D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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SITE SERVICING STUDY & STORMWATER MANAGEMENT REPORT

2040 ARROWSMITH DRIVE
OTTAWA, ONTARIO

REPORT NO. 22062

DECEMBER 21, 2022

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for a proposed 6-storey 50-unit residential apartment being built for Wigwamen Incorporated (a non-profit Aboriginal housing provider). The building will be located on a 6,020 sq.m. irregularly shaped property at 2040 Arrowsmith Drive in Ottawa, Ontario. The ground floor will consist of offices for Wigwamen; common spaces for the apartment occupants; and offices and space for the Gloucester Emergency Food Cupboard. The property currently has one-storey building (occupied by the Gloucester Emergency Food Cupboard) that will be demolished.

Refer to Pre-Application Consultation meeting notes in Appendix A.

This report forms part of the servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-14 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

The proposed building will have a sprinkler system; the fire department connection located on the front (west) façade of the building. The closest existing municipal fire hydrant is located in the Jasmine Crescent ROW. It is approximately 117 m unobstructed distance to the proposed fire department connection (FDC), which is more than the maximum 45 m permitted by the Ontario Building Code (OBC); therefore, a private fire hydrant is required. A private fire hydrant is proposed to be located in front (to the west) of the proposed building. It will be 6 m unobstructed distance to the proposed FDC.

In accordance with City of Ottawa Technical Bulletin ISTB-2021-03, when calculating the required fire flow where pipe sizing is affected, the Fire Underwriters Survey (FUS) method is to be used. Using the FUS method the required fire flow is calculated to be 8,000 L/min (133.3 L/s). Refer to calculations in Appendix B.

The boundary conditions in the 200 mm Arrowsmith Drive municipal watermain provided by the City of Ottawa for the 133.3 L/s fire flow at the subject property indicate a hydraulic grade line (HGL) of 97.6 m. Refer to Appendix B. This HGL calculates to 255 kPa (37 psi). Since the pressure is above the OBC's minimum required pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

In accordance with City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 Appendix I:

Class	Distance (m)	Contribution (L/min)
AA	≤ 75	5,700
	> 75 and ≤ 150	3,800

Since the pressure in the watermain during fire flow conditions is well above 140 kPa (20 psi) the proposed private fire hydrant (≤ 75 m) will be a Class AA; and since it is within 75 m of the proposed building it can contribute 5,700 L/min (95 L/s). The closest existing municipal fire hydrant is a Class AA and is between 75 m and 150 m of the proposed building; therefore it can contribute 3,800 L/min (63.3 L/s). Therefore, the aggregate flow from both hydrants is 9,500 L/min (158.3 L/s), which is greater than the required fire flow of 9,000 L/min (133.3 L/s).

2.2 DOMESTIC WATER SUPPLY

A 150 mm water service connecting to the 200 mm Arrowsmith Drive municipal watermain is proposed to service the sprinkler system. The same 150 mm water service will provide an adequate domestic water supply.

In accordance with the City of Ottawa Water Design Guidelines for the consumption rate and peaking factors, the average daily demand is calculated to be 0.4 L/s, the maximum daily demand is calculated to be 2.1 L/s and the maximum hourly demand is calculated to be 3.2 L/s. Refer to calculations in Appendix B.

The boundary conditions in the 200 mm Arrowsmith Drive municipal watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 110.3 m and a maximum HGL of 116.3 m. Refer to Appendix B. Based on these boundary conditions the pressure at the water meter is calculated to vary between 370 kPa (54 psi) and 428 kPa (62 psi). This is an acceptable range for the proposed development.

3.0 SANITARY SERVICING

In accordance with

i. the City of Ottawa Sewer Design Guidelines for the peaking factor, and
ii. City of Ottawa Technical Bulletin ISTB-2018-01 for the consumption rate and infiltration allowance,

the post-development sanitary flow rate is calculated to be 1.07 L/s. A 150 mm sanitary sewer service connection at a 1% slope is proposed to service the development. At the design flow rate the sanitary sewer service will only be at between 7% of its capacity. The proposed 150 mm sanitary sewer service will connect to a 250 mm municipal sanitary sewer, which at 1.01% slope has a capacity of 60.40 L/s. Refer to calculations in Appendix C. The proposed development is expected to have an acceptable impact on the 250 mm municipal sanitary sewer.

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

It expected that the Rideau Valley Conservation Authority (RVCA) will require an enhanced level of protection with 80% total suspended solids (TSS) removal from the rainwater runoff. To meet the water quality target of 80% TSS removal an oil grit separator (OGS) is proposed to be located downstream of the inlet control device (ICD). Based on the drainage area a CDS Model PMSU2015-4 is expected to be selected by the manufacturer based on the manufacturer's software which is expected to be calculated

that it will remove more than 80% of the TSS. The selected OGS has an oil capacity of 232 L and a sediment capacity of 0.7 cu.m. This OGS has an oil capacity of 232 L and a sediment capacity of 0.7 cu.m. Refer to Appendix D.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-7 and C-8 and notes 2.1 to 2.6 on drawing C-10.

i. A silt fence barrier is to be installed adjacent to the perimeter of the site where rainwater runoff will drain off the site.
ii. Sediment capture filter sock inserts are to be installed in all existing and proposed catch-basins adjacent to and within the site.
iii. Any material deposited on the public road is to be removed.

4.2 QUANTITY CONTROL

The stormwater quantity control criterion is to control the post-development 100-year peak flow rate to the pre-development 5-year peak flow rate. It is determined that the pre-development conditions reflect a 5-year runoff coefficient of 0.38. Using the Rational Method and a calculated time of concentration of 10 minutes, the maximum allowable release rate is calculated to be 8.701 L/s. The Rational and Modified Rational Methods were used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix D.

Drainage Area I (Uncontrolled Flow Off Site – 998 sq.m.)
Generally, the perimeter of the property will drain uncontrolled off site. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event
Maximum Flow Rate	31.89 L/s	16.41 L/s

Drainage Area II (Penthouse Roof – 163 sq.m.)
The one roof drain on the penthouse roof will be a flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. Each roof drain is to be installed with a single-parabolic slotted weir and release 0.01242 L/s/mm (5 USgpm/in). Roof drains are to be Watts with an Accutrol Weir RD-100-A1 or approved equivalent. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of 2 scuppers each a minimum 250 mm wide are to be installed 150 mm above the roof drains. Refer to architectural plans and details for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers (i.e. 200 mm depth at the roof drains). Refer to the structural engineer.

	100-Year Event	5-Year Event
Maximum Release Rate	1.61 L/s	1.22 L/s
Maximum Depth at Roof Drains	130 mm	98 mm
Maximum Volume Stored	4.64 cu.m.	1.98 cu.m.

Drainage Area II (6^{th} Floor Roof – 594 sq.m.)
The two roof drains on the 6^{th} floor roof are to be flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. Each roof drain is to be installed with a single-parabolic slotted weir and release 0.01242 L/s/mm (5 USgpm/in). Roof drains are to be Watts with an Accutrol

Weir RD-100-A1 or approved equivalent. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of 4 scuppers each a minimum 450 mm wide are to be installed 150 mm above the roof drains. Refer to architectural plans and details for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers (i.e. 200 mm depth at the roof drains). Refer to the structural engineer.

	100-Year Event	5-Year Event
Maximum Release Rate	3.42 L/s	2.62 L/s
Maximum Depth at Roof Drains	138 mm	105 mm
Maximum Volume Stored	21.58 cu.m.	9.71 cu.m.

Drainage Area IV (3,515 sq.m.)

An inlet control device (ICD) located in the outlet pipe of manhole MH-7 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond above catch basins CB-1, CB-2, CB-4, CB-5 and CB-6; and catch basin manhole CB/MH-3. The ICD will be a plug style with a round orifice located at the bottom of the plug with a trash basket manufactured by Pedro Plastics (or approved equal) and shall be sized by the manufacturer for a release rate of 21.77 L/s at 1.95 m. It is calculated that an orifice area of 5,766 sq.mm ($\pm$86 mm diam.) with a discharge coefficient of 0.61 will achieve the release rate of 21.77 L/s at 1.95 m. Based on this orifice the maximum release rate for the 5-year storm event is calculated to be 21.45 L/s at 1.90 m.

	100-Year Event	5-Year Event
Maximum Release Rate	21.77 L/s	21.45 L/s
Maximum Ponding Elevation	71.11 m	71.05 m
Maximum Volume Stored	76.40 cu.m.	27.31 cu.m.

Entire Site

	100-Year Event	5-Year Event
Pre-development Flow Rate	118.55 L/s	58.70 L/s
Maximum Allowable Release Rate	58.70 L/s	58.70 L/s
Maximum Release Rate	58.70 L/s	41.69 L/s
Maximum Volume Required	102.61 cu.m.	39.00 cu.m.
Maximum Volume Stored	102.61 cu.m.	39.00 cu.m.

The maximum post-development release rate during the 100-year event is calculated to be 58.70 L/s, which is 50% less than the pre-development flow rate and equal to the maximum allowable release rate. To achieve the maximum allowable release rate, a maximum storage volume of 102.61 cu.m. is required and provided. The maximum post-development release rate during the 5-year event is calculated to be 41.69 L/s, which is 29% less than the pre-development flow rate and maximum allowable release rate.

4.3 STORM SERVICING

There are no municipal storm sewers in the Arrowsmith Drive ROW (the property currently drains to a private storm sewer system owned by an adjacent property owner). Therefore, a new 450 mm storm

sewer serving the subject property is proposed (from manhole MH-9 to manhole MH-11; MH-11 is proposed to be installed in the existing 600mm municipal storm sewer in Jasmine Crescent). The last pipe segment of this proposed storm sewer will be at 36% of its capacity peak flow rate during the 2-year event which is calculated to be 62.10 L/s. Refer to calculations in Appendix D. The proposed storm sewer will have an acceptable impact on the existing municipal storm sewer since during the 5-year event the stormwater runoff will be 29% less than the pre-development flow rate.

The peak roof flow rate during the 2-year event is calculated to be 18.06 L/s. A 200 mm storm sewer service at 1% slope (33.24 L/s capacity) is proposed to service the roof drains. It will connect to the proposed 450 mm storm sewer in Arrowsmith Drive. At the peak 2-year flow rate the storm sewer service will be at 54% of its capacity (the restricted flow thorough the flow control roof drains will be significantly less). Refer to calculations in Appendix D.

A private storm sewer system is proposed to service the proposed parking area located to the south of the proposed building. It will connect to the proposed 450 mm storm sewer in Arrowsmith Drive at manhole MH-9. The last pipe segment of the proposed storm sewer will be at 87% of its capacity peak flow rate during the 2-year event which is calculated to be 48.42 L/s (the restricted flow thorough the ICD will be significantly less). Refer to calculations in Appendix D.

5.0 CONCLUSIONS

1. A private fire hydrant is required and provided.

2. There is an adequate water supply for firefighting from the existing municipal water distribution system.

3. The aggregate flow from the two closest hydrants is greater than the required fire flow.

4. There is an acceptable range of water pressures in the existing municipal water distribution system.

5. The post-development sanitary flow rate will be adequately handled by the proposed sanitary sewer service.

6. The proposed development is expected to have an acceptable impact on the existing municipal sanitary sewer.

7. It expected that an enhanced level of protection with 80% total suspended solids (TSS) removal from the rainwater runoff will be required. To meet the water quality target of 80% TSS removal an oil grit separator (OGS) is proposed.

8. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

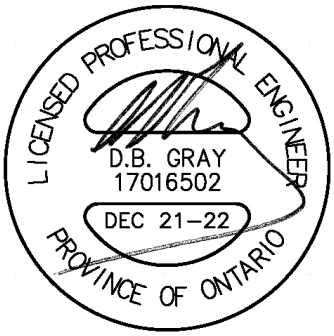
9. The maximum post-development release rate during the 100-year event is calculated to be 50% less than the pre-development flow rate and equal to the maximum allowable release rate. The maximum post-development release rate during the 5-year event is calculated to be 29% less than the pre-development flow rate and maximum allowable release rate.

10. There are no municipal storm sewers in the Arrowsmith Drive ROW; therefore, a new storm sewer serving the subject property is proposed; connecting existing 600mm municipal storm sewer in Jasmine Crescent.

11. The peak flow rates during the 2-year event will be adequately handled by the proposed storm sewer service connection and storm sewer system.

12. The proposed development is expected to have an acceptable impact on the existing municipal storm sewer in Jasmine Crescent.

Prepared by D.B. Gray Engineering Inc.



NOT VALID UNLESS
SIGNED & DATED

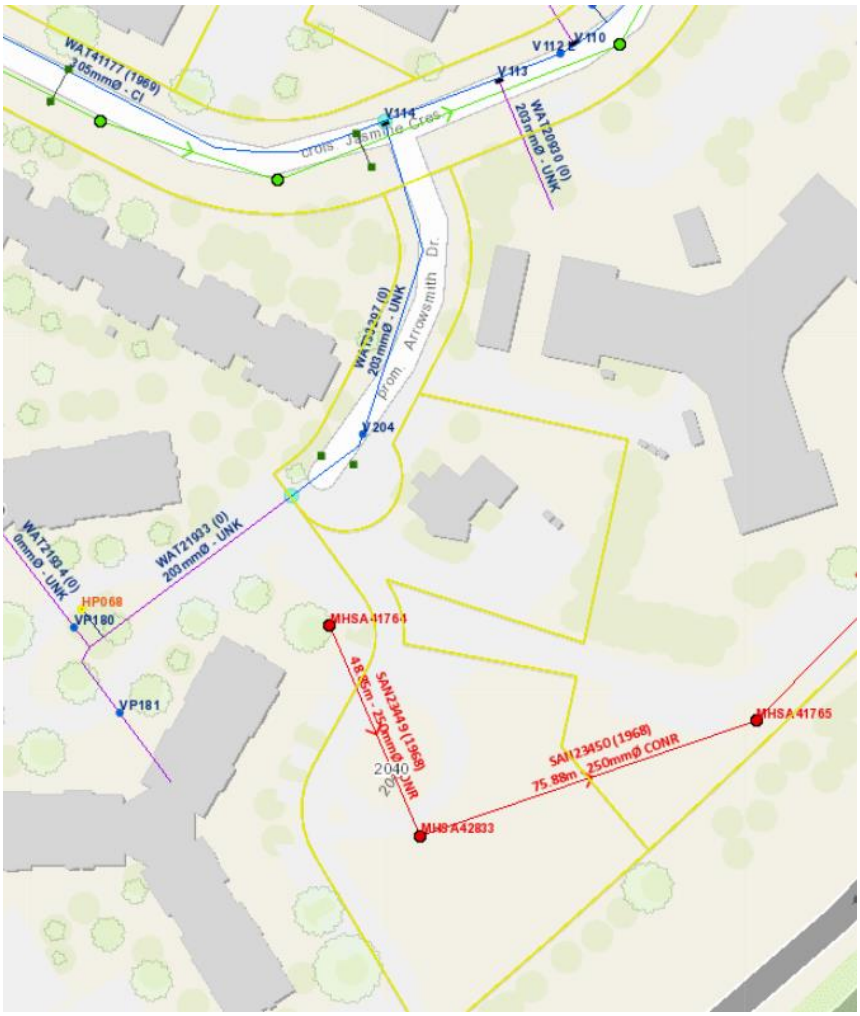
APPENDIX A

PRE-APPLICATION CONSULTATION MEETING NOTES

Site Plan/Zoning Pre-Application Consultation Notes

Date: Thursday, February
Site Location: 2040 Arrowsmith Drive
Type of Development: ☒ **Residential (**☐ **townhomes,** ☐ **stacked,** ☐ **singles,** ☒ **apartments),** ☐ **Office Space,** ☐ **Commercial,** ☐ **Retail,** ☐ **Institutional,** ☐ **Industrial, Other:** N/A

Infrastructure



Water

Existing public services:

- Arrowsmith Dr – 200mm PVC CI

Watermain Frontage Fees to be paid ($190.00 per metre) ☐ **Yes** ☒ **No**

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)
- Please submit sanitary demands with the water boundary conditions to identify any capacity constraints at the local pumping station

General comments

- 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.
- A District Metering Area Chamber (DMA) is required for services 150mm or greater in diameter.

Sanitary Sewer

Existing public services:

- Rear yard - 250mm PVC

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

General comments

- Please submit sanitary demands with the water boundary conditions to identify any capacity constraints at the local pumping station.

Storm Sewer

Existing public services:

- Jasmine Cres – 525mm Conc. (approx. 60m away)

General comments

- There are no public storm sewers adjacent to the site and the storm sewer would be required to extend the existing storm sewer on Jasmine Cres or connecting to the existing privately owner storm sewer. If the consultant connects to the existing privately owned stormwater system, the design must include the design of the existing stormwater management design and clearly show that pipe flows, ICDs, drainage areas of the existing stormwater network to accommodate 2040 Arrowsmith.
- Roof drains connecting to the storm sewer must be controlled at the roof and outlet to an uncontrolled system.

- Foundation drains, if required by the geotechnical design, must outlet to an uncontrolled system.

Stormwater Management

Quality Control:

- Rideau Valley Conservation Authority to confirm quality control requirements.

Quantity Control:

- Site is located within the Mud (Green's) Creek Area Subwatershed Study Area draining to the Ottawa River
- Time of concentration (Tc): Tc = pre-development; maximum Tc = 10 min
- Allowable run-off coefficient: post-development to pre-development to a maximum of 0.5
- Allowable flowrate: Allowable flowrate: Control the 100-year storm events to the 5-year storm event.
- When both underground and above ground storage is utilized, the release rate from the system will significantly differ than when solely one level storage is being used (i.e. greater range of head vs smaller change of head during storm event). If both levels of storage are to be accounted for then there are two options for SWM calculations: 1) use a dynamic computer model or 2) use an assumed average flow rate of half (50%) of the controlled peak flow rate of the area(s) utilizing two levels of storage.

Ministry of Environment, Conservation and Parks (MECEP)

All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

a. A transfer of review ECA application will be required based on the proposed sewer extension or servicing of one or more properties to the a single service.
b. Transfer of Review ECAs are reviewed by the MECP and may take 1-2 months for approval.
c. Approximately $1500 ECA application fees are collected by the City on behalf of the MECP for the proposed review.

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

- Existing sewer or watermains that are not reused must be decommissioned as per City Standards. Please show all road cuts on the plans.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.

Other

Capital Works Projects within proximity to application? ☒ **Yes** ☐ **No**

- Future asphalt resurfacing on Jasmine Cres to begin in 3-5 years. A three year moratorium is placed on future road cuts after the road resurfacing is completed. The applicant should coordinate with the City to avoid construction and timeline conflicts.

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 & 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/

PLANS & STUDIES LIST

For information on preparing required studies and plans refer to:
http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

S/Z	Number of copies	ENGINEERING		S/A	Number of copies
S		1. Site Servicing Plan	2. Site Servicing Brief	S/Z	
S		3. Grade Control and Drainage Plan	4. Geotechnical Study	S/Z	
		5. Composite Utility Plan	6. Groundwater Impact Study		
		7. Servicing Options Report	8. Wellhead Protection Study		
		9. Community Transportation Study and/or Transportation Impact Study / Brief	10. Erosion and Sediment Control Plan / Brief	S	
S/Z		11. Storm water Management Brief	12. Hydro-geological and Terrain Analysis		
		13. Water main Analysis	14. Noise / Vibration Study		
		15. Roadway Modification Design Plan	16. Confederation Line Proximity Study		

S – Required for Site Plan Control
Z – Required for Zoning By-Law Amendment

APPENDIX B

WATER SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

November 24, 2022

2040 Arrowsmith Drive

6-Storey Mixed-Use Building

Ottawa, Ontario

FIRE FLOW CALCULATIONS

FUS Method

RFF = Required Fire Flow in litres per minute
= $220CA^{0.5}$

C = Construction Coefficient related to the type of construction of the building
= 0.8 Type II Noncombustible Construction

A = Total Effectice Floor Area in square meters of the building

Penthouse:	163	50%	81.5	sq.m
6th Floor:	757	50%	378.5	sq.m
5th Floor:	757	50%	378.5	sq.m
4th Floor:	757	50%	378.5	sq.m
3rd Floor:	757	50%	378.5	sq.m
2nd Floor:	757	100%	757.0	sq.m
1st Floor:	917	100%	917.0	sq.m
	4,865		3,269.5	sq.m Total Effective Floor Area

RFF = 10,064 L/min
= 10,000 L/min (rounded to nearest 1,000 L/min)

Occupancy and Contents Adjustment Factor

-9% Limited Combustible and Free Burning Contents

-15% Limited Combustible Contents (3,948 sq.m Residential)

15% Free Burning Contents (917 sq.m Commercial)

= -935 L/min

RFF = 9,065 L/min

Automatic Sprinkler Protection Credit

30% Sprinkler system designed, installed and maintained in accordance with NFPA standards

10% Standard water supply for both the sprinkler system and fire department hose lines

= 3,626 L/min Automatic Sprinkler Protection Credit

Exposure Adjustment Charge

Side	Charge	Distance	Construction	Length	Storeys	Factor
NW	0%	20.1 m to 30 m	Type V	10	2	20
NE	8%	10.1 m to 20 m	Type I-II	35	14	490
SE	15%	3.1 m to 10 m	Type V	5	1	5
SW	0%	over 30 m				

23% Exposure Adjustment Charge

= 2,085 L/min Exposure Adjustment Charge

RFF = 7,524 L/min

= 8,000 L/min (rounded to nearest 1,000 L/min)

= 133.3 L/s

133.3 L/s Fire Flow HGL: 97.6 m

Elevation at Fire Hydrant: 71.6 m

Static Pressure at Fire Hydrant: 26.0 m 255 kPa 37 psi

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

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November 17, 2022

2040 Arrowsmith Drive

6-Storey Mixed-Use Building

Ottawa, Ontario

WATER DEMAND CALCULATIONS

	Number of Units	Persons per Unit	Population
1 Bedroom:	50	1.4	70
2 Bedroom:	0	2.1	0
3 Bedroom:	0	3.1	0
Average:	0	1.8	0
Total:	50		70

Residential Average Daily Demand:	280	L/capita/day				
	13.6	L/min	0.2	L/s	3.6	USgpm
Residential Maximum Daily Demand:	8.0	(Peaking factor for a population of 70 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	108.4	L/min	1.8	L/s	28.6	USgpm
Residential Maximum Hourly Demand:	12.0	(Peaking factor for a population of 70 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	163.3	L/min	2.7	L/s	43.1	USgpm
Commercial Average Daily Demand:	0.6020	ha				
	28,000	L/ha/day				
	16,856	L/day				
	24	hour day				
	11.7	L/min	0.2	L/s	3.1	USgpm
Commercial Maximum Daily Demand:	1.5	(Peaking factor as per City of Ottawa Water Design Guidelines)				
	17.6	L/min	0.3	L/s	4.6	USgpm
Commercial Maximum Hourly Demand:	1.8	(Peaking factor as per City of Ottawa Water Design Guidelines)				
	31.6	L/min	0.5	L/s	8.3	USgpm
Total Average Daily Demand:	25.3	L/min	0.4	L/s	6.7	USgpm
Total Maximum Daily Demand:	126.0	L/min	2.1	L/s	33.3	USgpm
Total Maximum Hourly Demand:	194.9	L/min	3.2	L/s	51.5	USgpm

Elevation of Water Meter:	72.61	m				
Finished Floor Elevation:	71.71	m				
Minimum HGL:	110.3	m				
Static Pressure at Water Meter:	37.7	m	370	kPa	54	psi
Maximum HGL:	116.3	m				
Static Pressure at Water Meter:	43.7	m	428	kPa	62	psi

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: Request for Boundary Conditions - 2040 Arrowsmith Drive

1 message

Rasool, Rubina <Rubina.Rasool@ottawa.ca> Wed, Dec 21, 2022 at 8:21 AM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Ryan,

I am not sure if these were provided to you while I was out-of-office.

Please see the WBC below.

Thanks,

******The following information may be passed on to the consultant, but do NOT forward this e-mail directly.******

The following are boundary conditions, HGL, for hydraulic analysis at 2040 Arrowsmith Drive (zone 1E) assumed to be connected to the 203 mm watermain on Arrowsmith Drive (see attached PDF for location).

Min HGL: 110.3 m

Max HGL: 116.3 m

Max Day + Fire Flow (133.3 L/s): 97.6 m

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

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

Rubina

Rubina Rasool, E.I.T.

Project Manager

Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique

Development Review – East Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1
rubina.rasool@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: November 24, 2022 3:36 PM
To: Charie, Kelsey <kelsey.charie@ottawa.ca>
Cc: Rasool, Rubina <Rubina.Rasool@ottawa.ca>; Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Fwd: Request for Boundary Conditions - 2040 Arrowsmith Drive

Hi Kelsey,

I understand Rubina is out of the office. Although not urgent, I would appreciate if you could forward this to your modelling group.

Thanks,

Ryan Faith
D.B. Gray Engineering Inc.
700 Long Point Circle
Ottawa, Ontario K1T 4E9
613-425-8044

---------- Forwarded message ---------
From: **Ryan Faith** <r.faith@dbgrayengineering.com>
Date: Thu, Nov 24, 2022 at 3:11 PM
Subject: Re: Request for Boundary Conditions - 2040 Arrowsmith Drive
To: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Rubina,

I have revised the fire flow calculations in accordance with the recently published guide by Fire Underwriters Survey. Please provide updated boundary conditions for the 200 mm Arrowsmith Drive municipal watermain at 2040 Arrowsmith

Drive.

Fire flow demand: 133.3 L/s
Average daily demand: 0.4 L/s
Maximum daily demand: 2.1 L/s
Maximum hourly demand: 3.2 L/s

Fire flow + maximum daily demand: 135.4 L/s

Calculations are attached.

Thanks,

Ryan Faith
D.B. Gray Engineering Inc.
700 Long Point Circle
Ottawa, Ontario K1T 4E9
613-425-8044

On Thu, Nov 17, 2022 at 8:52 AM Rasool, Rubina <Rubina.Rasool@ottawa.ca> wrote:

> Good morning,
>
> Please see the WBC for the proposed development:
>
> The following are boundary conditions, HGL, for hydraulic analysis at 2040 Arrowsmith Drive (zone 1E) assumed to be connected to the 203 mm watermain on Arrowsmith Drive (see attached PDF for location).
>
> Min HGL: 110.3 m
>
> Max HGL: 116.3 m
>
> Max Day + Fire Flow (183.3 L/s): 85.7 m
>
> These are for current conditions and are based on computer model simulation.
>
> *Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.*
>
> Best,
>
> **Rubina**

Rubina Rasool, E.I.T.

Project Manager

Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique

Development Review – East Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1
rubina.rasool@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: November 01, 2022 4:27 PM
To: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Request for Boundary Conditions - 2040 Arrowsmith Drive

Hi Rubina,

Please provide the boundary conditions for the 200 mm Arrowsmith Drive municipal watermain at 2040 Arrowsmith Drive.

Fire flow demand: 183.3 L/s
Average daily demand: 0.4 L/s
Maximum daily demand: 2.1 L/s
Maximum hourly demand: 3.2 L/s

Fire flow + maximum daily demand: 185.4 L/s

Calculations are attached.

Thanks,

Ryan Faith
D.B. Gray Engineering Inc.
700 Long Point Circle
Ottawa, Ontario K1T 4E9
613-425-8044

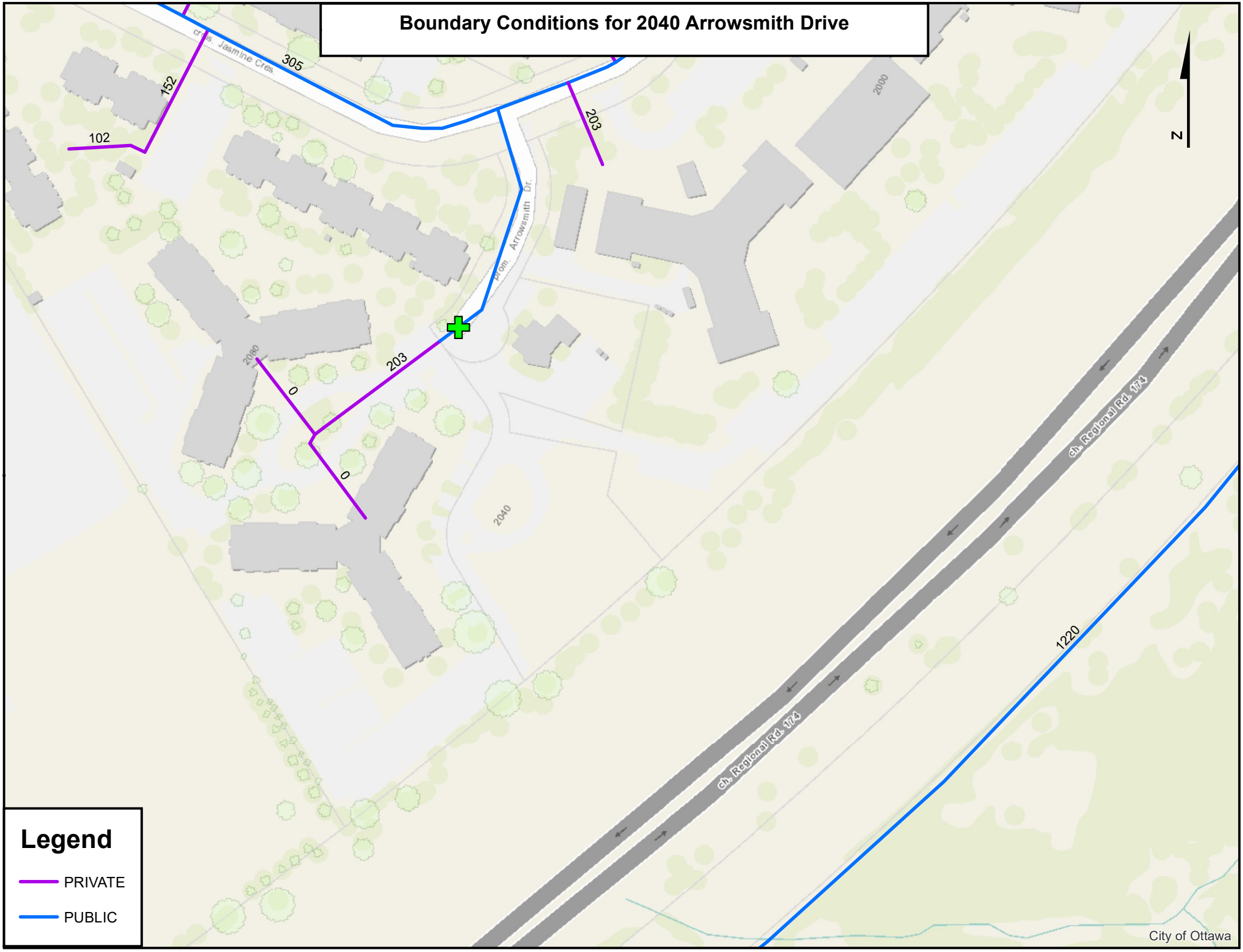
'

> Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Je vous remercie de votre collaboration.
>
> '

'

'

2040 Arrowsmith Drive REVISED November 2022.pdf
881K


Boundary Conditions for 2040 Arrowsmith Drive
305
152
102
203
203
0
0
2080
2040
2000
prom. Arrowsmith Dr.
cres. Jasmine Cres
ch. Regional Rd. 174
ch. Regional Rd. 174
1220
N
Legend
PRIVATE
PUBLIC
City of Ottawa

APPENDIX C

SANITARY SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

SANITARY SEWER CALCULATIONS

2040 Arrowsmith Dr
6-Storey mixed-use building
Ottawa, Ontario

December 16, 2022

Residential Average Daily Flow:	280	L/capita/day	Residential Peaking Factor:	Harmon Formula
Commercial Average Daily Flow:	28,000	L/ha/day	Harmon Formula Correction Factor:	0.8
Institutional Average Daily Flow:	28,000	L/ha/day	Commercial Peaking Factor:	1.5
Light Industrial Average Daily Flow:	35,000	L/ha/day	Institutional Peaking Factor:	1.5
Heavy Industrial Average Daily Flow:	55,000	L/ha/day	Industrial Peaking Factor:	Ministry of the Environment
Infiltration Allowance:	0.33	L/s/ha	Manning's Roughness Coefficient:	0.013

		Residential													Non-Residential				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual			Cumulative	Individual	Cumulative		Total							
Location		Single	Semi		Apartment				Area	Population	Area	Population	Peaking	Flow Rate	Area	Daily Flow	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached	Duplex	(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	L/ha/day	Factor	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	Q / Q_{Full}
		ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.4	ppu = 2.1	ppu = 3.1	ppu = 1.8																					
Building	Existing				50				0.5017	70	0.5017	70	3.2	0.73	0.1003	28,000	4.5	0.15	0.6020	0.6020	0.20	1.07	25.9	150	147	1.00	0.85	14.43	0.07
	250 SAN																												
																					250 mm Sanitary Sewer:		250	251	1.01	1.22	60.40	

APPENDIX D

STORMWATER MANAGEMENT

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	407 Smyth Road	**Engineer:**	**D.G. Gray Engineering**
Location:	Ottawa, ON	**Contact:**	L. Brosseau
OGS #:	OGS	**Report Date:**	24-Nov-22

Area	0.3742	ha	**Rainfall Station #**	215	
Weighted C	0.7		**Particle Size Distribution**	FINE	
CDS Model	2015-4		**CDS Treatment Capacity**	20	l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.5	9.2%	9.2%	0.4	0.4	1.8	98.3	9.0
1.0	10.6%	19.8%	0.7	0.7	3.7	97.8	10.4
1.5	9.9%	29.7%	1.1	1.1	5.5	97.3	9.6
2.0	8.4%	38.1%	1.5	1.5	7.3	96.8	8.1
2.5	7.7%	45.8%	1.8	1.8	9.2	96.2	7.4
3.0	5.9%	51.7%	2.2	2.2	11.0	95.7	5.7
3.5	4.4%	56.1%	2.5	2.5	12.9	95.2	4.1
4.0	4.7%	60.7%	2.9	2.9	14.7	94.6	4.4
4.5	3.3%	64.0%	3.3	3.3	16.5	94.1	3.1
5.0	3.0%	67.1%	3.6	3.6	18.4	93.6	2.8
6.0	5.4%	72.4%	4.4	4.4	22.0	92.5	5.0
7.0	4.4%	76.8%	5.1	5.1	25.7	91.5	4.0
8.0	3.5%	80.3%	5.8	5.8	29.4	90.4	3.2
9.0	2.8%	83.2%	6.6	6.6	33.1	89.4	2.5
10.0	2.2%	85.3%	7.3	7.3	36.7	88.3	1.9
15.0	7.0%	92.3%	10.9	10.9	55.1	83.1	5.8
20.0	4.5%	96.9%	14.6	14.6	73.5	77.8	3.5
25.0	1.4%	98.3%	18.2	18.2	91.8	72.5	1.0
30.0	0.7%	99.0%	21.8	19.8	100.0	63.7	0.4
35.0	0.5%	99.5%	25.5	19.8	100.0	54.6	0.3
40.0	0.5%	100.0%	29.1	19.8	100.0	47.8	0.3
45.0	0.0%	100.0%	32.8	19.8	100.0	42.5	0.0
50.0	0.0%	100.0%	36.4	19.8	100.0	38.2	0.0
							92.7

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 86.2%

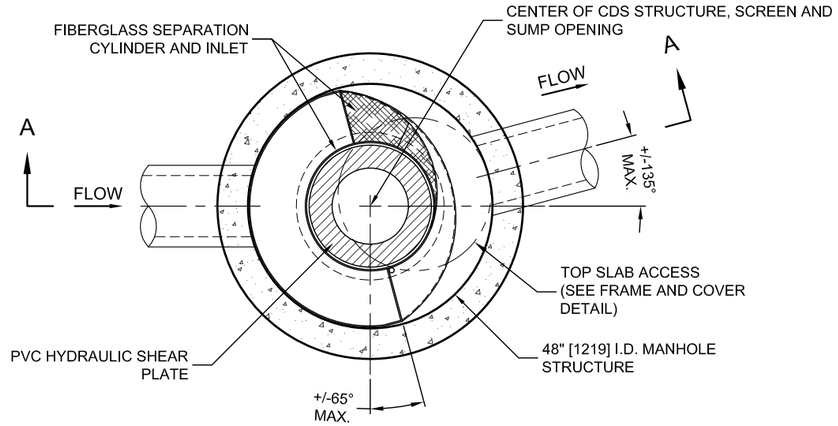
Predicted % Annual Rainfall Treated = 99.7%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON

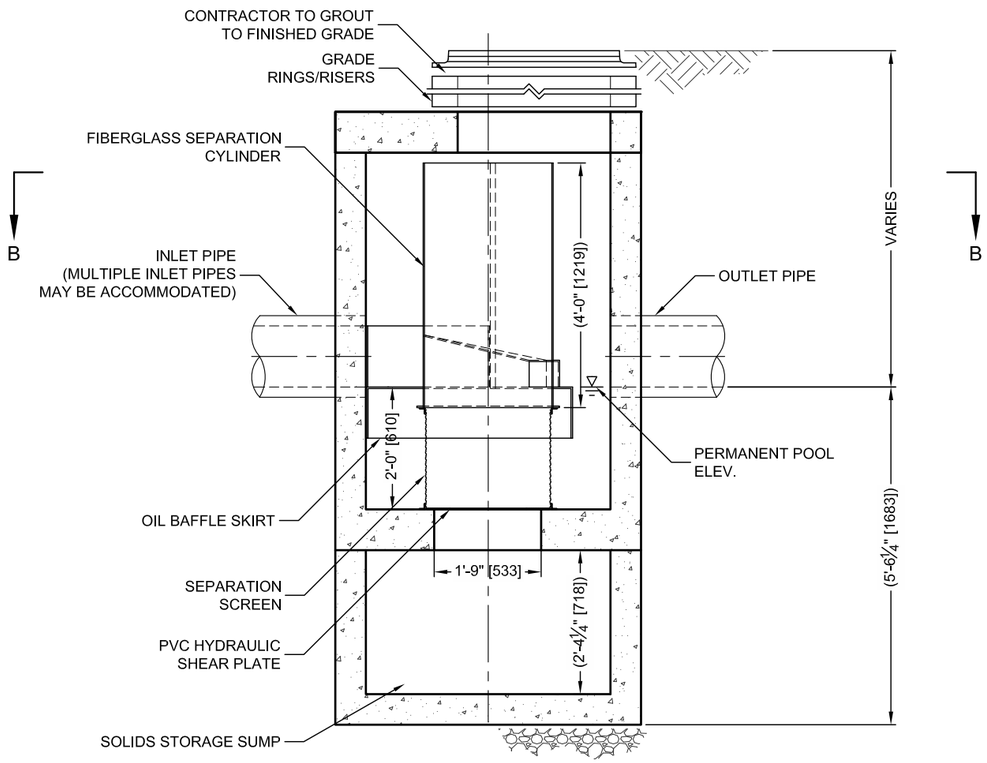
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

3 - CDS Efficiency based on testing conducted at the University of Central Florida

4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications



PLAN VIEW B-B
N.T.S.



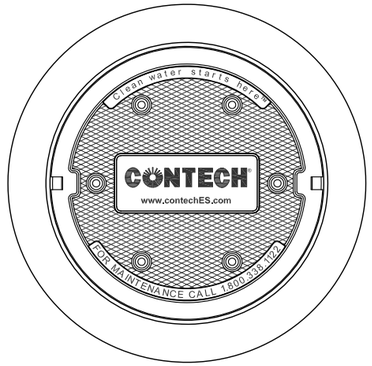
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 8,511,500; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CDS PMSU2015-4-C DESIGN NOTES

THE STANDARD CDS PMSU2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
CUSTOMIZABLE SUMP DEPTH AVAILABLE
ANTI-FLOTATION DESIGN AVAILABLE UPON REQUEST



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

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 CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS PMSU2015-4-C INLINE CDS STANDARD DETAIL

SUMMARY TABLES

100-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	31.89	-	-
AREA II (Penthouse Roof)	-	-	1.61	4.64	4.64
AREA III (6th Floor Roof)	-	-	3.42	21.58	21.58
AREA IV	-	-	21.77	76.40	76.40
TOTAL	118.55	58.70	58.70	102.61	102.61

5-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	16.41	-	-
AREA II (Penthouse Roof)	-	-	1.22	1.98	1.98
AREA III (6th Floor Roof)	-	-	2.62	9.71	9.71
AREA IV	-	-	21.45	27.31	27.31
TOTAL	58.70	58.70	41.69	39.00	39.00

December 21, 2022

2040 Arrowsmith Drive

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

100-YEAR EVENT

			C
Roof Area:	235	sq.m	1.00
Hard Area:	926	sq.m	1.00
Gravel Area:	320	sq.m	0.875
Soft Area:	3,789	sq.m	0.25
Total Catchment Area:	5,270	sq.m	0.45

Bransby Williams Formula (Used when C > 0.40)

$$Tc = \frac{0.057 \bullet L}{Sw^{0.2} \bullet A^{0.1}} \text{ min}$$

Sheet Flow Distance (L):	170	m
Slope of Land (Sw):	1.2	%
Area (A):	0.5270	ha
Time of Concentration (Sheet Flow):	10.0	min
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
100-Year Pre-Development Flow Rate (2.78AiC):	118.55	L/s

5-YEAR EVENT & MAXIMUM ALLOWABLE RELEASE RATE

			C
Roof Area:	235	sq.m	0.90
Hard Area:	926	sq.m	0.90
Gravel Area:	320	sq.m	0.70
Soft Area:	3,789	sq.m	0.20
Total Catchment Area:	5,270	sq.m	0.38

Time of Concentration:	10	min
Rainfall Intensity (i):	104	mm/hr
5-Year Pre-Development Flow Rate (2.78AiC): (Maximum Allowable Release Rate)	58.70	L/s

100-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(100-YEAR EVENT)

			C
Roof Area:	183	sq.m	1.00
Hard Area:	341	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	474	sq.m	0.25
Total Catchment Area:	998	sq.m	0.64
Area (A):	998	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.64		
Flow Rate (2.78AiC):	31.89	L/s	

DRAINAGE AREA II (Penthouse Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	163	sq.m	1.00

No. of Roof Drains:	1	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drain:	130	mm
Maximum Release Rate:	1.61	L/s

Pond Area:	107	sq.m
Maximum Volume Stored:	4.64	cu.m
Maximum Volume Required:	4.64	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	8.09	1.61	6.48	3.89
15	143	6.48	1.61	4.86	4.37
20	120	5.44	1.61	3.82	4.59
25	104	4.71	1.61	3.09	4.64
30	92	4.16	1.61	2.55	4.59
35	83	3.74	1.61	2.13	4.47
40	75	3.41	1.61	1.79	4.30
45	69	3.13	1.61	1.51	4.09
50	64	2.90	1.61	1.28	3.85
55	60	2.70	1.61	1.09	3.59
60	56	2.53	1.61	0.92	3.31
65	53	2.39	1.61	0.77	3.01
70	50	2.26	1.61	0.64	2.70
75	47	2.14	1.61	0.53	2.37
80	45	2.04	1.61	0.42	2.04
85	43	1.95	1.61	0.33	1.70
90	41	1.86	1.61	0.25	1.34
95	39	1.79	1.61	0.17	0.99
100	38	1.72	1.61	0.10	0.62
105	36	1.65	1.61	0.04	0.25
110	35	1.60	1.60	0.00	0.00
115	34	1.54	1.54	0.00	0.00
120	33	1.49	1.49	0.00	0.00
125	32	1.44	1.44	0.00	0.00
130	31	1.40	1.40	0.00	0.00
135	30	1.36	1.36	0.00	0.00
140	29	1.32	1.32	0.00	0.00
145	28	1.29	1.29	0.00	0.00
150	28	1.25	1.25	0.00	0.00
180	24	1.08	1.08	0.00	0.00
210	21	0.96	0.96	0.00	0.00
240	19	0.86	0.86	0.00	0.00
270	17	0.78	0.78	0.00	0.00
300	16	0.72	0.72	0.00	0.00

DRAINAGE AREA III (6th Floor Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	594	sq.m	1.00

No. of Roof Drains:	2	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drains:	138	mm
Maximum Release Rate:	3.42	L/s

Pond Area:	470	sq.m
Maximum Volume Stored:	21.58	cu.m
Maximum Volume Required:	21.58	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	29.49	3.42	26.07	15.64
15	143	23.60	3.42	20.18	18.16
20	120	19.81	3.42	16.39	19.67
25	104	17.15	3.42	13.73	20.59
30	92	15.17	3.42	11.75	21.15
35	83	13.64	3.42	10.22	21.46
40	75	12.41	3.42	8.99	21.58
45	69	11.40	3.42	7.98	21.56
50	64	10.56	3.42	7.14	21.43
55	60	9.85	3.42	6.43	21.21
60	56	9.23	3.42	5.81	20.92
65	53	8.69	3.42	5.27	20.57
70	50	8.22	3.42	4.80	20.17
75	47	7.80	3.42	4.38	19.73
80	45	7.43	3.42	4.01	19.25
85	43	7.09	3.42	3.67	18.74
90	41	6.79	3.42	3.37	18.20
95	39	6.51	3.42	3.09	17.63
100	38	6.26	3.42	2.84	17.04
105	36	6.03	3.42	2.61	16.43
110	35	5.81	3.42	2.39	15.80
115	34	5.62	3.42	2.20	15.16
120	33	5.43	3.42	2.01	14.50
125	32	5.26	3.42	1.84	13.82
130	31	5.10	3.42	1.68	13.13
135	30	4.95	3.42	1.53	12.43
140	29	4.81	3.42	1.40	11.72
145	28	4.68	3.42	1.26	11.00
150	28	4.56	3.42	1.14	10.27
180	24	3.95	3.42	0.53	5.71
210	21	3.49	3.42	0.07	0.92
240	19	3.14	3.14	0.00	0.00
270	17	2.86	2.86	0.00	0.00
300	16	2.62	2.62	0.00	0.00

DRAINAGE AREA IV

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	2,181	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	1,334	sq.m	0.25
Total Catchment Area:	3,515	sq.m	0.72

Water Elevation:	71.11	m
Head:	1.95	m
Centroid of ICD Orifice:	69.15	m
Invert of Outlet Pipe of MH-7:	69.11	m
Orifice Diameter:	86	mm
Orifice Area:	5,766	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	21.77	L/s

CB/MH	Top Area	Depth	Volume	
CB-1	161	0.14	7.30	cu.m
CB-2	409	0.19	25.45	cu.m
CB/MH-3	104	0.14	4.74	cu.m
CB-4	429	0.24	33.78	cu.m
CB-5	81	0.14	3.69	cu.m
CB-6	31	0.14	1.43	cu.m
		Maximum Volume Stored:	76.40	cu.m
		Maximum Volume Required:	76.40	cu.m

DRAINAGE AREA IV (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	124.82	21.77	103.04	61.83
15	143	99.89	21.77	78.11	70.30
20	120	83.85	21.77	62.07	74.49
25	104	72.59	21.77	50.82	76.23
30	92	64.22	21.77	42.44	76.40
35	83	57.72	21.77	35.95	75.50
40	75	52.53	21.77	30.75	73.81
45	69	48.27	21.77	26.49	71.53
50	64	44.71	21.77	22.93	68.79
55	60	41.68	21.77	19.90	65.68
60	56	39.07	21.77	17.30	62.27
65	53	36.80	21.77	15.03	58.61
70	50	34.80	21.77	13.03	54.73
75	47	33.03	21.77	11.26	50.66
80	45	31.45	21.77	9.68	46.44
85	43	30.03	21.77	8.25	42.08
90	41	28.74	21.77	6.96	37.60
95	39	27.57	21.77	5.79	33.01
100	38	26.50	21.77	4.72	28.32
105	36	25.51	21.77	3.74	23.55
110	35	24.61	21.77	2.83	18.70
115	34	23.77	21.77	2.00	13.77
120	33	22.99	21.77	1.22	8.78
125	32	22.27	21.77	0.50	3.73
130	31	21.60	21.60	0.00	0.00
135	30	20.97	20.97	0.00	0.00
140	29	20.38	20.38	0.00	0.00
145	28	19.82	19.82	0.00	0.00
150	28	19.30	19.30	0.00	0.00
180	24	16.71	16.71	0.00	0.00
210	21	14.78	14.78	0.00	0.00
240	19	13.29	13.29	0.00	0.00
270	17	12.09	12.09	0.00	0.00
300	16	11.11	11.11	0.00	0.00

5-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(5-YEAR EVENT)

			C
Roof Area:	183	sq.m	0.90
Hard Area:	341	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	0	sq.m	0.30
Soft Area:	474	sq.m	0.20
Total Catchment Area:	998	sq.m	0.57
Area (A):	998	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.57		
Flow Rate (2.78AiC):	16.41	L/s	

DRAINAGE AREA II (Penthouse Roof)

(5-YEAR EVENT)

			C
Total Catchment Area:	163	sq.m	0.90

No. of Roof Drains:	1	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drain:	98	mm
Maximum Release Rate:	1.22	L/s

Pond Area:	61	sq.m
Maximum Volume Stored:	1.98	cu.m
Maximum Volume Required:	1.98	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	4.25	1.22	3.03	1.82
15	84	3.41	1.22	2.19	1.97
20	70	2.87	1.22	1.65	1.98
25	61	2.48	1.22	1.27	1.90
30	54	2.20	1.22	0.98	1.77
35	49	1.98	1.22	0.76	1.60
40	44	1.80	1.22	0.59	1.41
45	41	1.66	1.22	0.44	1.19
50	38	1.54	1.22	0.32	0.96
55	35	1.43	1.22	0.22	0.72
60	33	1.34	1.22	0.13	0.46
65	31	1.27	1.22	0.05	0.20
70	29	1.20	1.20	0.00	0.00
75	28	1.14	1.14	0.00	0.00
80	27	1.08	1.08	0.00	0.00
85	25	1.03	1.03	0.00	0.00
90	24	0.99	0.99	0.00	0.00

DRAINAGE AREA III (6th Floor Roof)

(5-YEAR EVENT)

			C	
Total Catchment Area:	594	sq.m	0.90	
No. of Roof Drains:	2			
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)		
Depth at Roof Drains:	105	mm		
Maximum Release Rate:	2.62	L/s	Pond Area:	276 sq.m
			Maximum Volume Stored:	9.71 cu.m
			Maximum Volume Required:	9.71 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	15.49	2.62	12.87	7.72
15	84	12.42	2.62	9.80	8.82
20	70	10.44	2.62	7.82	9.38
25	61	9.05	2.62	6.43	9.65
30	54	8.01	2.62	5.39	9.71
35	49	7.21	2.62	4.59	9.64
40	44	6.57	2.62	3.95	9.47
45	41	6.04	2.62	3.42	9.23
50	38	5.60	2.62	2.98	8.93
55	35	5.22	2.62	2.60	8.58
60	33	4.90	2.62	2.28	8.19
65	31	4.61	2.62	1.99	7.78
70	29	4.37	2.62	1.75	7.33
75	28	4.14	2.62	1.52	6.86
80	27	3.95	2.62	1.33	6.37
85	25	3.77	2.62	1.15	5.87
90	24	3.61	2.62	0.99	5.34
95	23	3.46	2.62	0.84	4.81
100	22	3.33	2.62	0.71	4.26
105	22	3.21	2.62	0.59	3.70
110	21	3.09	2.62	0.47	3.13
115	20	2.99	2.62	0.37	2.55
120	19	2.89	2.62	0.27	1.97
125	19	2.80	2.62	0.18	1.37
130	18	2.72	2.62	0.10	0.77
135	18	2.64	2.62	0.02	0.16
140	17	2.57	2.57	0.00	0.00
145	17	2.50	2.50	0.00	0.00
150	16	2.43	2.43	0.00	0.00
180	14	2.11	2.11	0.00	0.00
210	13	1.87	1.87	0.00	0.00
240	11	1.68	1.68	0.00	0.00
270	10	1.53	1.53	0.00	0.00
300	9	1.41	1.41	0.00	0.00

DRAINAGE AREA IV

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	2,181	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	0	sq.m	0.30
Soft Area:	1,334	sq.m	0.20
Total Catchment Area:	3,515	sq.m	0.63

Water Elevation:	71.05	m
Head:	1.90	m
Centroid of ICD Orifice:	69.15	m
Invert of Outlet Pipe of MH-7:	69.11	m
Orifice Diameter:	86	mm
Orifice Area:	5,766	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	21.45	L/s

CB/MH	Top Area	Depth	Volume	
CB-1	87	0.08	2.28	cu.m
CB-2	209	0.13	9.00	cu.m
CB/MH-3	34	0.08	0.91	cu.m
CB-4	246	0.18	14.69	cu.m
CB-5	17	0.08	0.44	cu.m
CB-6	4	0.08	0.11	cu.m
		Maximum Volume Stored:	27.31	cu.m
		Maximum Volume Required:	27.31	cu.m

DRAINAGE AREA IV (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	64.58	21.45	43.13	25.88
15	84	51.79	21.45	30.34	27.31
20	70	43.55	21.45	22.09	26.51
25	61	37.75	21.45	16.29	24.44
30	54	33.43	21.45	11.98	21.56
35	49	30.07	21.45	8.62	18.11
40	44	27.39	21.45	5.94	14.25
45	41	25.18	21.45	3.73	10.08
50	38	23.34	21.45	1.89	5.66
55	35	21.77	21.45	0.32	1.05
60	33	20.42	20.42	0.00	0.00
65	31	19.24	19.24	0.00	0.00
70	29	18.21	18.21	0.00	0.00
75	28	17.29	17.29	0.00	0.00
80	27	16.46	16.46	0.00	0.00
85	25	15.72	15.72	0.00	0.00
90	24	15.06	15.06	0.00	0.00
95	23	14.45	14.45	0.00	0.00
100	22	13.89	13.89	0.00	0.00
105	22	13.38	13.38	0.00	0.00
110	21	12.91	12.91	0.00	0.00
115	20	12.47	12.47	0.00	0.00
120	19	12.07	12.07	0.00	0.00
125	19	11.69	11.69	0.00	0.00
130	18	11.34	11.34	0.00	0.00
135	18	11.01	11.01	0.00	0.00
140	17	10.70	10.70	0.00	0.00
145	17	10.41	10.41	0.00	0.00
150	16	10.14	10.14	0.00	0.00
180	14	8.79	8.79	0.00	0.00
210	13	7.78	7.78	0.00	0.00
240	11	7.00	7.00	0.00	0.00
270	10	6.38	6.38	0.00	0.00
300	9	5.86	5.86	0.00	0.00

D.B. Gray Engineering Inc.

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STORM SEWER CALCULATIONS

Rational Method — Two-YEAR EVENT

2040 Arrowsmith Dr
6-Storey Mixed-use Building
Ottawa, Ontario

December 21, 2022

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
From	To	Roof C = 0.90 (ha)	Hard C = 0.90 (ha)	Gravel C = 0.70 (ha)	Soft C = 0.20 (ha)	2.78AC	2.78AC	Time (min)	Rainfall Intensity (mm/hr)	Flow Rate (L/s)	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Slope (%)	Velocity (m/s)	Q_{Full} Capacity (L/s)	Time (min)	Q / Q_{Full}
CB-1	CB-2		0.0217		0.0125	0.0612	0.0612	10.00	77	4.70	16.4	250	251	0.432	0.80	39.50	0.34	0.12
CB-2	CB/MH-3				0.0739	0.0411	0.1023	10.34	76	7.73	19	250	251	0.432	0.80	39.50	0.40	0.20
CB-4	CB/MH-3		0.0893		0.0267	0.2383	0.2383	10.00	77	18.30	2.7	250	251	0.432	0.80	39.50	0.06	0.46
CB-5	CB/MH-3		0.1129		0.0470	0.3086	0.3086	10.00	77	23.70	3.8	250	251	0.432	0.80	39.50	0.08	0.60
CB/MH-3	MH-7		0.0146			0.0365	0.6857	10.74	74	50.80	46.6	300	299	0.432	0.90	62.99	0.87	0.81
CB-6	MH-7		0.0049		0.0026	0.0137	0.0137	10.00	77	1.05	3.8	250	251	0.432	0.80	39.50	0.08	0.03
MH-7	MH-8					0.0000	0.6994	11.60	71	49.76	29.2	300	299	0.34	0.80	55.89	0.61	0.89
MH-8	MH-9					0.0000	0.6994	12.22	69	48.42	3.7	300	299	0.34	0.80	55.89	0.08	0.87
ROOF	MH-9	0.0940				0.2352	0.2352	10.00	77	18.06	10.9	200	201	1.00	1.05	33.24	0.17	0.54
MH-9	MH-10					0.0000	0.9346	12.29	69	64.48	55.8	450	457	0.34	1.06	173.23	0.88	0.37
MH-10	MH-11					0.0000	0.9346	13.17	66	62.10	32.3	450	457	0.34	1.06	173.23	0.51	0.36
											EXISTING JASMINE CR MUNICIPAL STORM SEWER							
												600	610	0.71	1.85	540.69		

APPENDIX E

DEVELOPMENT SERVICING STUDY CHECKLIST

GENERAL

Executive Summary: **N/A**

Date and revision number of report: **Included**

Location map and plan showing municipal address, boundary and layout of proposed development: **Included**

Plan showing site and location of all existing services: **Included**

Development statistics, land use, density, adherence to zoning and Official Plan and reference to applicable watershed and subwatershed plans: **N/A**

Summary of Pre-Application Consultation meetings with City of Ottawa and other approval agencies: **Included**

Confirmation of conformance with higher level studies: **Included**

Statement of objectives and servicing criteria: **Included**

Identification of existing and proposed infrastructure available in the immediate area: **Included**

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development: **Included**

Concept level master grading plan to confirm existing and proposed grades in the proposed development: **Included**

Identification of potential impacts of proposed piped services on private services on adjacent lands: **N/A**

Proposed phasing of proposed development: **N/A**

Reference to geotechnical studies: **Included**

All preliminary and formal site plan submissions should have the following information:

- Metric scale: **Included**
- North arrow: **Included**
- Key plan: **Included**
- Property limits: **Included**
- Existing and proposed structures and parking areas: **Included**
- Easements, road widenings and right-of-ways: **Included**
- Street names: **Included**

WATER SERVICING

Confirmation of conformance with Master Servicing Study: **N/A**

Availability of public infrastructure to service proposed development: **Included**

Identification of system constraints: **Included**

Identification of boundary conditions: **Included**

Confirmation of adequate domestic supply: **Included**

Confirmation of adequate fire flow: **Included**

Check of high pressures: **Included**

Definition of phasing constraints: **N/A**

Address reliability requirements: **N/A**

Check on necessity of a pressure zone boundary modification: **N/A**

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for proposed development: **Included**

Description of proposed water distribution network: **Included**

Description of required off-site infrastructure to service proposed development: **N/A**

Confirmation that water demands are calculated based on the City of Ottawa Water Design Guidelines: **Included**

Provision of a model schematic showing the boundary conditions locations, streets, parcels and building locations: **Included**

SANITARY SERVICING

Summary of proposed design criteria: **Included**

Confirmation of conformance with Master Servicing Study: **N/A**

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the City of Ottawa Sewer Design Guidelines: **N/A**

Description of existing sanitary sewer available for discharge of wastewater from proposed development: **Included**

Verification of available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service proposed development: **N/A**

Calculations related to dry-weather and wet-weather flow rates: **Included**

Description of proposed sewer network: **Included**

Discussion of previously identified environmental constraints and impact on servicing: **N/A**

Impacts of proposed development on existing pumping stations or requirements for new pumping station: **N/A**

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: **N/A**

Identification and implementation of emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: **N/A**

Special considerations (e.g. contamination, corrosive environment): **N/A**

STORMWATER MANAGEMENT & STORM SERVICING

Description of drainage outlets and downstream constraints: **Included**

Analysis of available capacity in existing public infrastructure: **N/A**

Plan showing subject lands, its surroundings, receiving watercourse, existing drainage pattern and proposed drainage pattern: **Included**

Water quantity control objective: **Included**

Water quality control objective: **Included**

Description of the stormwater management concept: **Included**

Setback from private sewage disposal systems: **N/A**

Watercourse and hazard lands setbacks: **N/A**

Record of pre-consultation with the Ministry of the Environment, Conservation and Parks and the Conservation Authority having jurisdiction on the affected watershed: **N/A**

Confirmation of conformance with Master Servicing Study: **N/A**

Storage requirements and conveyance capacity for minor events (5-year return period) and major events (100-year return period): **Included**

Identification of watercourses within the proposed development and how watercourses will be protected or if necessary altered by the proposed development: **N/A**

Calculation of pre-development and post-development peak flow rates: **Included**

Any proposed diversion of drainage catchment areas from one outlet to another: **N/A**

Proposed minor and major systems: **Included**

If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event: **N/A**

Identification of potential impacts to receiving watercourses: **N/A**

Identification of municipal drains: **N/A**

Description of how the conveyance and storage capacity will be achieved for the proposed development: **Included**

100-year flood levels and major flow routing: **Included**

Inclusion of hydraulic analysis including hydraulic grade line elevations: **N/A**

Description of erosion and sediment control during construction: **Included**

Obtain relevant floodplain information from Conservation Authority: **N/A**

Identification of fill constraints related to floodplain and geotechnical investigation: **N/A**

APPROVAL AND PERMIT REQUIREMENTS

Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act: **N/A**

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act: **N/A**

Changes to Municipal Drains: **N/A**

Other permits (e.g. National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation): **N/A**

CONCLUSIONS

Clearly stated conclusions and recommendations: **Included**

Comments received from review agencies: **N/A**

Signed and stamped by a professional Engineer registered in Ontario: **Included**