4	1.6	2.5
28	41.9	4.8	4.4	0.4	0.7	56.5	6.5	6.0	0.5	0.9	96.3	12.3	11.4	1.0	1.6
30	40.0	4.6	4.4	0.2	0.4	53.9	6.2	6.0	0.2	0.4	91.9	11.7	11.4	0.4	0.7
32	38.3	4.4	4.4	0.0	0.0	51.6	5.9	6.0	0.0	0.0	87.9	11.2	11.4	-0.1	-0.2
34	36.8	4.2	4.4	-0.2	-0.3	49.5	5.7	6.0	-0.3	-0.5	84.3	10.8	11.4	-0.6	-1.2
36	35.4	4.1	4.4	-0.3	-0.7	47.6	5.5	6.0	-0.5	-1.1	81.0	10.4	11.4	-1.0	-2.2
38	34.1	3.9	4.4	-0.5	-1.1	45.8	5.3	6.0	-0.7	-1.6	77.9	10.0	11.4	-1.4	-3.2
40	32.9	3.8	4.4	-0.6	-1.5	44.2	5.1	6.0	-0.9	-2.1	75.1	9.6	11.4	-1.7	-4.2
Max =					**2.7**					**3.6**					**6.9**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

IDF curve equations (Intensity in mm/hr)

100 year Intensity	$= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$
50 year Intensity	$= 1569.580 / (\text{Time in min} + 6.014)^{0.820}$
25 year Intensity	$= 1402.884 / (\text{Time in min} + 6.018)^{0.819}$
10 year Intensity	$= 1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 year Intensity	$= 998.071 / (\text{Time in min} + 6.053)^{0.814}$
2 year Intensity	$= 732.951 / (\text{Time in min} + 6.199)^{0.810}$

TABLE B18
Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: **TOWER B2**

C_{AVG} = 0.90 (2-yr)

C_{AVG} = 0.90 (5-yr)

C_{AVG} = 1.00 (100-yr, Max 1.0)

Time Interval = 3.00 (mins)

Drainage Area = 0.0750 (hectares)

Intensity Incr (%) = 0% (Use 20% for Climate Change)

Actual Release Rate (L/sec) = 15.1

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used)

Release Rate Used for Estimation of 100-year Storage (L/sec) = 15.1

Duration (min)	Release Rate = 5.9 (L/sec); Return Period = 2.0 (years); IDF Parameters, A = 733.0, B = 0.810, C = 6.199 ($I = A/(T_c+C)$)					Release Rate = 8.0 (L/sec); Return Period = 5.0 (years); IDF Parameters, A = 998.1, B = 0.814, C = 6.053 ($I = A/(T_c+C)$)					Release Rate = 15.1 (L/sec); Return Period = 100.0 (years); IDF Parameters, A = 1735.7, B = 0.820, C = 6.014 ($I = A/(T_c+C)$)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	31.4	5.9	25.5	0.0	230.5	43.2	8.0	35.3	0.0	398.6	83.1	15.1	68.0	0.0
3	121.5	22.8	5.9	16.9	3.0	166.1	31.2	8.0	23.2	4.2	286.0	59.6	15.1	44.5	8.0
6	96.6	18.1	5.9	12.3	4.4	131.6	24.7	8.0	16.7	6.0	226.0	47.1	15.1	32.0	11.5
9	80.9	15.2	5.9	9.3	5.0	109.8	20.6	8.0	12.7	6.8	188.3	39.3	15.1	24.1	13.0
12	69.9	13.1	5.9	7.3	5.2	94.7	17.8	8.0	9.8	7.1	162.1	33.8	15.1	18.7	13.4
15	61.8	11.6	5.9	5.7	5.2	83.6	15.7	8.0	7.7	7.0	142.9	29.8	15.1	14.7	13.2
18	55.5	10.4	5.9	4.6	4.9	75.0	14.1	8.0	6.1	6.6	128.1	26.7	15.1	11.6	12.5
21	50.5	9.5	5.9	3.6	4.5	68.1	12.8	8.0	4.8	6.1	116.3	24.2	15.1	9.1	11.5
24	46.4	8.7	5.9	2.8	4.1	62.5	11.7	8.0	3.8	5.4	106.7	22.2	15.1	7.1	10.2
27	43.0	8.1	5.9	2.2	3.6	57.9	10.9	8.0	2.9	4.7	98.7	20.6	15.1	5.4	8.8
30	40.0	7.5	5.9	1.7	3.0	53.9	10.1	8.0	2.2	3.9	91.9	19.2	15.1	4.0	7.2
33	37.5	7.0	5.9	1.2	2.3	50.5	9.5	8.0	1.5	3.0	86.0	17.9	15.1	2.8	5.5
36	35.4	6.6	5.9	0.8	1.7	47.6	8.9	8.0	1.0	2.1	81.0	16.9	15.1	1.7	3.8
39	33.5	6.3	5.9	0.4	1.0	45.0	8.4	8.0	0.5	1.1	76.5	16.0	15.1	0.8	1.9
42	31.8	6.0	5.9	0.1	0.2	42.7	8.0	8.0	0.1	0.1	72.6	15.1	15.1	0.0	0.0
45	30.2	5.7	5.9	-0.2	-0.5	40.6	7.6	8.0	-0.3	-0.9	69.1	14.4	15.1	-0.7	-2.0
48	28.9	5.4	5.9	-0.4	-1.3	38.8	7.3	8.0	-0.7	-1.9	65.9	13.7	15.1	-1.4	-4.0
51	27.6	5.2	5.9	-0.7	-2.1	37.1	7.0	8.0	-1.0	-3.0	63.0	13.1	15.1	-2.0	-6.1
54	26.5	5.0	5.9	-0.9	-2.9	35.6	6.7	8.0	-1.3	-4.1	60.4	12.6	15.1	-2.5	-8.2
57	25.5	4.8	5.9	-1.1	-3.7	34.2	6.4	8.0	-1.5	-5.2	58.1	12.1	15.1	-3.0	-10.4
60	24.6	4.6	5.9	-1.3	-4.5	32.9	6.2	8.0	-1.8	-6.4	55.9	11.7	15.1	-3.5	-12.6
Max =					**5.2**					**7.1**					**13.4**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

IDF curve equations (Intensity in mm/hr)

100 year Intensity	= 1735.688 / (Time in min + 6.014) $^{0.820}$
50 year Intensity	= 1569.580 / (Time in min + 6.014) $^{0.820}$
25 year Intensity	= 1402.884 / (Time in min + 6.018) $^{0.819}$
10 year Intensity	= 1174.184 / (Time in min + 6.014) $^{0.816}$
5 year Intensity	= 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity	= 732.951 / (Time in min + 6.199) $^{0.810}$

TABLE B19

Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: **FUTURE PODIUM B2 / B3**

C_{AVG} = 0.90 (2-yr)

C_{AVG} = 0.90 (5-yr)

C_{AVG} = 1.00 (100-yr, Max 1.0)

Time Interval = 2.00 (mins)

Drainage Area = 0.0510 (hectares)

Intensity Incr (%) = 0% (Use 20% for Climate Change)

Actual Release Rate (L/sec) = 11.4

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used)

Release Rate Used for Estimation of 100-year Storage (L/sec) = 11.4

Duration (min)	Release Rate = 4.4 (L/sec); Return Period = 2.0 (years); IDF Parameters, A = 733.0, B = 0.810, C = 6.199; (I = A/(T_c+C))					Release Rate = 6.0 (L/sec); Return Period = 5.0 (years); IDF Parameters, A = 998.1, B = 0.814, C = 6.053; (I = A/(T_c+C))					Release Rate = 11.4 (L/sec); Return Period = 100.0 (years); IDF Parameters, A = 1735.7, B = 0.820, C = 6.014; (I = A/(T_c+C))				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	21.3	4.4	16.9	0.0	230.5	29.4	6.0	23.4	0.0	398.6	56.5	11.4	45.2	0.0
2	133.3	17.0	4.4	12.6	1.5	182.7	23.3	6.0	17.3	2.1	315.0	44.7	11.4	33.3	4.0
4	111.7	14.3	4.4	9.9	2.4	152.5	19.5	6.0	13.5	3.2	262.4	37.2	11.4	25.8	6.2
6	96.6	12.3	4.4	7.9	2.9	131.6	16.8	6.0	10.8	3.9	226.0	32.0	11.4	20.7	7.4
8	85.5	10.9	4.4	6.5	3.1	116.1	14.8	6.0	8.9	4.2	199.2	28.2	11.4	16.9	8.1
10	76.8	9.8	4.4	5.4	3.2	104.2	13.3	6.0	7.3	4.4	178.6	25.3	11.4	14.0	8.4
12	69.9	8.9	4.4	4.5	3.3	94.7	12.1	6.0	6.1	4.4	162.1	23.0	11.4	11.6	8.4
14	64.2	8.2	4.4	3.8	3.2	86.9	11.1	6.0	5.1	4.3	148.7	21.1	11.4	9.7	8.2
16	59.5	7.6	4.4	3.2	3.1	80.5	10.3	6.0	4.3	4.1	137.5	19.5	11.4	8.1	7.8
18	55.5	7.1	4.4	2.7	2.9	75.0	9.6	6.0	3.6	3.9	128.1	18.2	11.4	6.8	7.3
20	52.0	6.6	4.4	2.2	2.7	70.3	9.0	6.0	3.0	3.6	120.0	17.0	11.4	5.7	6.8
22	49.0	6.3	4.4	1.9	2.5	66.1	8.4	6.0	2.5	3.3	112.9	16.0	11.4	4.6	6.1
24	46.4	5.9	4.4	1.5	2.2	62.5	8.0	6.0	2.0	2.9	106.7	15.1	11.4	3.8	5.4
26	44.0	5.6	4.4	1.2	1.9	59.3	7.6	6.0	1.6	2.5	101.2	14.3	11.4	3.0	4.7
28	41.9	5.4	4.4	1.0	1.6	56.5	7.2	6.0	1.2	2.1	96.3	13.6	11.4	2.3	3.9
30	40.0	5.1	4.4	0.7	1.3	53.9	6.9	6.0	0.9	1.7	91.9	13.0	11.4	1.7	3.0
32	38.3	4.9	4.4	0.5	1.0	51.6	6.6	6.0	0.6	1.2	87.9	12.5	11.4	1.1	2.1
34	36.8	4.7	4.4	0.3	0.6	49.5	6.3	6.0	0.4	0.7	84.3	11.9	11.4	0.6	1.2
36	35.4	4.5	4.4	0.1	0.3	47.6	6.1	6.0	0.1	0.2	81.0	11.5	11.4	0.1	0.3
38	34.1	4.3	4.4	0.0	-0.1	45.8	5.8	6.0	-0.1	-0.3	77.9	11.0	11.4	-0.3	-0.7
40	32.9	4.2	4.4	-0.2	-0.5	44.2	5.6	6.0	-0.3	-0.8	75.1	10.7	11.4	-0.7	-1.7
Max =					**3.3**					**4.4**					**8.4**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, I = $A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

IDF curve equations (Intensity in mm/hr)

100 year Intensity = $1735.688 / (\text{Time in min} + 6.014)^{0.820}$

50 year Intensity = $1569.580 / (\text{Time in min} + 6.014)^{0.820}$

25 year Intensity = $1402.884 / (\text{Time in min} + 6.018)^{0.819}$

10 year Intensity = $1174.184 / (\text{Time in min} + 6.014)^{0.816}$

5 year Intensity = $998.071 / (\text{Time in min} + 6.053)^{0.814}$

2 year Intensity = $732.951 / (\text{Time in min} + 6.199)^{0.810}$

TABLE B20

Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: **FUTURE TOWER B3**

C_{AVG} = 0.90 (2-yr)

C_{AVG} = 0.90 (5-yr)

C_{AVG} = 1.00 (100-yr, Max 1.0)

Time Interval = 2.00 (mins)

Drainage Area = 0.0750 (hectares)

Intensity Incr (%) = 0% (Use 20% for Climate Change)

Actual Release Rate (L/sec) = 15.1

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used)

Release Rate Used for Estimation of 100-year Storage (L/sec) = 15.1

Duration (min)	Release Rate = 5.9 (L/sec); Return Period = 2.0 (years); IDF Parameters, A = 733.0, B = 0.810, C = 6.199 (I = A/(T_c+C))					Release Rate = 8.0 (L/sec); Return Period = 5.0 (years); IDF Parameters, A = 998.1, B = 0.814, C = 6.053 (I = A/(T_c+C))					Release Rate = 15.1 (L/sec); Return Period = 100.0 (years); IDF Parameters, A = 1735.7, B = 0.820, C = 6.014 (I = A/(T_c+C))				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	31.4	5.9	25.5	0.0	230.5	43.2	8.0	35.3	0.0	398.6	83.1	15.1	68.0	0.0
2	133.3	25.0	5.9	19.2	2.3	182.7	34.3	8.0	26.3	3.2	315.0	65.7	15.1	50.5	6.1
4	111.7	21.0	5.9	15.1	3.6	152.5	28.6	8.0	20.7	5.0	262.4	54.7	15.1	39.6	9.5
6	96.6	18.1	5.9	12.3	4.4	131.6	24.7	8.0	16.7	6.0	226.0	47.1	15.1	32.0	11.5
8	85.5	16.0	5.9	10.2	4.9	116.1	21.8	8.0	13.8	6.6	199.2	41.5	15.1	26.4	12.7
10	76.8	14.4	5.9	8.6	5.1	104.2	19.6	8.0	11.6	7.0	178.6	37.2	15.1	22.1	13.3
12	69.9	13.1	5.9	7.3	5.2	94.7	17.8	8.0	9.8	7.1	162.1	33.8	15.1	18.7	13.4
14	64.2	12.1	5.9	6.2	5.2	86.9	16.3	8.0	8.4	7.0	148.7	31.0	15.1	15.9	13.3
16	59.5	11.2	5.9	5.3	5.1	80.5	15.1	8.0	7.1	6.9	137.5	28.7	15.1	13.5	13.0
18	55.5	10.4	5.9	4.6	4.9	75.0	14.1	8.0	6.1	6.6	128.1	26.7	15.1	11.6	12.5
20	52.0	9.8	5.9	3.9	4.7	70.3	13.2	8.0	5.2	6.3	120.0	25.0	15.1	9.9	11.8
22	49.0	9.2	5.9	3.3	4.4	66.1	12.4	8.0	4.5	5.9	112.9	23.5	15.1	8.4	11.1
24	46.4	8.7	5.9	2.8	4.1	62.5	11.7	8.0	3.8	5.4	106.7	22.2	15.1	7.1	10.2
26	44.0	8.3	5.9	2.4	3.7	59.3	11.1	8.0	3.2	5.0	101.2	21.1	15.1	6.0	9.3
28	41.9	7.9	5.9	2.0	3.4	56.5	10.6	8.0	2.6	4.4	96.3	20.1	15.1	4.9	8.3
30	40.0	7.5	5.9	1.7	3.0	53.9	10.1	8.0	2.2	3.9	91.9	19.2	15.1	4.0	7.2
32	38.3	7.2	5.9	1.3	2.6	51.6	9.7	8.0	1.7	3.3	87.9	18.3	15.1	3.2	6.1
34	36.8	6.9	5.9	1.0	2.1	49.5	9.3	8.0	1.3	2.7	84.3	17.6	15.1	2.4	5.0
36	35.4	6.6	5.9	0.8	1.7	47.6	8.9	8.0	1.0	2.1	81.0	16.9	15.1	1.7	3.8
38	34.1	6.4	5.9	0.5	1.2	45.8	8.6	8.0	0.6	1.5	77.9	16.2	15.1	1.1	2.5
40	32.9	6.2	5.9	0.3	0.7	44.2	8.3	8.0	0.3	0.8	75.1	15.7	15.1	0.5	1.3
Max =					**5.2**					**7.1**					**13.4**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, I = $A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

IDF curve equations (Intensity in mm/hr)

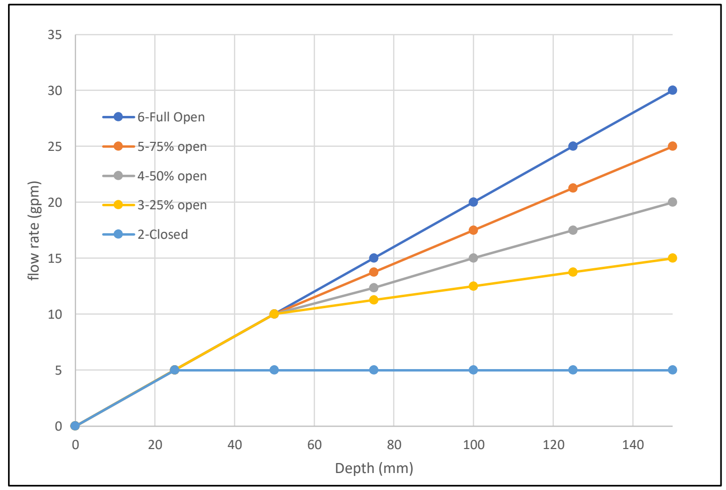
100 year Intensity	= 1735.688 / (Time in min + 6.014) $^{0.820}$
50 year Intensity	= 1569.580 / (Time in min + 6.014) $^{0.820}$
25 year Intensity	= 1402.884 / (Time in min + 6.018) $^{0.819}$
10 year Intensity	= 1174.184 / (Time in min + 6.014) $^{0.816}$
5 year Intensity	= 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity	= 732.951 / (Time in min + 6.199) $^{0.810}$

TABLE B21
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER B1

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**Tower B1**	
Total Roof Area (m2)	**750**	
Minimium Number of Drains Required	0.8	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	17,250	
Max Permitted Load from All Drains (L/sec)	19.2	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	144	
Estimated Distance from roof edge to drains (m)	**6**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	6	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	8	*Use if known*
Effecive Roof Percentage (%)	**80%**	*Allowance for Mechanical units on roof*
Effecive Total Roof Area (m2)	600	
Area per Drain (m2)	75	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	37.5	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	15.1	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.41	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00252	0.025	2.1	0.0	0.1
0.05	10	0.63	0.00505	0.05	8.3	0.1	1.1
0.075	15	0.95	0.00757	0.075	18.8	0.5	3.8
0.1	20	1.26	0.01009	0.1	33.3	1.1	8.9
0.125	25	1.58	0.01262	0.125	52.1	2.2	17.4
0.15	30	1.89	0.01514	0.15	75.0	3.8	30.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	2.5236
0.05	5.0472
0.075	7.5708
0.1	10.0944
0.125	12.6180
0.15	15.1416

RATING CURVE FOR MODELLING ROOF STORAGE

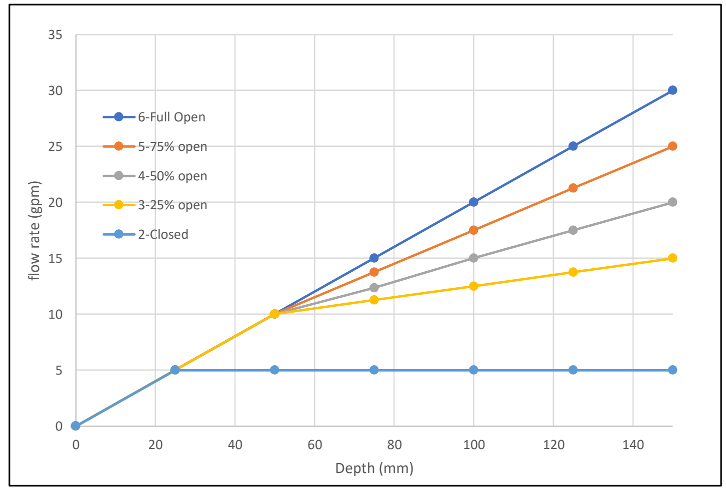
Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	2.1
0.05	8.3
0.075	18.8
0.1	33.3
0.125	52.1
0.15	75.0

TABLE B22
ESTIMATION OF ROOF STORAGE AND OUTFLOW - PODIUM B1 / B2

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**Podium B1 / B2**	
Total Roof Area (m2)	**460**	
Minimum Number of Drains Required	0.5	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	10,580	
Max Permitted Load from All Drains (L/sec)	11.8	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	144	
Estimated Distance from roof edge to drains (m)	**6**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	6	*Use if known*
Effective Roof Percentage (%)	**80%**	*Allowance for Mechanical units on roof*
Effective Total Roof Area (m2)	368	
Area per Drain (m2)	61	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	23.0	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	11.4	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.50	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00189	0.025	1.7	0.0	0.1
0.05	10	0.63	0.00379	0.05	6.8	0.1	0.7
0.075	15	0.95	0.00568	0.075	15.3	0.4	2.3
0.1	20	1.26	0.00757	0.1	27.3	0.9	5.5
0.125	25	1.58	0.00946	0.125	42.6	1.8	10.6
0.15	30	1.89	0.01136	0.15	61.3	3.1	18.4
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	1.8927
0.05	3.7854
0.075	5.6781
0.1	7.5708
0.125	9.4635
0.15	11.3562

RATING CURVE FOR MODELLING ROOF STORAGE

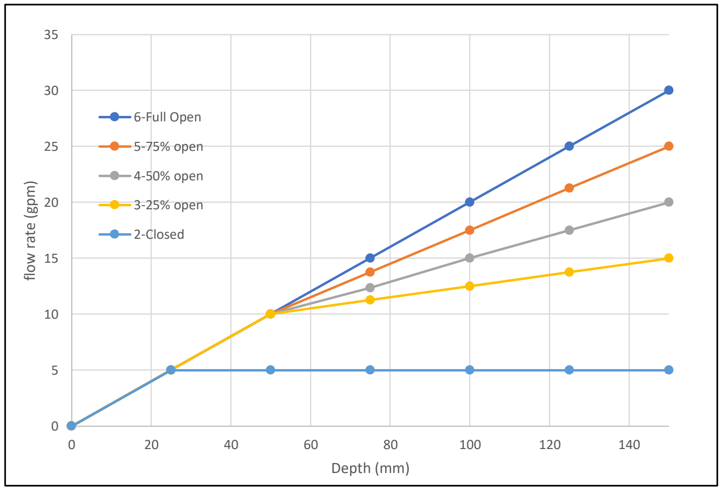
Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	1.7
0.05	6.8
0.075	15.3
0.1	27.3
0.125	42.6
0.15	61.3

TABLE B23
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER B2

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**Tower B2**	
Total Roof Area (m2)	**750**	
Minimum Number of Drains Required	0.8	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	17,250	
Max Permitted Load from All Drains (L/sec)	19.2	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	144	
Estimated Distance from roof edge to drains (m)	**6**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	6	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	8	*Use if known*
Effecive Roof Percentage (%)	**80%**	*N0 Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	600	
Area per Drain (m2)	75	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	37.5	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	15.1	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.41	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00252	0.025	2.1	0.0	0.1
0.05	10	0.63	0.00505	0.05	8.3	0.1	1.1
0.075	15	0.95	0.00757	0.075	18.8	0.5	3.8
0.1	20	1.26	0.01009	0.1	33.3	1.1	8.9
0.125	25	1.58	0.01262	0.125	52.1	2.2	17.4
0.15	30	1.89	0.01514	0.15	75.0	3.8	30.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	2.5236
0.05	5.0472
0.075	7.5708
0.1	10.0944
0.125	12.6180
0.15	15.1416

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	2.1
0.05	8.3
0.075	18.8
0.1	33.3
0.125	52.1
0.15	75.0

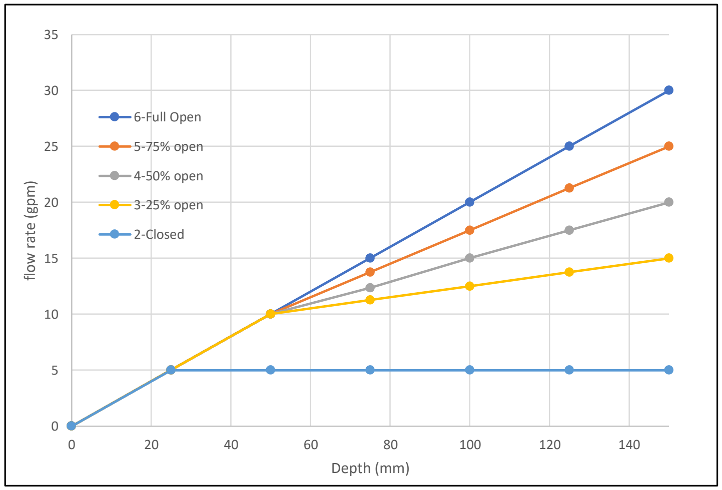
TABLE B24

ESTIMATION OF ROOF STORAGE AND OUTFLOW - FUTURE PODIUM B2 / B3

WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

BUILDING ROOF INFORMATION

Buidling Number	**Podium B2 / B3**	
Total Roof Area (m2)	**510**	
Minimum Number of Drains Required	0.6	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	11,730	
Max Permitted Load from All Drains (L/sec)	13.0	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	144	
Estimated Distance from roof edge to drains (m)	**6**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	6	*Use if known*
Effecive Roof Percentage (%)	**80%**	*N0 Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	408	
Area per Drain (m2)	68	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	25.5	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	11.4	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.45	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00189	0.025	1.9	0.0	0.1
0.05	10	0.63	0.00379	0.05	7.6	0.1	0.8
0.075	15	0.95	0.00568	0.075	17.0	0.4	2.6
0.1	20	1.26	0.00757	0.1	30.2	1.0	6.0
0.125	25	1.58	0.00946	0.125	47.2	2.0	11.8
0.15	30	1.89	0.01136	0.15	68.0	3.4	20.4
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	1.8927
0.05	3.7854
0.075	5.6781
0.1	7.5708
0.125	9.4635
0.15	11.3562

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	1.9
0.05	7.6
0.075	17.0
0.1	30.2
0.125	47.2
0.15	68.0

TABLE B25
ESTIMATION OF ROOF STORAGE AND OUTFLOW - FUTURE TOWER B3

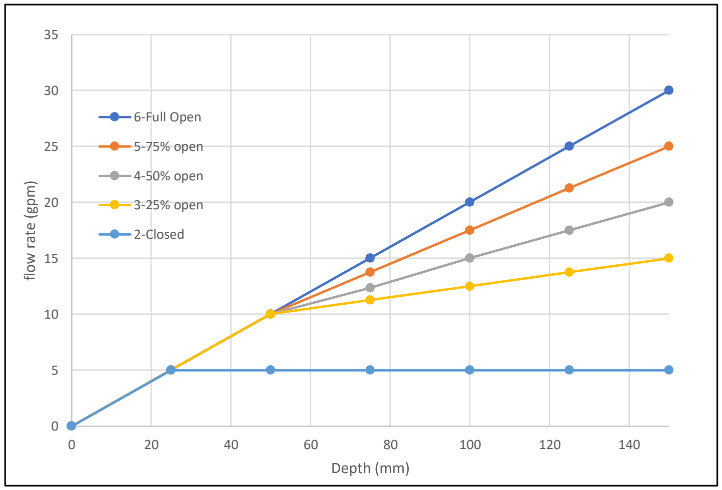
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



BUILDING ROOF INFORMATION

Buidling Number	**Tower B1**	
Total Roof Area (m2)	**750**	
Minimum Number of Drains Required	0.8	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	17,250	
Max Permitted Load from All Drains (L/sec)	19.2	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	144	
Estimated Distance from roof edge to drains (m)	**6**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	6	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	8	*Use if known*
Effecive Roof Percentage (%)	**80%**	*N0 Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	600	
Area per Drain (m2)	75	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	37.5	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	15.1	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.41	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00252	0.025	2.1	0.0	0.1
0.05	10	0.63	0.00505	0.05	8.3	0.1	1.1
0.075	15	0.95	0.00757	0.075	18.8	0.5	3.8
0.1	20	1.26	0.01009	0.1	33.3	1.1	8.9
0.125	25	1.58	0.01262	0.125	52.1	2.2	17.4
0.15	30	1.89	0.01514	0.15	75.0	3.8	30.0
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	2.5236
0.05	5.0472
0.075	7.5708
0.1	10.0944
0.125	12.6180
0.15	15.1416

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	2.1
0.05	8.3
0.075	18.8
0.1	33.3
0.125	52.1
0.15	75.0

Appendix C – Manufacturers Information

Watts ACCUTROL Flow Control Specification

Stormceptor Sizing Report

Stormceptor EF Brochure

Stormceptor EF06 Detail

Adjustable Accutrol Weir

Tag: ____________________

Adjustable Flow Control for Roof Drains

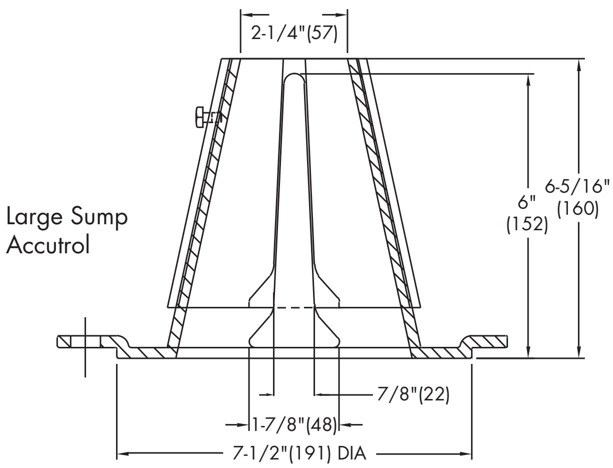
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

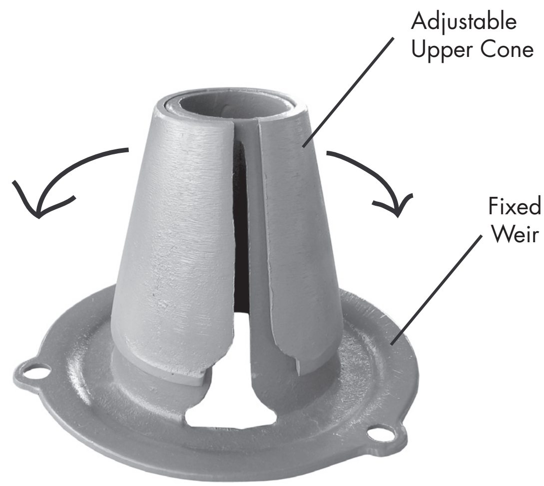
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name ____________________ Contractor ____________________

Job Location ____________________ Contractor's P.O. No. ____________________

Engineer ____________________ Representative ____________________

A Watts Water Technologies Company

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

09/03/2020

Province:	Ontario
City:	ottawa
Nearest Rainfall Station:	OTTAWA MACDONALD-CARTIER INT'L AP
NCDC Rainfall Station Id:	6000
Years of Rainfall Data:	37

Project Name:	1009 trim Road
Project Number:	259629
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:	

Site Name:	1009 Trim Road
Drainage Area (ha):	0.97
% Imperviousness:	43.00

Runoff Coefficient 'c': 0.55

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	85.00
Estimated Water Quality Flow Rate (L/s):	13.82
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	75
EFO6	83
EFO8	87
EFO10	89
EFO12	91

Recommended Stormceptor EFO Model:	**EFO6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**83**
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)

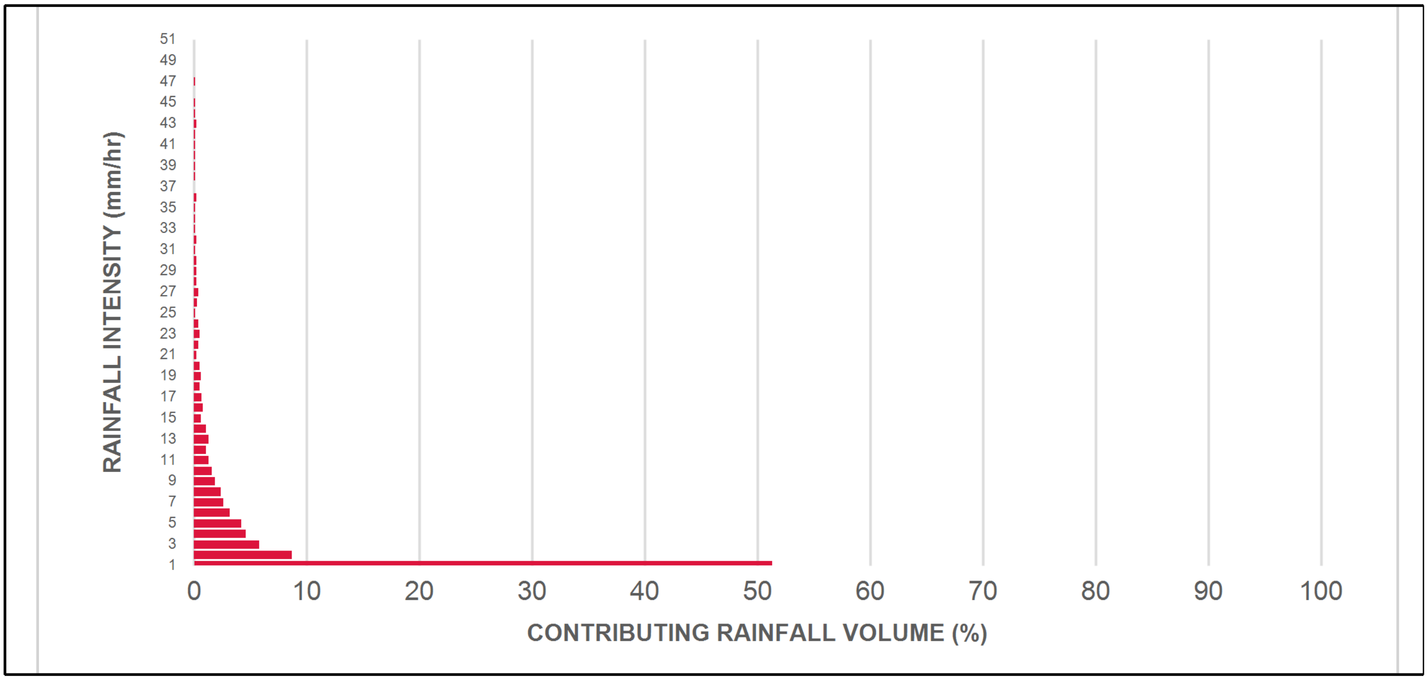
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a 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

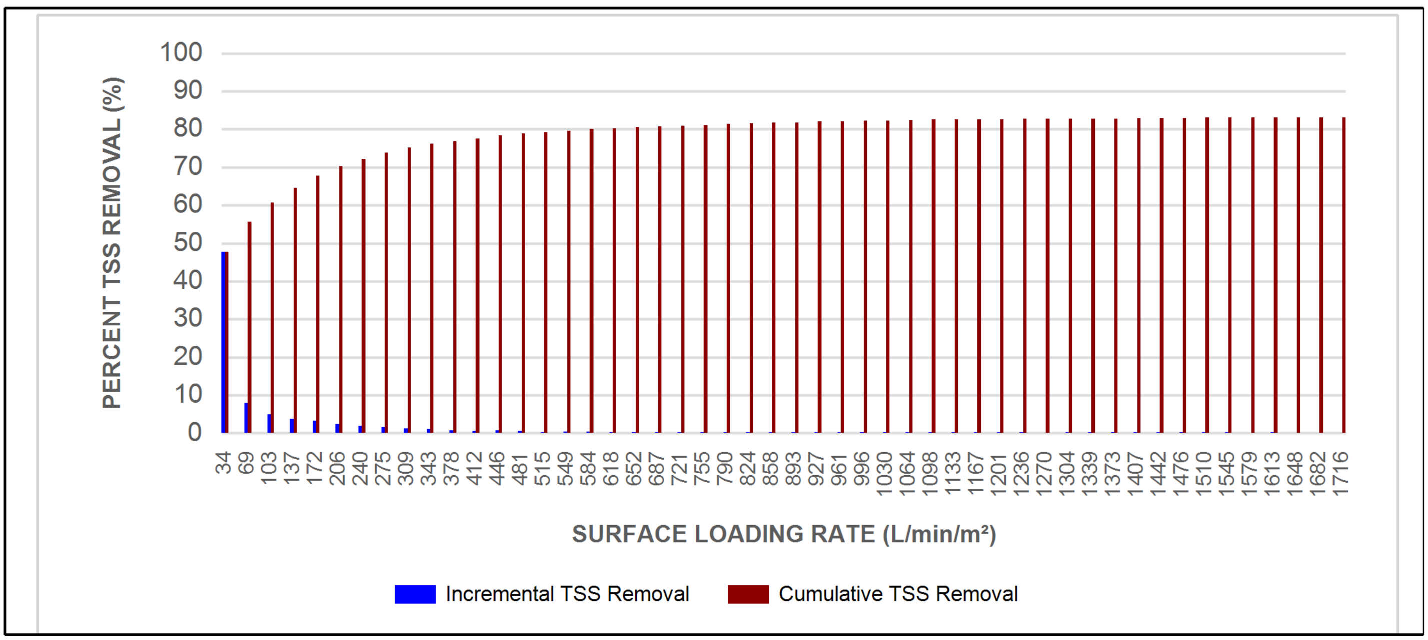
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	51.3	51.3	1.50	90.0	34.0	93	47.7	47.7
2	8.7	60.0	3.01	181.0	69.0	91	7.9	55.6
3	5.8	65.8	4.51	271.0	103.0	87	5.0	60.7
4	4.6	70.4	6.02	361.0	137.0	84	3.8	64.5
5	4.2	74.6	7.52	451.0	172.0	79	3.3	67.8
6	3.2	77.8	9.03	542.0	206.0	76	2.4	70.3
7	2.6	80.4	10.53	632.0	240.0	72	1.9	72.2
8	2.4	82.8	12.04	722.0	275.0	70	1.7	73.8
9	1.9	84.7	13.54	813.0	309.0	67	1.3	75.1
10	1.6	86.3	15.05	903.0	343.0	63	1.0	76.1
11	1.3	87.6	16.55	993.0	378.0	61	0.8	76.9
12	1.1	88.7	18.06	1083.0	412.0	58	0.6	77.5
13	1.3	90.0	19.56	1174.0	446.0	57	0.7	78.3
14	1.1	91.1	21.07	1264.0	481.0	56	0.6	78.9
15	0.6	91.7	22.57	1354.0	515.0	55	0.3	79.2
16	0.8	92.5	24.08	1445.0	549.0	54	0.4	79.6
17	0.7	93.2	25.58	1535.0	584.0	53	0.4	80.0
18	0.5	93.7	27.08	1625.0	618.0	52	0.3	80.3
19	0.6	94.3	28.59	1715.0	652.0	52	0.3	80.6
20	0.5	94.8	30.09	1806.0	687.0	52	0.3	80.8
21	0.2	95.0	31.60	1896.0	721.0	51	0.1	80.9
22	0.4	95.4	33.10	1986.0	755.0	51	0.2	81.1
23	0.5	95.9	34.61	2076.0	790.0	51	0.3	81.4
24	0.4	96.3	36.11	2167.0	824.0	51	0.2	81.6
25	0.1	96.4	37.62	2257.0	858.0	51	0.1	81.7

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.3	96.7	39.12	2347.0	893.0	51	0.2	81.8
27	0.4	97.1	40.63	2438.0	927.0	50	0.2	82.0
28	0.2	97.3	42.13	2528.0	961.0	50	0.1	82.1
29	0.2	97.5	43.64	2618.0	996.0	50	0.1	82.2
30	0.2	97.7	45.14	2708.0	1030.0	50	0.1	82.3
31	0.1	97.8	46.65	2799.0	1064.0	49	0.0	82.4
32	0.2	98.0	48.15	2889.0	1098.0	49	0.1	82.5
33	0.1	98.1	49.66	2979.0	1133.0	49	0.0	82.5
34	0.1	98.2	51.16	3070.0	1167.0	48	0.0	82.6
35	0.1	98.3	52.66	3160.0	1201.0	48	0.0	82.6
36	0.2	98.5	54.17	3250.0	1236.0	48	0.1	82.7
37	0.0	98.5	55.67	3340.0	1270.0	47	0.0	82.7
38	0.1	98.6	57.18	3431.0	1304.0	47	0.0	82.7
39	0.1	98.7	58.68	3521.0	1339.0	47	0.0	82.8
40	0.1	98.8	60.19	3611.0	1373.0	46	0.0	82.8
41	0.1	98.9	61.69	3702.0	1407.0	46	0.0	82.9
42	0.1	99.0	63.20	3792.0	1442.0	45	0.0	82.9
43	0.2	99.2	64.70	3882.0	1476.0	44	0.1	83.0
44	0.1	99.3	66.21	3972.0	1510.0	43	0.0	83.1
45	0.1	99.4	67.71	4063.0	1545.0	42	0.0	83.1
46	0.0	99.4	69.22	4153.0	1579.0	41	0.0	83.1
47	0.1	99.5	70.72	4243.0	1613.0	40	0.0	83.1
48	0.0	99.5	72.23	4334.0	1648.0	39	0.0	83.1
49	0.0	99.5	73.73	4424.0	1682.0	38	0.0	83.1
50	0.0	99.5	75.24	4514.0	1716.0	38	0.0	83.1
Estimated Net Annual Sediment (TSS) Load Reduction =								**83 %**

RAINFALL DATA FROM OTTAWA MACDONALD-CARTIER INT'L AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter (m)	Model Diameter (ft)	Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter (mm)	Max Inlet Pipe Diameter (in)	Max Outlet Pipe Diameter (mm)	Max Outlet Pipe Diameter (in)	Peak Conveyance Flow Rate (L/s)	Peak Conveyance Flow Rate (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

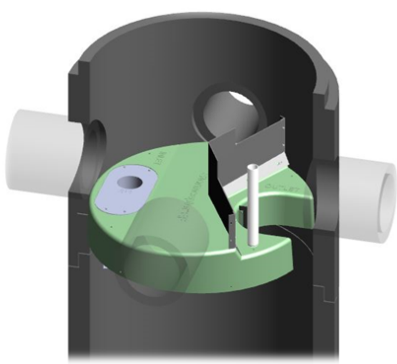
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

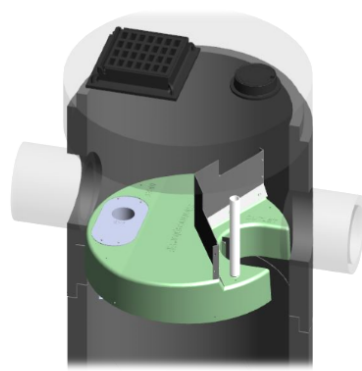
DESIGN FLEXIBILITY

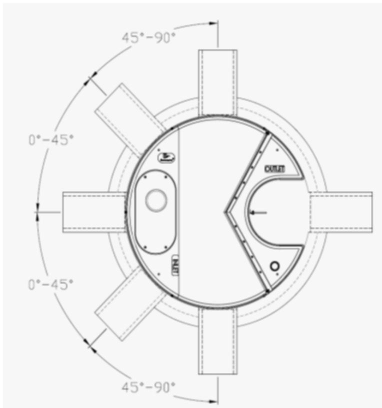
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

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

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

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

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

Stormceptor® EF

Stormceptor® EF Overview

imbrium®

About Imbrium® Systems

Imbrium® Systems is dedicated to protecting Canada's waterways. Based on our knowledge and experience in the Canadian stormwater industry, we have the ability to provide the most effective stormwater treatment technologies that capture and retain harmful pollutants from urban runoff before it enters our streams, rivers, lakes, and oceans.

Imbrium's engineered treatment solutions have been third-party tested and verified in accordance with the ISO 14034 Environmental Technology Verification (ETV) protocol to ensure performance in real-world conditions as designed. Our team of highly skilled engineers and partners provide the highest level of service from design to installation and long-term maintenance.

By working with Imbrium and our partners, you can expect superior treatment technology, unparalleled customer service, compliance with local stormwater regulations, and cleaner water. To find your local representative, please visit **www.imbriumsystems.com/localrep**.

Learn About the Stormceptor® EF

Go online and watch our animation to learn how the Stormceptor EF works. The animation highlights important features of the Stormceptor EF including:

- Functionality
- Applications
- Inspection and Maintenance

To view the Stormceptor EF animation, visit **www.imbriumsystems.com/stormceptoref**

Stormceptor® EF

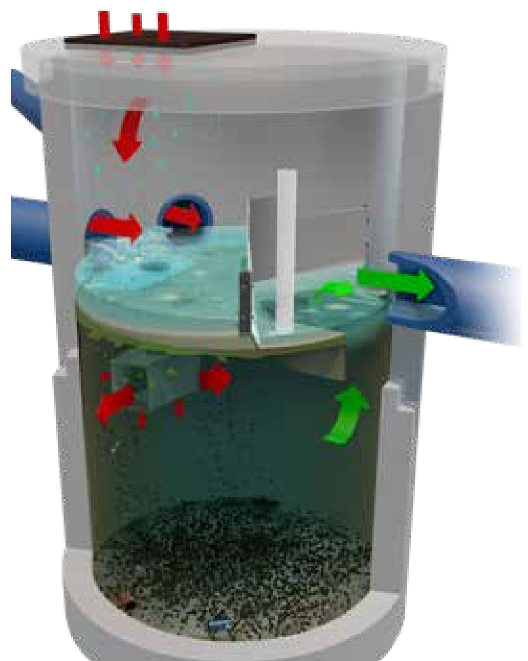
A CONTINUATION AND EVOLUTION OF THE MOST GLOBALLY RECOGNIZED OIL GRIT SEPARATOR (OGS) STORMWATER TREATMENT TECHNOLOGY

Stormceptor EF effectively targets sediment (TSS), free oils, gross pollutants and other pollutants that attach to particles, such as nutrients and metals. Stormceptor EF's independently tested and verified, patent- pending treatment and scour prevention platform ensures pollutants are captured and contained during all rainfall events.

Stormceptor EF also offers design flexibility in one platform, accepting flow from a single inlet pipe, multiple inlet pipes, and from the surface through an inlet grate. Stormceptor EF can also accommodate a 90-degree inlet to outlet bend angle, and tailwater conditions.

Ideal Uses

- Sediment (TSS) removal
- Hydrocarbon control and hotspots (Stormceptor EF)
- Debris and small floatables capture
- Pretreatment for filtration, detention/retention systems, ponds, wetlands, and bioretention
- Retrofit and redevelopment projects

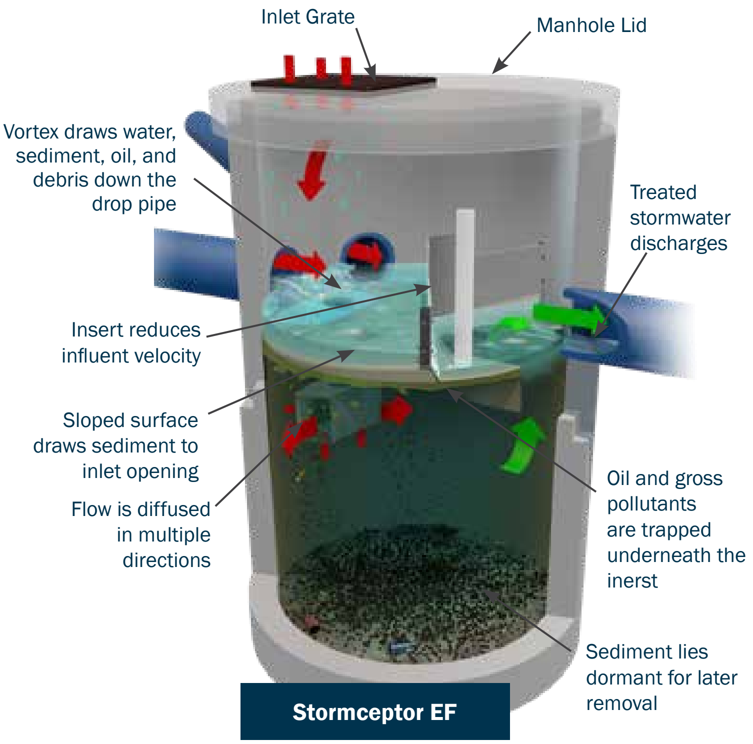


Stormceptor EF

Stormceptor EF and Stormceptor EFO have been verified in accordance with ISO 14034 Environment Management - Environmental Technology Verification (ETV) protocol.

How the Stormceptor® EF Works

- Flow enters the Stormceptor through one or more inlet pipes or an inlet grate.
- A specially designed insert reduces influent velocity by creating a pond upstream of the weir, allowing sediments to begin settling.
- Swirling flow sweeps water and pollutants across the sloped insert surface to the drop pipe, where a strong vortex draws water, sediment, oil, and debris down the drop pipe cone and into the lower chamber.
- Flow exits the drop pipe through two large rectangular openings, while also diffusing through perforations in multiple directions. This reduces stream velocities and increases pollutant removal efficiency while preventing resuspension and washout of previously captured pollutants.
- Floatables, such as oil and gross pollutants, rise up and are trapped beneath the insert.
- Sediment settles to the sump.
- Treated stormwater discharges to the top side of the insert downstream of the weir, where it exits through the outlet pipe.
- During intense storm events excess influent passes over the weir and exits through the outlet pipe. The pond continues to separate sediment from all incoming flows, while full treatment in the lower chamber continues at the maximum flow rate, without scour of previously captured pollutants.

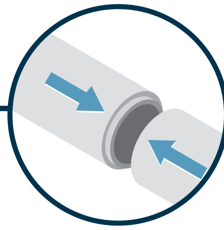


* Fiberglass system is an option

Stormceptor® EF Features & Benefits

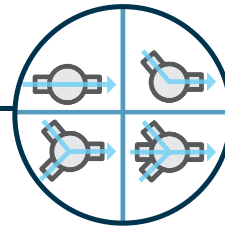
EASY TO INSTALL

Small footprint saves time and money with limited disruption to your site.



SEAMLESS

Minimal drop between inlet and outlet pipes makes Stormceptor ideal for retrofits and new development projects.



FLEXIBLE

Multiple inlets can connect to a single unit. Can be used as a bend structure.

FEATURES	BENEFITS
Patent-pending enhanced flow treatment and scour prevention technology	Superior, third-party verified performance
Third-party verified light liquid capture and retention (EFO version)	Proven performance for fuel/oil hotspot locations
Functions as bend, junction or inlet structure	Cost savings and design flexibility
Minimal drop between inlet and outlet	Site installation ease
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade

Stormceptor® EF Standard Configurations

Single Inlet Pipe

Multiple Inlet Pipes

Grate Inlet

High Tailwater

OPTIONS & ACCESSORIES

The following options and accessories are available for specific functions and site conditions:

- **Tailwater/Submerged Site** – For sites with standing water during dry weather periods, weir modifications can be implemented to ensure optimal performance.
- **Additional Sediment Storage Volume** – For sites with high pollutant loads or remote sites, additional sediment storage volume can easily be added.
- **Oil Alarm** – To mitigate spill liability, a monitoring system can be employed to trigger a visual and audible alarm when an oil or fuel spill occurs.
- **Additional Oil Capture** – A draw-off tank can be incorporated to increase spill storage capacity.
- **High Load** – Standard design loading is CHBDC or AASHTO H-20. Specialized loading can be designed to withstand very high loadings typical of airports and port facilities.
- **Lightweight** – Sites that required lightweight or above ground units are available as complete fiberglass systems.

Optional Oil Alarm

For any of these options or accessories, please contact your Stormceptor representative for design assistance.

Stormceptor® EFO

Accidents and spills happen, whether it is a fueling station, port, ndustrial site, or general hot spot with daily vehicle traffic. Protect the environment and your site from potentially costly clean-up, remediation, litigation and fines with the Stormceptor EFO configuration.

The Stormceptor EFO has been third-party tested to ensure oil capture, and retention during high flow events. The hydraulics of the Stormceptor EFO have been optimized to enhance oil and hydrocarbon capture.

STORMCEPTOR EFO – HYDROCARBON SPILL PROTECTION

- Stormceptor EFO configuration has been third-party performance tested for safe oil capture and retention.
- Patent-pending technology ensures captured oil and sediment are retained even during the largest rain events, for secure storage, environmental protection and easy removal.
- Stormceptor EFO provides double wall containment for captured hydrocarbons.
- Stormceptor EFO is ideal for gas stations, fuel depots, ports, garages, loading docks, industrial sites, fast food locations, high-collision intersections and other hotspots with spill-prone areas.
- Stormceptor EFO can accommodate an optional oil alarm and additional storage to increase spill storage capacity.

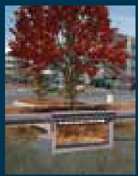
Stormceptor® Inspection & Maintenance

Conducted at grade, the Stormceptor EF design makes inspection and maintenance an easy and inexpensive process. Once maintained, the Stormceptor EF is functionally restored as designed, with full pollutant capture capacity.

MAINTENANCE RECOMMENDATIONS:

- Inspect every six months for the first year to determine the pollutant accumulation rate.
- In subsequent years, inspections can be based on observations or local requirements.
- Inspect the unit immediately after an oil, fuel or chemical spill. A licensed waste management company should remove oil and sediment, and dispose responsibly.

Stormceptor maintenance is performed at grade with a standard vacuum truck



FILTERRA BIORETENTION

The Filterra® Bioretention System is an engineered biofiltration device with components that make it similar to bioretention in pollutant removal and application, but has been optimized for high volume/flow treatment in a compact system.

JELLYFISH FILTER

The Jellyfish® Filter is a stormwater treatment technology featuring pretreatment and membrane filtration in a compact stand-alone treatment system that removes a high level and a wide variety of stormwater pollutants.

LITTATRAP CATCH BASIN

The LittaTrap™ is a simple and effective solution to remove sediment and trash from stormwater systems at its source. The LittaTrap sits inside the storm drain and captures and retains sediment and trash before it enters stormwater infrastructure, effectively pretreating downstream structures and aiding in pollutant removal.

LEARN MORE

- Access project profiles, photos, videos, and more online at **www.imbriumsystems.com/stormceptoref.**

REQUEST DESIGN ASSISTANCE

- Call us at (888) 279-8826 or 301-279-8827 to talk to one of our engineers for technical support or design assistance.

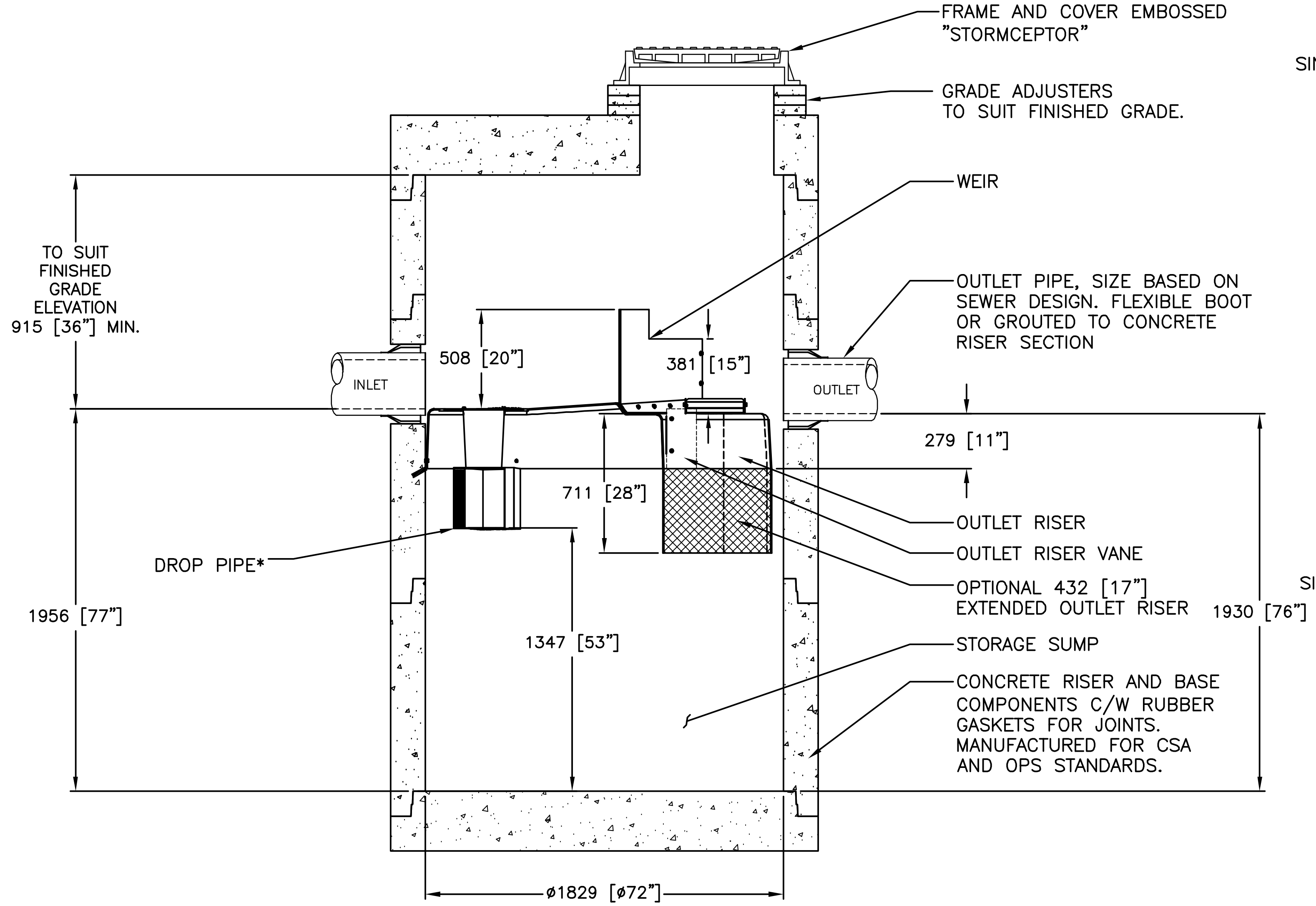
START A PROJECT

- Submit your system requirements on our product Design Worksheet at **www.imbriumsystems.com/pdw.**

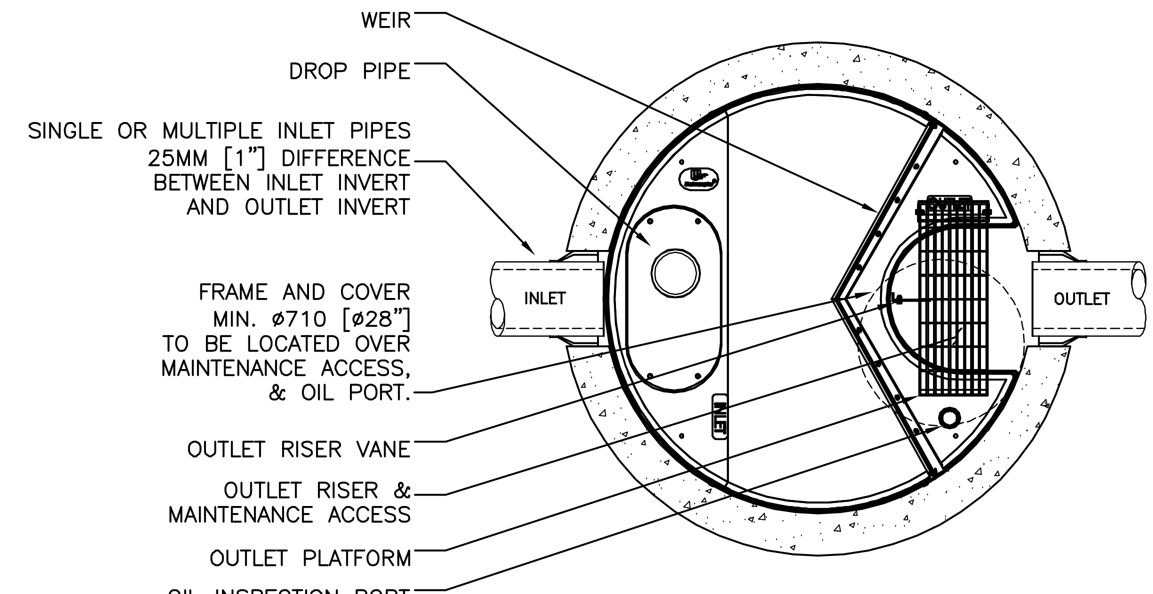
FIND A LOCAL REPRESENTATIVE

- Visit **www.imbrumsystems.com/localrep** for contact information for your local Imbrium representative.

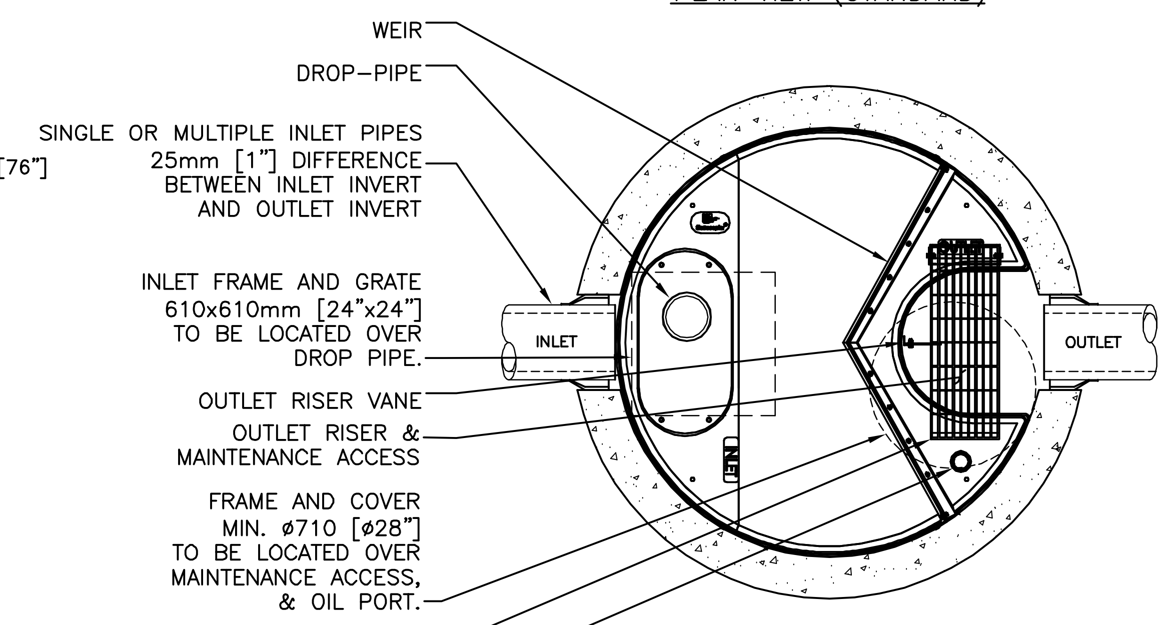
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF6 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO6 (OIL CAPTURE CONFIGURATION).

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

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

INSTALLATION NOTES

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

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO6				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY
###	###	###	###
###	###	###	###
###	###	###	###
1	6/8/18	OUTLET PLATFORM	JSK
0	05/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®

407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

DATE: 10/13/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EFO6	SEQUENCE No.: *
SHEET: 1 OF 1	

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EFO DRAWINGS & DETAILS\STANDARD DETAILS\EFO STANDARD DETAILS\EFO6-DETAIL.DWG 4/12/2019 11:05 AM

Appendix D – Consultation / Correspondence

City of Ottawa Pre-Application Consolation Notes, June 01, 2020

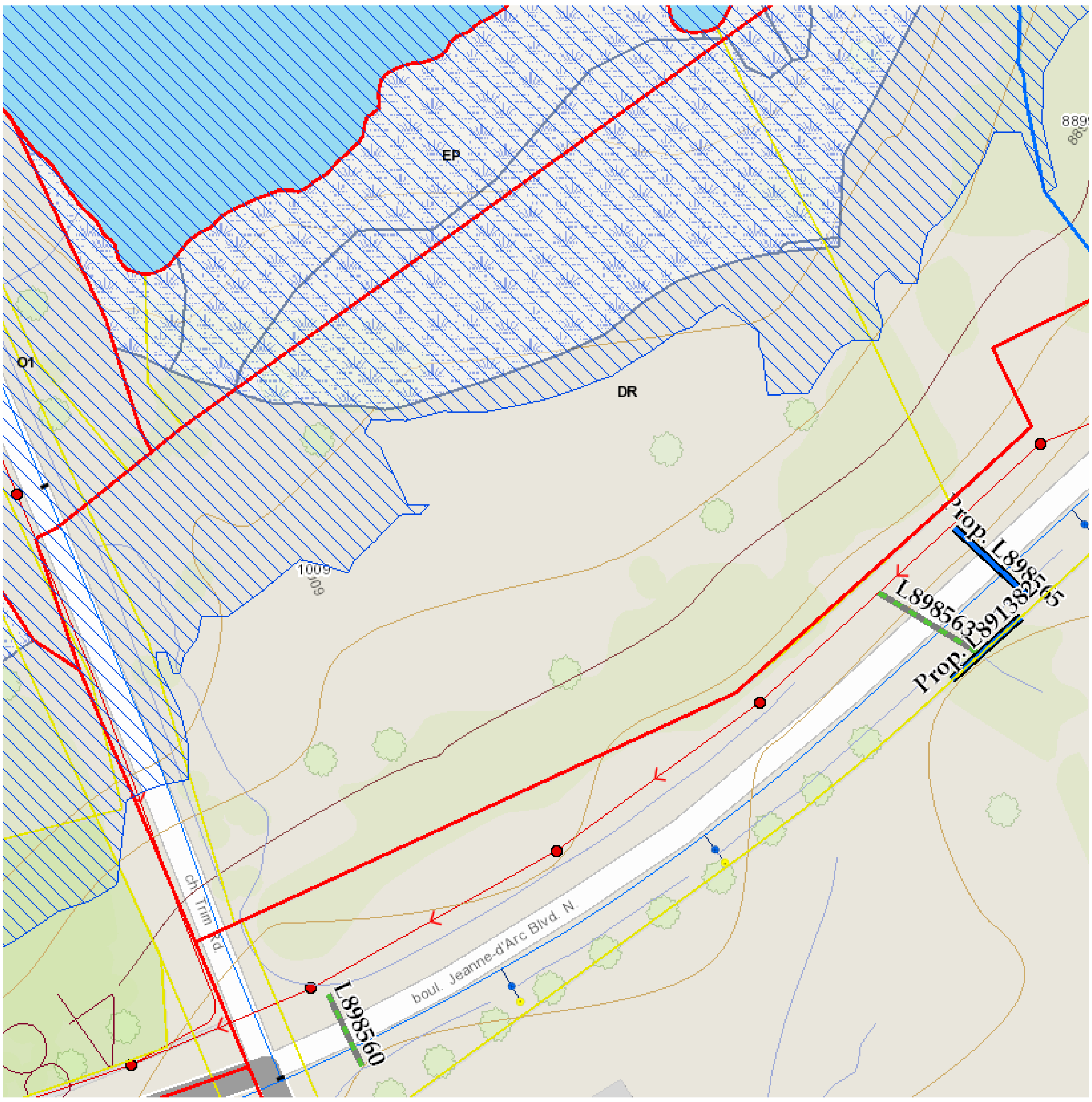
Email from City of Ottawa on Water System Boundary Conditions

OPA and ZBL Pre- Application Consultation Notes

Date: 1 June 2020
Site Location: 1009 Trim Rd
Type of Development: ☒ **Residential (**☐ **townhomes,** ☐ **stacked,** ☐ **singles,**
☒ **apartments),** ☐ **Office Space,** ☒ **Commercial,** ☐ **Retail,** ☐ **Institutional,**
☐ **Industrial, Other:** N/A

Project Manager: Will Curry / Natasha Baird
Assigned Planner: Shoma Murshid

Infrastructure



Water

Water District Plan No: 384-040
Existing public services:

- Jeanne d’Arc N Blvd – 406mm PVC

Boundary conditions:
Civil consultant must request boundary conditions from the City’s assigned Project Manager prior to first submission.

- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:

- Location of service(s)
    - Type of development and the amount of fire flow required (as per FUS, 1999).
    - Average daily demand: ___ l/s.
    - Maximum daily demand: ___l/s.
    - Maximum hourly daily demand: ___ l/s.
- Fire protection (Fire demand, Hydrant Locations)

General comments

- At time of Site Plan Control, a water meter sizing questionnaire [water card] will have to be completed prior to receiving a water permit (water card will be provided post approval).
- Service areas with a basic demand greater than 50 m^3/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.

Sanitary Sewer

Existing public services:

- Jeanne d'Arc N Blvd – 300mm PVC

Is a monitoring manhole required on private property? ☒ **Yes** ☐ **No**

General comments

- Adequacy of servicing will be required at the OPA stage for this development.
- Any premise in which there is commercial or institutional food preparation shall install a grease and oil inceptor on all fixtures.
- The Environmental Site Assessment (ESA) may provide recommendations where site contamination may be present. The recommendations from the ESA need to be coordinated with the servicing report to ensure compliance with the Sewer Use By-Law.

Storm Sewer

Existing public services:

- 2 culvert are located on Jeanne d'Arc N Blvd: 900mm CSP

General comments

- Adequacy of servicing will be required at the OPA stage for this development. An Environmental Assessment will be required if a storm outlet is discharging to the river is required.
- The site is required to accommodate the road drainage and the existing flow out-letting from the culverts towards the river.

Stormwater Management

Quality Control:

- Rideau Valley Conservation Authority to confirm quality control requirements.

Quantity Control:

- No quantity control is required for this development ONLY if it is discharging to the river.
- Please contact the City if this development will require municipal stormwater servicing.

Ministry of Environment, Conservation and Parks (MECEP)

At time of site plan control, this site will require an ECA for the outlet(s) to the river through direct submission.

a. Pre-consultation with local District office of MECP is recommended for direct submission.
b. Consultant completes an MECP request form for a pre-consultation. Sends request to moeccottawasewage@ontario.ca

NOTE: Site Plan Approval, or Draft Approval, is required before any Ministry of the Environment and Climate Change (MOECC) application is sent

General Service Design Comments

- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.

- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- Manholes are required for connections to sanitary or combined trunk sewers as per City of Ottawa Standards S13.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.
- Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstration minimum separation distances. A watermain crossing table may be provided.

Geotechnical and Slope Stability Analysis

- This development requires a geotechnical analysis and a slope stability analysis prior to the OPA to determine the developable lands. The site is adjacent to a waterway and is on sensitive clays with a slope. The City will require geotechnical information to ensure that the height and type of building supported by the OPA and ZA is satisfied.
- Provide an updated geotechnical report and slope stability analysis certified by a qualified engineer.
- Development shall comply to the current City of Ottawa Geotechnical Guideline: https://documents.ottawa.ca/sites/documents/files/documents/cap137602.pdf
- Development shall comply to the current City of Ottawa Slope Stability Guidelines for Development Applications: https://documents.ottawa.ca/sites/documents/files/documents/cap137604.pdf

Environmental Site Assessment

- As per the Official Plan, the environmental site assessment shall be completed as per Environmental Protection Act - O. Reg. 153/04, Part VII & VIII.
- Any reports older than 2 years shall be updated.

Other

At time of site plan control application, it will be required to verify if:

- Capital Works Projects will be within proximity to application.
- Watermain Frontage Fees are applicable.

References and Resources

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.
- All required plans are to be submitted on standard A1 size sheets (594mm x 841mm) sheets, utilizing a reasonable and appropriate metric scale as per City of Ottawa Servicing and Grading Plan Requirements: title blocks are to be placed on the right of the sheets and not along the bottom. Engineering plans may be combined, but the Site Plans must be provided separately. Plans shall include the survey monument used to confirm datum. Information shall be provided to enable a non-surveyor to locate the survey monument presented by the consultant.
- All required plans & reports are to be provided in *.pdf format (at application submission and for any, and all, re-submissions)
- Please find relevant City of Ottawa Links to Preparing Studies and Plans below: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#standards-policies-and-guidelines
- To request City of Ottawa plan(s) or report information please contact the City of Ottawa Information Centre: InformationCentre@ottawa.ca<mailto:InformationCentre@ottawa.ca>

(613) 580-2424 ext. 44455

- geoOttawa
  http://maps.ottawa.ca/geoOttawa/

Boundary Conditions
1009 Trim Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	342	5.70
Maximum Daily Demand	852	14.20
Peak Hour	1,866	31.10
Fire Flow Demand #1	6,000	100.00
Fire Flow Demand #2	10,020	167.00

Location

Results

Connection 1 – Jeanne D'Arc Blvd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	113.6	88.5
Peak Hour	106.7	78.6
Max Day plus Fire 1	112.0	86.2
Max Day plus Fire 2	102.9	73.3

[1] Ground Elevation = 51.4 m

Connection 2 – Jeanne D'Arc Blvd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	113.6	89.2
Peak Hour	106.7	79.3
Max Day plus Fire 1	107.7	80.7
Max Day plus Fire 2	102.9	74.0

[1] Ground Elevation = 50.9 m

Notes

1. A second connection to the watermain is required to decrease vulnerability of the water system in case of breaks.
2. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix E – Drawings

Architectural Plans (11 pages)

CONCEPT PLAN

1009 Trim Road

Ottawa ON

Master Planning Proposal

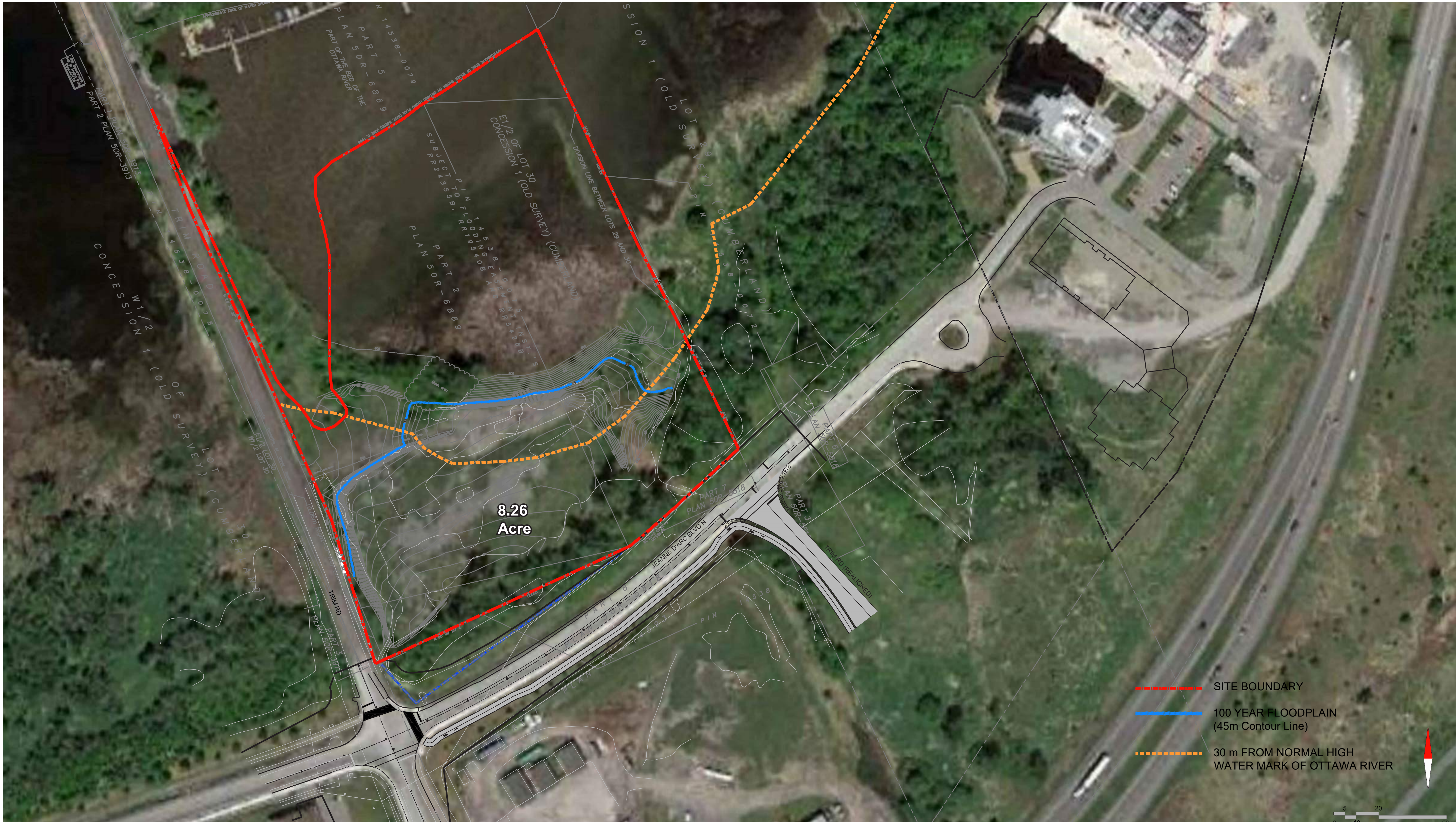
AUG 27, 2020

rla/architecture

Site

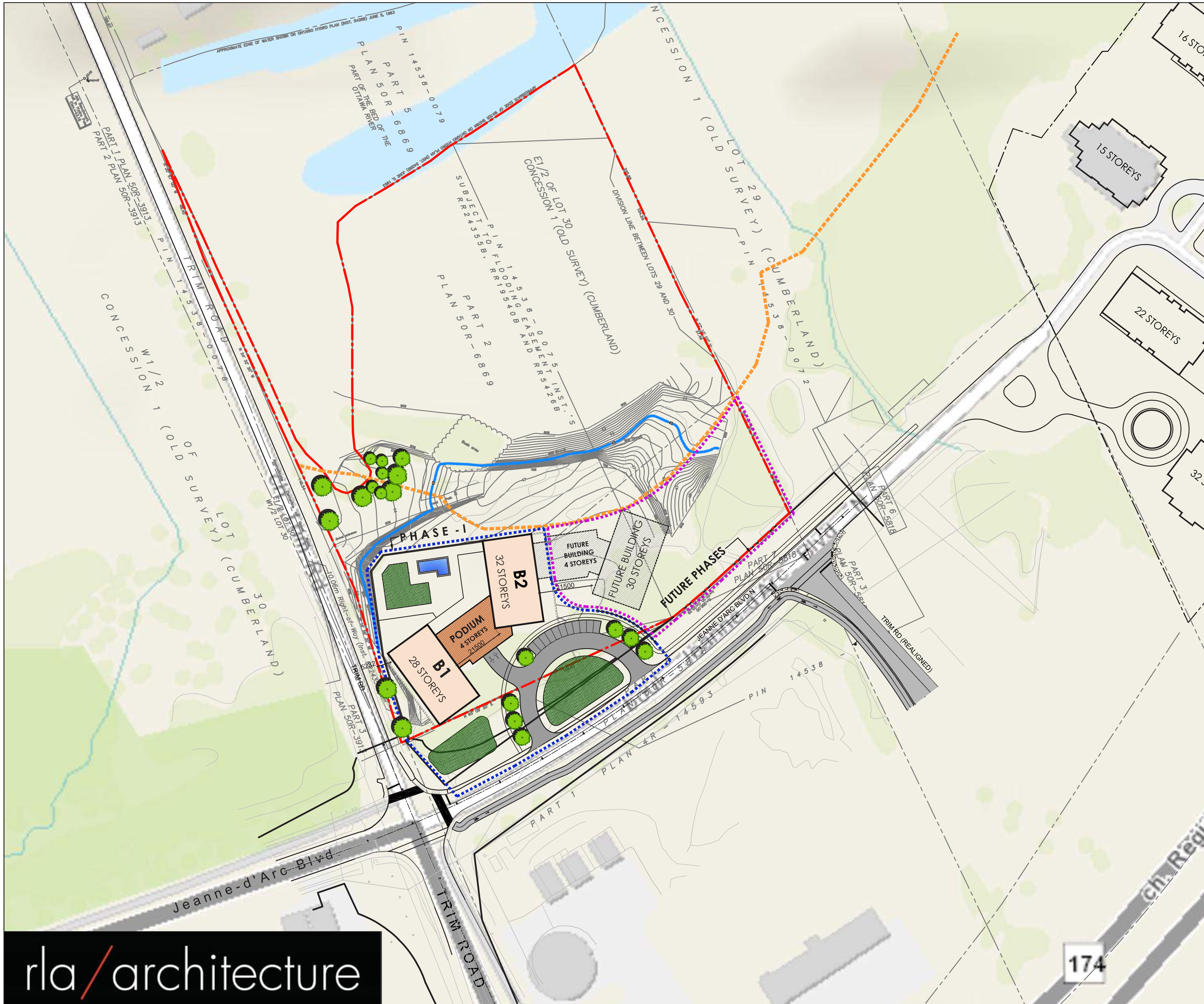
Site Area = 33,446.15 sq m (8.26 acre)

Zone - DR (Development Reserve Zone)



SITE PLAN

1009 Trim Road
Concept Master Plan



Development Summary:

Site Area =	34,897.74	sq m	(8.62 acres)
PHASE-1			
Planning approvals sought are to allow for the development shown as Phase 1			
Gross Construction Area =	494,919	sq ft	
Gross Floor Area =	420,681	sq ft approx.	
(assuming 85% efficiency)			
Total Residential Units =	**524**	**Units** approx.	
Total 1+ BR Units =	171	Units	32.63%
Total 2+ BR Units =	353	Units	67.37%
Surface parking spaces =	11	Spaces	
Underground Parking spaces (3 levels) =	456	Spaces	
Total no. of parking spaces =	**467**	**Spaces** approx.	0.89 car space per unit
Total amenities area =	34,417	sq ft approx.	
Commercial space on Gr. floor =	6082	sq ft approx.	
PHASE-2			
Phase 2 is not part of the current planning approvals being sought but is being shown to provide an understanding of the ultimate desired development that may be pursued through an amendment to the current application upon confirmation of additional lands that may be able to be developed.			
Gross Construction Area =	259,314	sq ft	
Gross Floor Area =	220,417	sq ft approx.	
(assuming 85% efficiency)			
Total Residential Units =	**271**	**Units** approx.	
Total 1+ BR Units =	90	Units	33.21%
Total 2+ BR Units =	181	Units	66.79%
Surface parking spaces =	22	Spaces	
Underground Parking spaces (3 levels) =	222	Spaces	
Total no. of parking spaces =	**244**	**Spaces** approx.	0.90 car space per unit
Total amenities area =	17,873	sq ft approx.	
Commercial space on Gr. floor =	5134	sq ft approx.	

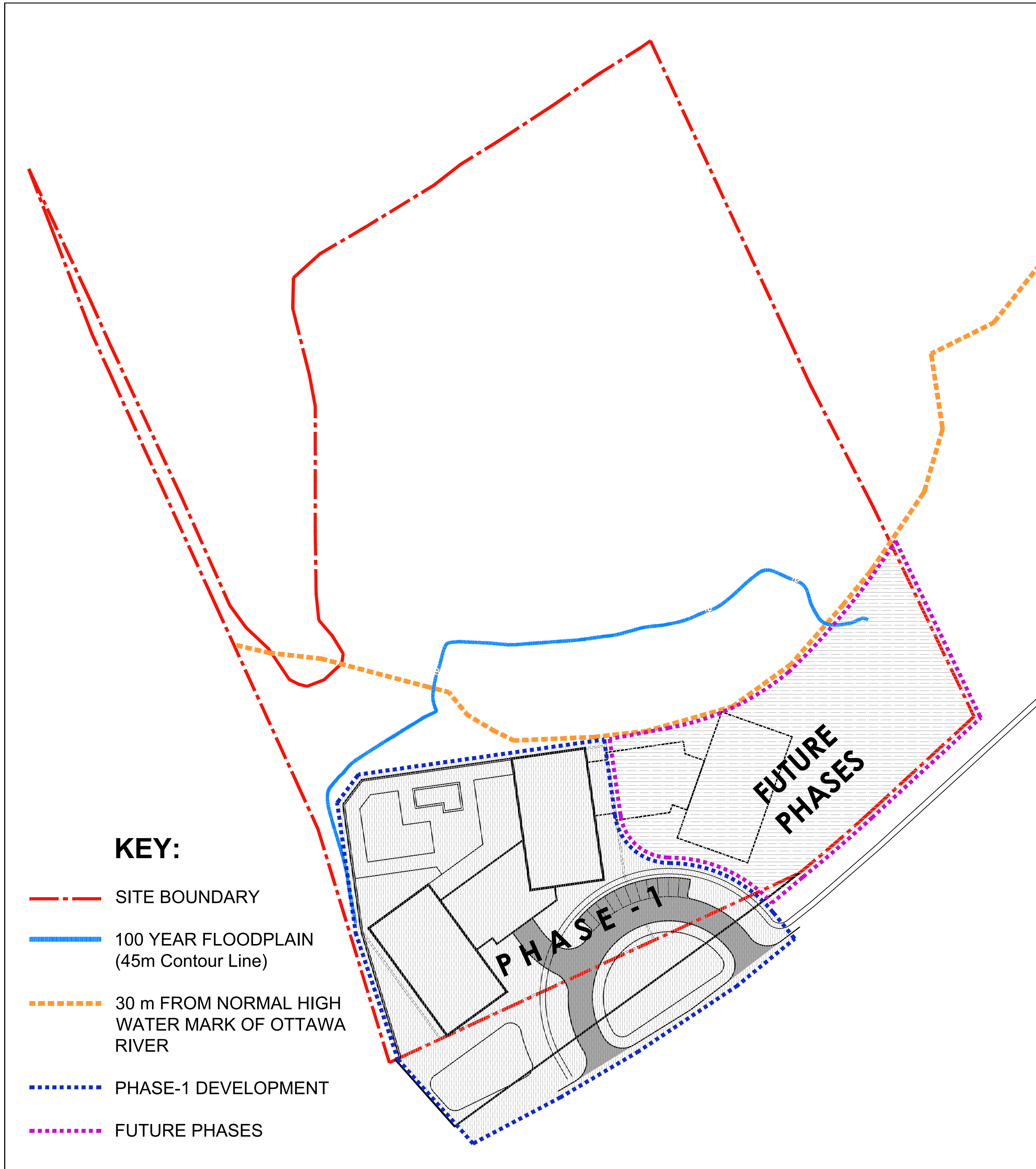
0 5 10 20 50 m

KEY:

- SITE BOUNDARY
- 100 YEAR FLOODPLAIN (45m Contour Line)
- 30 m FROM NORMAL HIGH WATER MARK OF OTTAWA RIVER
- PHASE-1 DEVELOPMENT
- FUTURE PHASES
- PROPOSED TOWER
- PROPOSED PODIUM
- FUTURE BULDINGS (Not a part of the initial application as submitted)

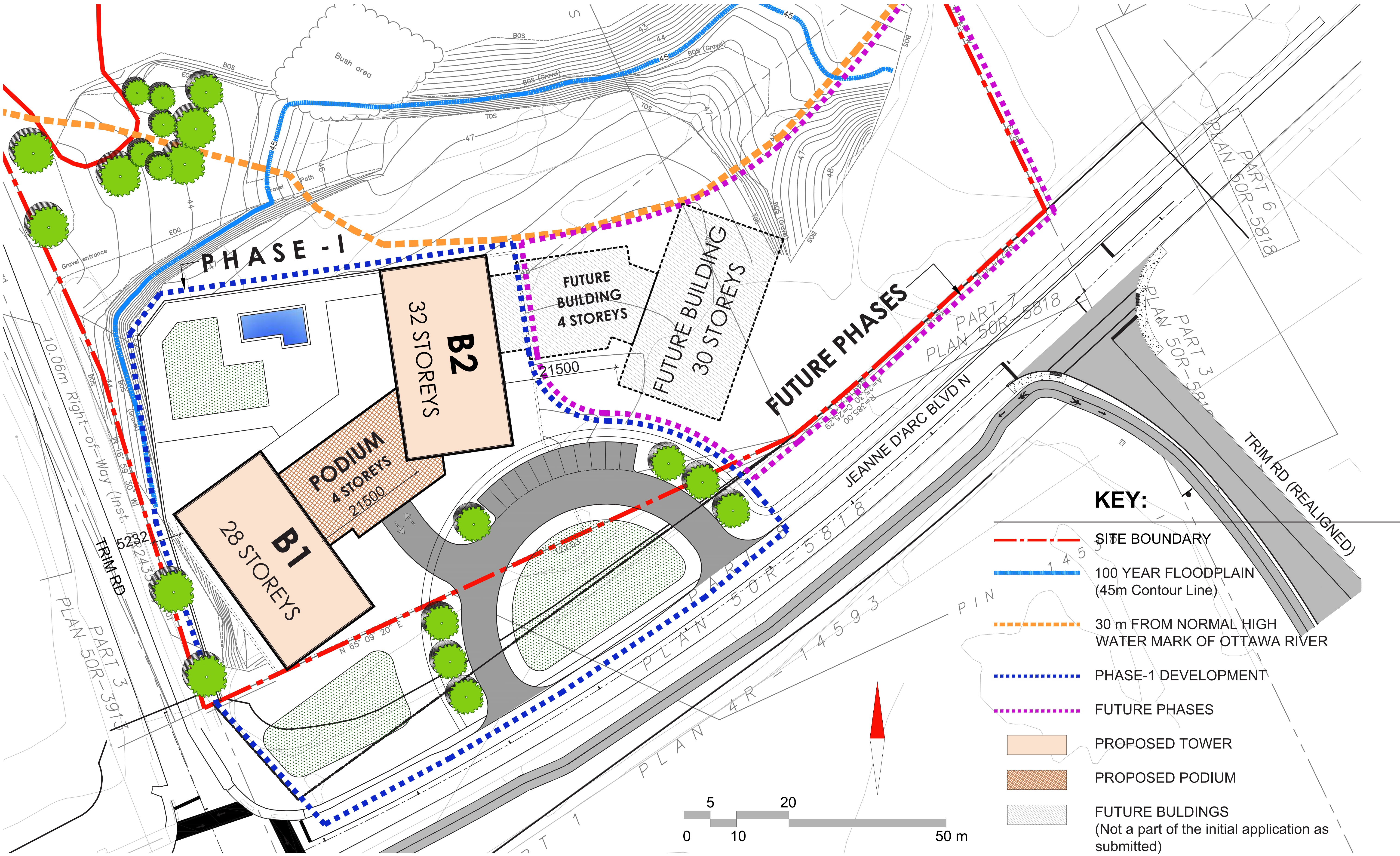
Site Plan
1009 TRIM ROAD, Ottawa ON

PHASING

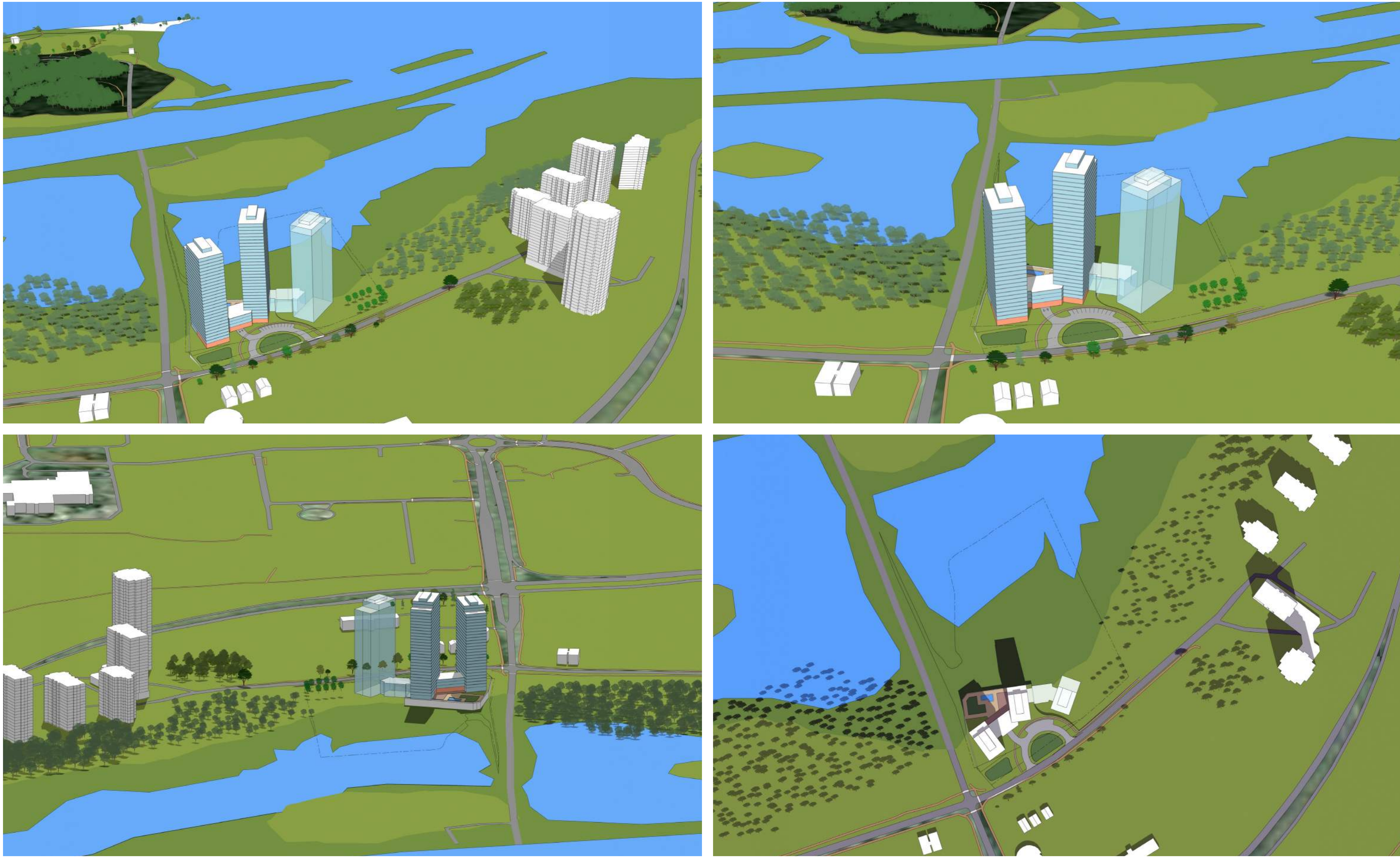


Development Summary:				
Site Area =	34,897.74	sq m	(8.62 acres)	
PHASE-1				
Planning approvals sought are to allow for the development shown as Phase 1				
Gross Construction Area =	494,919	sq ft		
Gross Floor Area =	420,681	sq ft approx.		
(assuming 85% efficiency)				
Total Residential Units =	**524**	**Units** approx.		
Total 1+ BR Units =	171	Units		32.63%
Total 2+ BR Units =	353	Units		67.37%
Surface parking spaces =	11	Spaces		
Underground Parking spaces (3 levels) =	456	Spaces		
Total no. of parking spaces =	**467**	**Spaces** approx.	0.89 car space per unit	
Total amenities area =	34,417	sq ft approx.		
Commercial space on Gr. floor =	6082	sq ft approx.		
PHASE-2				
Phase 2 is not part of the current planning approvals being sought but is being shown to provide an understanding of the ultimate desired development that may be pursued through an amendment to the current application upon confirmation of additional lands that may be able to be developed.				
Gross Construction Area =	259,314	sq ft		
Gross Floor Area =	220,417	sq ft approx.		
(assuming 85% efficiency)				
Total Residential Units =	**271**	**Units** approx.		
Total 1+ BR Units =	90	Units		33.21%
Total 2+ BR Units =	181	Units		66.79%
Surface parking spaces =	22	Spaces		
Underground Parking spaces (3 levels) =	222	Spaces		
Total no. of parking spaces =	**244**	**Spaces** approx.	0.90 car space per unit	
Total amenities area =	17,873	sq ft approx.		
Commercial space on Gr. floor =	5134	sq ft approx.		

SITE PLAN (Detailed)



CONCEPTUAL VIEWS



CONCEPTUAL VIEW

CONCEPTUAL VIEW

CONCEPTUAL VIEWS

CONCEPTUAL VIEW

CONCEPTUAL VIEW