D.B. Gray Engineering Inc.

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

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SITE SERVICING & STORMWATER MANAGEMENT REPORT

433-435 CHURCHILL AVENUE NORTH
468-472 BYRON PLACE
OTTAWA, ONTARIO

REPORT NO. 26057

AUGUST 14, 2026

CONTENTS

1.0 INTRODUCTION
2.0 WATER SERVICING
3.0 SANITARY SERVICING
4.0 STORMWATER MANAGEMENT
5.0 CONCLUSIONS

LIST OF APPENDICES

A WATER SERVICING
B SANITARY SERVICING
C STORMWATER MANAGEMENT

1.0 INTRODUCTION

This report has been prepared in support of the Zoning By-law Amendment application for 433-435 Churchill Avenue North and 468-472 Byron Place in Ottawa, Ontario. The Zoning By-law Amendment would permit the development of the proposed apartment buildings.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

2.1.1 BUILDING 1 – 433-435 CHURCHILL AVENUE NORTH

The proposed building will have a fully supervised sprinkler system. The sprinkler system is to be designed, installed and maintained in accordance with NFPA standards and the Fire Underwriters Survey. Refer to Appendix A.

When calculating the required fire flow on private property in urban areas, the Ontario Building Code Method is to be used. Using the Ontario Building Code Method, the required fire flow is calculated to be 9,000 L/min (150 L/s). When the Ontario Building Code Method yields a required fire flow of 9,000 L/min (150 L/s), the Fire Underwriters Survey Method is to be used instead. Using the Fire Underwriters Survey Method, the required fire flow is calculated to be 14,000 L/min (233.3 L/s). Refer to calculations in Appendix A.

The boundary conditions in the 400 mm Churchill Avenue North municipal watermain provided by the City of Ottawa at Connection 1 indicate a hydraulic grade line (HGL) of 109.2 m for the 233.3 L/s fire flow. Refer to Appendix A. This HGL calculates to 307 kPa (45 psi). Since the pressure is above the Ontario Building Code's minimum required pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

The aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. There are three existing municipal Class AA fire hydrants within 75 m of the proposed building; one is located in front of 439 Churchill Avenue North; one is located directly across from 468-472 Byron Place; and one is located in front of 421 Churchill Avenue North. Each can contribute 5,700 L/min (95 L/s) for an aggregate flow of 17,100 L/min (285 L/s), which is greater than the required fire flow of 14,000 L/min (233.3 L/s).

2.1.2 BUILDING 2 – 472 BYRON PLACE

When calculating the required fire flow on private property in urban areas, the Ontario Building Code Method is to be used. Using the Ontario Building Code Method, the required fire flow is calculated to be 4,500 L/min (75 L/s). Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Byron Place municipal watermain provided by the City of Ottawa at Connection 2 indicate a hydraulic grade line (HGL) of 109.7 m for the 75 L/s fire flow. Refer to Appendix A. This HGL calculates to 325 kPa (47 psi). Since the pressure is above the Ontario Building Code's minimum required pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

The aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. There is an existing municipal Class AA fire hydrant located directly across Byron Place. It can contribute 5,700 L/min (95 L/s), which is greater than the required fire flow of 4,500 L/min (75 L/s).

2.1.3 BUILDING 3 – 468 BYRON PLACE

When calculating the required fire flow on private property in urban areas, the Ontario Building Code Method is to be used. Using the Ontario Building Code Method, the required fire flow is calculated to be 3,600 L/min (60 L/s). Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Highcroft Avenue municipal watermain provided by the City of Ottawa at Connection 3 indicate a hydraulic grade line (HGL) of 109.7 m for the 60 L/s fire flow. Refer to Appendix A. This HGL calculates to 325 kPa (47 psi). Since the pressure is above the Ontario Building Code's minimum required pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

The aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. There is an existing municipal Class AA fire hydrant located directly across Byron Place. It can contribute 5,700 L/min (95 L/s), which is greater than the required fire flow of 3,600 L/min (60 L/s).

2.2 DOMESTIC WATER SUPPLY

2.2.1 BUILDING 1 – 433-435 CHURCHILL AVENUE NORTH

Based on the 30 – 1 bedroom apartment units, 15 – 2 bedroom apartment units and 5 – 3 bedroom apartment units, the average daily demand is calculated to be 0.3 L/s, the maximum daily demand is calculated to be 2.1 L/s and the maximum hourly demand is calculated to be 3.1 L/s. Refer to calculations in Appendix A.

The boundary conditions in the 400 mm Churchill Avenue North municipal watermain provided by the City of Ottawa at Connection 1 indicate a minimum HGL of 109.4 m and a maximum HGL of 114.5 m. Refer to Appendix A. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 327 kPa (47 psi) and 377 kPa (55 psi). This is an acceptable range for the proposed development.

2.2.2 BUILDING 2 – 472 BYRON PLACE

Based on the 12 – 2 bedroom apartment units, the average daily demand is calculated to be 0.1 L/s, the maximum daily demand is calculated to be 0.8 L/s and the maximum hourly demand is calculated to be 1.2 L/s. Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Byron Place municipal watermain provided by the City of Ottawa at Connection 2 indicate a minimum HGL of 109.4 m and a maximum HGL of 114.5 m. Refer to Appendix A. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 327 kPa (47 psi) and 377 kPa (55 psi). This is an acceptable range for the proposed development.

2.2.3 BUILDING 3 – 468 BYRON PLACE

Based on the 12 – 2 bedroom apartment units, the average daily demand is calculated to be 0.1 L/s, the maximum daily demand is calculated to be 0.8 L/s and the maximum hourly demand is calculated to be 1.2 L/s. Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Highcroft Avenue municipal watermain provided by the City of Ottawa at Connection 3 indicate a minimum HGL of 109.4 m and a maximum HGL of 114.5 m. Refer to Appendix A. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 327 kPa (47 psi) and 377 kPa (55 psi). This is an acceptable range for the proposed development.

3.0 SANITARY SERVICING

3.1 BUILDING 1 – 433-435 CHURCHILL AVENUE NORTH

Based on the 30 – 1 bedroom apartment units, 15 – 2 bedroom apartment units and 5 – 3 bedroom apartment units, the post-development sanitary flow rate is calculated to be 0.95 L/s. A 200 mm sanitary sewer service at the minimum 1% slope (32.80 L/s capacity) could service the proposed development. At the design flow rate the sanitary sewer service would only be at 3% capacity. The 200 mm sanitary sewer service would connect to the existing 250 mm Churchill Avenue North municipal sanitary sewer, which at 0.7% slope has a capacity of 49.75 L/s. Refer to calculations in Appendix B. The post-development increase in flow is expected to have an acceptable impact on the 250 mm Churchill Avenue North municipal sanitary sewer.

3.2 BUILDING 2 – 472 BYRON PLACE

Based on the 12 – 2 bedroom apartment units, the post-development sanitary flow rate is calculated to be 0.28 L/s. A 150 mm sanitary sewer service at the minimum 1% slope (15.23 L/s capacity) could service the proposed development. At the design flow rate the sanitary sewer service would only be at 2% capacity. The 150 mm sanitary sewer service would connect to the existing 250 mm Byron Place municipal sanitary sewer, which at 1.15% slope has a capacity of 63.77 L/s. Refer to calculations in Appendix B. The post-development increase in flow is expected to have an acceptable impact on the 250 mm Byron Place municipal sanitary sewer.

3.3 BUILDING 3 – 468 BYRON PLACE

Based on the 12 – 2 bedroom apartment units, the post-development sanitary flow rate is calculated to be 0.28 L/s. A 150 mm sanitary sewer service at the minimum 1% slope (15.23 L/s capacity) could service the proposed development. At the design flow rate the sanitary sewer service would only be at 2% capacity. The 150 mm sanitary sewer service would connect to the existing 250 mm Highcroft Avenue municipal sanitary sewer, which at 0.4% slope has a capacity of 37.61 L/s. Refer to calculations in Appendix B. The post-development increase in flow is expected to have an acceptable impact on the 250 mm Highcroft Avenue municipal sanitary sewer.

4.0 STORMWATER MANAGEMENT

4.1 BUILDING 1 – 433-435 CHURCHILL AVENUE NORTH

Using the City of Ottawa's Quick Stormwater Management Tool, a maximum storage volume of 14,450 L (14.45 cu.m) and release rate of 5.14 L/s are required. Refer to Appendix C. The Rational and Modified Rational Methods are used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix C.

Drainage Area I (Building 1 Roof – 535 sq.m)
The 3 roof drains 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.

	100-Year Event
Maximum Release Rate	4.78 L/s
Maximum Depth at Roof Drains	128 mm
Maximum Volume Stored	15.99 cu.m

Summary
The maximum post-development release rate during the 100-year event through the flow control roof drains is calculated to be 4.78 L/s, which is 7% less than the maximum allowable release rate calculated by the City of Ottawa's Quick Stormwater Management Tool. To achieve the maximum post-development release rate, a maximum storage volume of 15.99 cu.m is required and provided during the 100-year event, which is 11% greater than the maximum storage volume calculated by the City of Ottawa's Quick Stormwater Management Tool.

	100-Year Event
Maximum Allowable Release Rate	5.14 L/s
Maximum Release Rate	4.78 L/s
Maximum Volume Required	14.45 cu.m
Maximum Volume Stored	15.99 cu.m

4.2 BUILDING 2 – 472 BYRON PLACE

Using the City of Ottawa's Quick Stormwater Management Tool, a maximum storage volume of 6,755 L (6.755 cu.m) and release rate of 2.4 L/s are required. Refer to Appendix C. The Rational and Modified Rational Methods are used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix C.

Drainage Area II (Building 2 Roof – 250 sq.m)
The 2 roof drains are to be flow control type roof drains, which will restrict the flow of stormwater and cause it to pond on the roof. Roof drains are to be Watts RD-100 c/w a Watts Adjustable Accutrol Weir in the ½ open position and release 1.26 L/s at 150 mm (20 USgpm at 6”). The roof drains will drain to an outlet 0.30 m above grade.

	100-Year Event
Maximum Release Rate	2.25 L/s
Maximum Depth at Roof Drains	130 mm
Maximum Volume Stored	7.45 cu.m

Summary
The maximum post-development release rate during the 100-year event through the flow control roof drains is calculated to be 2.25 L/s, which is 6% less than the maximum allowable release rate calculated by the City of Ottawa’s Quick Stormwater Management Tool. To achieve the maximum post-development release rate, a maximum storage volume of 7.45 cu.m is required and provided during the 100-year event, which is 10% greater than the maximum storage volume calculated by the City of Ottawa’s Quick Stormwater Management Tool.

	100-Year Event
Maximum Allowable Release Rate	2.4 L/s
Maximum Release Rate	2.25 L/s
Maximum Volume Required	6.755 cu.m
Maximum Volume Stored	7.45 cu.m

4.3 BUILDING 3 – 468 BYRON PLACE

Using the City of Ottawa’s Quick Stormwater Management Tool, a maximum storage volume of 6,755 L (6.755 cu.m) and release rate of 2.4 L/s are required. Refer to Appendix C. The Rational and Modified Rational Methods are used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix C.

Drainage Area III (Building 3 Roof – 250 sq.m)
The 2 roof drains are to be flow control type roof drains, which will restrict the flow of stormwater and cause it to pond on the roof. Roof drains are to be Watts RD-100 c/w a Watts Adjustable Accutrol Weir in the ½ open position and release 1.26 L/s at 150 mm (20 USgpm at 6”).

	100-Year Event
Maximum Release Rate	2.25 L/s
Maximum Depth at Roof Drains	130 mm
Maximum Volume Stored	7.45 cu.m

Summary

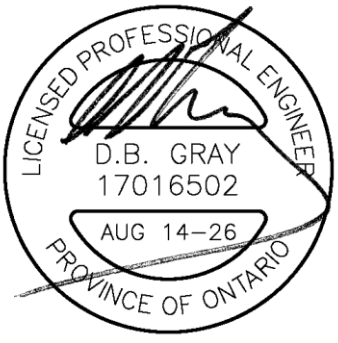
The maximum post-development release rate during the 100-year event through the flow control roof drains is calculated to be 2.25 L/s, which is 6% less than the maximum allowable release rate calculated by the City of Ottawa's Quick Stormwater Management Tool. To achieve the maximum post-development release rate, a maximum storage volume of 7.45 cu.m is required and provided during the 100-year event, which is 10% greater than the maximum storage volume calculated by the City of Ottawa's Quick Stormwater Management Tool.

	100-Year Event
Maximum Allowable Release Rate	2.4 L/s
Maximum Release Rate	2.25 L/s
Maximum Volume Required	6.755 cu.m
Maximum Volume Stored	7.45 cu.m

5.0 CONCLUSIONS

1. There is an adequate water supply for firefighting from the existing municipal water distribution system.
2. There is an acceptable range of water pressures in the existing municipal water distribution system.
3. The post-development sanitary flow rates will be adequately handled by the proposed sanitary sewer services.
4. The post-development increase in sanitary flow is expected to have an acceptable impact on the existing municipal sanitary sewers.
5. The maximum post-development release rates during the 100-year event through the flow control roof drains will be less than the maximum allowable release rates calculated by the City of Ottawa's Quick Stormwater Management Tool; and the maximum storage volumes provided during the 100-year event will be greater than the maximum storage volumes calculated by the City of Ottawa's Quick Stormwater Management Tool.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

WATER SERVICING

D.B. Gray Engineering Inc.

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July 30, 2026

433-435 Churchill Avenue North

6-Storey Apartment Building 1

Ottawa, Ontario

FIRE FLOW CALCULATIONS

OBC Method

Q = Required water supply in litres
= KVS_{Total}

K = Water supply coefficient as per OBC A-3.2.5.7. Table 1
= 18 Group C Occupancy, Building is of combustible construction with fire separations and fire resistance ratings in accordance with Subsection 3.2.2.

V = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
6th Floor:	535	3	1,605
5th Floor:	535	3	1,605
4th Floor:	590	3	1,770
3rd Floor:	610	3	1,830
2nd Floor:	610	3	1,830
1st Floor:	535	3	1,605
Basement:	535	3	1,605
			11,850

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0.0	10	(to centerline of Byron Place)
$S_{Side\ 2}$	0.25	7.5	(to east property line)
$S_{Side\ 3}$	0.5	1.5	(to south property line)
$S_{Side\ 4}$	0.0	12	(to centerline of Churchill Avenue North)
S_{Total}	1.75		

Q = 373,275 L
= 9,000 L/min as per OBC A-3.2.5.7. Table 2
= 150 L/s

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August 12, 2026

433-435 Churchill Avenue North

6-Storey Apartment Building 1

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
= 1.5 Type V Wood Frame Construction

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

6th Floor:	535	sq.m
5th Floor:	535	sq.m
4th Floor:	590	sq.m
3rd Floor:	610	sq.m
2nd Floor:	610	sq.m
1st Floor:	535	sq.m
	3,415	sq.m

RFF = 19,285 L/min
= 19,000 L/min (rounded to nearest 1,000 L/min)

Occupancy and Contents Adjustment Factor

	-15%	Limited Combustible Contents
=	-2,850	L/min Occupancy and Contents Adjustment Factor

RFF = 16,150 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
10%	Fully supervised sprinkler system

= 8,075 L/min Automatic Sprinkler Protection Credit

Exposure Adjustment Charge

Side	Charge	Distance	Construction	Length	Storeys	Factor
North	0%	over 30 m				
East	17%	3.1 m to 10 m	Type V	20	3	60
South	16%	3.1 m to 10 m	Type V	17	2	34
West	2%	20.1 m to 30 m	Type V	13	2	26

35% Exposure Adjustment Charge

= 5,653 L/min Exposure Adjustment Charge

RFF = 13,728 L/min

= 14,000 L/min (rounded to nearest 1,000 L/min)

= 233.3 L/s

233.3 L/s Fire Flow HGL: 109.2 m

Elevation at Fire Hydrant: 77.9 m

Static Pressure at Fire Hydrant: 31.3 m 307 kPa 45 psi

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August 12, 2026

472 Byron Place

3-Storey Apartment Building 2

Ottawa, Ontario

FIRE FLOW CALCULATIONS

OBC Method

Q = Required water supply in litres
= KVS_{Total}

K = Water supply coefficient as per OBC A-3.2.5.7. Table 1
= 23 Group C Occupancy, Building is of combustible construction with fire separations without fire resistance ratings.

V = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
3rd Floor:	250	3	750
2nd Floor:	250	3	750
1st Floor:	250	3	750
Basement:	250	3	750
			3,000

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0.0	10	(to centerline of Byron Place)
$S_{Side\ 2}$	0.5	1.7	(to east property line)
$S_{Side\ 3}$	0.25	7.5	(to south property line)
$S_{Side\ 4}$	0.5	1.5	(to west property line)
S_{Total}	2.25		Need not exceed 2.0

Q = 138,000 L
= 4,500 L/min as per OBC A-3.2.5.7. Table 2
= 75 L/s

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75 L/s Fire Flow HGL: 109.7 m

Elevation at Fire Hydrant: 76.6 m

Static Pressure at Fire Hydrant: 33.1 m 325 kPa 47 psi

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August 12, 2026

468 Byron Place

3-Storey Apartment Building 3

Ottawa, Ontario

FIRE FLOW CALCULATIONS

OBC Method

Q = Required water supply in litres
= KVS_{Total}

K = Water supply coefficient as per OBC A-3.2.5.7. Table 1
= 23 Group C Occupancy, Building is of combustible construction with fire separations without fire resistance ratings.

V = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
3rd Floor:	250	3	750
2nd Floor:	250	3	750
1st Floor:	250	3	750
Basement:	250	3	750
			3,000

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0.0	10	(to centerline of Byron Place)
$S_{Side\ 2}$	0.0	10	(to centerline of Highcroft Avenue)
$S_{Side\ 3}$	0.25	7.5	(to south property line)
$S_{Side\ 4}$	0.5	1.7	(to west property line)
S_{Total}	1.75		

Q = 120,750 L
= 3,600 L/min as per OBC A-3.2.5.7. Table 2
= 60 L/s

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60 L/s Fire Flow HGL: 109.7 m

Elevation at Fire Hydrant: 76.6 m

Static Pressure at Fire Hydrant: 33.1 m 325 kPa 47 psi

WATER SUPPLY
FOR
PUBLIC FIRE PROTECTION

A Guide to Recommended Practice in Canada

2020



Fire Underwriters Survey

Automatic Sprinkler Protection

The required fire flow may be reduced by up to 50 percent for complete Automatic Sprinkler Protection depending upon adequacy of the system. Where only part of a building is protected by Automatic Sprinkler Protection, credit should be interpolated by determining the percentage of the Total Floor Area being protected by the automatic sprinkler system.

To be able to apply the full 50 percent reduction, the following areas should be reviewed to determine the appropriate level of credit for having Automatic Sprinkler Protection as per the table below:

Table 4 Sprinkler Credits

Automatic Sprinkler System Design	Credit	
	With complete building coverage	With partial building coverage of X%
Automatic sprinkler protection designed and installed in accordance with NFPA 13	30%	30% × Percentage of Total Floor Area Serviced by Sprinkler System
Water supply is standard for both the system and Fire Department hose lines	10%	10% × Percentage of Total Floor Area Serviced by Sprinkler System
Fully supervised system	10%	10% × Percentage of Total Floor Area Serviced by Sprinkler System

Automatic Sprinkler Protection Designed and Installed in Accordance with Applicable NFPA Standards (30%)

The initial credit for Automatic Sprinkler Protection is a maximum of 30% based on the system being designed and installed in accordance with the applicable criteria of NFPA 13, *Standard for Installation of Sprinkler Systems,* NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential* Occupancies, or NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes* and being maintained in accordance with the applicable criteria of NFPA 25, *Standard for the Inspections, Testing and Maintenance of Water-Based Fire* (see Recognition of Automatic Sprinkler Protection).

Water Supply is Standard for both the Sprinkler System and Fire Department Hose Lines (10%)

To qualify to apply an additional 10% reduction, a water supply that is standard for both the sprinkler system and fire department hose lines is required, to qualify the following conditions should be satisfied:

a) Sprinkler system is supplied by a pressurized water supply system (public or private) that is designed and built with no major non-conformance issues (i.e. water supply system is designed in accordance with Part 1 of the Water Supply for Public Fire Protection to qualify for fire insurance grading recognition).

b) Calculated demand for maximum sprinkler design area operation in addition to hose stream requirements are below the available water supply curve (at the corresponding flow rate and pressure). An appropriate safety margin is used to take into account the difference between the available water supply curve at the time of hydrant flow testing as compared to the available water supply curve during Maximum Day Demand.

c) Volume of water available is adequate for the total flow rate including the maximum sprinkler design area operation plus required hose streams plus Maximum Day Demand for the full duration of the design fire event.
d) Residual pressure at all points in the water supply system can be maintained at not less than 150 kPa during the flowing of the sprinkler and required hose streams (plus Maximum Day Demand).

Fully Supervised System (10%)

To qualify to apply an additional 10% reduction, an automatic sprinkler system should be fully supervised. The purpose of the supervisory signal is to ensure that malfunctions of the automatic sprinkler system will be discovered and corrected promptly, while the water flow alarm serves to notify emergency services of the fire as soon as the automatic sprinkler system activates.

- a distinctive supervisory signal to indicate conditions that could impair the satisfactory operation of the sprinkler system (a fault alarm), which is to sound and be displayed, either at a location within the building that is constantly attended by qualified personnel (such as a security room), or at an approved remotely located receiving facility (such as a monitoring facility of the sprinkler system manufacturer); and
- a water flow alarm to indicate that the sprinkler system has been activated, which is to be transmitted to an approved, proprietary alarm-receiving facility, a remote station, a central station or the fire department.

Additional Reductions for Community Level Automatic Sprinkler Protection of Area

Buildings located within communities or subdivisions that are completely sprinkler protected may apply up to a maximum additional 25% reduction in required fire flows beyond the normal maximum of 50% reduction for sprinkler protection of an individual building.
This additional reduction may be applied where all the following conditions are met:

a) the community has a bylaw requiring all buildings that may be built within 30 m of the subject building to be fully sprinkler protected. I.e. future development will not create unsprinklered buildings within 30 m of the subject building, and
b) all buildings within 30 meters of the subject building are fully sprinkler protected with systems that are designed and installed in accordance with the applicable criteria of NFPA 13, *Standard for Installation of Sprinkler Systems,* NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential* Occupancies, or NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* and
c) the community has in place a Fire Prevention Program that provides a system of ensuring that installed fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25: *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, and
d) the community maintains the pressure and flow rate requirements for fire sprinkler installations. I.e. the community does not make significant reductions to the operating pressures or flows across the distribution network.

Adjustment of Sprinkler Reductions for Community Level Oversight of Sprinkler Maintenance, Testing and Water Supply Requirements

The reduction in required fire flows for sprinkler protection may be reduced or eliminated if

a) the community does not have a Fire Prevention Program that provides a system of ensuring that installed fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25: *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, or
b) the community does not maintain the pressure and flow rate requirements for fire sprinkler installations, or otherwise allows the flow rates and pressure levels that were available during sprinkler system design to significantly degrade, increasing the probability of inadequate water supply for effective sprinkler operation.

Recognition of Automatic Sprinkler Protection

A property should be considered as "sprinkler protected" for the purposes of determining required fire flows, if the building has an automatic fire sprinkler system:

- designed and installed throughout all areas in accordance with NFPA 13, *Standard for Installation of Sprinkler Systems*, and maintained in accordance with the NFPA 25, *Standard for the Inspections, Testing and Maintenance of Water-Based Fire Protection Systems*, and
- supplied by water infrastructure capable of meeting all pressure and flow requirements of the sprinkler system concurrently with Max Day Demand (if connected to a domestic system)

Evidence of the sprinkler system design, installation should be acquired from the party responsible for the building (the owner, building engineer or property manager) or the municipal fire prevention office.

On site, the sprinkler system should carry test tags verifying that a qualified person has conducted tests including:

- flushing and hydrostatic tests of both the underground and overhead piping in accordance with NFPA 13;
- full-flow main drain test within the previous 48 months.
- dry-pipe trip test (if applicable) conducted within the last 48 months
- fire-pump test (if applicable) conducted within the last 48 months

Items of Note for Sprinkler Systems

i. It is important to note that installation of automatic sprinkler systems provides a highly effective and reliable system of fire protection however, this does not preclude the need for manual fire flows entirely as some fires, for various reasons, grow beyond the capability of sprinkler protection to be effective, and in these cases, manual fire fighting intervention is required.

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August 12, 2026

433-435 Churchill Avenue North

6-Storey Apartment Building 1

Ottawa, Ontario

WATER DEMAND CALCULATIONS

	Number of Units	Persons per Unit	Population
1 Bedroom:	30	1.4	42
2 Bedroom:	15	2.1	31.5
3 Bedroom:	5	3.1	15.5
Average:	0	1.8	0
Total:	50		89

Average Daily Demand: 280 L/capita/day

17.3 L/min | 0.3 L/s | 4.6 USgpm

Maximum Daily Demand: 7.2 (Peaking factor for a population of 89 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)

125.3 L/min | 2.1 L/s | 33.1 USgpm

Maximum Hourly Demand: 10.9 (Peaking factor for a population of 89 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)

188.8 L/min | 3.1 L/s | 49.9 USgpm

Elevation of Water Meter:	76.00	m			
Basement Floor Elevation:	75.1	m			
Minimum HGL:	109.4	m			
Static Pressure at Water Meter:	33.4	m	327	kPa	47 psi
Maximum HGL:	114.5	m			
Static Pressure at Water Meter:	38.5	m	377	kPa	55 psi

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

August 12, 2026

472 Byron Place

3-Storey Apartment Building 2

Ottawa, Ontario

WATER DEMAND CALCULATIONS

	Number of Units	Persons per Unit	Population
1 Bedroom:	0	1.4	0
2 Bedroom:	12	2.1	25.2
3 Bedroom:	0	3.1	0
Average:	0	1.8	0
Total:	12		25.2

Average Daily Demand:	280	L/capita/day				
	4.9	L/min	0.1	L/s	1.3	USgpm
Maximum Daily Demand:	9.5	(Peaking factor for a population of 25.2 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	46.6	L/min	0.8	L/s	12.3	USgpm
Maximum Hourly Demand:	14.3	(Peaking factor for a population of 25.2 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	70.1	L/min	1.2	L/s	18.5	USgpm

Elevation of Water Meter:	76.00	m				
Basement Floor Elevation:	75.1	m				
Minimum HGL:	109.4	m				
Static Pressure at Water Meter:	33.4	m	327	kPa	47	psi
Maximum HGL:	114.5	m				
Static Pressure at Water Meter:	38.5	m	377	kPa	55	psi

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

August 12, 2026

468 Byron Place

3-Storey Apartment Building 3

Ottawa, Ontario

WATER DEMAND CALCULATIONS

	Number of Units	Persons per Unit	Population
1 Bedroom:	0	1.4	0
2 Bedroom:	12	2.1	25.2
3 Bedroom:	0	3.1	0
Average:	0	1.8	0
Total:	12		25.2

Average Daily Demand:	280	L/capita/day				
	4.9	L/min	0.1	L/s	1.3	USgpm
Maximum Daily Demand:	9.5	(Peaking factor for a population of 25.2 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	46.6	L/min	0.8	L/s	12.3	USgpm
Maximum Hourly Demand:	14.3	(Peaking factor for a population of 25.2 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	70.1	L/min	1.2	L/s	18.5	USgpm

Elevation of Water Meter:	76.00	m				
Basement Floor Elevation:	75.1	m				
Minimum HGL:	109.4	m				
Static Pressure at Water Meter:	33.4	m	327	kPa	47	psi
Maximum HGL:	114.5	m				
Static Pressure at Water Meter:	38.5	m	377	kPa	55	psi

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Request for Boundary Conditions - 433-435 Churchill Avenue North and 468-472 Byron Place

1 message

Hughes, Brett <brett.hughes@ottawa.ca> Wed, Aug 12, 2026 at 9:12 AM
To: "r.faith" <r.faith@dbgrayengineering.com>
Cc: "d.gray" <d.gray@dbgrayengineering.com>, "Wessel, Shawn" <shawn.wessel@ottawa.ca>, "Wu, John" <John.Wu@ottawa.ca>

Ryan,

The following are boundary conditions, HGL, for hydraulic analysis at 433-435 Churchill Ave and 468-472 Byron Pl (zone 1W) assumed to be connected at the locations identified below.: (see attached PDF for location).

Connection 1 - 433-435 Churchill Ave.: 406mm on Churchill Ave

Minimum HGL = 109.4 m

Maximum HGL = 114.5 m

Max Day + Fire Flow (233.3 L/s) = 109.2 m

Connection 2 – 472 Byron Pl.: 203mm on Byron Pl

Minimum HGL = 109.4 m

Maximum HGL = 114.5 m

Max Day + Fire Flow (75 L/s) = 109.7 m

Connection 3 – 468 Byron Pl.: 203mm on Highcroft Ave

Minimum HGL = 109.4 m

Maximum HGL = 114.5 m

Max Day + Fire Flow (60 L/s) = 109.7 m

Notes:

Any connection to a watermain 406 mm or larger should be approved by DWS as per ***the Water Design Guidelines Section 2.4*** Review by Drinking Water Services.

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.

Regards,

Brett Hughes

Senior Project Manager, Infrastructure Approvals

Development Review East

Planning, Development & Building Services (PDBS)

110 Laurier Ave West | 4th Floor | Ottawa, ON | K1P 1J1

City of Ottawa | Ville d'Ottawa

613.580.2424 ext./poste 76665

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: July 30, 2026 4:46 PM
To: Hughes, Brett <brett.hughes@ottawa.ca>
Cc: d.gray <d.gray@dbgrayengineering.com>
Subject: Request for Boundary Conditions - 433-435 Churchill Avenue North and 468-472 Byron Place

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.

ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

Hi Brett,

Please provide the boundary conditions for the municipal watermains at 433-435 Churchill Avenue North and 468-472 Byron Place. Point of connection for Building 1 is expected to be at the midpoint of the Churchill Avenue North frontage; point of connection for Building 2 is expected to be at the midpoint of the Byron Place frontage; and point of connection for Building 3 is expected to be at the midpoint of the Highcroft Avenue frontage. We have calculated the following expected demands:

Building 1
Fire flow demand: 233.3 L/s
Average daily demand: 0.3 L/s
Maximum daily demand: 2.1 L/s
Maximum hourly demand: 3.1 L/s

Building 2
Fire flow demand: 75 L/s
Average daily demand: 0.1 L/s
Maximum daily demand: 0.8 L/s
Maximum hourly demand: 1.2 L/s

Building 3
Fire flow demand: 60 L/s
Average daily demand: 0.1 L/s
Maximum daily demand: 0.8 L/s
Maximum hourly demand: 1.2 L/s

Calculations and site plan are attached.

Thanks,

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

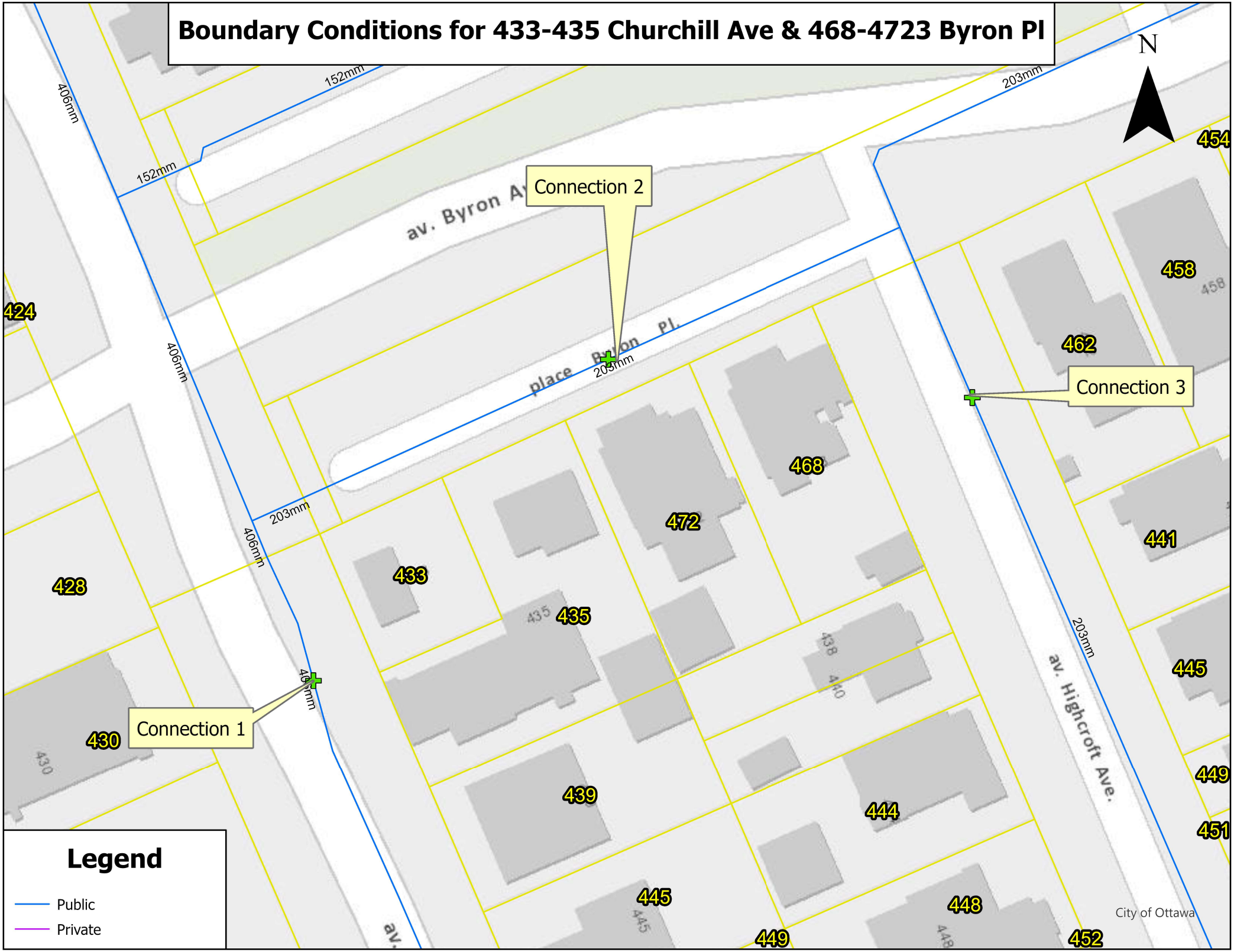
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'

Churchill Ave, 433-435, Byron Pl 468-472 August 2026.pdf
1287K


Boundary Conditions for 433-435 Churchill Ave & 468-4723 Byron Pl
N
Connection 1
Connection 2
Connection 3
406mm
152mm
203mm
av. Byron Ave.
place Byron Pl.
av. Highcroft Ave.
424
428
430
433
435
439
445
449
451
454
458
462
468
472
441
444
448
452
City of Ottawa
Legend
Public
Private

APPENDIX B

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

Project: 433-435 Churchill Avenue North
6-Storey Apartment Building 1
Ottawa, Ontario

Date: August 14, 2026

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													Commercial				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual	Cumulative			Individual	Cumulative		Total							
Location		Single	Semi	Duplex	Apartment	Apartment	Apartment	Apartment	Area	Population	Area	Population	Peaking	Flow Rate	Area	Area	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached		(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	(ha)	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 1	250 SAN				30	15	5		0.0943	89.0	0.0943	89.0	3.2	0.92					0.0943	0.0943	0.03	0.95		200	200	1	1.04	32.80	3%
																							Existing 250 mm Churchill Avenue North Municipal Sanitary Sewer:	250	250	0.7	1.01	49.75	

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

Project: 472 Byron Place
3-Storey Apartment Building 2
Ottawa, Ontario

Date: August 14, 2026

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													Commercial				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual	Cumulative			Individual	Cumulative		Total							
Location		Single	Semi	Duplex	Apartment	Apartment	Apartment	Apartment	Area	Population	Area	Population	Peaking	Flow Rate	Area	Area	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached		(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	(ha)	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 2	250 SAN					12			0.0479	25.2	0.0479	25.2	3.2	0.26					0.0479	0.0479	0.02	0.28		150	150	1	0.86	15.23	2%
																						Existing 250 mm Byron Place Municipal Sanitary Sewer:		250	250	1.15	1.30	63.77	

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

Project: 468 Byron Place
3-Storey Apartment Building 3
Ottawa, Ontario

Date: August 14, 2026

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													Commercial				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual	Cumulative			Individual	Cumulative		Total							
Location		Single	Semi	Duplex	Apartment	Apartment	Apartment	Apartment	Area	Population	Area	Population	Peaking	Flow Rate	Area	Area	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached		(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	(ha)	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 3	250 SAN					12			0.04835	25.2	0.04835	25.2	3.2	0.26					0.04835	0.04835	0.02	0.28		150	150	1	0.86	15.23	2%
																						Existing 250 mm Highcroft Avenue Municipal Sanitary Sewer:		250	250	0.4	0.77	37.61	

APPENDIX C

STORMWATER MANAGEMENT

Quick Stormwater Management Tool

Proposed Site Details

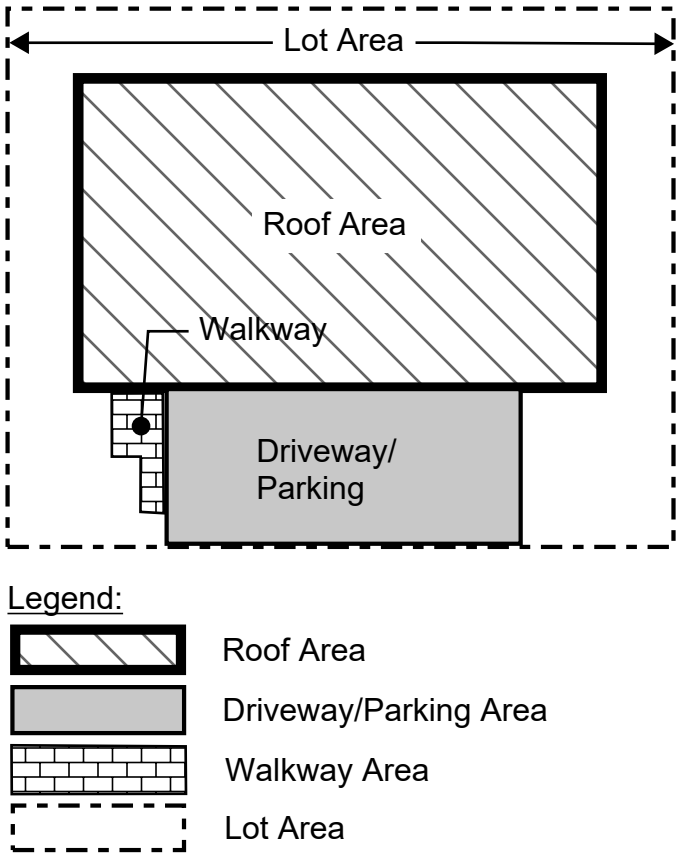
Lot Area (m²)

943

The lot area is calculated based on property boundaries shown on GeoOttawa or a Legal Plan. GeoOttawa: https://maps.ottawa.ca/geoottawa/

Roof Area (m²)	Driveway/Parking Area (m²)	Walkway Area (m²)
535		

Driveway/Parking and Walkway areas include all hard landscaping, defined as non-vegetative surfaces such as brick, pavers, rock, stone, concrete, tile, and wood. The roof area of a site is calculated by measuring the plan view area of all roofs on the property and is equivalent to the area of the building footprint.



Is this site subject to on-site stormwater management?

Yes, limit of 337m² of hardscaped area exceeded.

If "Yes", proceed to the On-Site Stormwater Management Requirements section below.

On-Site Stormwater Management Requirements

On-site Stormwater Storage Volume Requirement (L)	Overall Site Release Rate Requirement (L/s)
14450	5.14

The required stormwater storage and discharge methods must be clearly identified on the submitted Site Grading and Servicing Plan, and match the requirements of this tool and demonstrate how the storage and site release rate requirements are being achieved.

Underground Storage Configuration Option: ☐

Underground stormwater storage* with gravity release to a free outlet using a 28mm orifice. Alternatively, using a pumping scheme with the specified maximum release rate

Rooftop Storage Configuration Option: ☑

Rooftop stormwater storage* controlled to the total maximum release rate.

*Designers are required to demonstrate how storage volume is achieved on their submitted plan. A SWM brief shall be provided if other measures, such as at-grade solutions, infiltration measures or a combination thereof, are proposed.

Quick Stormwater Management Tool

Proposed Site Details

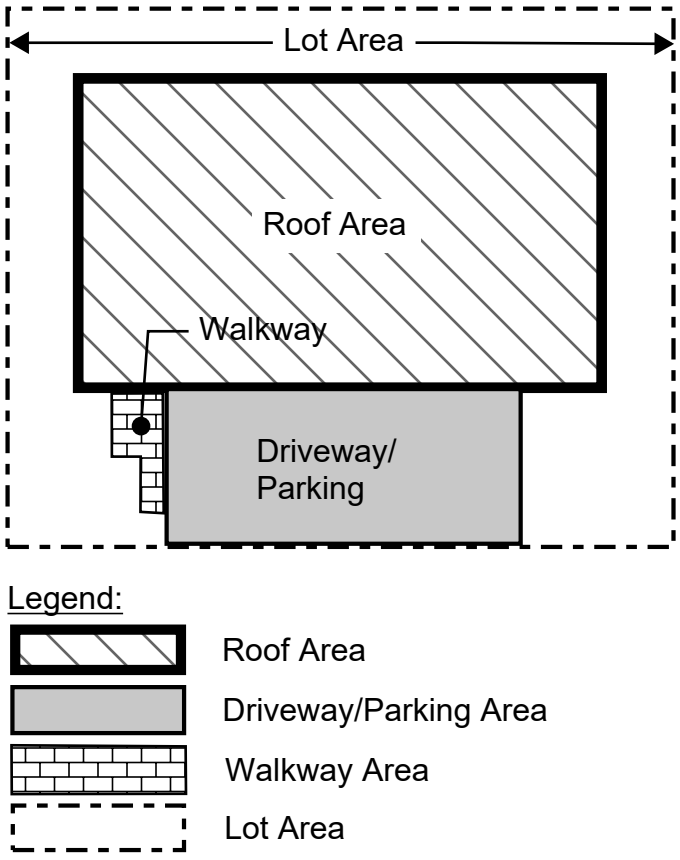
Lot Area (m²)

479

The lot area is calculated based on property boundaries shown on GeoOttawa or a Legal Plan. GeoOttawa: https://maps.ottawa.ca/geoottawa/

Roof Area (m²)	Driveway/Parking Area (m²)	Walkway Area (m²)
250		

Driveway/Parking and Walkway areas include all hard landscaping, defined as non-vegetative surfaces such as brick, pavers, rock, stone, concrete, tile, and wood. The roof area of a site is calculated by measuring the plan view area of all roofs on the property and is equivalent to the area of the building footprint.



Is this site subject to on-site stormwater management?

Yes, limit of 171m² of hardscaped area exceeded.

If "Yes", proceed to the On-Site Stormwater Management Requirements section below.

On-Site Stormwater Management Requirements

On-site Stormwater Storage Volume Requirement (L)	Overall Site Release Rate Requirement (L/s)
6755	2.4

The required stormwater storage and discharge methods must be clearly identified on the submitted Site Grading and Servicing Plan, and match the requirements of this tool and demonstrate how the storage and site release rate requirements are being achieved.

Underground Storage Configuration Option: ☐

Underground stormwater storage* with gravity release to a free outlet using a 28mm orifice. Alternatively, using a pumping scheme with the specified maximum release rate

Rooftop Storage Configuration Option: ☑

Rooftop stormwater storage* controlled to the total maximum release rate.

*Designers are required to demonstrate how storage volume is achieved on their submitted plan. A SWM brief shall be provided if other measures, such as at-grade solutions, infiltration measures or a combination thereof, are proposed.

Quick Stormwater Management Tool

Proposed Site Details

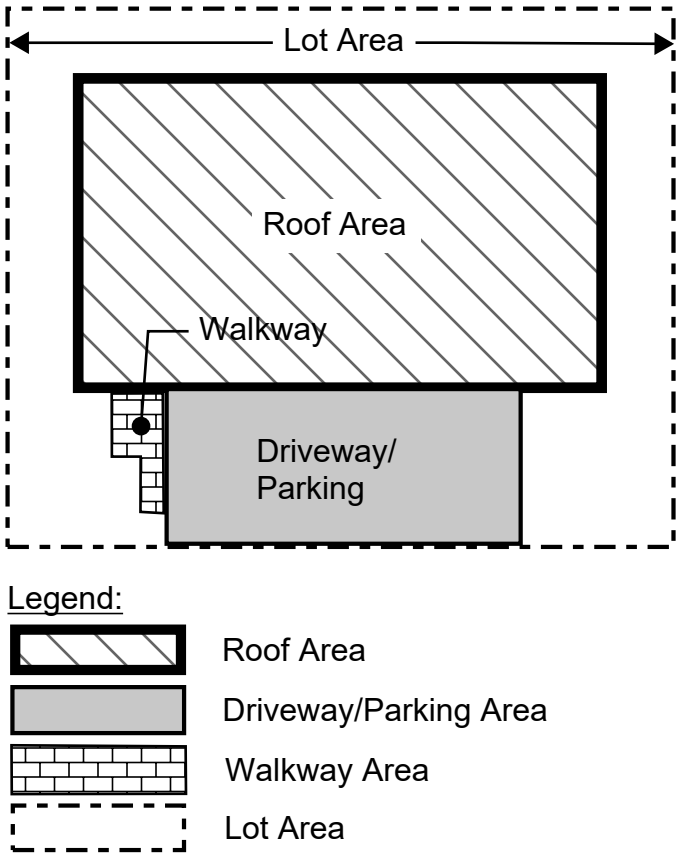
Lot Area (m²)

483.5

The lot area is calculated based on property boundaries shown on GeoOttawa or a Legal Plan. GeoOttawa: https://maps.ottawa.ca/geoottawa/

Roof Area (m²)	Driveway/Parking Area (m²)	Walkway Area (m²)
250		

Driveway/Parking and Walkway areas include all hard landscaping, defined as non-vegetative surfaces such as brick, pavers, rock, stone, concrete, tile, and wood. The roof area of a site is calculated by measuring the plan view area of all roofs on the property and is equivalent to the area of the building footprint.



Is this site subject to on-site stormwater management?

Yes, limit of 173m² of hardscaped area exceeded.

If "Yes", proceed to the On-Site Stormwater Management Requirements section below.

On-Site Stormwater Management Requirements

On-site Stormwater Storage Volume Requirement (L)	Overall Site Release Rate Requirement (L/s)
6755	2.4

The required stormwater storage and discharge methods must be clearly identified on the submitted Site Grading and Servicing Plan, and match the requirements of this tool and demonstrate how the storage and site release rate requirements are being achieved.

Underground Storage Configuration Option: ☐

Underground stormwater storage* with gravity release to a free outlet using a 28mm orifice. Alternatively, using a pumping scheme with the specified maximum release rate

Rooftop Storage Configuration Option: ☑

Rooftop stormwater storage* controlled to the total maximum release rate.

*Designers are required to demonstrate how storage volume is achieved on their submitted plan. A SWM brief shall be provided if other measures, such as at-grade solutions, infiltration measures or a combination thereof, are proposed.

August 14, 2026

433-435 Churchill Avenue North
468-472 Byron Place

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

100-YEAR EVENT

DRAINAGE AREA I (Building 1 Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	535	sq.m	1.00

No. of Roof Drains:	3	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drains:	128	mm
Maximum Release Rate:	4.78	L/s

Pond Area:	374	sq.m
Maximum Volume Stored:	15.99	cu.m
Maximum Volume Required:	15.99	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	26.56	4.78	21.77	13.06
15	143	21.25	4.78	16.47	14.82
20	120	17.84	4.78	13.06	15.67
25	104	15.45	4.78	10.66	15.99
30	92	13.66	4.78	8.88	15.99
35	83	12.28	4.78	7.50	15.75
40	75	11.18	4.78	6.39	15.35
45	69	10.27	4.78	5.49	14.82
50	64	9.51	4.78	4.73	14.19
55	60	8.87	4.78	4.09	13.48
60	56	8.31	4.78	3.53	12.71
65	53	7.83	4.78	3.05	11.89
70	50	7.41	4.78	2.62	11.02
75	47	7.03	4.78	2.25	10.11
80	45	6.69	4.78	1.91	9.16
85	43	6.39	4.78	1.61	8.19
90	41	6.11	4.78	1.33	7.19
95	39	5.87	4.78	1.08	6.17
100	38	5.64	4.78	0.85	5.13
105	36	5.43	4.78	0.65	4.07
110	35	5.24	4.78	0.45	2.99
115	34	5.06	4.78	0.28	1.90
120	33	4.89	4.78	0.11	0.79
125	32	4.74	4.74	0.00	0.00

DRAINAGE AREA II (Building 2 Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	250	sq.m	1.00

No. of Roof Drains: 2
Wier Opening: 1/2

Depth at Roof Drains: 130 mm

Maximum Release Rate: 2.25 L/s

Pond Area: 172 sq.m

Maximum Volume Stored: 7.45 cu.m

Maximum Volume Required: 7.45 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	12.41	2.25	10.16	6.09
15	143	9.93	2.25	7.68	6.91
20	120	8.34	2.25	6.08	7.30
25	104	7.22	2.25	4.96	7.45
30	92	6.38	2.25	4.13	7.44
35	83	5.74	2.25	3.49	7.32
40	75	5.22	2.25	2.97	7.13
45	69	4.80	2.25	2.55	6.87
50	64	4.44	2.25	2.19	6.57
55	60	4.14	2.25	1.89	6.24
60	56	3.88	2.25	1.63	5.87
65	53	3.66	2.25	1.41	5.48
70	50	3.46	2.25	1.21	5.07
75	47	3.28	2.25	1.03	4.64
80	45	3.13	2.25	0.87	4.19
85	43	2.99	2.25	0.73	3.73
90	41	2.86	2.25	0.60	3.26
95	39	2.74	2.25	0.49	2.78
100	38	2.63	2.25	0.38	2.29
105	36	2.54	2.25	0.28	1.78
110	35	2.45	2.25	0.19	1.27
115	34	2.36	2.25	0.11	0.76
120	33	2.29	2.25	0.03	0.24
125	32	2.21	2.21	0.00	0.00

DRAINAGE AREA III (Building 3 Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	250	sq.m	1.00

No. of Roof Drains: 2
Wier Opening: 1/2

Depth at Roof Drains: 130 mm

Maximum Release Rate: 2.25 L/s

Pond Area: 172 sq.m

Maximum Volume Stored: 7.45 cu.m

Maximum Volume Required: 7.45 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	12.41	2.25	10.16	6.09
15	143	9.93	2.25	7.68	6.91
20	120	8.34	2.25	6.08	7.30
25	104	7.22	2.25	4.96	7.45
30	92	6.38	2.25	4.13	7.44
35	83	5.74	2.25	3.49	7.32
40	75	5.22	2.25	2.97	7.13
45	69	4.80	2.25	2.55	6.87
50	64	4.44	2.25	2.19	6.57
55	60	4.14	2.25	1.89	6.24
60	56	3.88	2.25	1.63	5.87
65	53	3.66	2.25	1.41	5.48
70	50	3.46	2.25	1.21	5.07
75	47	3.28	2.25	1.03	4.64
80	45	3.13	2.25	0.87	4.19
85	43	2.99	2.25	0.73	3.73
90	41	2.86	2.25	0.60	3.26
95	39	2.74	2.25	0.49	2.78
100	38	2.63	2.25	0.38	2.29
105	36	2.54	2.25	0.28	1.78
110	35	2.45	2.25	0.19	1.27
115	34	2.36	2.25	0.11	0.76
120	33	2.29	2.25	0.03	0.24
125	32	2.21	2.21	0.00	0.00