Functional Site Servicing and Stormwater Management Report 1015 Tweddle Road (Formerly 1009 Trim Road), Ottawa, ON

Client:
Trim 1 GP 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

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Date Submitted:
December 17, 2021
Revised: July 13, 2022

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Date Submitted:
December 17, 2021
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1 Introduction

1.1 Overview

EXP Services Inc. (EXP) was retained by Trim 1 GP Inc. to prepare a Functional Site Servicing and Stormwater Management Report for the proposed development of 1015 Tweddle 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 Tweddle Road and Jeanne D'Arc Boulevard North 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 over-all property area is 3.34 ha. The proposed development will occupy 1.43 ha of the total property parcel. The proposed development will consist of four high-rise buildings. Tower A and C both will be 28 storey, tower B will be 32 storey and tower D will be 24 storeys high. All four towers will be constructed above underground parking. Proposed development will have total 1006 residential units and around 5329 m^2 of commercial/retail space. Tower A will have 238 units, tower B will have 278 units, tower C will have 275 units and tower D will have 215 units.

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.

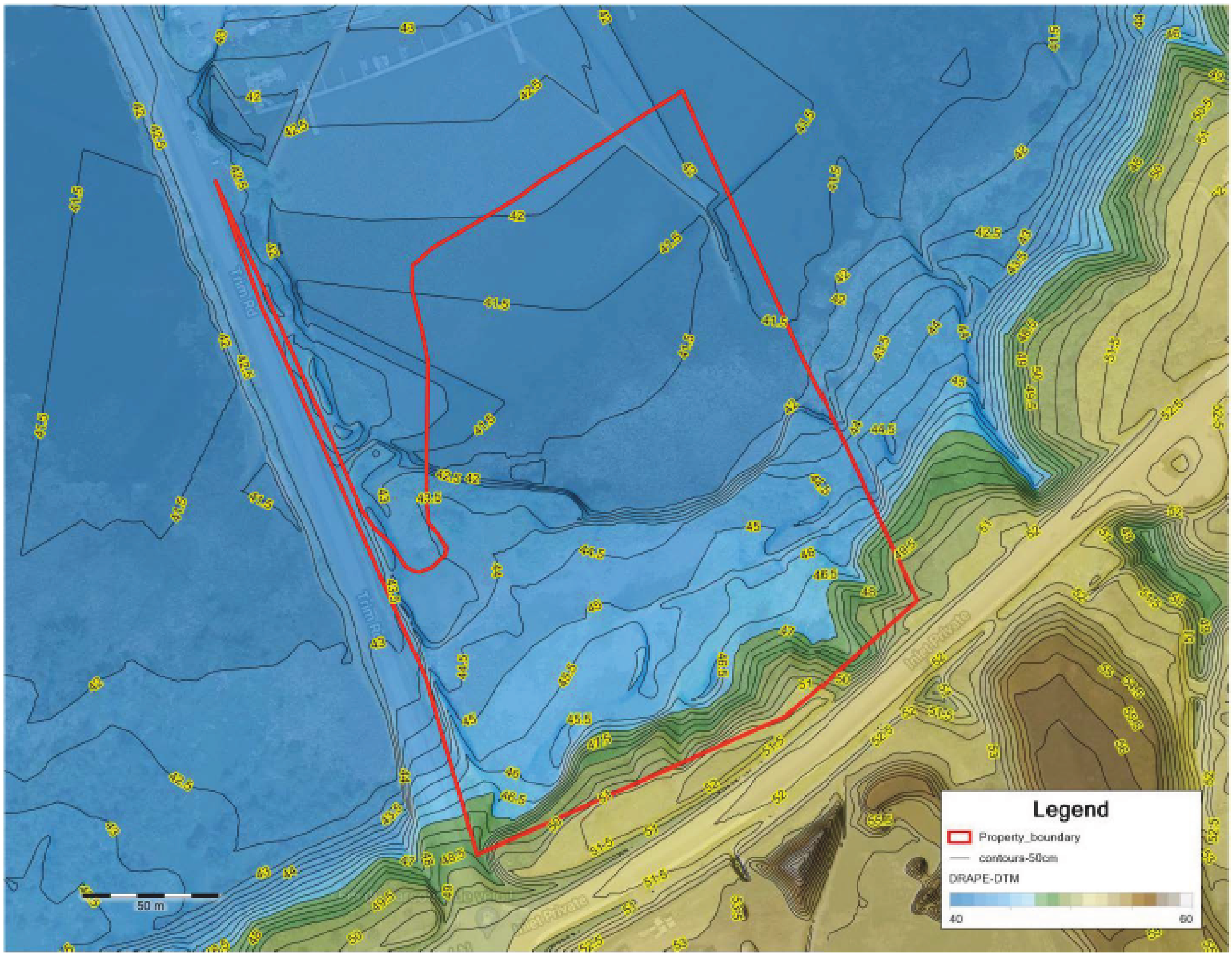

Figure 2-1 - Site Topography

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. **Figure A1** and **Figure A3** in **Appendix A** shows Ottawa River Normal High Water Mark, Edge of Wetlands, Ottawa River 100-Yr Flood Line, Limit of Hazard Lands Line, Top of Slope Line, 15m Setback from Top of Slope and 30m Setback from Wetlands.

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)
    - Technical Bulletin ISTB-2021-03 (18 August 2021)
- 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), 2020.
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing.

5 Water Servicing

5.1 Water Servicing Design Criteria

Table 5-1 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 5-1 - 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	280 L/person/day	✓
Average Day Demands – Commercial / Institutional	5 L/m² 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)	✓

5.2 Water Servicing Proposal

The proposed development will include ±1006 residential units and ±5329 square meters of level 1 and level 2 retail space housed within the four towers.

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 406mm 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.

5.3 Estimated Water Demands

The following **Table 5-2** below summarizes the anticipated water demands for the proposed development based on following:

- 4 towers having total 1006 residential units. Estimated residential population of 1710 persons.
- Commercial spaces on level 1 and 2. Estimated area of 5329 m^2.

Table 5-2 : Water Demand Summary

Water Demand Conditions	Tower A Water Demands (L/sec)	Tower B Water Demands (L/sec)	Tower C Water Demands (L/sec)	Tower D Water Demands (L/sec)	Total Water Demands (L/sec)
Average Day	1.36	1.57	1.63	1.29	5.85
Max Day	3.31	3.83	4.01	3.17	14.32
Peak Hour	7.22	8.37	8.78	6.94	31.31

5.4 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.

5.5 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 2020 (FUS).

The following equation from the Fire Underwriters document "Water Supply for Public Fire Protection", 2020, 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 5-3** 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.**

Detailed calculation of Required Fire Flow (RFF) for proposed buildings can be found in **Table B3** to **Table B6** in **Appendix B.**

Table 5-3 - Summary of Design Parameters Used in Calculating Required Fire Flows (RFF) Using FUS

Building #	[1]No of Storeys	Fire Flow, F (L/min)	Type of Constr. Coeff, C	Reduction Due to Occupancy (%)	Reduction Due to Sprinklers (%)	Total Increase due to Exposures (%)	Required Fire Flow in	
							(L/min)	(L/sec)
Tower A	28	13,000	0.8	-15%	-50%	5%	6,000	100
Tower B	32	13,000	0.8	-15%	-50%	10%	7,000	117
Tower C	28	13,000	0.8	-15%	-50%	10%	7,000	117
Tower D	24	13,000	0.8	-15%	-50%	5%	6,000	100

5.6 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 5-1 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 owned hydrant. All hydrants were 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 **Table 5-4** below.

Table 5-4 –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 A	6,000 (or 100 L/sec)	11,400
Tower B	7,000 (or 117 L/sec)	17,100
Tower C	7,000 (or 117 L/sec)	19,000
Tower D	6,000 (or 100 L/sec)	15,200

Detailed calculations of the available fire flows based on hydrant spacing is provided in **Table B8** 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.

5.7 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 B7** 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.

Figure 5-1 – Review of Hydrant Spacing

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. The estimated pressure available at the building connection would be within ± 1.0 psi - 2.0 psi of the pressure in the city main based on two - 200mm supply during peak hour or max day plus fire flow conditions. If only one of the two mains were in operation, the pressure at the building would be ± 4.0 psi of the pressure in the city main, under maximum day plus fire flow conditions.

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.

6 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 6-1** below summarizes the design parameters used.

Table 6-1 – 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	✓

6.1 Proposed Sewage Conditions

It is proposed that the mechanical piping from each building discharge into 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 ±85 L/sec based on Manning's Equation under full flow conditions. The estimated peak sanitary flow rate from the proposed property is **±17.35 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 6-2** below summarizes the sewage anticipated peak sewage flows for the proposed site.

Table 6-2 – Summary of Anticipated Sewage Rates

Sewage Condition	Sanitary Sewage Flow (L/sec)
Peak Residential Flow (for 1,710 persons)	16.07
Peak Commercial Flow (for 5,329 m2)	0.17
Infiltration Flow (for 3.45 ha)	1.11
Peak Design Flow	17.35

6.2 Offsite Sanitary Sewer Review

The sanitary sewer run on Jeanne D'Arc Boulevard North (from Tweddle 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 Tweddle Road (Formerly 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 2021, 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 per capita flow allowance was lowered from 350 L/p/day to 280 L/p/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 B9 in **Appendix B** summarizes the anticipated peak sewage flows in all sanitary sewers runs up to the Tweddle Road (formerly Trim Road) intersection, whereas **Figure A2** in **Appendix A** illustrates the sanitary drainage areas tributary to this sewer run.

The total peak flow is estimated at 40.35 L/sec, which includes peak sanitary flows from:

- ±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 28,000 L/gross ha of commercial flow
- An additional 17.35 L/sec from proposed site at 1015 Tweddle Road (formerly 1009 Trim Road), based on 1,710 persons and 5,329 m^2 commercial space.

It should be noted that the developer has proposed to acquire Part 9 of Plan 50R-5818 – Jeanne D'Arc ROW at the north-east corner of Jeanne D'Arc Boulevard North and Tweddle Road (formerly Trim Road), from the City. Sanitary manhole #MHSA22037 is proposed to be relocated outside the property line. With this relocation, it is also proposed to upsize the pipes between MHSA22036-MHSA22037-MHSA54993 from 300mm dia. to 375mm dia. as shown on **Figure A1** in **Appendix A**.

Table B9 in **Appendix B** shows that the proposed 375 sanitary sewer will run at 51% capacity at 0.2% slope, with full flow capacity of ±79.77 L/sec.

For the site at 1015 Tweddle Road (formerly 1009 Trim Road), a single 250mm diameter PVC sewer lateral having a slope of 2.0% is proposed to service the development, at this time. The estimated capacity of a 250mm pipe at 2% is ±85 L/sec. A lateral at this slope would permit 8,300 fixture units as per OBC. Further detail will be advanced as the project progresses.

7 Storm Servicing & Stormwater Management

7.1 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.

7.1.1 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.

7.1.2 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 where 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.

7.2 Runoff Coefficients

Runoff coefficients used 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. Runoff coefficient for gravel surface was taken as 0.7. Average runoff coefficients were calculated for catchments (or drainage areas) using the area-weighting method in excel. The runoff coefficients for all pre-development and post-development catchments are provided in **Table B10** and **Table B13,** respectively.

7.3 Pre-Development Release Rate

Since the proposed development will occupy only 1.43 ha out of 3.34 ha of total site area, pre-development and post-development stormwater management calculation are conducted only for 1.43 ha of development area. Rest of the site area will remain same as pre-development conditions. Pre-development runoff coefficient for 1.43 ha site area was estimated to be 0.38. The calculated time of concentration was 3.18 mins. Therefore, the pre-development discharge rates during 2-year, 5-year and 100-year storm events were estimated with average runoff coefficient of 0.38 and time of concentration of 10 mins as per the City of Ottawa guidelines, summarized in **Table 7-1** below. Detailed calculation of pre-development discharge rate can be found in **Table B12** in **Appendix B**.

Table 7-1 – Summary of Stormwater Peak Flows

Development	Pre-Development Discharge Rates (L/sec)		
	2-year	5-year	100-year
1015 Tweddle Road (formerly 1009 Trim Road)	116.3	157.8	338.1

7.4 Post-Development Stormwater Management Scheme

As noted above, the City of Ottawa allowed for "NO" quantity control of post-development runoff due to the sites proximity to the Ottawa River, if stormwater system is discharging directly into the Ottawa river. The portion of development discharging to the City ROW would be controlled to 5-year pre-development discharge rates with maximum run-off coefficient of 0.5. However, at this stage, the whole site is proposed to discharge via one outlet to the north into the Ottawa River. Therefore, no quantity control has been proposed.

Further detailed post-development stormwater management design will be provided at the site plan control application stage.

7.5 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 of six (6) subcatchments (or drainage areas) are shown on this drawing with average runoff coefficients calculated for each drainage area. The stormwater works shall consist of the following elements:

- For Towers A, B, C and D, Flow-control roof drains to be provided.
- Runoff from surface areas surrounding the proposed towers will be collected by area drains and discharge to internal drainage piping in the underground parking structure. This in turn discharges directly to an oil-grit separator manhole, prior to discharging to the Ottawa River
- Runoff from the lower landscaped areas along the river front to the north will be collected via a Low Impact Development (LID) feature for quality control. Which will then discharge into the Ottawa River

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 B20 to **Table B23** in **Appendix B.**

It should be noted that the Jeanne D'Arc Boulevard will be urbanized as indicated on drawing #EJV-S0O174-RWY-DWG-3915 received from the City. As a result of urbanization and proposed development at 1015 Tweddle Road, a storm sewer is proposed under Jeanne D'Arc Boulevard. To allow for the development, the existing culvert and associated upstream drainage area will need to be rerouted to discharge into the proposed storm sewer.

Figure A4 in **Appendix A** shows the existing storm drainage area for the 3 existing culverts along Jeanne D'Arc Boulevard near the proposed site. The existing culvert at the intersection on Jeanne D'Arc Boulevard and Tweddle Road is proposed to be rerouted as shown on **Figure A1** to allow for the proposed development and to maintain the existing storm drainage pattern.

Detailed design will be provided at the Site Plan Application after coordination with the City.

7.6 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 B19**, provide the storage volumes necessary on the roof to attenuate the controlled release rates. **Table B15** 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 7-2** below.

Table 7-2 – 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 A roof	5.9	8.0	15.1	10.4	14.1	26.7	44.7		Flow Controlled Roof Drains
S02	Tower B roof	5.9	8.0	15.1	9.5	12.8	24.3	42.3		Flow Controlled Roof Drains
S03	Tower C roof	6.6	8.9	17.0	11.1	14.9	28.2	48.5		Flow Controlled Roof Drains
S04	Tower D roof	6.6	8.9	17.0	10.3	13.8	26.2	46.4		Flow Controlled Roof Drains
S05	Area around Tower A,B,C,D	111.4	151.2	323.9						none
S06	Area below the main deck	30.4	41.2	88.4						none
Total (All)		**166.8**	**226.2**	**476.6**	**41.5**	**55.9**	**105.8**	**181.9**		

7.7 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 7-3 – Design Parameters Used for Oil Grit Separator Sizing

Parameter	Value Used
Drainage Area	1.147 hectares
Runoff Coefficient	0.81
Target TSS Removal Requirements	80 %
Target Runoff Volume Capture	90 %
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 EF6 is necessary to meet the required TSS removal of 80%. The EF6 will provide an approximate TSS removal of 87%.

8 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.

9 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 **6,000 L/min** (100 L/sec) for Tower A, **7,000 L/min** (117 L/sec) for Tower B, **7,000 L/min** (117 L/sec) for Tower C and **6,000 L/min** (100 L/sec) for Tower D. The total minimum available flows for firefighting purposes, based on the contribution from hydrants, was estimated at **11,400 L/min, 17,100 L/min, 19,000 L/min and 15,200 L/min** for each building, respectively.
- Based on hydraulic boundary conditions (HGL) provided by the City of Ottawa, a system pressure of **±77.5 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 **17.35 L/sec** are anticipated. A review of the sanitary sewers on Jeanne D'Arc Boulevard was completed. It was determined that the sanitary main between MHSA 22036 and MHSA 54993 will be upsized from 300mm diameter to 375mm diameter pipes to match with the downstream pipes. It is also determined that the sanitary manhole MHSA 22037 will need to be relocated outside the property line as a result of Part 9 of Plan 50R-5818 acquisition.

Stormwater

- Total pre-development discharge rate from the development area of the site was calculated based on a runoff coefficient of 0.38 and a time of concentration of 10 minutes. Pre-development discharge rates from the 1.43 ha development area were estimated to be **116.3 L/sec, 157.8 L/sec** and **338.1 L/sec** during 2-year, 5-year and 100-year storm events, respectively.
- Post-development release rates were calculated by estimating C_{AVG} based on the proposed development. Post-development C_{AVG} for the 1.43 ha development was estimated to be 0.75. Post-development uncontrolled discharge rates from 1.43 ha development area were estimated to be **229.2 L/sec, 311.0 L/sec** and **638.0 L/sec** with controlled discharge rates being **166.8 L/sec, 226.2 L/sec** and **476.6 L/sec** during 2-year, 50-year and 100-year storm events, respectively.
- 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. Although runoff does not need to be detained onsite, stormwater control and storage will be provided on building roof using flow control roof drains.
- 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 **64.4 L/sec** (Tower A, B, C, D).
- The remaining areas will not have flow controls with 100-yr anticipated peak flows of **412.2 L/sec.** Further opportunities for stormwater control and storage within the site area will be evaluated at site plan control application as required.
- An oil-grit separator (OG) is required to meet the TSS removal efficiency of 80%. A Stormceptor Model EF6 was selected which is estimated to have a removal efficiency of **87%.**

Legal Notification

This report was prepared by EXP Services Inc. for the account of Trim 1 GP 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

0 10m 20m 40m
HORIZONTAL 1:1000

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DESIGN	AJ	1015 TWEDDLE ROAD	SCALE 1:1000
DRAWN	AJ		SKETCH NO
DATE	07/11/22	CONCEPTUAL SERVICING PLAN	FIG A1
FILE NO	OTT-259629-A0		

Filename: \\exp\data\OTT\OTT-00259629-A0\60 Execution\65 Drawings\Figures\FIG 1-3.dwg
Last Saved: Jul 13, 2022 11:51 AM Last Plotted: Jul 13, 2022 11:52 AM Plotted by: JoriwalaA

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DESIGN AJ	1015 TWEDDLE ROAD		SCALE 1:2500
DRAWN AJ			SKETCH NO
DATE 07/11/22	SANITARY DRAINAGE PLAN		FIG A2
FILE NO OTT-259629-A0			

Filename: \\exp\data\OTT\OTT-00259629-A0\60 Execution\65 Drawings\Figures\FIG 1-3.dwg
Last Saved: Jul 13, 2022 11:51 AM Last Plotted: Jul 13, 2022 11:54 AM Plotted by: JariwalaA

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DESIGN	AJ	1015 TWEDDLE ROAD	SCALE	1:1000
DRAWN	AJ		SKETCH NO	
DATE	07/11/22	STORM DRAINAGE PLAN	FIG A3	
FILE NO	OTT-259629-A0			

Filename: \\exp\data\OTT-00259629-A0\60 Execution\65 Drawings\Figures\FIG 1-3.dwg
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DESIGN	AJ
DRAWN	AJ
DATE	07/11/22
FILE NO	OTT-259629-A0

1015 TWEDDLE ROAD

EXISTING STORM DRAINAGE AREA

SCALE 1:2500

SKETCH NO FIG A4

Filename: \\exp\data\OTT\OTT-00259629-A0\60 Execution\65 Drawings\Figures\FIG 1-3.dwg
Last Saved: Jul 13, 2022 11:51 AM Last Plotted: Jul 13, 2022 11:57 AM Plotted by: JariwalaA

Appendix B – Design Tables

TABLE B1

Water Demand Chart

Junction Number (Building)	No. of Units										Total Pop	Residential Demands					Commercial						Total Demands in (L/sec)		
	Singles/Semis/Towns				Apartments														Peaking Factors (x Avg Day)						
	Single Family	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)
Tower A (Trim Rd)						156		82			390.6	109,368	2.5	5.5	273,420	601,524	1650.0	8,250	1.5	2.7	12,375	22,275	1.36	3.31	7.22
Tower B (Trim Rd)						184		94			455.0	127,400	2.5	5.5	318,500	700,700	1650.0	8,250	1.5	2.7	12,375	22,275	1.57	3.83	8.37
Tower C (Trim Rd)						134		141			483.7	135,436	2.5	5.5	338,590	744,898	1029.0	5,145	1.5	2.7	7,718	13,892	1.63	4.01	8.78
Tower D (Trim Rd)						101		114			380.8	106,624	2.5	5.5	266,560	586,432	1000.0	5,000	1.5	2.7	7,500	13,500	1.29	3.17	6.94
Totals =						*575*		*431*			*1710.1*	*478,828*			*1,197,070*	*2,633,554*	*5329.0*				*39,968*	*71,942*	*5.85*	*14.32*	*31.31*

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) =	280
Max Day Peaking Factor (* avg day) =	2.5
Peak Hour Factor (* avg day) =	5.5

Industrial/Commercial/Institutional Water Consumption

Light Industrial (L/gross ha/day) =	35,000
Heavy Industrial (L/gross ha/day) =	55,000
Commer/Instit (L/m² 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:
Aaditya Jariwala, M.Eng.	Ottawa, Ontario
Checked:	
Bruce Thomas, P.Eng.	
File Reference:	Page No:
259629 Water - Demand Chart, July 2022.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 (%)	[5]Total Increase due to Exposures (%)	[6]Required Fire Flow in	
								(L/min)	(L/sec)
Tower A	high-rise condo	28	13,000	0.8	-15%	-50%	5%	6,000	100
Tower B	high-rise condo	32	13,000	0.8	-15%	-50%	10%	7,000	117
Tower C	high-rise condo	28	13,000	0.8	-15%	-50%	10%	7,000	117
Tower D	high-rise condo	24	13,000	0.8	-15%	-50%	5%	6,000	100

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 2020.
6 – Required Fire Flows are rounded to nearest 1,000 L/min.

TABLE B3 (Tower A)

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

PROJECT: 1015 Tweddle Road (Formerly 1009 Trim Road)

Building No: Tower A

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: Area	% Used	Area Used	Comment	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	5468.0 m²	
	Floor 11 to 28		759.6	0	0.0	Two largest adjoining floors + 50% of floors above (up to eight)		
	Floor 10		759.6	50%	379.8			
	Floor 9		759.6	50%	379.8			
	Floor 8		759.6	50%	379.8			
	Floor 7		759.6	50%	379.8			
	Floor 6		759.6	50%	379.8			
	Floor 5		759.6	50%	379.8			
	Floor 4		1038.7	50%	519.3			
	Floor 3		1038.7	50%	519.3			
	Floor 2		1038.7	100%	1038.7			
	Floor 1 (Main Level)		1111.8	100%	1111.8			
	Basement (At least 50% below grade, not included)			0%	0.0			
Fire Flow (F)	F = 220 * C * SQRT(A)							13,014
Fire Flow (F)	Rounded to nearest 1,000							13,000

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%	-1,950	11,050
	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%	-3,315	7,735
	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%	-1,105	6,630
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,105	5,525
	Not Fully Supervised or N/A	0%				

Choose Structure Exposure Distance

Exposures	Separation Dist (m)	Cond	Separation Condition	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)
Side 1 (west)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%	5%	553	6,078
Side 2 (east)	23	4	20.1 to 30	Type IV-III (U)	38	28	1064	4F	5%			
Front (north)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
Back (south)	46	5	30.1 to 45	Type IV-III (U)	38	28	1064	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 Construction (from Table G5)

Type V	Wood Frame
Type IV-III (U)	Mass Timber or Ordinary with Unprotected Openings
Type IV-III (P)	Mass Timber or Ordinary with Protected Openings
Type II-I (U)	Noncombustible or Fire Resistive with Unprotected Openings
Type II-I (P)	Noncombustible or Fire Resistive with Protected Openings

Conditions for Separation

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

TABLE B4 (Tower B)

FIRE FLOW REQURIEMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
PROJECT: 1015 Tweddle Road (Formerly 1009 Trim Road)
Building No: Tower B

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	5530.5 m²	
	Floor 11 to 32		759.6	0	0.0			
	Floor 10		759.6	50%	379.8	Two largest adjoining floors + 50% of floors above (up to eight)		
	Floor 9		759.6	50%	379.8			
	Floor 8		759.6	50%	379.8			
	Floor 7		759.6	50%	379.8			
	Floor 6		987.4	50%	493.7			
	Floor 5		987.4	50%	493.7			
	Floor 4		987.4	50%	493.7			
	Floor 3		987.4	50%	493.7			
	Floor 2		987.4	100%	987.4			
	Floor 1 (Main Level)		1049.3	100%	1049.3			
	Basement (At least 50% below grade, not included)			0%	0.0			
Fire Flow (F)	F = 220 * C * SQRT(A)							13,089
Fire Flow (F)	Rounded to nearest 1,000							13,000

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%	-1,950	11,050
	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%	-3,315	7,735
	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%	-1,105	6,630
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,105	5,525
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Condition	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-Height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	23	4	20.1 to 30	Type IV-III (U)	45	28	1260	4F	5%	10%	1,105	6,630
	Side 2 (east)	26.6	4	20.1 to 30	Type IV-III (U)	40	28	1120	4F	5%			
	Front (north)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
	Back (south)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												7,000
	Total Required Fire Flow, L/s =												117

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

Type V	Wood Frame
Type IV-III (U)	Mass Timber or Ordinary with Unprotected Openings
Type IV-III (P)	Mass Timber or Ordinary with Protected Openings
Type II-I (U)	Noncombustible or Fire Resistive with Unprotected Openings
Type II-I (P)	Noncombustible or Fire Resistive with Protected Openings

Conditions for Separation

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

TABLE B5 (Tower C)

FIRE FLOW REQURIEMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
PROJECT: 1015 Tweddle Road (Formerly 1009 Trim Road)
Building No: Tower C

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	5803.6 m²	
	Floor 11 to 28		782.1	0	0.0			
	Floor 10		782.1	50%	391.0	Two largest adjoining floors + 50% of floors above (up to eight)		
	Floor 9		782.1	50%	391.0			
	Floor 8		782.1	50%	391.0			
	Floor 7		782.1	50%	391.0			
	Floor 6		782.1	50%	391.0			
	Floor 5		782.1	50%	391.0			
	Floor 4		1090.7	50%	545.3			
	Floor 3		1135.8	50%	567.9			
	Floor 2		1135.8	100%	1135.8			
	Floor 1 (Main Level)		1208.3	100%	1208.3			
	Basement (At least 50% below grade, not included)			0%	0.0			
Fire Flow (F)	F = 220 * C * SQRT(A)							13,408
Fire Flow (F)	Rounded to nearest 1,000							13,000

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%	-1,950	11,050
	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%	-3,315	7,735
	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%	-1,105	6,630
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,105	5,525
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Condition	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-Height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	26.6	4	20.1 to 30	Type IV-III (U)	31	28	868	4F	5%	10%	1,105	6,630
	Side 2 (east)	23	4	20.1 to 30	Type IV-III (U)	26	24	624	4F	5%			
	Front (north)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
	Back (south)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												7,000
	Total Required Fire Flow, L/s =												117

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

Type V	Wood Frame
Type IV-III (U)	Mass Timber or Ordinary with Unprotected Openings
Type IV-III (P)	Mass Timber or Ordinary with Protected Openings
Type II-I (U)	Noncombustible or Fire Resistive with Unprotected Openings
Type II-I (P)	Noncombustible or Fire Resistive with Protected Openings

Conditions for Separation

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

TABLE B6 (Tower D)

FIRE FLOW REQURIEMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
PROJECT: 1015 Tweddle Road (Formerly 1009 Trim Road)
Building No: Tower D

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 m² (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/Unrated Mass Timber	1.5	Non-combustible Construction/Encapsulated Mass Timber				0.8	
	Ordinary Construction/Ordinary Mass Timber	1						
	Rated Mass Timber	0.9						
	Non-combustible Construction/Encapsulated Mass Timber	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used	Comment	5645.7 m²	
	Floor 11 to 24		782.1	0	0.0	Two largest adjoining floors + 50% of floors above (up to eight)		
	Floor 10		782.1	50%	391.0			
	Floor 9		782.1	50%	391.0			
	Floor 8		782.1	50%	391.0			
	Floor 7		782.1	50%	391.0			
	Floor 6		782.1	50%	391.0			
	Floor 5		782.1	50%	391.0			
	Floor 4		1052.2	50%	526.1			
	Floor 3		1085.4	50%	542.7			
	Floor 2		1085.4	100%	1085.4			
	Floor 1 (Main Level)		1145.2	100%	1145.2			
	Basement (At least 50% below grade, not included)			0%	0.0			
Fire Flow (F)	F = 220 * C * SQRT(A)							13,224
Fire Flow (F)	Rounded to nearest 1,000							13,000

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%	-1,950	11,050
	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%	-3,315	7,735
	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%	-1,105	6,630
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,105	5,525
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Condition	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-Height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
Choose Structure Exposure Distance	Side 1 (west)	23	4	20.1 to 30	Type IV-III (U)	35	24	840	4F	5%	5%	553	6,078
	Side 2 (east)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
	Front (north)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	6	0%			
	Back (south)	46	5	30.1 to 45	Type IV-III (U)	0	0	0	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 Construction (from Table G5)

Type V	Wood Frame
Type IV-III (U)	Mass Timber or Ordinary with Unprotected Openings
Type IV-III (P)	Mass Timber or Ordinary with Protected Openings
Type II-I (U)	Noncombustible or Fire Resistive with Unprotected Openings
Type II-I (P)	Noncombustible or Fire Resistive with Protected Openings

Conditions for Separation

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

TABLE B7
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	5.850	20 m	204	0.204	0.0003	0.006	51.60	52.30	-0.7	610.2	(88.5)	603.3	(87.5)	1.0
Double 200mm watermain	Main	Basement	2.925	20 m	204	0.204	8.3E-05	0.0017	51.60	52.30	-0.7	610.2	(88.5)	603.3	(87.5)	1.0
Max Day Conditons																
Single 200mm watermain	Main	Basement	14.318	20 m	204	0.204	0.00156	0.0313	51.60	52.30	-0.7	610.2	(88.5)	603.0	(87.5)	1.0
Double 200mm watermain	Main	Basement	7.159	20 m	204	0.204	0.00043	0.0087	51.60	52.30	-0.7	610.2	(88.5)	603.2	(87.5)	1.0
Peak Hour Conditons																
Single 200mm watermain	Main	Basement	31.314	20 m	204	0.204	0.00666	0.1332	51.60	52.30	-0.7	542.5	(78.7)	534.3	(77.5)	1.2
Double 200mm watermain	Main	Basement	15.657	20 m	204	0.204	0.00185	0.0369	51.60	52.30	-0.7	542.5	(78.7)	535.3	(77.6)	1.0
Max Day Plus Fireflow Conditons																
Single 200mm watermain	Main	Basement	131.3	20 m	204	0.204	0.09476	1.8951	51.60	52.30	-0.7	505.2	(73.3)	479.8	(69.6)	3.7
Double 200mm watermain	Main	Basement	65.659	20 m	204	0.204	0.02625	0.525	51.60	52.30	-0.7	505.2	(73.3)	493.2	(71.5)	1.7

Water Demand Info

Average Demand =	5.85	L/sec
Max Day Demand =	14.32	L/sec
Peak Hr Deamand =	31.31	L/sec
Fireflow Requriement =	117	L/sec (Tower C highest RFF)
Max Day Plus FF Demand =	131.3	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 B8

FIRE FLOW REQUIREMENTS BASED ON HYDRANT SPACING

Hydrant #	Tower A		Tower B		Tower C		Tower D	
	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	[1]Distance (m)	[2]Fire Flow Contributio n (L/min)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)
H029	175	0	161	0	230	0	276	0
H030	80	3,800	65	5,700	125	3,800	180	0
H031	93	3,800	18	5,700	44	5,700	97	3,800
H001	130	3,800	65	5,700	15	5,700	49	5,700
H002	232	0	166	0	114	3,800	20	5,700
Total (L/min)		11,400		17,100		19,000		15,200
FUS RFF in L/min or (L/sec)		6,000 (100)		7,000 (117)		7,000 (117)		6,000 (100)
Meets Requreiment (Yes/No)		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 B9

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			10.0898											1874.40	3.09	18.77		6.32		3.07							10.09	3.33	25.17	300	299.36	0.24	58.96	46.69	0.54	0.66
	MHSA54993	MHSA22037	1015 TWEDDLE RD	3.3567	13.4465					575		431		1006	1710.1	3584.50	2.9	33.69	0.533	6.854	4%	2.22						3.357	13.447	4.44	40.35	375	375	0.21	62.81	79.77	0.51	0.72
	MHSA22037	MHSA22036																														375	375	0.30	43.99	96.03		0.86
	MHSA22036	MHSA22035																															375	0.31	104.40	97.62		0.88
	MHSA22035	MHSA22028																															375	0.30	106.00	96.03		0.86
	MHSA22028	MHSA22027																															375	0.18	11.60	74.39		0.67
	MHSA22027	MHSA22026																														900	900	0.12	90.00	627.11		0.98
				13.447					3	814	334	913	18	2082	3584.5				6.854									13.447							941.13			

Proposed upsized

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 = 0.405092593
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:
Aaditya Jariwala, M.Eng.	1015 Tweddle Road (Formerly 1009 Trim Road)
Checked:	Location:
J. Fitzpatrick, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
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TABLE B10

CALCULATION OF AVERAGE RUNOFF COEFFICIENTS FOR PRE-DEVELOPMENT CONDITIONS

Area No.	Roof Areas C=0.90		Asphalt Areas C=0.90		Concrete / Pavers C=0.90		Gravel C=0.75		Grassed Areas C=0.20		Sum AC	Total Area (m^2)	C_{AVG}
	Area (m^2)	A * C	Area (m^2)	A * C	Area (m^2)	A * C	Area (m^2)	A * C	Area (m^2)	A * C			
Site							4700.00	3525.0	9618.00	1923.60	5448.6	14318.00	0.38

TABLE B11

CALCULATION OF CATCHMENT TIME OF CONCENTRATION FOR PRE-DEVELOPMENT CONDITIONS

Catchment No.	Area (ha)	High Elev (m)	Low Elev (m)	Flow Path Length (m)	Indiv Slope	Avg. C	Time of Conc. Tc (mins)	Description
Site	1.432	48.5	46.2	78.3	2.9	0.38	3.18	See Note 1

Notes

1) For Catchments with Runoff Coefficient less than C=0.40, Time of Concentration Based on Federal Aviation Formula (Airport Method), from

2) For Catchments with Runoff Coefficient greater than C=0.40, Time of Concentration Based on Bransby Williams Equation, from MTO

TABLE B12

CALCULATION OF PEAK RUNOFF FOR PRE-DEVELOPMENT CONDITIONS

Area No	Outlet Location	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr		
				I_2 (mm/hr)	Cavg	Q_2 (L/sec)	I_5 (mm/hr)	Cavg	Q_5 (L/sec)	I_{100} (mm/hr)	Cavg	Q_{100} (L/sec)
Site	Ottawa River	1.432	10	76.81	0.38	116.3	104.19	0.38	157.8	178.56	0.48	338.1

Notes

1) Intensity, $I = 732.951/(Tc+6.199)^{0.810}$ (2-year, City of Ottawa)

2) Intensity, $I = 998.071/(Tc+6.053)^{0.814}$ (5-year, City of Ottawa)

3) Intensity, $I = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

4) Cavg for 100-year is increased by 25% to a maximum of 1.0

5) The standard minimium Time of Concentraion of 10 minutes was used, rather then the calaculted time, since calcualted time was less than 10 minutes.

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			1118.40	1006.6			1006.6	1118	0.90	Tower A roof
S02	Roof Drains			1057.29	951.6			951.6	1057	0.90	Tower B roof
S03	Roof Drains			1212.34	1091.1			1091.1	1212	0.90	Tower C roof
S04	Roof Drains			1159.21	1043.3			1043.3	1159	0.90	Tower D roof
S05	Area Drains	5478.71	4930.8			1444.25	289	5219.7	6923	0.75	Area around Towers A,B,C,D
S06	Area Drains/swales	1220.49	1098.4			1627.31	325	1423.9	2848	0.50	Area below the main deck
Total (All)		6,699	6,029	4,547	4,093	3,072	614	10,736	14,318	0.75	

Notes
1) Areas dericed from CAD to calculate CAVG

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	0.1118	10	0.90	76.81	21.5	(5.9)	0.90	104.19	29.2	(8.0)	1.00	178.56	55.5	(15.1)	Roof Drains	Tower A roof
S02	0.1057	10	0.90	76.81	20.3	(5.9)	0.90	104.19	27.6	(8.0)	1.00	178.56	52.5	(15.1)	Roof Drains	Tower B roof
S03	0.1212	10	0.90	76.81	23.3	(6.6)	0.90	104.19	31.6	(8.9)	1.00	178.56	60.2	(17.0)	Roof Drains	Tower C roof
S04	0.1159	10	0.90	76.81	22.3	(6.6)	0.90	104.19	30.2	(8.9)	1.00	178.56	57.5	(17.0)	Roof Drains	Tower D roof
S05	0.6923	10	0.75	76.81	111.4	111.4	0.75	104.19	151.2	151.2	0.94	178.56	323.9	323.9	Area Drains	Area around Towers A,B,C,D
S06	0.2848	10	0.50	76.81	30.4	30.4	0.50	104.19	41.2	41.2	0.63	178.56	88.4	88.4	Area Drains/swales	Area below the main deck
Total (All)	1.4318				229.2	166.8			311.0	226.2			638.0	476.6		

Notes
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	10.4	14.1	26.7	44.7		Flow Controlled Roof Drains	Tower A roof
S02	5.9	8.0	15.1	9.5	12.8	24.3	42.3		Flow Controlled Roof Drains	Tower B roof
S03	6.6	8.9	17.0	11.1	14.9	28.2	48.5		Flow Controlled Roof Drains	Tower C roof
S04	6.6	8.9	17.0	10.3	13.8	26.2	46.4		Flow Controlled Roof Drains	Tower D roof
S05	111.4	151.2	323.9						none	
S06	30.4	41.2	88.4						none	
Total (All)	166.8	226.2	476.6	41.3	55.6	105.4	181.9			

TABLE B16

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

Area No: TOWER A

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 = 0.1118 (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	46.8	5.9	40.9	0.0	230.5	64.5	8.0	56.5	0.0	398.6	123.9	15.1	108.8	0.0
2	133.3	37.3	5.9	31.4	3.8	182.7	51.1	8.0	43.2	5.2	315.0	97.9	15.1	82.8	9.9
4	111.7	31.3	5.9	25.4	6.1	152.5	42.7	8.0	34.7	8.3	262.4	81.6	15.1	66.4	15.9
6	96.6	27.0	5.9	21.2	7.6	131.6	36.8	8.0	28.9	10.4	226.0	70.3	15.1	55.1	19.8
8	85.5	23.9	5.9	18.1	8.7	116.1	32.5	8.0	24.5	11.8	199.2	61.9	15.1	46.8	22.5
10	76.8	21.5	5.9	15.6	9.4	104.2	29.2	8.0	21.2	12.7	178.6	55.5	15.1	40.4	24.2
12	69.9	19.6	5.9	13.7	9.9	94.7	26.5	8.0	18.5	13.4	162.1	50.4	15.1	35.3	25.4
14	64.2	18.0	5.9	12.1	10.2	86.9	24.3	8.0	16.4	13.8	148.7	46.2	15.1	31.1	26.1
16	59.5	16.7	5.9	10.8	10.4	80.5	22.5	8.0	14.6	14.0	137.5	42.8	15.1	27.6	26.5
18	55.5	15.5	5.9	9.7	10.4	75.0	21.0	8.0	13.0	14.1	128.1	39.8	15.1	24.7	26.7
20	52.0	14.6	5.9	8.7	10.4	70.3	19.7	8.0	11.7	14.0	120.0	37.3	15.1	22.2	26.6
22	49.0	13.7	5.9	7.9	10.4	66.1	18.5	8.0	10.6	13.9	112.9	35.1	15.1	20.0	26.3
24	46.4	13.0	5.9	7.1	10.2	62.5	17.5	8.0	9.5	13.7	106.7	33.2	15.1	18.0	26.0
26	44.0	12.3	5.9	6.5	10.1	59.3	16.6	8.0	8.7	13.5	101.2	31.5	15.1	16.3	25.5
28	41.9	11.7	5.9	5.9	9.9	56.5	15.8	8.0	7.9	13.2	96.3	29.9	15.1	14.8	24.8
30	40.0	11.2	5.9	5.3	9.6	53.9	15.1	8.0	7.1	12.8	91.9	28.6	15.1	13.4	24.2
32	38.3	10.7	5.9	4.9	9.3	51.6	14.4	8.0	6.5	12.5	87.9	27.3	15.1	12.2	23.4
34	36.8	10.3	5.9	4.4	9.0	49.5	13.9	8.0	5.9	12.0	84.3	26.2	15.1	11.1	22.6
36	35.4	9.9	5.9	4.0	8.7	47.6	13.3	8.0	5.4	11.6	81.0	25.2	15.1	10.0	21.7
38	34.1	9.5	5.9	3.7	8.4	45.8	12.8	8.0	4.9	11.1	77.9	24.2	15.1	9.1	20.7
40	32.9	9.2	5.9	3.3	8.0	44.2	12.4	8.0	4.4	10.6	75.1	23.4	15.1	8.2	19.7
Max =					10.4					14.1					26.7

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:	TOWER B	
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 =	0.1057	(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	44.2	5.9	38.4	0.0	230.5	61.0	8.0	53.0	0.0	398.6	117.2	15.1	102.0	0.0
2	133.3	35.3	5.9	29.4	3.5	182.7	48.3	8.0	40.4	4.8	315.0	92.6	15.1	77.4	9.3
4	111.7	29.6	5.9	23.7	5.7	152.5	40.3	8.0	32.4	7.8	262.4	77.1	15.1	62.0	14.9
6	96.6	25.6	5.9	19.7	7.1	131.6	34.8	8.0	26.9	9.7	226.0	66.4	15.1	51.3	18.5
8	85.5	22.6	5.9	16.7	8.0	116.1	30.7	8.0	22.8	10.9	199.2	58.6	15.1	43.4	20.8
10	76.8	20.3	5.9	14.5	8.7	104.2	27.6	8.0	19.6	11.8	178.6	52.5	15.1	37.3	22.4
12	69.9	18.5	5.9	12.6	9.1	94.7	25.1	8.0	17.1	12.3	162.1	47.7	15.1	32.5	23.4
14	64.2	17.0	5.9	11.1	9.3	86.9	23.0	8.0	15.0	12.6	148.7	43.7	15.1	28.6	24.0
16	59.5	15.7	5.9	9.9	9.5	80.5	21.3	8.0	13.3	12.8	137.5	40.4	15.1	25.3	24.3
18	55.5	14.7	5.9	8.8	9.5	75.0	19.8	8.0	11.9	12.8	128.1	37.6	15.1	22.5	24.3
20	52.0	13.8	5.9	7.9	9.5	70.3	18.6	8.0	10.6	12.8	120.0	35.3	15.1	20.1	24.1
22	49.0	13.0	5.9	7.1	9.4	66.1	17.5	8.0	9.5	12.6	112.9	33.2	15.1	18.0	23.8
24	46.4	12.3	5.9	6.4	9.2	62.5	16.5	8.0	8.6	12.4	106.7	31.4	15.1	16.2	23.3
26	44.0	11.6	5.9	5.8	9.0	59.3	15.7	8.0	7.7	12.1	101.2	29.7	15.1	14.6	22.8
28	41.9	11.1	5.9	5.2	8.8	56.5	14.9	8.0	7.0	11.7	96.3	28.3	15.1	13.2	22.1
30	40.0	10.6	5.9	4.7	8.5	53.9	14.3	8.0	6.3	11.4	91.9	27.0	15.1	11.9	21.3
32	38.3	10.1	5.9	4.3	8.2	51.6	13.7	8.0	5.7	10.9	87.9	25.8	15.1	10.7	20.5
34	36.8	9.7	5.9	3.9	7.9	49.5	13.1	8.0	5.1	10.5	84.3	24.8	15.1	9.6	19.6
36	35.4	9.4	5.9	3.5	7.5	47.6	12.6	8.0	4.6	10.0	81.0	23.8	15.1	8.7	18.7
38	34.1	9.0	5.9	3.1	7.2	45.8	12.1	8.0	4.2	9.5	77.9	22.9	15.1	7.8	17.7
40	32.9	8.7	5.9	2.8	6.8	44.2	11.7	8.0	3.7	9.0	75.1	22.1	15.1	6.9	16.7
Max =					9.5					12.8					24.3

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 C

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 = 0.1212 (hectares)

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

Actual Release Rate (L/sec) = 17.0

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) = 17.0

Duration (min)	Release Rate = 6.6 (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 = 8.9 (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 = 17.0 (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	50.7	6.6	44.1	0.0	230.5	69.9	8.9	61.0	0.0	398.6	134.3	17.0	117.3	0.0
3	121.5	36.8	6.6	30.2	5.4	166.1	50.4	8.9	41.4	7.5	286.0	96.4	17.0	79.4	14.3
6	96.6	29.3	6.6	22.7	8.2	131.6	39.9	8.9	31.0	11.1	226.0	76.2	17.0	59.1	21.3
9	80.9	24.5	6.6	17.9	9.7	109.8	33.3	8.9	24.4	13.2	188.3	63.4	17.0	46.4	25.1
12	69.9	21.2	6.6	14.6	10.5	94.7	28.7	8.9	19.8	14.2	162.1	54.6	17.0	37.6	27.1
15	61.8	18.7	6.6	12.1	10.9	83.6	25.3	8.9	16.4	14.8	142.9	48.2	17.0	31.1	28.0
18	55.5	16.8	6.6	10.2	11.1	75.0	22.7	8.9	13.8	14.9	128.1	43.2	17.0	26.1	28.2
21	50.5	15.3	6.6	8.7	11.0	68.1	20.7	8.9	11.7	14.8	116.3	39.2	17.0	22.2	27.9
24	46.4	14.1	6.6	7.5	10.8	62.5	19.0	8.9	10.0	14.4	106.7	36.0	17.0	18.9	27.2
27	43.0	13.0	6.6	6.4	10.4	57.9	17.6	8.9	8.6	13.9	98.7	33.3	17.0	16.2	26.3
30	40.0	12.1	6.6	5.6	10.0	53.9	16.4	8.9	7.4	13.3	91.9	31.0	17.0	13.9	25.1
33	37.5	11.4	6.6	4.8	9.5	50.5	15.3	8.9	6.4	12.6	86.0	29.0	17.0	12.0	23.7
36	35.4	10.7	6.6	4.1	8.9	47.6	14.4	8.9	5.5	11.8	81.0	27.3	17.0	10.3	22.1
39	33.5	10.1	6.6	3.6	8.3	45.0	13.6	8.9	4.7	11.0	76.5	25.8	17.0	8.8	20.5
42	31.8	9.6	6.6	3.0	7.7	42.7	12.9	8.9	4.0	10.1	72.6	24.5	17.0	7.4	18.7
45	30.2	9.2	6.6	2.6	7.0	40.6	12.3	8.9	3.4	9.1	69.1	23.3	17.0	6.2	16.8
48	28.9	8.8	6.6	2.2	6.2	38.8	11.8	8.9	2.8	8.1	65.9	22.2	17.0	5.2	14.9
51	27.6	8.4	6.6	1.8	5.5	37.1	11.3	8.9	2.3	7.1	63.0	21.2	17.0	4.2	12.9
54	26.5	8.0	6.6	1.5	4.7	35.6	10.8	8.9	1.9	6.0	60.4	20.4	17.0	3.3	10.8
57	25.5	7.7	6.6	1.1	3.9	34.2	10.4	8.9	1.4	4.9	58.1	19.6	17.0	2.5	8.7
60	24.6	7.4	6.6	0.9	3.1	32.9	10.0	8.9	1.0	3.8	55.9	18.8	17.0	1.8	6.5
Max =					11.1					14.9					28.2

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:	TOWER D		
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 =	0.1159	(hectares)	
Intensity Incr (%) =	0%	(Use 20% for Climate Change)	

Actual Release Rate (L/sec) =	17.0	
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) =	17.0	

Duration (min)	Release Rate = 6.6 (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 = 8.9 (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 = 17.0 (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	48.5	6.6	41.9	0.0	230.5	66.8	8.9	57.9	0.0	398.6	128.5	17.0	111.4	0.0
2	133.3	38.7	6.6	32.1	3.8	182.7	53.0	8.9	44.0	5.3	315.0	101.5	17.0	84.5	10.1
4	111.7	32.4	6.6	25.8	6.2	152.5	44.2	8.9	35.3	8.5	262.4	84.6	17.0	67.5	16.2
6	96.6	28.0	6.6	21.4	7.7	131.6	38.2	8.9	29.2	10.5	226.0	72.8	17.0	55.8	20.1
8	85.5	24.8	6.6	18.2	8.7	116.1	33.7	8.9	24.7	11.9	199.2	64.2	17.0	47.2	22.6
10	76.8	22.3	6.6	15.7	9.4	104.2	30.2	8.9	21.3	12.8	178.6	57.5	17.0	40.5	24.3
12	69.9	20.3	6.6	13.7	9.8	94.7	27.5	8.9	18.5	13.3	162.1	52.2	17.0	35.2	25.4
14	64.2	18.6	6.6	12.0	10.1	86.9	25.2	8.9	16.3	13.7	148.7	47.9	17.0	30.9	26.0
16	59.5	17.3	6.6	10.7	10.2	80.5	23.3	8.9	14.4	13.8	137.5	44.3	17.0	27.3	26.2
18	55.5	16.1	6.6	9.5	10.3	75.0	21.7	8.9	12.8	13.8	128.1	41.3	17.0	24.2	26.2
20	52.0	15.1	6.6	8.5	10.2	70.3	20.4	8.9	11.4	13.7	120.0	38.7	17.0	21.6	25.9
22	49.0	14.2	6.6	7.6	10.1	66.1	19.2	8.9	10.2	13.5	112.9	36.4	17.0	19.3	25.5
24	46.4	13.5	6.6	6.9	9.9	62.5	18.1	8.9	9.2	13.2	106.7	34.4	17.0	17.3	25.0
26	44.0	12.8	6.6	6.2	9.6	59.3	17.2	8.9	8.3	12.9	101.2	32.6	17.0	15.6	24.3
28	41.9	12.2	6.6	5.6	9.4	56.5	16.4	8.9	7.4	12.5	96.3	31.0	17.0	14.0	23.5
30	40.0	11.6	6.6	5.0	9.0	53.9	15.6	8.9	6.7	12.1	91.9	29.6	17.0	12.6	22.6
32	38.3	11.1	6.6	4.5	8.7	51.6	15.0	8.9	6.0	11.6	87.9	28.3	17.0	11.3	21.7
34	36.8	10.7	6.6	4.1	8.3	49.5	14.4	8.9	5.4	11.0	84.3	27.2	17.0	10.1	20.6
36	35.4	10.3	6.6	3.7	7.9	47.6	13.8	8.9	4.9	10.5	81.0	26.1	17.0	9.1	19.6
38	34.1	9.9	6.6	3.3	7.5	45.8	13.3	8.9	4.3	9.9	77.9	25.1	17.0	8.1	18.4
40	32.9	9.5	6.6	2.9	7.0	44.2	12.8	8.9	3.9	9.3	75.1	24.2	17.0	7.2	17.2
Max =					10.3					13.8					26.2

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)

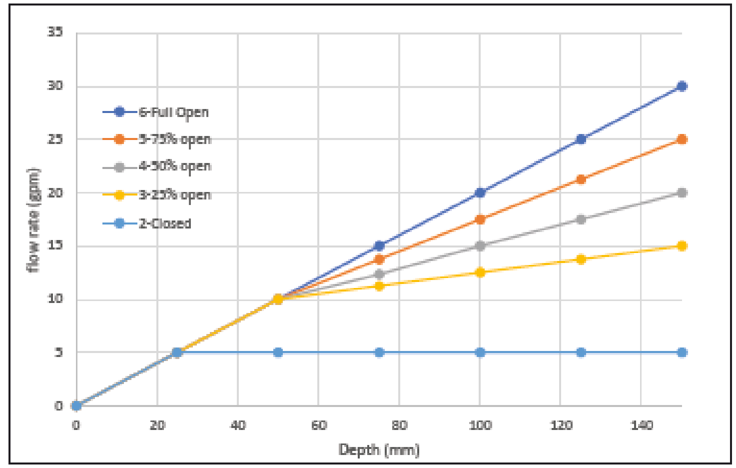
100 year Intensity	$= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$
50 year Intensity	$= 1569.580 / (\text{Time in min} + 6.014)^{0.820}$
25 year Intensity	$= 1402.884 / (\text{Time in min} + 6.018)^{0.819}$
10 year Intensity	$= 1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 year Intensity	$=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

TABLE B20
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER A

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 A	
Total Roof Area (m2)	1118	
Minimium Number of Drains Required	1.2	*Minimum 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)	25,723	
Max Permitted Load from All Drains (L/sec)	28.6	*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	8	*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)	895	
Area per Drain (m2)	112	*Based on Effective Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	150	
Estimated Total Volume for Ponding on Roof (m3)	55.9	*Prism 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	0.27	*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	3.1	0.0	0.2
0.05	10	0.63	0.00505	0.05	12.4	0.2	1.7
0.075	15	0.95	0.00757	0.075	28.0	0.7	5.6
0.1	20	1.26	0.01009	0.1	49.7	1.7	13.3
0.125	25	1.58	0.01262	0.125	77.7	3.2	25.9
0.15	30	1.89	0.01514	0.15	111.8	5.6	44.7
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

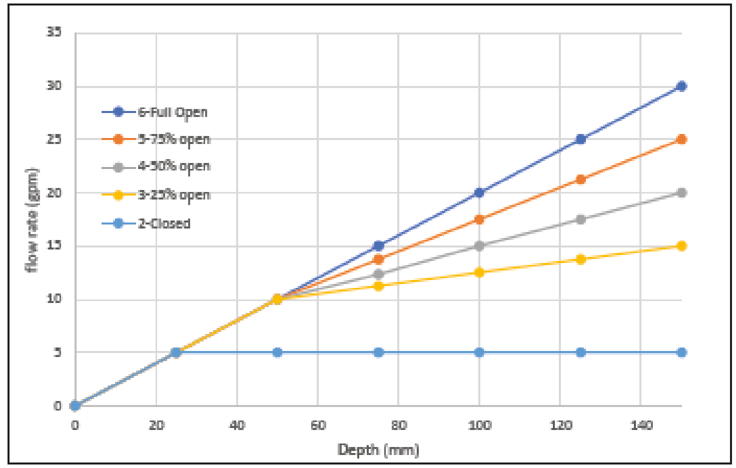
Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	3.1
0.05	12.4
0.075	28.0
0.1	49.7
0.125	77.7
0.15	111.8

TABLE B21
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER B

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 B	
Total Roof Area (m2)	1057	
Minimum Number of Drains Required	1.2	*Minimum 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)	24,318	
Max Permitted Load from All Drains (L/sec)	27.0	*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	8	*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)	846	
Area per Drain (m2)	106	*Based on Effective Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	150	
Estimated Total Volume for Ponding on Roof (m3)	52.9	*Prism 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	0.29	*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	2.9	0.0	0.2
0.05	10	0.63	0.00505	0.05	11.7	0.2	1.6
0.075	15	0.95	0.00757	0.075	26.4	0.7	5.3
0.1	20	1.26	0.01009	0.1	47.0	1.6	12.5
0.125	25	1.58	0.01262	0.125	73.4	3.1	24.5
0.15	30	1.89	0.01514	0.15	105.7	5.3	42.3
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	2.9
0.05	11.7
0.075	26.4
0.1	47.0
0.125	73.4
0.15	105.7

TABLE B22
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER C

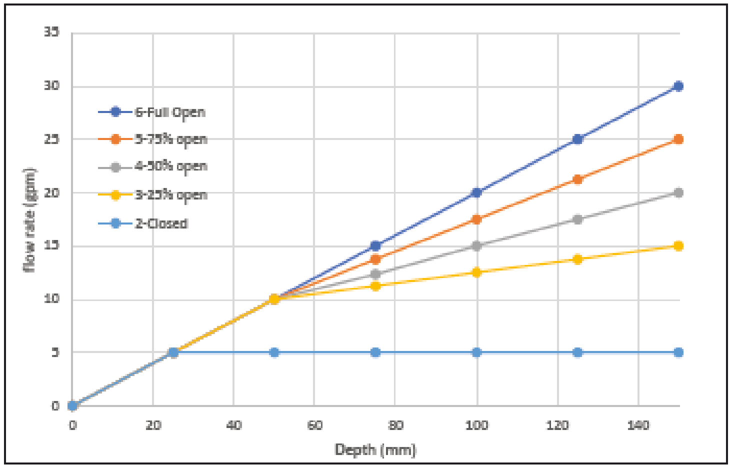
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

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 C	
Total Roof Area (m2)	1212	
Minimum Number of Drains Required	1.3	*Minimum 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)	27,884	
Max Permitted Load from All Drains (L/sec)	31.0	*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	9	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	9	*Use if known*
Effecive Roof Percentage (%)	80%	*NO Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	970	
Area per Drain (m2)	108	*Based on Effective Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	150	
Estimated Total Volume for Ponding on Roof (m3)	60.6	*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)	17.0	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.28	*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	0.00284	0.025	3.0	0.0	0.2
0.05	10	0.63	0.00568	0.05	12.0	0.2	1.8
0.075	15	0.95	0.00852	0.075	26.9	0.7	6.1
0.1	20	1.26	0.01136	0.1	47.9	1.6	14.4
0.125	25	1.58	0.01420	0.125	74.8	3.1	28.1
0.15	30	1.89	0.01703	0.15	107.8	5.4	48.5
Weir Position =	6-Full Open						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outlfow (L/sec)
0	0.0000
0.025	2.8391
0.05	5.6781
0.075	8.5172
0.1	11.3562
0.125	14.1953
0.15	17.0344

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	3.0
0.05	12.0
0.075	26.9
0.1	47.9
0.125	74.8
0.15	107.8

TABLE B23
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER D

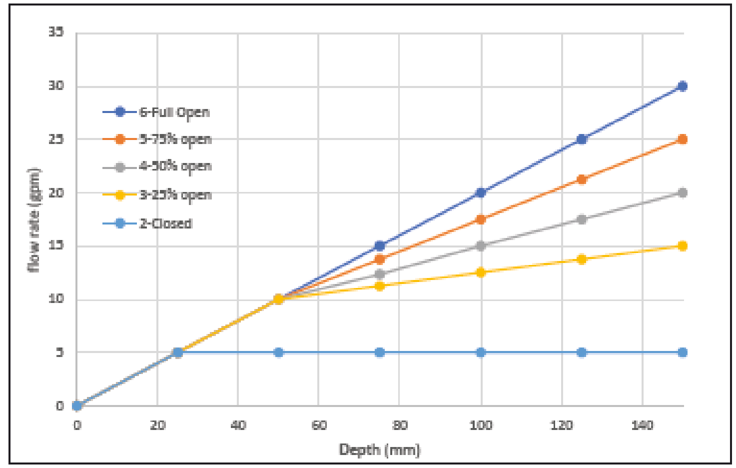
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

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 D	
Total Roof Area (m2)	1159	
Minimum Number of Drains Required	1.3	*Minimum 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)	26,662	
Max Permitted Load from All Drains (L/sec)	29.6	*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	9	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	9	*Use if known*
Effecive Roof Percentage (%)	80%	*NO Allowance for Mechanical units on this roof*
Effecive Total Roof Area (m2)	927	
Area per Drain (m2)	103	*Based on Effective Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	150	
Estimated Total Volume for Ponding on Roof (m3)	58.0	*Prism 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)	17.0	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.30	*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	0.00284	0.025	2.9	0.0	0.2
0.05	10	0.63	0.00568	0.05	11.4	0.2	1.7
0.075	15	0.95	0.00852	0.075	25.8	0.6	5.8
0.1	20	1.26	0.01136	0.1	45.8	1.5	13.7
0.125	25	1.58	0.01420	0.125	71.6	3.0	26.8
0.15	30	1.89	0.01703	0.15	103.0	5.2	46.4
Weir Position =	6-Full Open						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outflow (L/sec)
0	0.0000
0.025	2.8391
0.05	5.6781
0.075	8.5172
0.1	11.3562
0.125	14.1953
0.15	17.0344

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	2.9
0.05	11.4
0.075	25.8
0.1	45.8
0.125	71.6
0.15	103.0

Appendix C – Manufacturers Information

Watts ACCUTROL Flow Control Specification

Stormceptor Sizing Report

Stormceptor EF Brochure

Stormceptor EF6 Detail

WATTS	**Adjustable Accutrol Weir** Tag: ______________	**Adjustable Flow Control for Roof Drains**

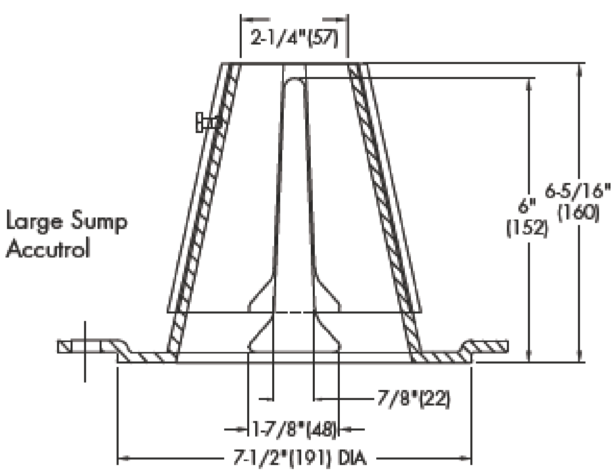
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

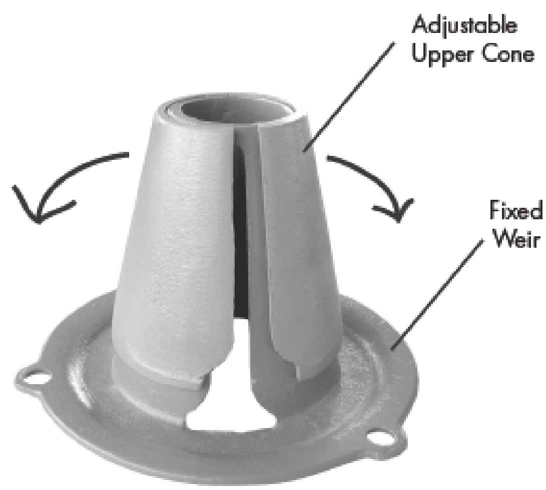
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the 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 ______________________

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STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/11/2022

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	1015 Tweddle Road
Drainage Area (ha):	1.147
Runoff Coefficient 'c':	0.81
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	29.99
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	388.20
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	1015 Tweddle Road
Project Number:	259629
Designer Name:	Aaditya Jariwala
Designer Company:	EXP Inc
Designer Email:	aaditya.jariwala@exp.com
Designer Phone:	613-816-5961
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	78
EF6	87
EF8	92
EF10	95
EF12	97

Recommended Stormceptor EF Model:	**EF6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**87**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

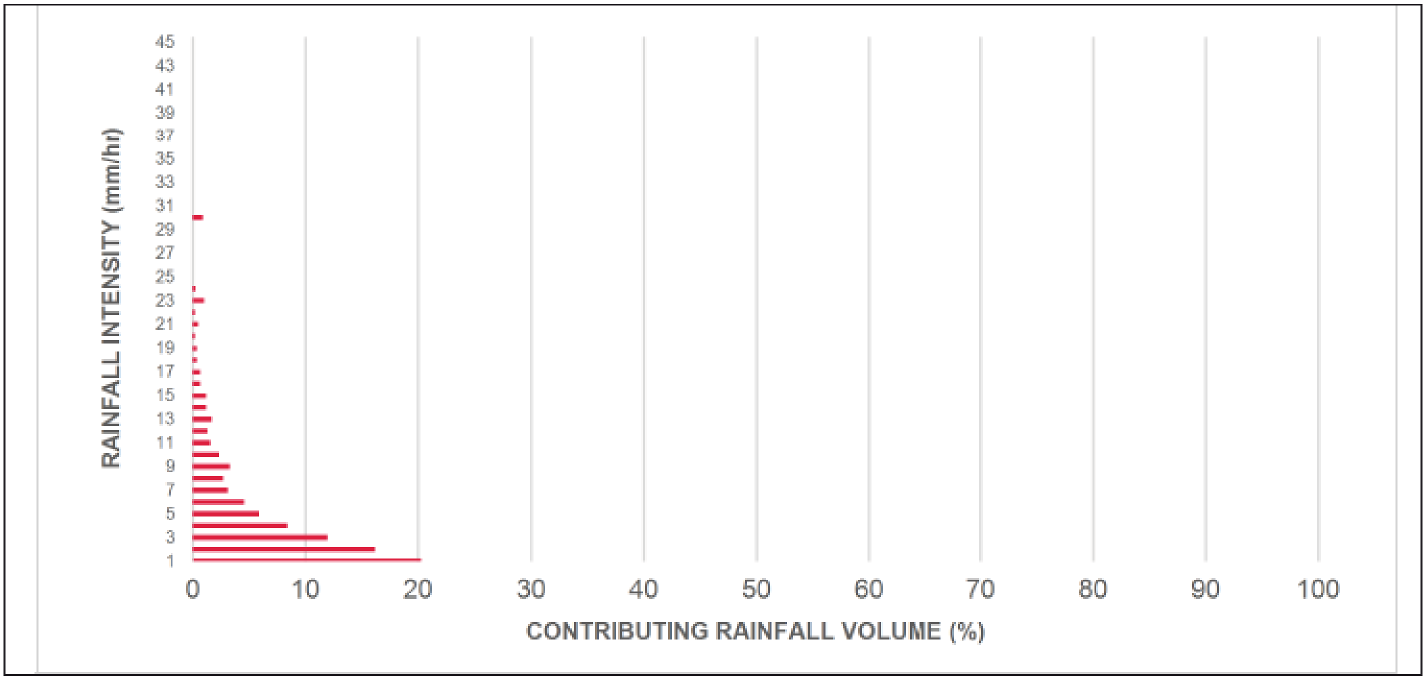
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor EF Sizing Report

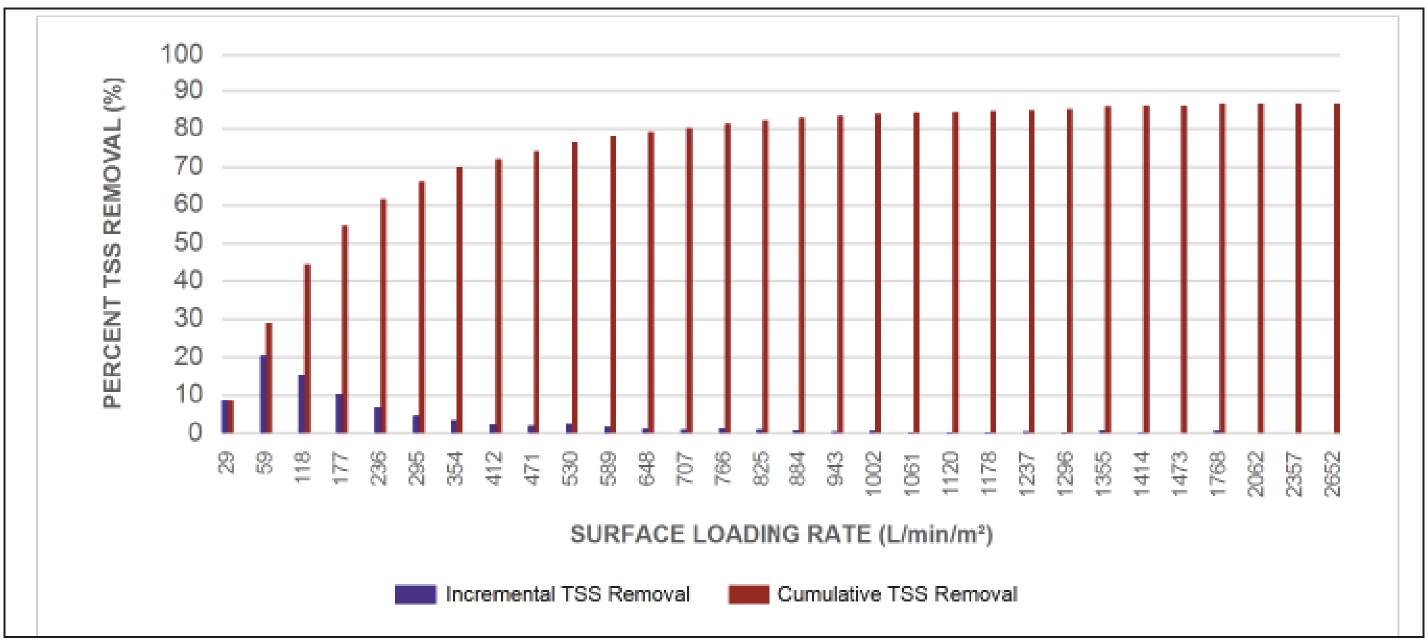
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.6	8.6	1.29	77.0	29.0	100	8.6	8.6
1	20.3	29.0	2.58	155.0	59.0	100	20.3	29.0
2	16.2	45.2	5.17	310.0	118.0	95	15.3	44.3
3	12.0	57.2	7.75	465.0	177.0	87	10.4	54.7
4	8.4	65.6	10.33	620.0	236.0	82	6.9	61.6
5	5.9	71.6	12.91	775.0	295.0	79	4.7	66.3
6	4.6	76.2	15.50	930.0	354.0	76	3.5	69.9
7	3.1	79.3	18.08	1085.0	412.0	74	2.3	72.1
8	2.7	82.0	20.66	1240.0	471.0	73	2.0	74.1
9	3.3	85.3	23.25	1395.0	530.0	72	2.4	76.5
10	2.3	87.6	25.83	1550.0	589.0	71	1.6	78.1
11	1.6	89.2	28.41	1705.0	648.0	70	1.1	79.2
12	1.3	90.5	30.99	1860.0	707.0	70	0.9	80.2
13	1.7	92.2	33.58	2015.0	766.0	70	1.2	81.4
14	1.2	93.5	36.16	2170.0	825.0	69	0.8	82.2
15	1.2	94.6	38.74	2325.0	884.0	69	0.8	83.0
16	0.7	95.3	41.33	2480.0	943.0	68	0.5	83.5
17	0.7	96.1	43.91	2634.0	1002.0	68	0.5	84.0
18	0.4	96.5	46.49	2789.0	1061.0	69	0.3	84.2
19	0.4	96.9	49.07	2944.0	1120.0	70	0.3	84.5
20	0.2	97.1	51.66	3099.0	1178.0	71	0.2	84.7
21	0.5	97.5	54.24	3254.0	1237.0	72	0.3	85.0
22	0.2	97.8	56.82	3409.0	1296.0	73	0.2	85.2
23	1.0	98.8	59.40	3564.0	1355.0	74	0.7	85.9
24	0.3	99.1	61.99	3719.0	1414.0	75	0.2	86.1
25	0.0	99.1	64.57	3874.0	1473.0	72	0.0	86.1
30	0.9	100.0	77.48	4649.0	1768.0	60	0.6	86.7
35	0.0	100.0	90.40	5424.0	2062.0	51	0.0	86.7
40	0.0	100.0	103.31	6199.0	2357.0	45	0.0	86.7
45	0.0	100.0	116.23	6974.0	2652.0	41	0.0	86.7
Estimated Net Annual Sediment (TSS) Load Reduction =								**87 %**

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

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

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

SCOUR PREVENTION AND ONLINE CONFIGURATION

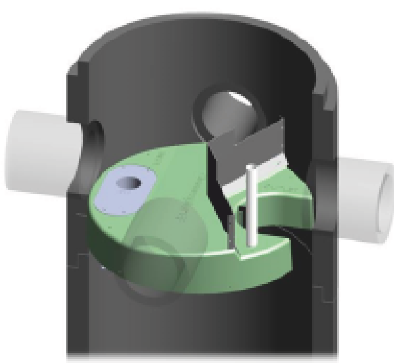
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

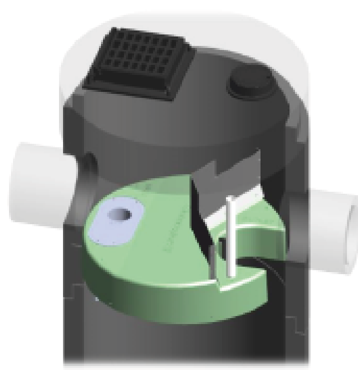
DESIGN FLEXIBILITY

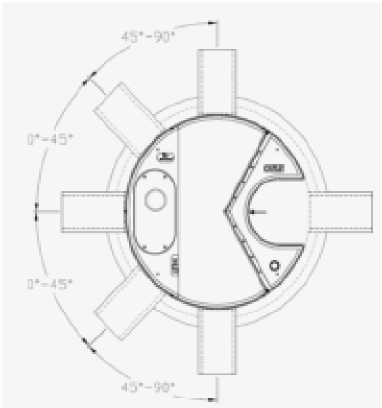
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

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

Pollutant Capacity

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

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

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

PART 1 – GENERAL

1.1 WORK INCLUDED

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

1.2 REFERENCE STANDARDS & PROCEDURES

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

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

1.3 SUBMITTALS

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

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

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

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

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

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

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

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

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

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

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

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

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

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

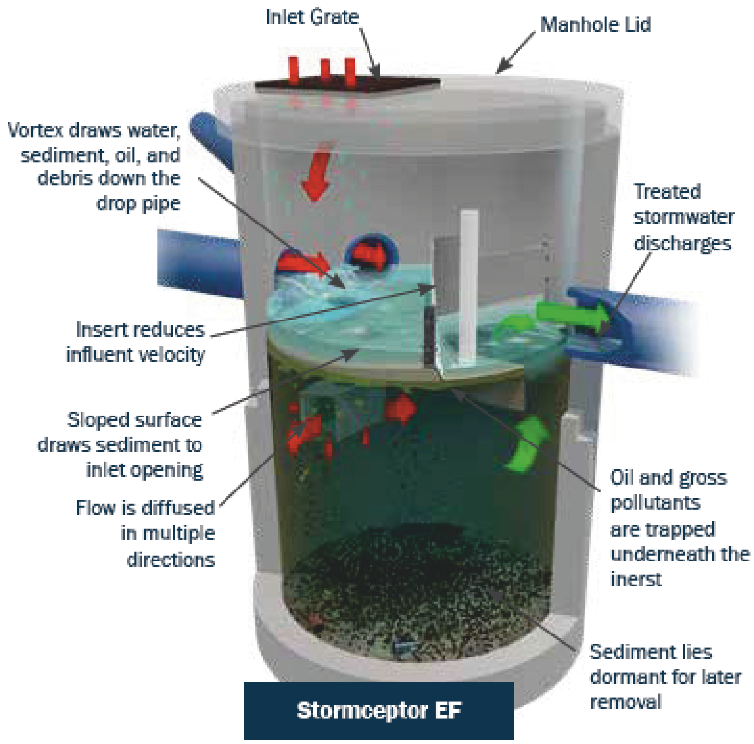
- Sediment (TSS) removal
- Hydrocarbon control and hotspots (Stormceptor EF)
- Debris and small floatables capture
- Pretreatment for filtration, detention/retention systems, ponds, wetlands, and bioretention
- Retrofit and redevelopment projects

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.

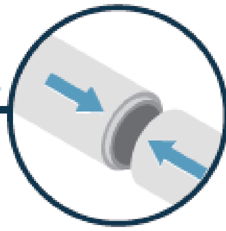


* Fiberglass system is an option

Stormceptor® EF Features & Benefits

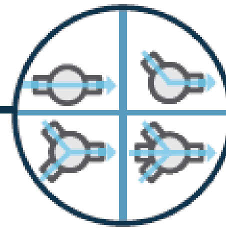
EASY TO INSTALL

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.

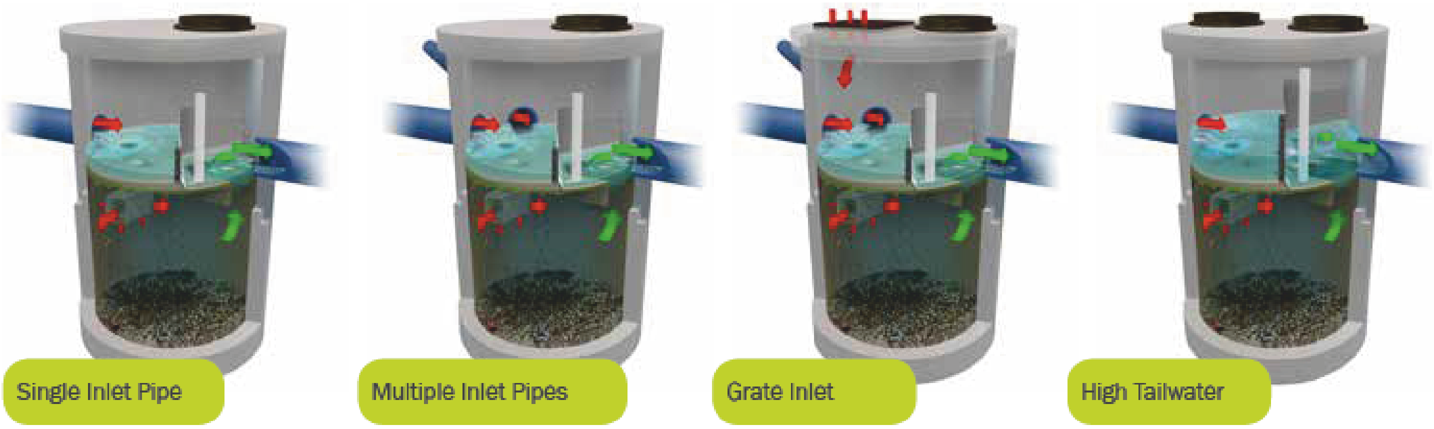


FLEXIBLE

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



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.

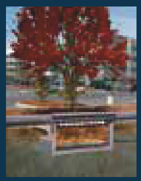
Stormceptor® Inspection & Maintenance

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.

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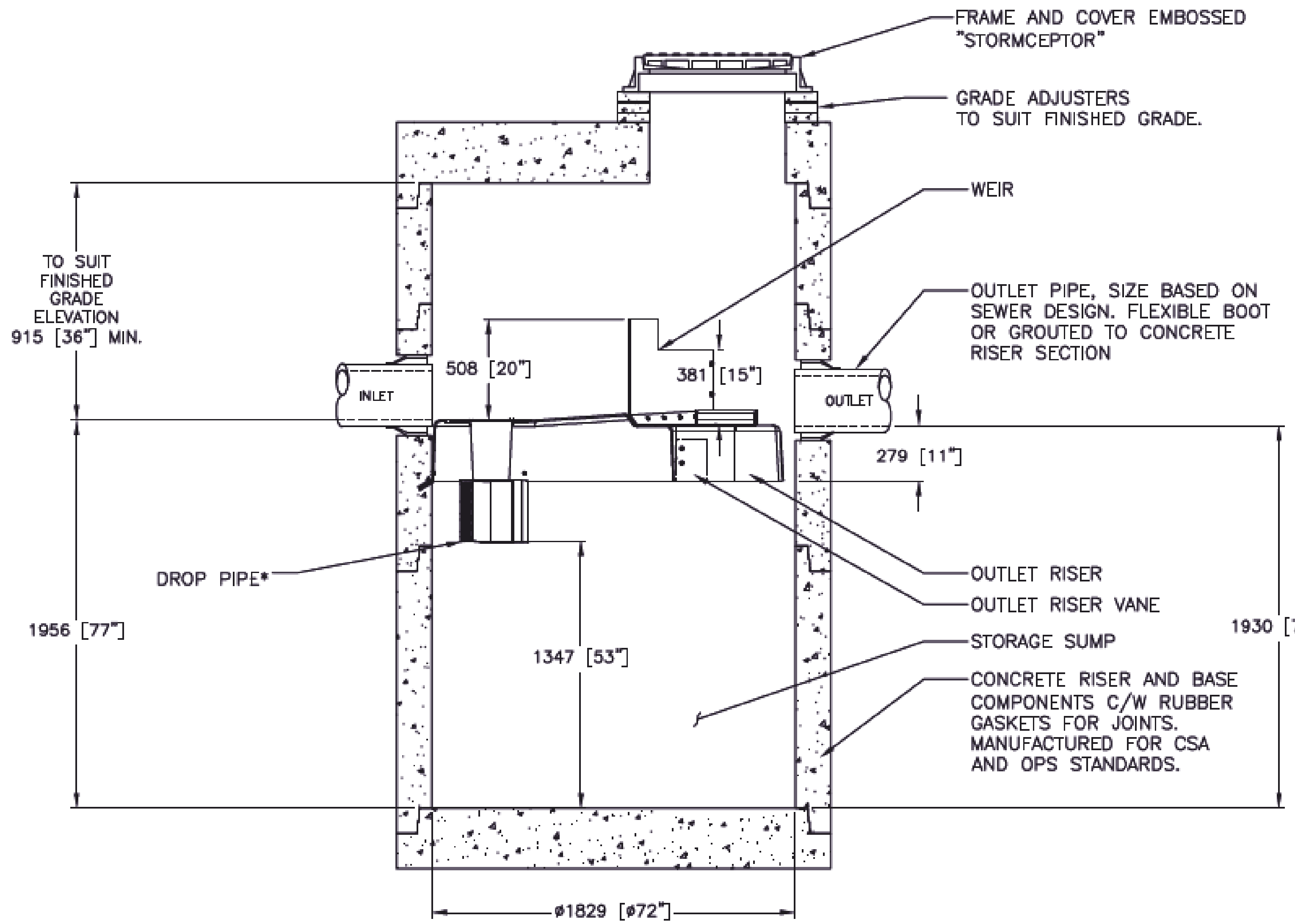
www.imbriumsystems.com

Imbrium® Systems is an engineered stormwater treatment company that designs and manufactures stormwater treatment solutions that protect water resources from harmful pollutants. By developing technologies to address the long-term impact of urban runoff, Imbrium ensures our clients' projects are compliant with government water quality regulations. For information, visit www.imbriumsystems.com or call +1 416-960-9900.

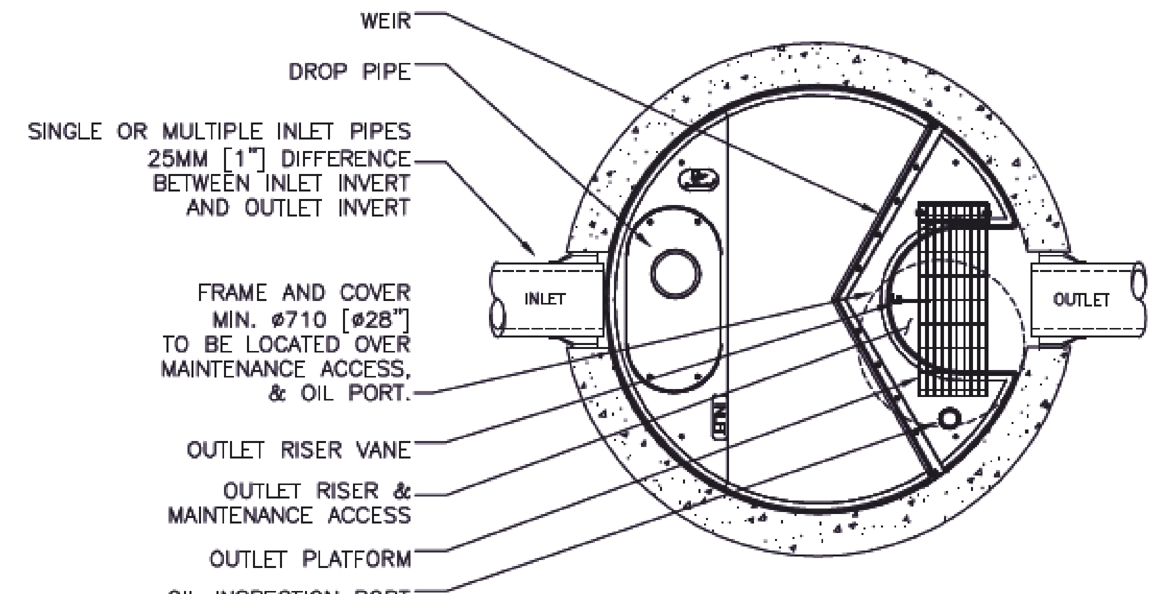
Get Social With Us!

IB-Stormceptor EF Bro 5/19 PDF

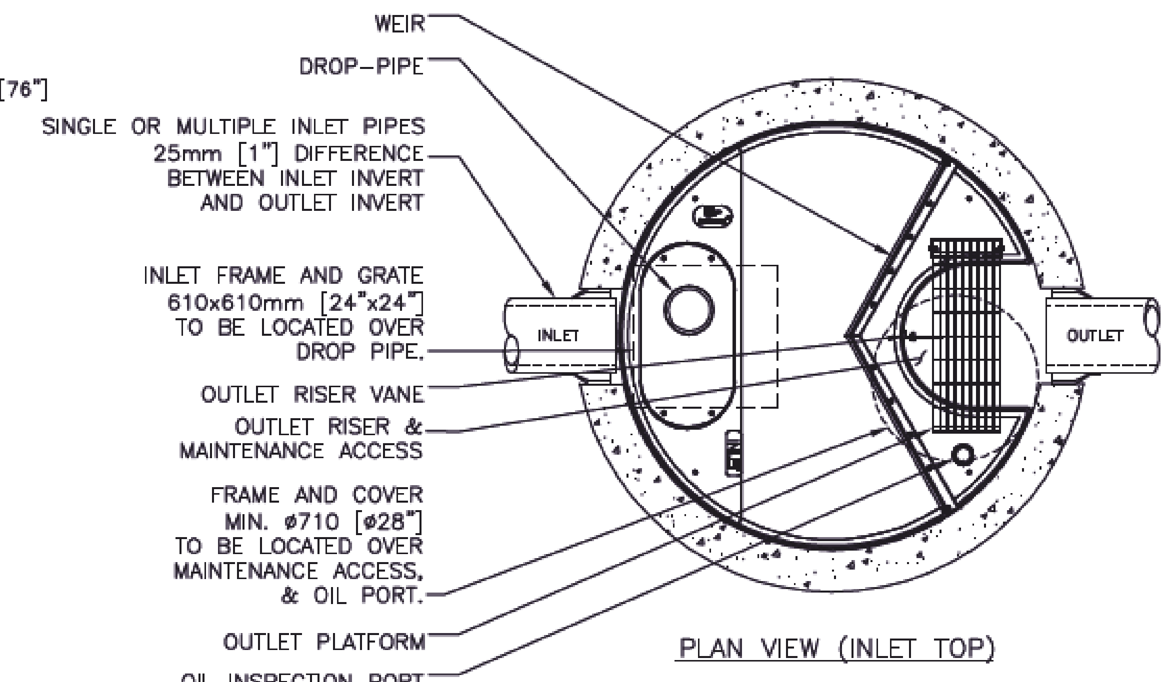
DRAWING NOT TO BE USED FOR CONSTRUCTION



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.

INSTALLATION NOTES

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

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

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF6				
STRUCTURE ID	*				
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

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

Stormceptor® EF

SCALE = NTS

imbrium

DATE: 5/26/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EF6	SEQUENCE No.: *
SHEET: 1 OF 1	

Appendix D – Consultation / Correspondence

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

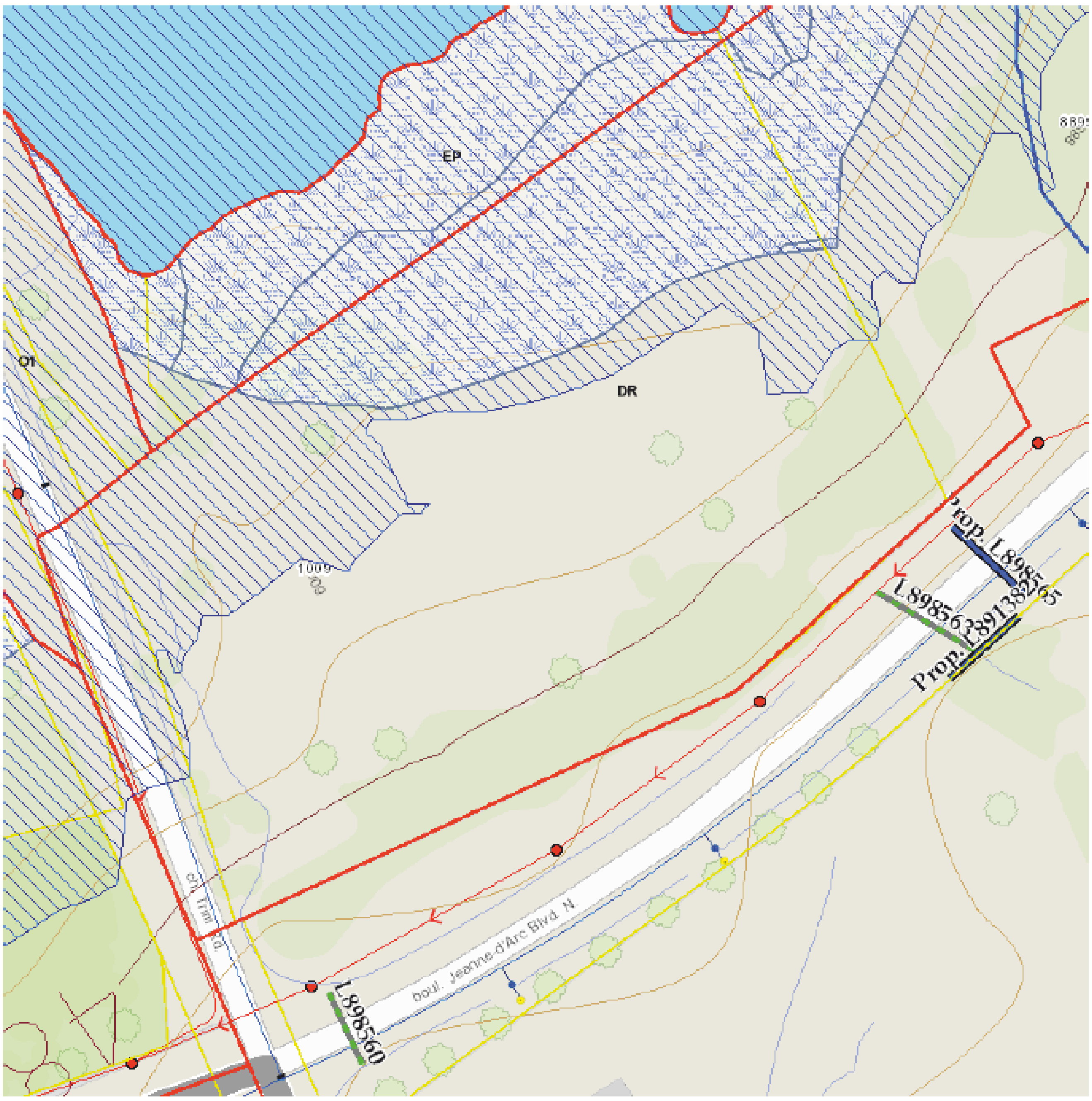
Email from City of Ottawa on Water System Boundary Conditions

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 (11x17) (21 Pages)

TOTAL SITE AREA:	33,567 sq.m	361,311 SF
SITE AREA ABOVE 30m FROM WETLAND BUFFER	12,342 sq.m	132,848 SF
AREA GIVEN TO CITY OF OTTAWA:	1,371 sq.m	14,752 SF
CITY AREA ACQUIRED:	1,450 sq.m	15,609 SF
SITE COVERAGE (BUILT-UP PARKING):	11,242 sq.m	121,011 SF
BUILDING FOOTPRINTS:	4,477 sq.m	48,188 SF

PARKING SPOTS PROVIDED:	829
PARKING/UNIT:	0.82
BIKES:	714
BIKES/UNIT:	0.71
TOTAL COMMERCIAL AREA:	37,510 SF
TOTAL OFFICE AREA:	19,850 SF

BUILDING A - 28 STOREYS	GFA	BALCONY + GFA	UNITS/FLOOR
L1	11,867 SF		0
L2	11,087 SF	12,030 SF	0
L3-4	11,087 SF	12,030 SF	11
L5	8,108 SF	11,597 SF	9
L6-28	8,108 SF	10,026 SF	9
TOTAL	**239,720 SF**	**290,162 SF**	**238**

BUILDING B - 32 STOREYS	GFA	BALCONY + GFA	UNITS/FLOOR
L1	11,200 SF		0
L2	10,539 SF	11,364 SF	0
L3-6	10,539 SF	11,364 SF	11
L7	8,108 SF	10,959 SF	9
L8-32	8,108 SF	10,026 SF	9
TOTAL	**274,703 SF**	**329,639 SF**	**278**

BUILDING C - 28 STOREYS	GFA	BALCONY + GFA	UNITS/FLOOR
L1	12,897 SF		0
L2-3	12,124 SF	13,067 SF	12
L4	11,642 SF	12,919 SF	12
L5	8,348 SF	11,992 SF	9
L6-26	8,348 SF	10,102 SF	9
L27	7,825 SF	9,402 SF	9
L28	7,301 SF	8,737 SF	8
TOTAL	**271,815 SF**	**282,446 SF**	**275**

BUILDING D - 24 STOREYS	GFA	BALCONY + GFA	UNITS/FLOOR
L1	12,224 SF		0
L2-3	11,586 SF	12,481 SF	12
L4	11,231 SF	12,388 SF	12
L5	8,348 SF	11,588 SF	9
L6-22	8,348 SF	10,102 SF	9
L23	7,825 SF	9,403 SF	9
L24	7,301 SF	8,738 SF	8
TOTAL	**212,018 SF**	**251,030 SF**	**215**

TOTAL GFA	TOTAL UNITS
998,256 SF	1006

PARKING - 3 LEVELS	PARKING	BIKES
P1	255	714
P2	287	
P3	287	
TOTAL	**829**	**714**

rla / architecture

CONTEXT PLAN

SCALE: 1 : 2000

DATE: 2022/07/12

OTTAWA **1009 TRIM ROAD** ONTARIO

K4A 3P4

SHEET #

D001

PROJ. No. 2017

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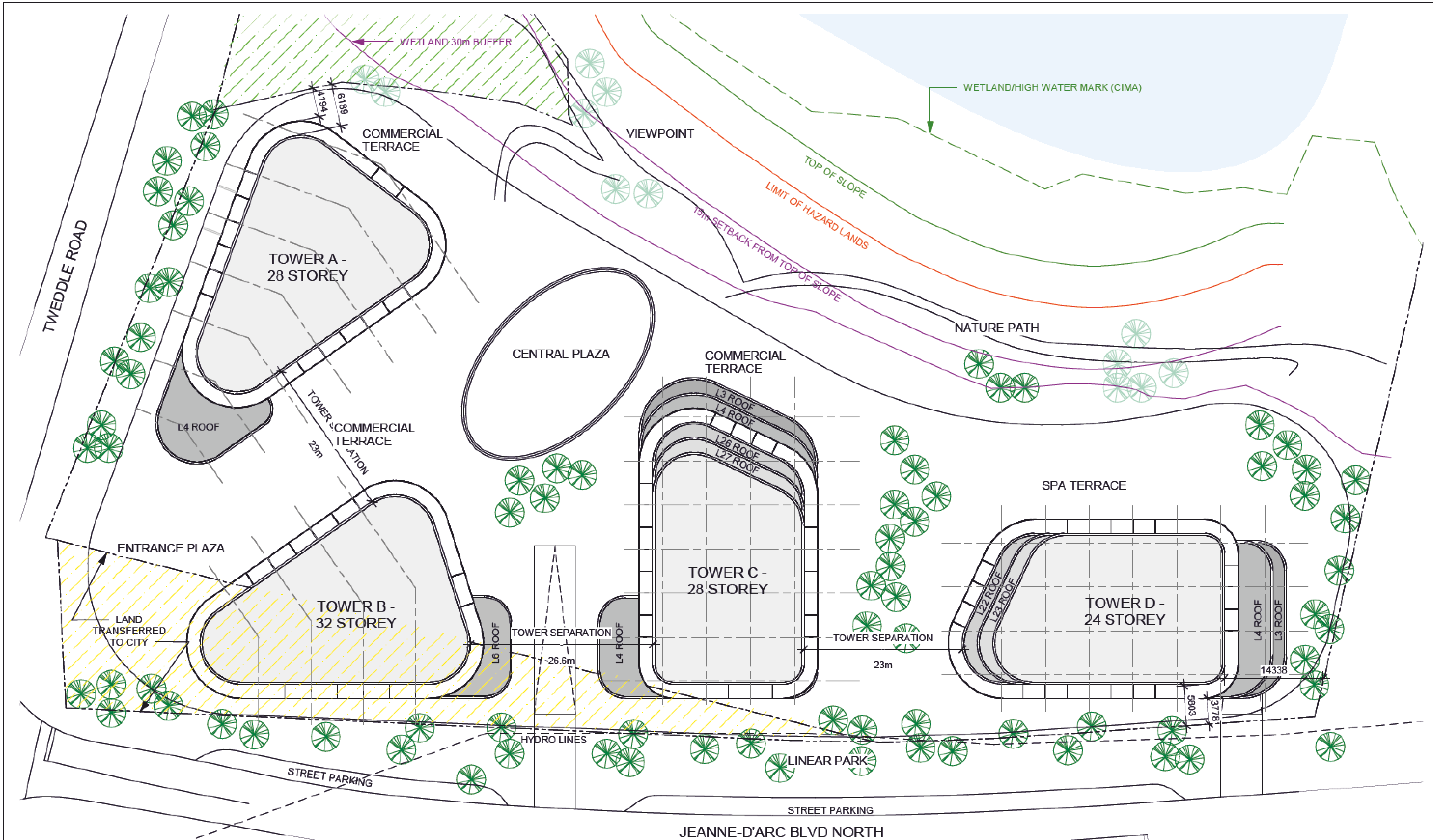

rla / architecture

SITE PLAN

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D010

PROJ. No. 2017

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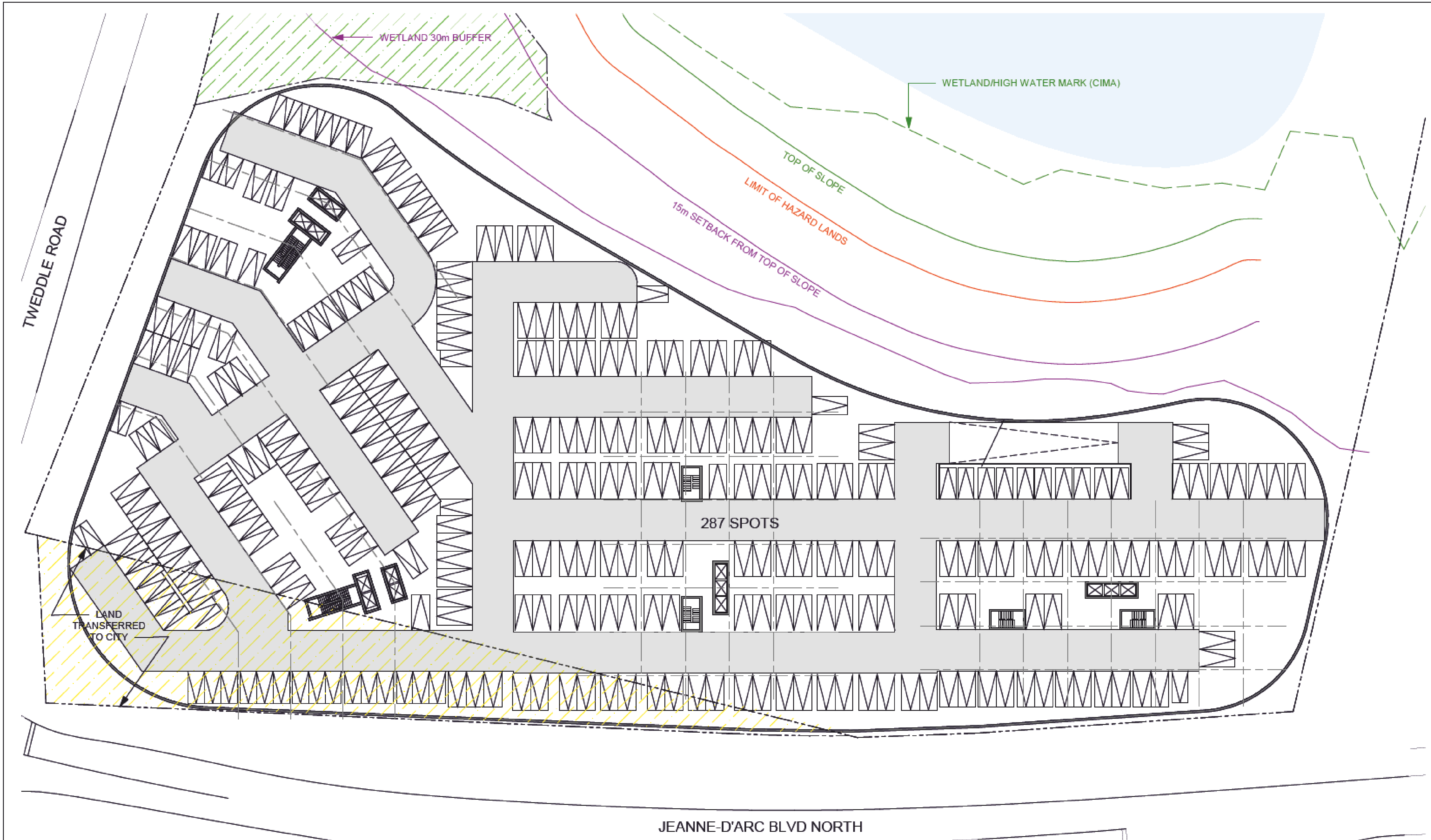

rla / architecture

P2-P3 PLAN

SCALE: 1 : 500

DATE: 2022/07/12

OTTAWA 1009 TRIM ROAD ONTARIO

K4A 3P4

SHEET #

D101

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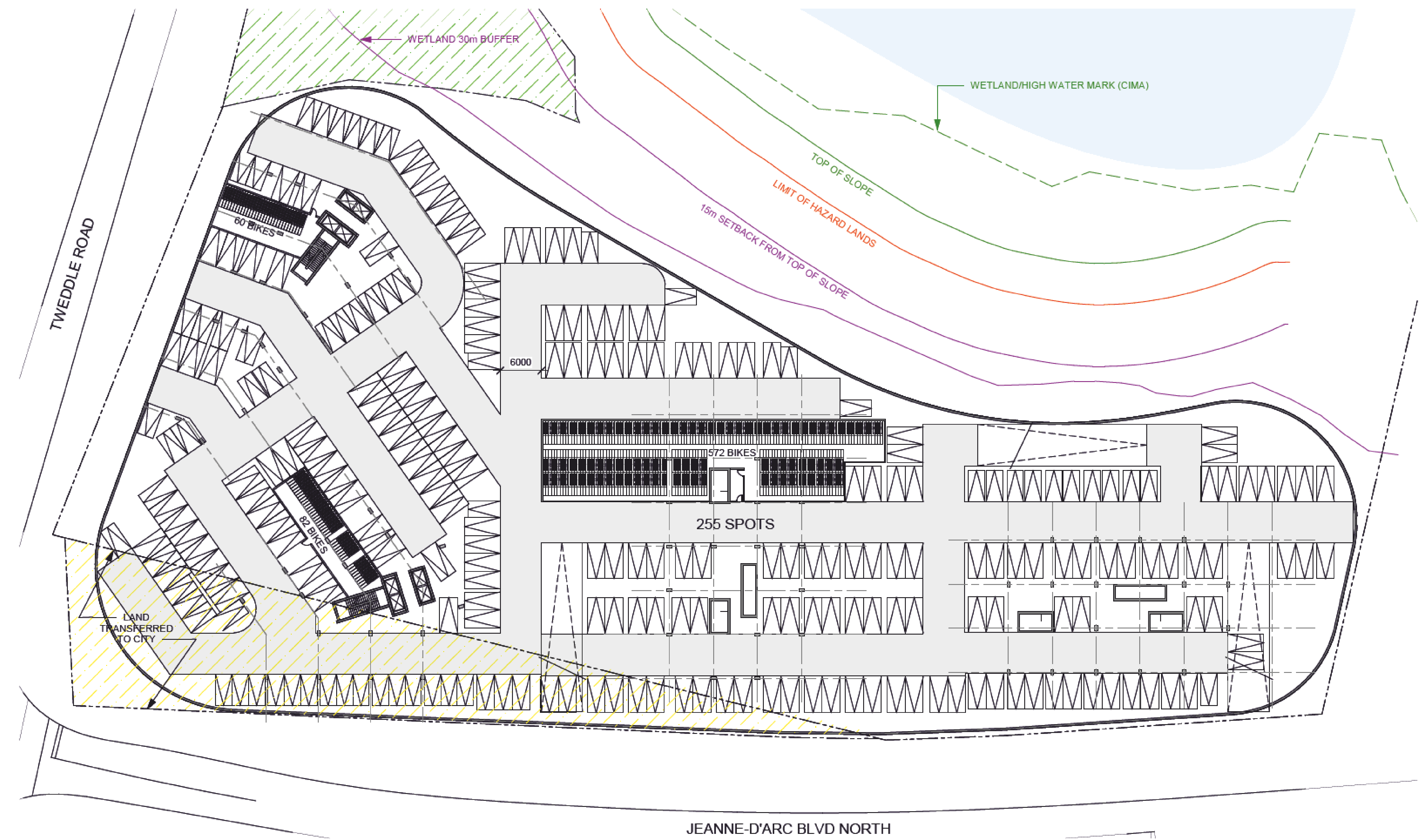

rla/architecture

P1 PLAN

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D102

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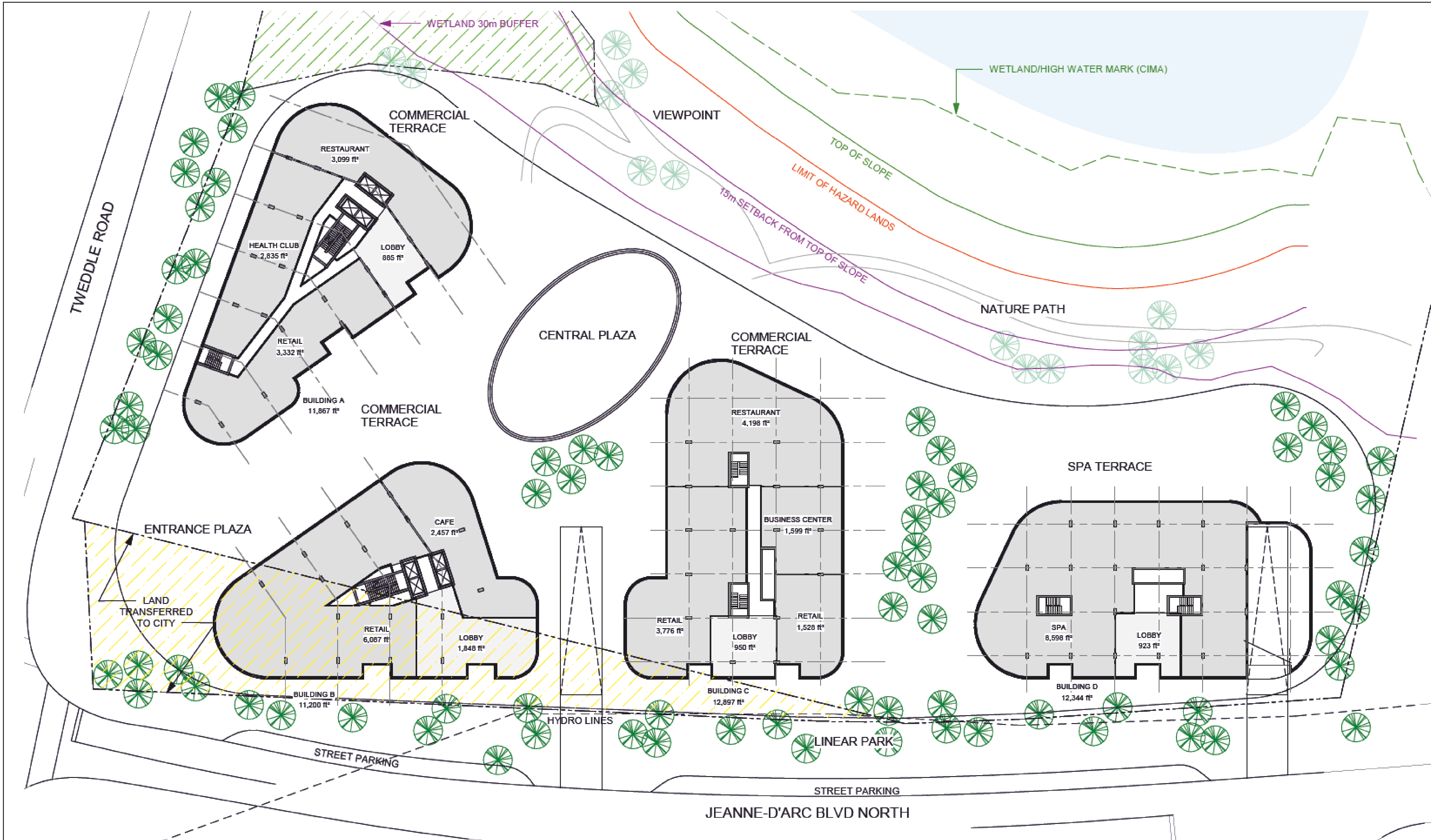

rla / architecture

GROUND FLOOR PLAN

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D103

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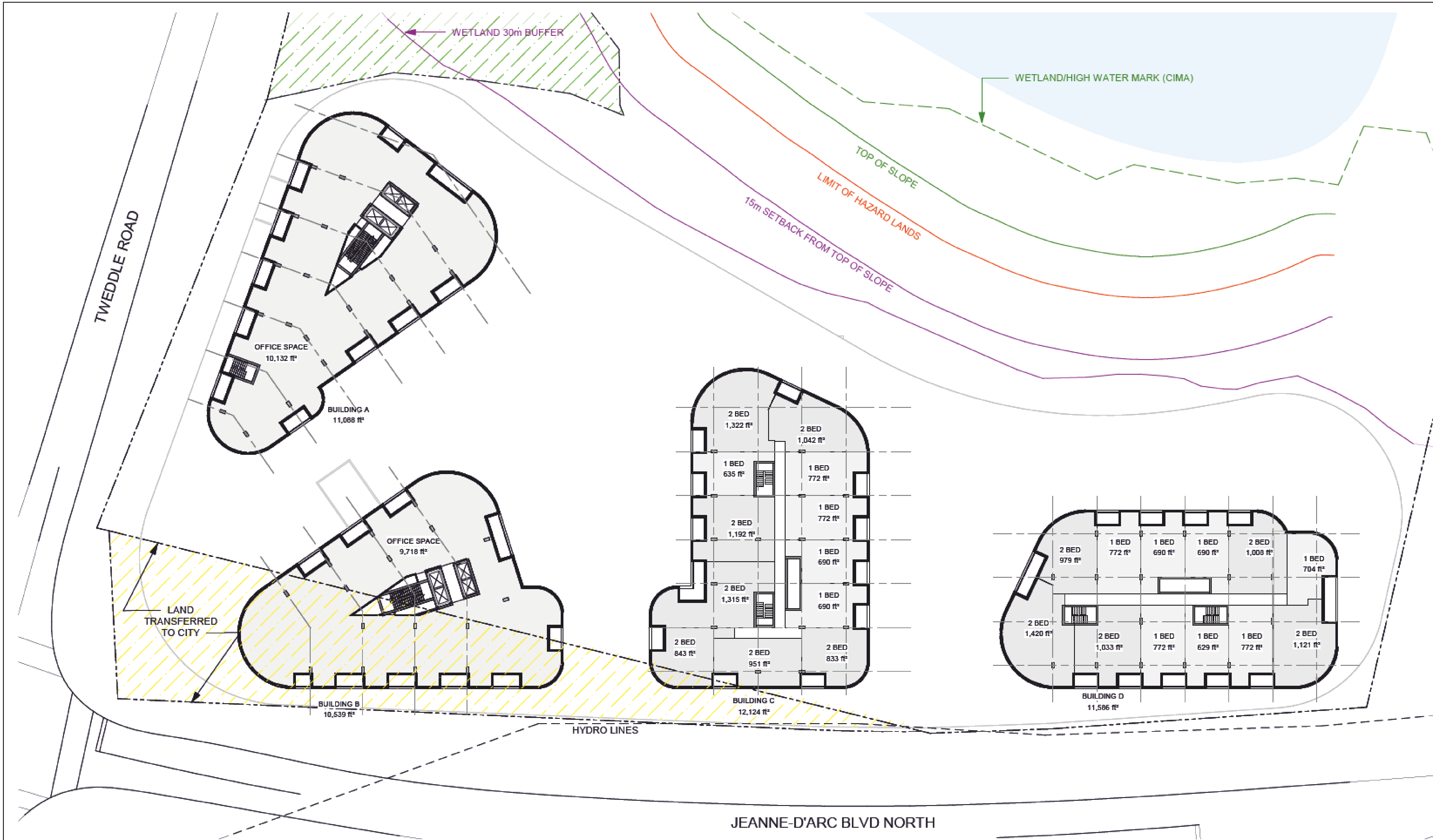

rla / architecture

L2 PLAN

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D104

PROJ. No. 2017

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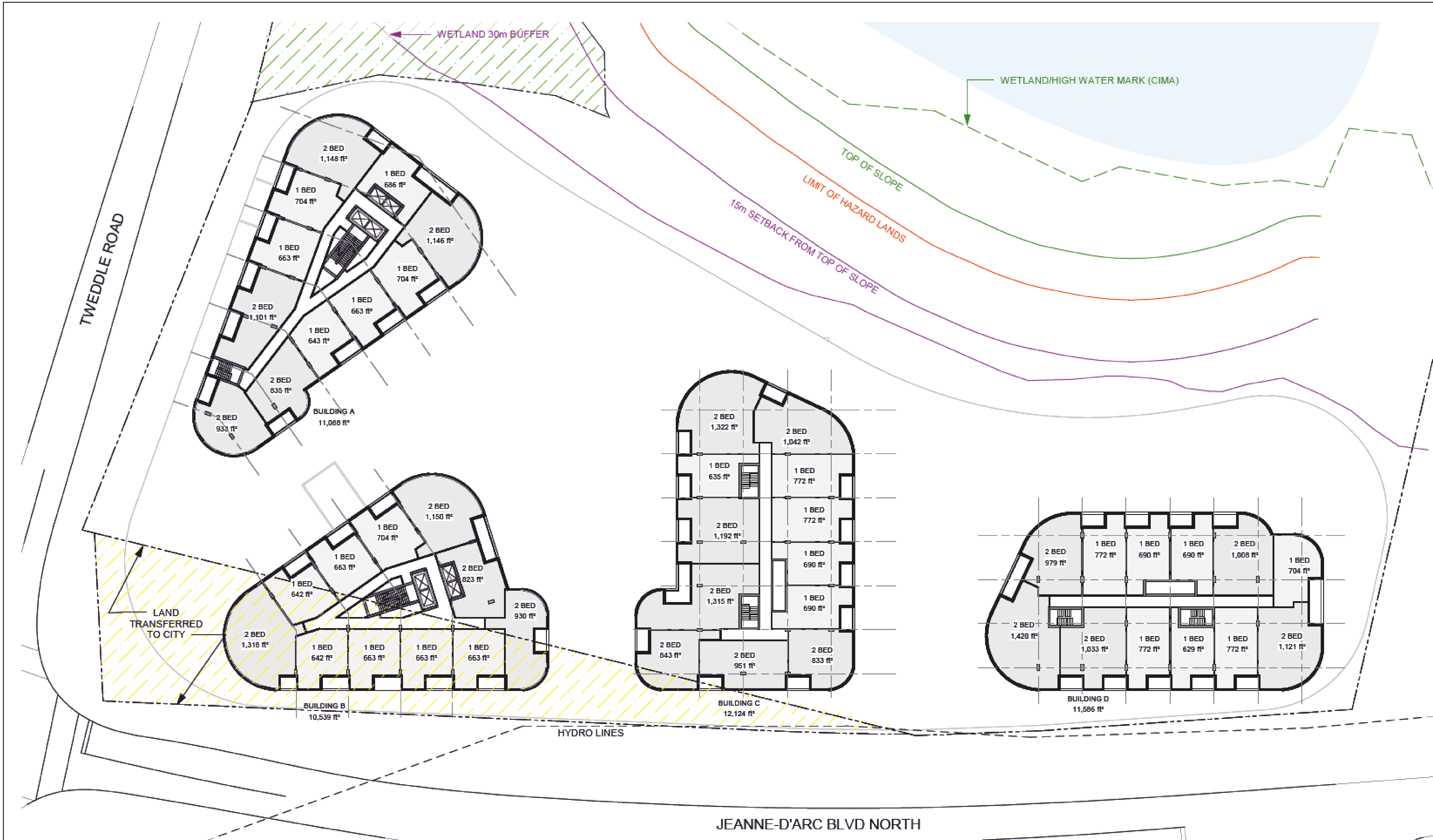

rla / architecture

PODIUM PLAN

SCALE: 1 : 500

DATE: 2022/07/12

OTTAWA **1009 TRIM ROAD** ONTARIO

K4A 3P4

SHEET #

D105

PROJ. No. 2017

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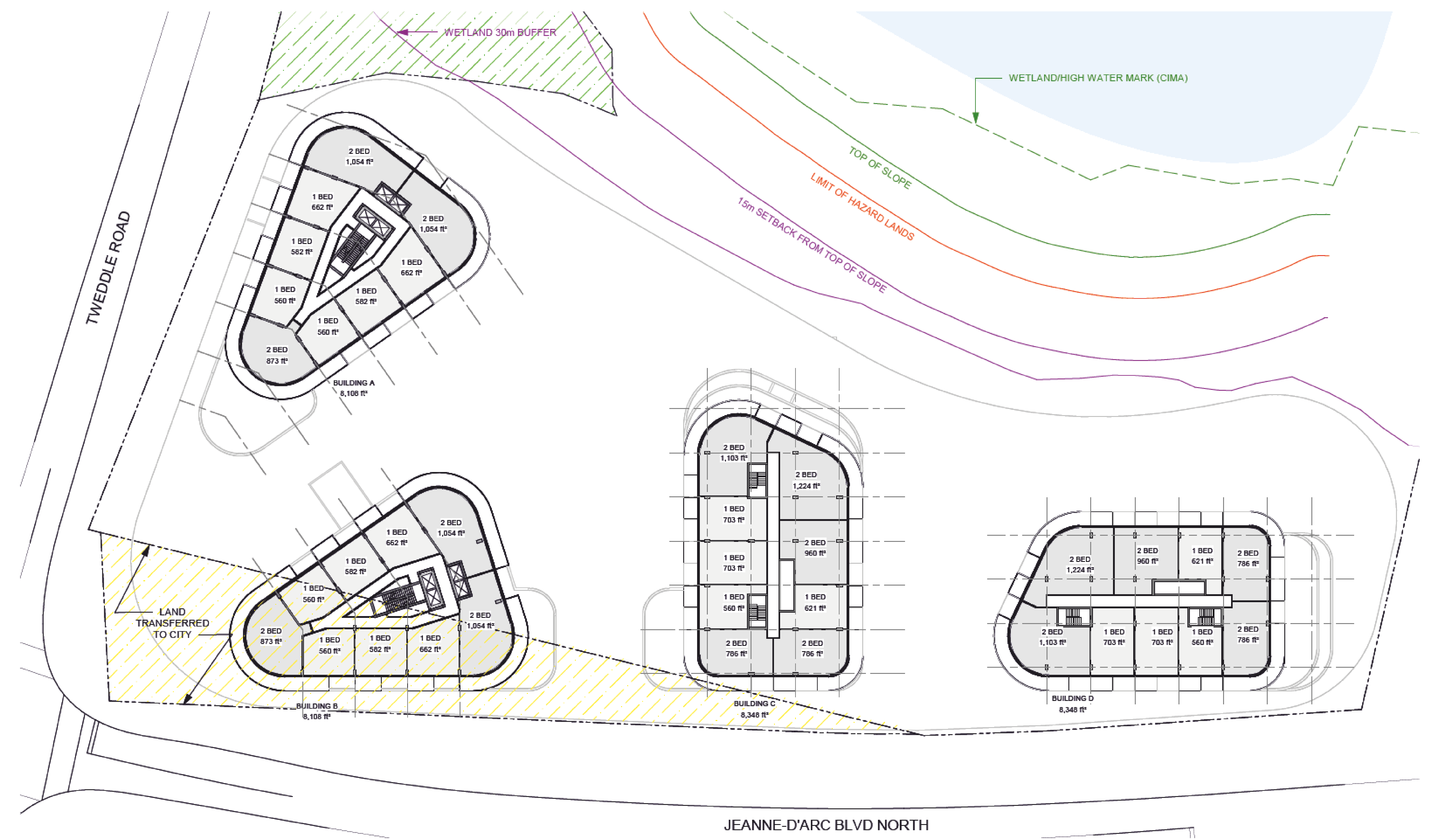

rla / architecture

TYPICAL TOWER PLAN

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D108

PROJ. No. 2017

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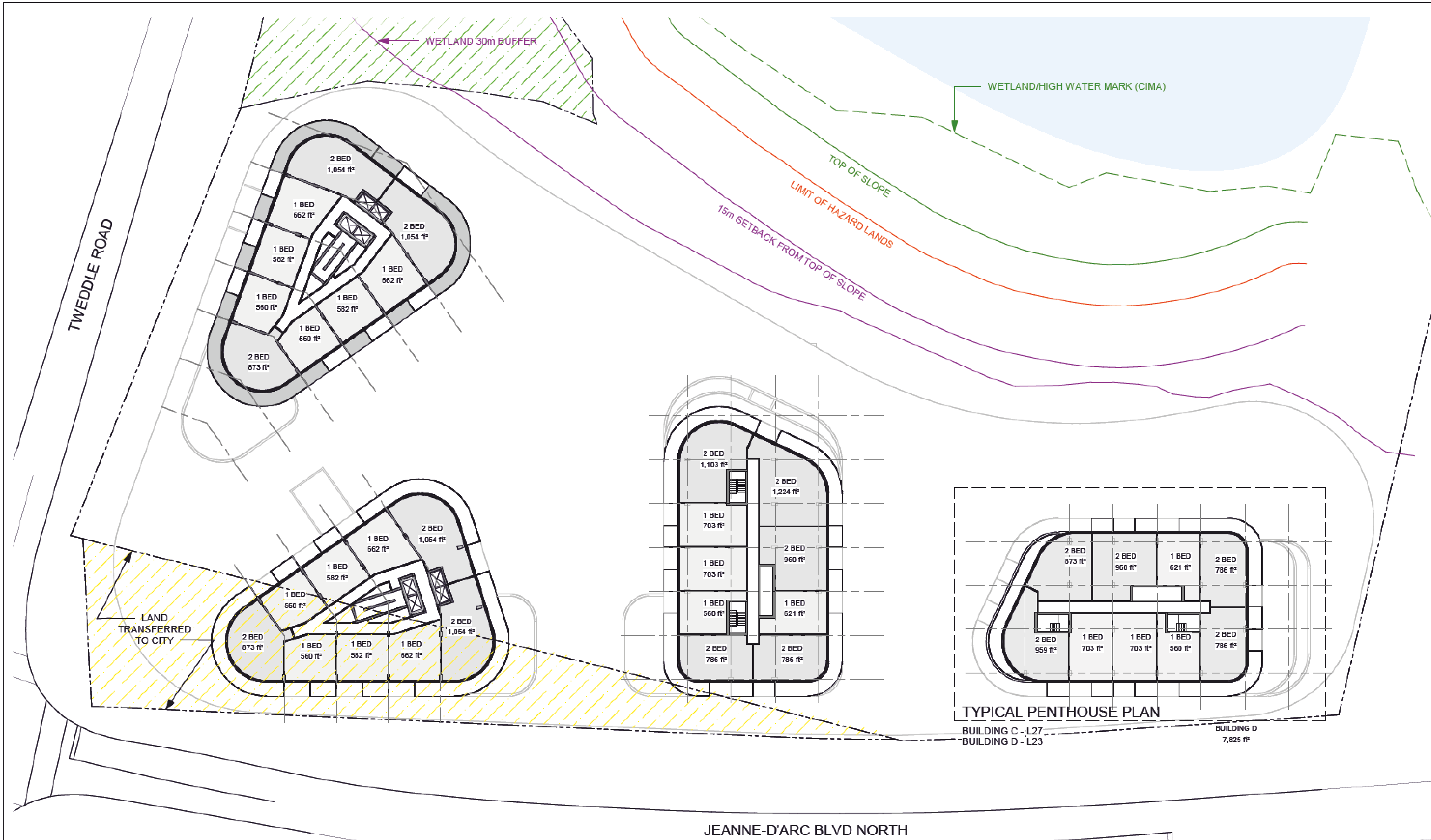

rla / architecture

PENTHOUSE PLAN - C/D - L23/L27

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D109

PROJ. No. 2017

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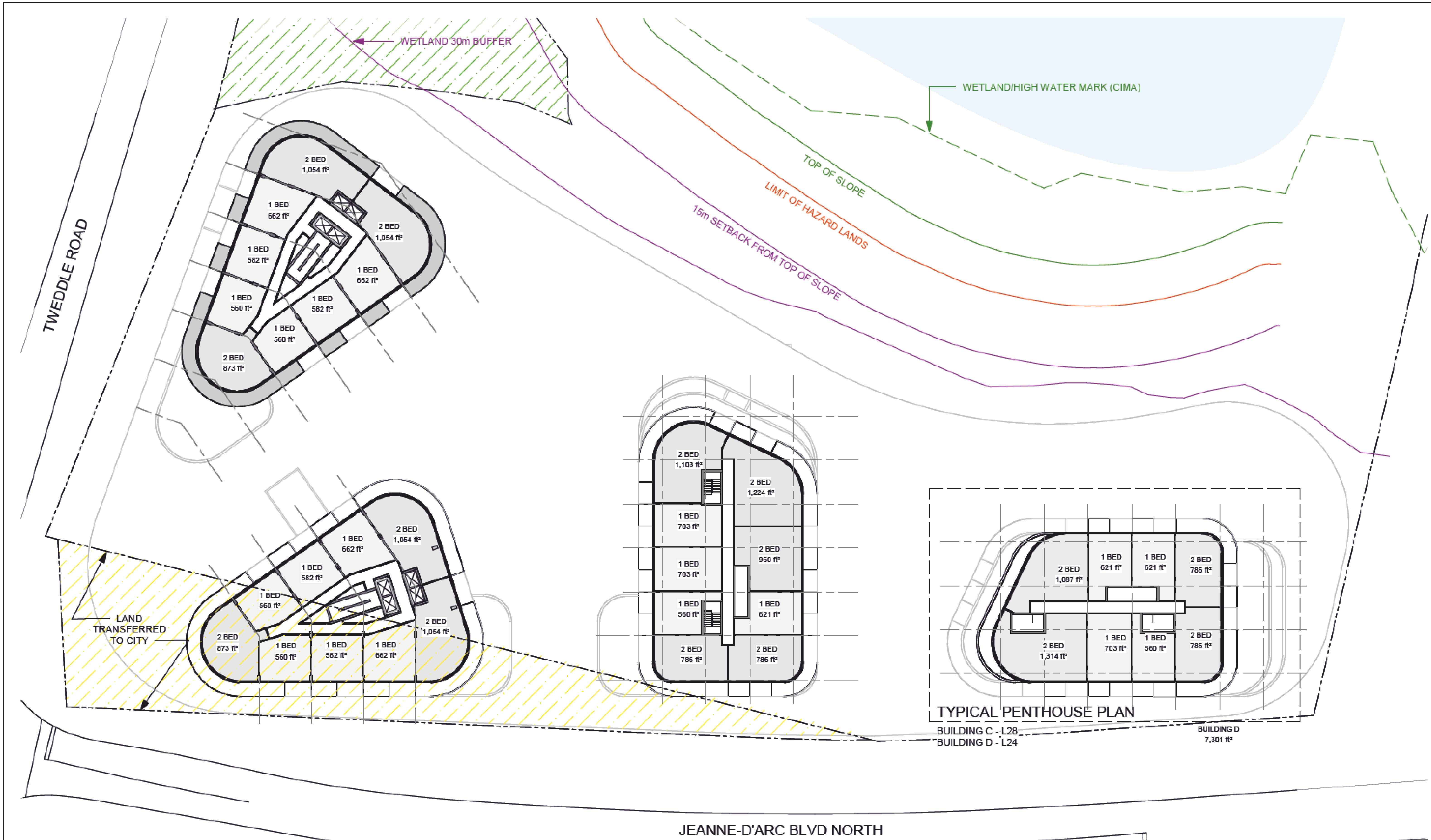

rla/architecture

PENTHOUSE PLAN - C/D - L24/L28

SCALE: 1 : 500

DATE: 2022/07/12

1009 TRIM ROAD

OTTAWA K4A 3P4 ONTARIO

SHEET #

D110

PROJ. No. 2017

PLOT DATE: 2022-07-13 2:40:04 PM

PLOT SCALE: 1:1

PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

rla/architecture

NORTH ELEVATION

SCALE: 1 : 500

DATE: 2022/07/12

OTTAWA 1015 TWEDDLE ROAD ONTARIO

K4A 3P4

SHEET #

D300

PROJ. No. 2017

PLOT DATE: 2022-07-12 9:59:06 AM

PLOT SCALE: 1:1

PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

rla / architecture

SOUTH ELEVATION

SCALE: 1 : 500

DATE: 2022/07/12

OTTAWA

1015 TWEDDLE ROAD

ONTARIO

K4A 3P4

SHEET #

D301

PROJ. No. 2017

PLOT DATE: 2022-07-12 9:59:55 AM

PLOT SCALE: 1:1

PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

rla / architecture

EAST ELEVATION

SCALE: 1 : 500

DATE: 2022/07/12

OTTAWA

1015 TWEDDLE ROAD

ONTARIO

K4A 3P4

SHEET #

D302

PROJ. No. 2017

PLOT DATE: 2022-07-12 10:00:23 AM

PLOT SCALE: 1:1

PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

rla/architecture

WEST ELEVATION

SCALE: 1 : 500

DATE: 2022/07/12

1015 TWEDDLE ROAD

OTTAWA ONTARIO

K4A 3P4

SHEET #

D303

PROJ. No. 2017

PLOT DATE: 2022-07-12 10:00:53 AM PLOT SCALE: 1:1 PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

rla/architecture

PERSPECTIVE

SCALE:

DATE: 2022/07/12

OTTAWA

1015 TWEDDLE ROAD

ONTARIO

K4A 3P4

SHEET #

D304

PROJ. No. 2017

PLOT DATE: 2022-07-12 10:01:47 AM

PLOT SCALE: 1:1

PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

rla/architecture

PERSPECTIVE VIEW

SCALE:

DATE: 2022/07/12

OTTAWA

1015 TWEDDLE ROAD

K4A 3P4

ONTARIO

SHEET #

D400

PROJ. No. 2017

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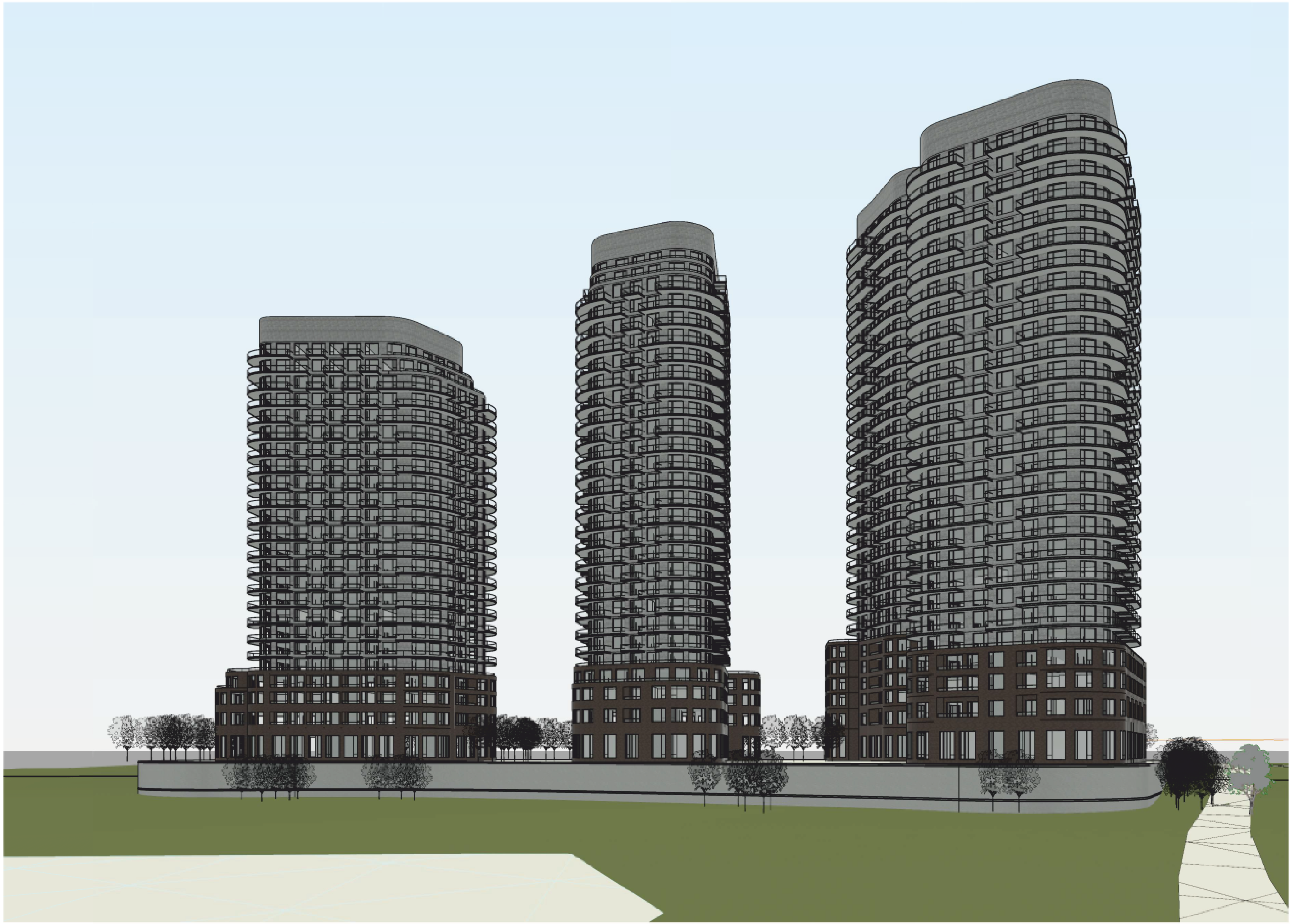

rla / architecture

PERSPECTIVE VIEW

SCALE:

DATE: 2022/07/12

OTTAWA

1015 TWEDDLE ROAD

ONTARIO

K4A 3P4

SHEET #

D401

PROJ. No. 2017

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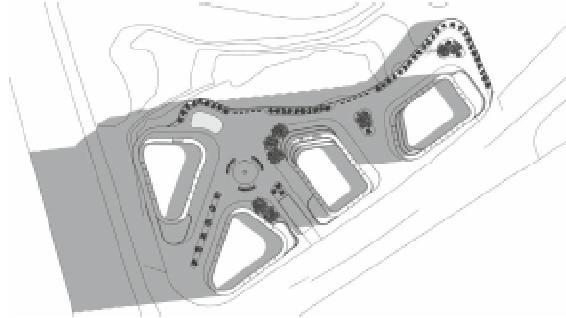
PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

JUNE 21 (UTC -04:00)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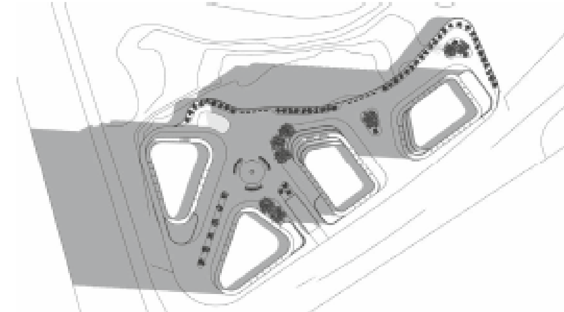
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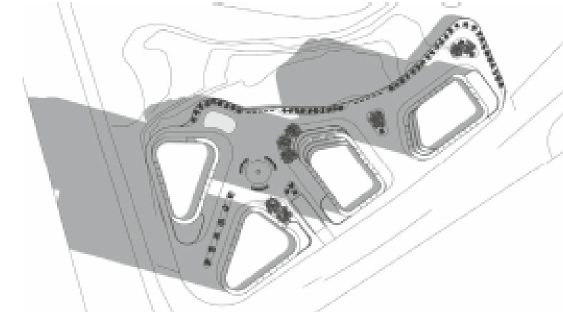
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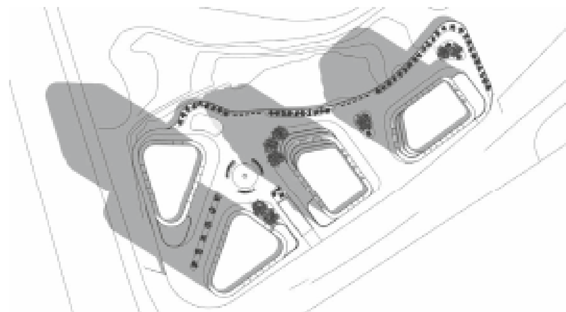
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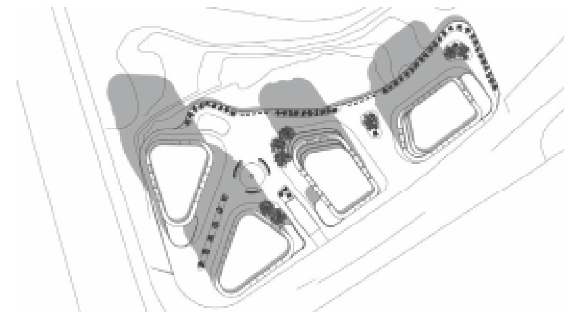
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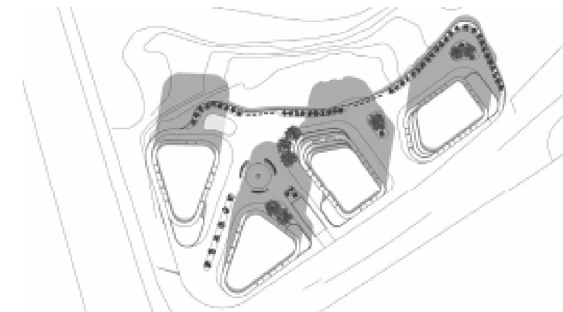
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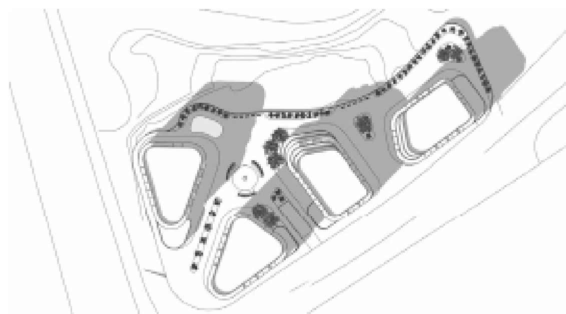
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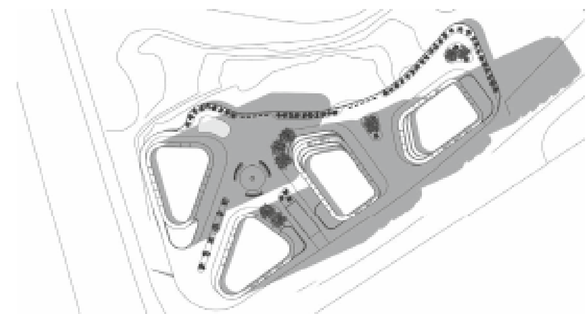
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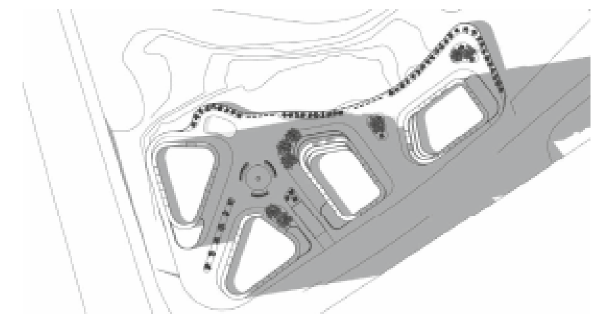
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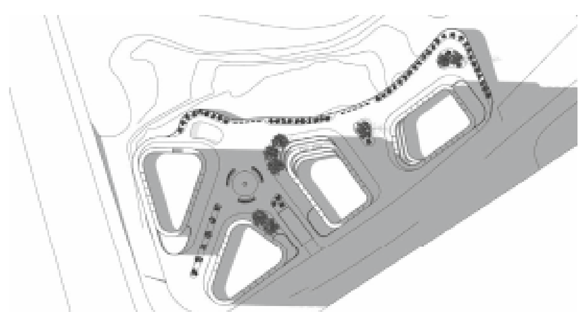
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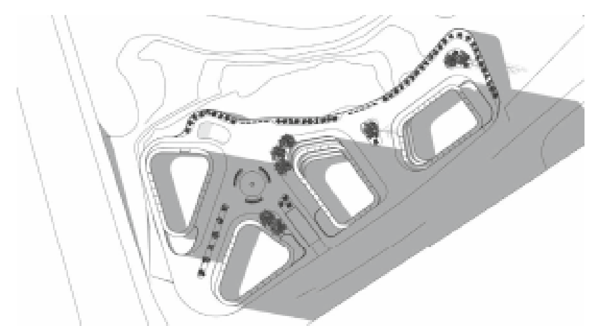
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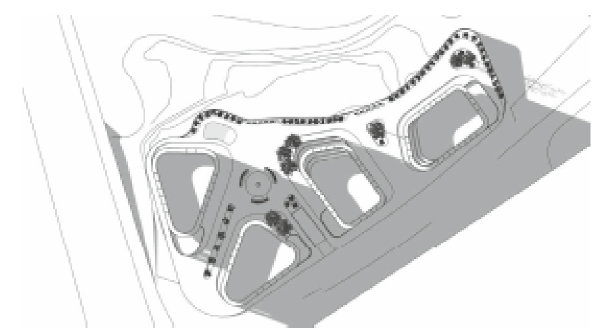
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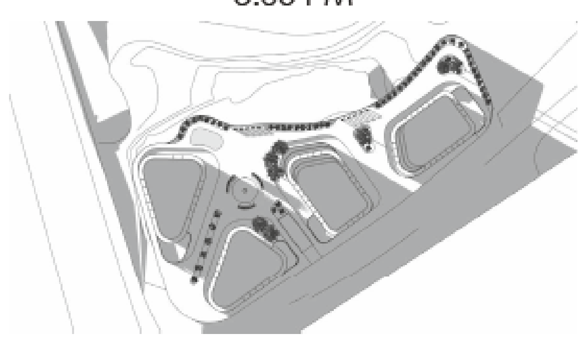
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SOLAR STUDY

SCALE:

DATE: 2022/07/12

OTTAWA 1015 TWEDDLE ROAD ONTARIO

K4A 3P4

SHEET #

D500

PROJ. No. 2017

PLOT DATE: 2021-12-17 9:53:17 AM

PLOT SCALE: 1:1

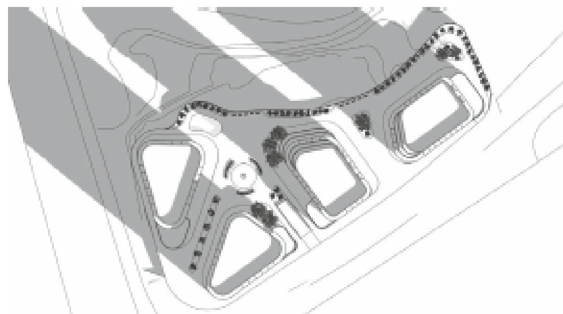
PAPER SIZE: ANSI B Tabloid 11" x 17" (279.40 x 431.80mm)

SEPTEMBER 21 (UTC -04:00)

8:00 AM

9:00 AM

10:00 AM



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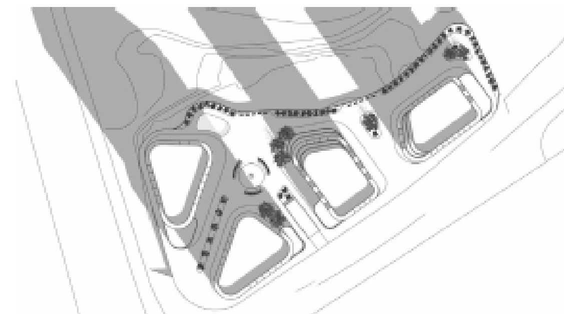

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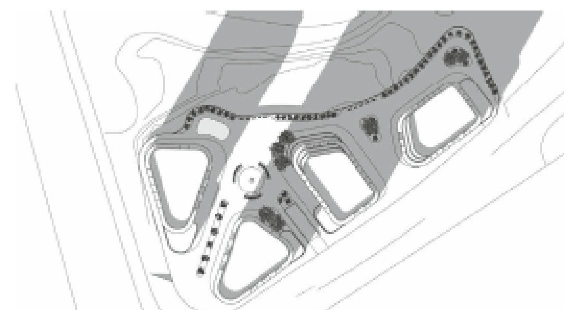

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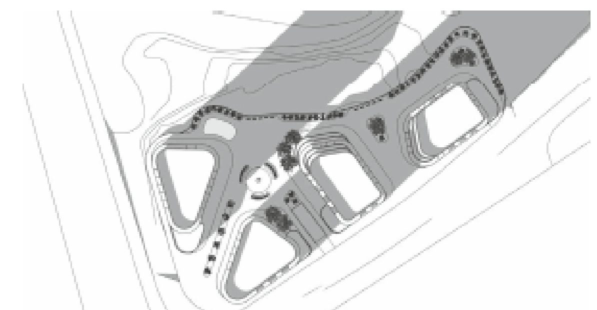

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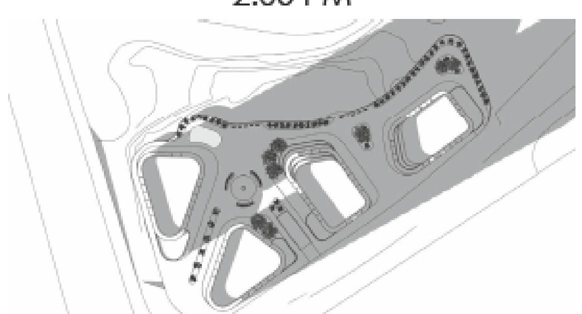

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PLOT DATE: 2021-12-17 9:53:17 AM

PLOT SCALE: 1:1

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DECEMBER 21 (UTC -05:00)

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10:00 AM

11:00 AM

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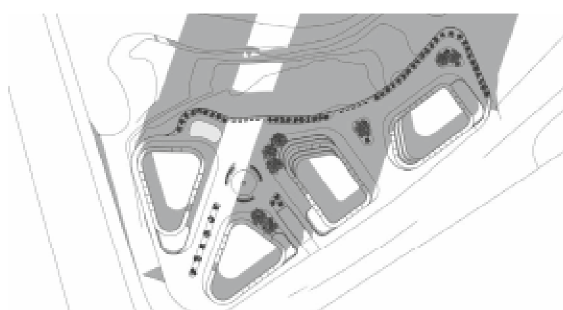

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OTTAWA 1015 TWEDDLE ROAD ONTARIO

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MARSHLAND
OTTAWA RIVER
TWEDDLE ROAD
NATURE PATH
VIEWPOINT
COMMERCIAL TERRACE
TOWER A
28 STOREY
L4 ROOF
LIMIT OF UNDERGROUND PARKING
CENTRAL PLAZA
COMMERCIAL TERRACE
23000 TOWER SEPARATION
FEATURE COMMERCIAL SPACE
ENTRANCE PLAZA
TOWER B
32 STOREY
L6 ROOF
26600 TOWER SEPARATION
TOWER C
28 STOREY
L3 ROOF
L4 ROOF
L26 ROOF
L27 ROOF
SPA TERRACE
TOWER D
24 STOREY
L22 ROOF
L23 ROOF
L4 ROOF
L3 ROOF
23000 TOWER SEPARATION
TOP OF SLOPE BASED ON FIELD OBSERVATIONS
(JUNE 2, 2020 PATERSONGROUP)
15.0m SETBACK FROM TOP OF SLOPE
LIMIT OF HAZARD LANDS
PSW 30m Buffer (CIMA)
WETLAND/HIGH WATER MARK (CIMA)
LINE BETWEEN LOTS 29 AND 30
LAND TRANSFERRED TO THE CITY
HYDRO LINE
LINEAR PARK
JEANNE-D'ARC BLVD NORTH
PART 8 PLAN 50R-5818
PART 7 PLAN 50R-5818
PART 3 PLAN 50R-3913
PART 1 PLAN 4R-14593
30 (CUMBERLAND)
TRIM ROAD (REALIGNED)
0 5 10 20 40m
July 12, 2022
1015 TWEDDLE ROAD
OTTAWA ON
rla/architecture