D.B. Gray Engineering Inc.

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

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SITE SERVICING & STORMWATER MANAGEMENT REPORT

2506 INNES ROAD
OTTAWA, ONTARIO

REPORT NO. 23087

MAY 6, 2024

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for the proposed stacked townhomes located at 2506 Innes Road in Ottawa, Ontario. The property is currently occupied by an auto repair shop to be demolished. Refer to Pre-Application Consultation meeting notes in Appendix A.

This report forms part of the site servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-10 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

The closest existing municipal fire hydrant is located between 203 Innes Road and 205 Innes Road. It is ±110 m unobstructed distance to the furthest entrance to Building A, and ±115 m unobstructed distance to the furthest entrance to Building B, which is more than the maximum 90 m permitted by the Ontario Building Code; therefore, a new fire hydrant is required. The next closest existing municipal fire hydrant is located ±170 m east at the intersection of Innes Road and Gravelle Crescent. In accordance with the City of Ottawa Water Design Guidelines, fire hydrant spacing shall not exceed 90 m for institutional, commercial, industrial, apartments and high density areas. A municipal fire hydrant is proposed to be located in front of the subject property in the Innes Road municipal right-of-way. It is 60 m unobstructed distance to the furthest entrance to Building A, and 85 m unobstructed distance to furthest entrance to Building B.

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 Method is to be used. Using the Fire Underwriters Survey Method, the required fire flow was calculated to be 12,000 L/min (200 L/s). Refer to calculations in Appendix B.

The buildings are to be of ordinary construction (Type III) in accordance with the Fire Underwriters Survey. Refer to Appendix B.

The City of Ottawa indicated that 239.0 L/s is available. Refer to Appendix B. Therefore, 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

The proposed fire hydrant discussed above can contribute 5,700 L/min (95 L/s). The existing municipal fire hydrant located between 203 Innes Road and 205 Innes Road can also contribute 5,700 L/min (95 L/s).

The existing municipal fire hydrant located at the intersection of Innes Road and Gravelle Crescent can contribute 3,800 L/min (63.3 L/s). The aggregate flow of the three contributing fire hydrants is 15,200 L/min (253.3 L/s), which is greater than the required fire flow of 12,000 L/min (200 L/s).

2.2 DOMESTIC WATER SUPPLY

In accordance with

i. the City of Ottawa Water Design Guidelines for the populations,
ii. City of Ottawa Technical Bulletin ISTB-2021-03 for the consumption rate, and
iii. the Ministry of the Environment Water Design Guidelines for the peaking factors, and

based on the 44 – 2 bedroom units, the average daily demand was calculated to be 0.3 L/s, the maximum daily demand was calculated to be 2.1 L/s and the maximum hourly demand was calculated to be 3.2 L/s. Refer to calculations in Appendix B.

The boundary conditions in the 400 mm Innes Road municipal watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 110.0 m and a maximum HGL of 117.4 m. Refer to Appendix B. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 346 kPa (50 psi) and 418 kPa (61 psi). This is an acceptable range for the proposed development.

A 50 mm private watermain connecting to a 100 mm private watermain connecting to the existing 400 mm Innes Road municipal watermain is proposed to service the development.

25 mm water services connecting to the proposed private watermains are proposed to service each set of four back-to-back stacked units.

3.0 SANITARY SERVICING

In accordance with

i. the City of Ottawa Sewer Design Guidelines for the populations,
ii. City of Ottawa Technical Bulletin ISTB-2018-01 for the average daily flow, Harmon Formula correction factor and infiltration allowance, and
iii. the Harmon Formula for the peaking factor, and

based on the 44 – 2 bedroom units, the post-development sanitary flow rate was calculated to be 1.09 L/s. Refer to calculations in Appendix C.

150 mm sanitary sewer services at 2% slope (1.22 m/s velocity and 21.54 L/s capacity) are proposed to service each set of four back-to-back stacked units. The proposed sanitary sewer services will connect to the proposed private sanitary sewer system.

A 200 mm private sanitary sewer at 0.32% slope (0.59 m/s velocity and 18.55 L/s capacity) is proposed to service the development. At the design flow rate the 200 mm sanitary sewer will only be at up to 6% of its capacity. The proposed 200 mm sanitary sewer will connect to the existing 450 mm Innes Road municipal sanitary sewer, which at 0.29% slope has a capacity of 159.05 L/s. Refer to calculations in Appendix C.

The pre-development sanitary flow rate was calculated to be 1.33 L/s. Refer to calculations in Appendix C. The 0.24 L/s post-development reduction in flow is expected to have a negligible impact on the 450 mm Innes Road municipal sanitary sewer.

4.0 STORMWATER MANAGEMENT

4.1 QUANTITY CONTROL

Criterion
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 using a calculated pre-development runoff coefficient not more than 0.5 and a calculated pre-development time of concentration not less than 10 minutes.

Drainage Area A (Uncontrolled Flow Off Site to Innes Road – 2,618 sq.m)
It was calculated that the pre-development conditions reflect a 100-year runoff coefficient of 0.87. Using the Bransby Williams Formula, the pre-development time of concentration was calculated to be 3 minutes. Using the Rational Method with a time of concentration of 10 minutes, the pre-development flow rates were calculated to be 113.09 L/s during the 100-year event and 59.06 L/s during the 5-year event.

Drainage Area B (Uncontrolled Flow Off Site to Rear – 1,330 sq.m)
It was calculated that the pre-development conditions reflect a 100-year runoff coefficient of 0.25. Using the Bransby Williams Formula, the pre-development time of concentration was calculated to be 1 minute. Using the Rational Method with a time of concentration of 10 minutes, the pre-development flow rates were calculated to be 16.51 L/s during the 100-year event and 7.70 L/s during the 5-year event.

Maximum Allowable Release Rate
Using the Rational Method with a time of concentration of 10 minutes and runoff coefficient of 0.5, the maximum allowable release rate was calculated to be 57.18 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 to Innes Road – 198 sq.m)
The NE corner of the property will drain uncontrolled off site to Innes Road. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event
Maximum Flow Rate	6.18 L/s	3.17 L/s

Drainage Area II (Uncontrolled Flow Off Site to Rear – 180 sq.m)
The SW corner of the property will drain uncontrolled off site to the rear. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event
Maximum Flow Rate	2.23 L/s	1.04 L/s

Drainage Area III (3,570 sq.m)
An inlet control device (ICD) located in the outlet pipe of CB/MH-9 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond above CB-4, CB/MH-5, CB-6, CB/MH-7, CB/MH-8 and CB/MH-9. The ICD will be a plug style with a round orifice located at the bottom of the plug manufactured by Pedro Plastics or approved equivalent sized by the manufacturer for a release rate of

48.76 L/s at 2.95 m. It was calculated that an orifice area of 10,505 sq.mm (116 mm dia) with a discharge coefficient of 0.61 will achieve the required release rate.

	100-Year Event	5-Year Event
Maximum Release Rate	48.76 L/s	48.35 L/s
Maximum Water Elevation	75.22 m	75.17 m
Maximum Volume Stored	77.31 cu.m	23.91 cu.m

Summary

The maximum post-development release rate during the 100-year event was calculated to be 57.18 L/s, which is equal to the maximum allowable release rate. To achieve the maximum allowable release rate, a maximum storage volume of 77.31 cu.m is required and provided during the 100-year event. The maximum post-development release rate during the 5-year event was calculated to be 52.56 L/s, which is 8% less than the maximum allowable release rate. A maximum storage volume of 23.91 cu.m is required and provided during the 5-year event. The post-development reduction in flow is expected to have a positive impact on the 675 mm Innes Road municipal storm sewer.

	100-Year Event	5-Year Event
Maximum Allowable Release Rate	57.18 L/s	57.18 L/s
Maximum Release Rate	57.18 L/s	52.56 L/s
Maximum Volume Required	77.31 cu.m	23.91 cu.m
Maximum Volume Stored	77.31 cu.m	23.91 cu.m

4.2 QUALITY CONTROL

An oil grit separator (OGS) manhole is proposed to be located downstream of the inlet control device. Calculations by the manufacturer indicate that the CDS PMSU2015-4 OGS will remove 85.2% of total suspended solids. Refer to calculations in Appendix D. The CDS PMSU2015-4 OGS has an oil capacity of 232 L and a grit capacity of 0.84 cu.m.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-5 and notes 2.1 to 2.6 on drawing C-6.

i. Sediment capture filter sock inserts are to be installed in all existing and proposed catch-basins and catch-basin/manholes adjacent to and within the site.
ii. A silt fence barrier is to be installed along the perimeter of the site.
iii. Any material deposited on the public road is to be removed.

4.3 STORM SERVICING

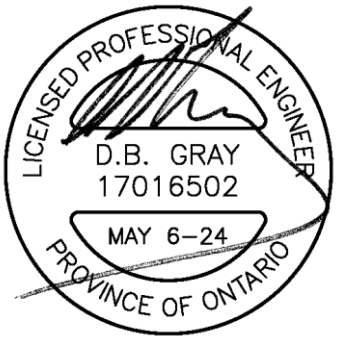
The peak unrestricted flow rate draining into the private storm sewer system during the 2-year event was calculated to be 58.67 L/s. A 300 mm storm sewer at 1.56% slope (1.71 m/s velocity and 120.78 L/s capacity) is proposed to connect to the existing 675 mm Innes Road municipal storm sewer, which at 0.31% slope has a capacity of 486.74 L/s. At the peak unrestricted 2-year flow rate the proposed 300 mm storm sewer would only be at 49% of its capacity. The peak restricted flow rate draining into the private storm

sewer system during the 100-year event was calculated to be 48.76 L/s. At the peak restricted 100-year flow rate the proposed 300 mm storm sewer will only be at 40% of its capacity. Refer to calculations in Appendix D.

5.0 CONCLUSIONS

1. A new fire hydrant is required and provided.
2. There is an adequate water supply for firefighting from the existing municipal water distribution system.
3. There is an acceptable range of water pressures in the existing municipal water distribution system.
4. The post-development sanitary flow rates will be adequately handled by the proposed sanitary sewer services and private sanitary sewer system.
5. The post-development reduction in sanitary flow is expected to have a negligible impact on the existing municipal sanitary sewer.
6. The maximum post-development release rate during the 100-year event will be equal to the maximum allowable release rate.
7. The post-development reduction in stormwater flow is expected to have a positive impact on the existing municipal storm sewer.
8. The proposed OGS will achieve an enhanced (80% TSS removal) level of protection.
9. An Erosion & Sediment Control Plan has been developed to be implemented during construction.
10. The peak unrestricted flow rate during the 2-year event will be adequately handled by the proposed private storm sewer system.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

PRE-APPLICATION CONSULTATION MEETING NOTES

MEMO 1

File	Recipient	Department
PC2023-0167	**Lucy Ramirez**	**Planning, Real Estate & Eco Dev. Dept.**
Date	Purpose	
July 27, 2023	**2506 Innes Road** **1st Pre-application Consultation**	

Message

Please note the following information regarding the engineering design for the above noted site:

Water	District Metering Area (DMA) Chamber(s) are required for private developments serviced by a connection 150 mm or larger or when there are two or more private connections to the public watermain. Refer to the City of Ottawa Water Distribution Guidelines. Please be advised that capacity of the existing system will be determined after Water Boundary conditions are requested. Water Boundary condition requests must be submitted to the City Project Manager, Development Review by the civil design engineer or consultant prior to the 2nd pre-application consultation and include the following information: ▪ The location of the service and the expected water demand of the proposed development shown on a plan, figure, or map; ▪ Type of development; ▪ Average daily demand: ___ l/s; ▪ Maximum daily demand: ___l/s; ▪ Maximum hourly daily demand: ___ l/s; ▪ Required fire flow and completed FUS Design Declaration if applicable; ▪ Supporting Calculations for all demands listed above and required fire flow as per Ontario Building Code or Fire Underwriter Surveys (See technical Bulletin ISTB-2021-03; ▪ Watermain system analysis demonstrating adequate pressure as per section 4.2.2 of the Water Distribution Guidelines; ▪ Demonstrate adequate hydrant coverage for fire protection. Please review Technical Bulletin ISTB-2018-02, Appendix I Table 1 – maximum flow to be considered from a given hydrant; ▪ Proposed emergency route (to be satisfactory to Fire Services).
Sanitary Sewers	A monitoring maintenance hole shall be required just inside the property line for all non-residential and multi residential buildings connections from a private sewer to a public sewer. See the sewer use by-law for details. Provide an analysis to demonstrate that there is adequate residual capacity in the receiving and downstream wastewater system to accommodate the proposed development. Please apply the wastewater design flow parameters in Technical Bulletin PIEDTB-2018-01.

	A maintenance hole is required to be installed over the public sewer where private sewer connection to the public sewer exceeds 50% of the public sewer diameter. If a maintenance hole is proposed to be installed over existing City infrastructure, clearly indicate on the design drawings the applicable Standard City Drawing. For example, S12.1 or doghouse structure / S12.2, etc.
Storm Sewers	A monitoring maintenance hole shall be required just inside the property line for all non-residential and multi residential buildings connections from a private sewer to a public sewer. See the sewer use by-law for details. A maintenance hole is required to be installed over the public sewer where private sewer connection to the public sewer exceeds 50% of the public sewer diameter. If a maintenance hole is proposed to be installed over existing City infrastructure, clearly indicate on the design drawings the applicable Standard City Drawing. For example, S12.1 or doghouse structure / S12.2, etc.
SWM Water Quality	Characterize the water quality to be protected and Stormwater Contaminants (e.g., suspended solids, nutrients, bacteria, water temperature) for potential impact on the Natural Environment, and control as necessary; OR As per the MSS, watershed/subwatershed plan, similar area-wide Stormwater study, or Stormwater management plan to minimize, or where possible, prevent increases in Contaminant loads and impacts to receiving waters. Provide Enhanced level of protection (80%) for suspended solids removal. OGS unit sizing shall be as per ISO 14034 Environmental Technology Verification (ETV)
SWM Water Quantity	Stormwater Management for the site requires runoff detention of the 100 year post to 5 year pre The allowable release rate is to be computed using the lesser of C=0.5 or existing. Time of concentration (Tc) to be calculated, min Tc = 10mins
Grading and Drainage	Permissible ponding of 350mm for 100-year. No spilling to adjacent sites. At 100-year ponding elevation you must spill to the ROW. 100-year Spill elevation must be 300mm lower than any building opening or ramp. Consider pedestrian Accessibilities at max 5%.
Geotechnical and Slope Stability	Sensitive Marine Clay (SMC) is widely found across Ottawa- geotechnical reports should include Atterberg Limits, consolidation testing, sensitivity values, and vane shear test. Refer to City of Ottawa Geotechnical and Slope Stability Guidelines.
MECP ECA	If required, to be provided after site plan approval.

Additional Notes	Provide consultation notes with the Conservation Authority No Capital Work Project that would impact the application has been identified at this time No road moratorium that would impact the application has been identified Any easement identified should be shown on all plans For any proposed exterior light fixtures, please provide certification from a licensed professional engineer confirming lighting has been designed only using fixtures that meet the criteria for full cut-off classification as recognized by the Illuminating Engineering Society of North America and result in minimal light spillage onto adjacent properties (maximum allowable spillage is 0.5 fc). Additionally, include in the submission the location of the fixtures, fixture type (make, model, part number and mounting height
Guidelines and By-Laws	For information on preparing required studies and plans refer to: ▪ Planning application submission information and materials | City of Ottawa; ▪ Ottawa Sewer Design Guidelines (October 2012); ▪ Ottawa Design Guidelines – Water Distribution (2010); ▪ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007); ▪ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012); ▪ City of Ottawa Environmental Noise Control Guidelines (January, 2016); ▪ City of Ottawa Park and Pathway Development Manual (2012); ▪ City of Ottawa Accessibility Design Standards (2012); ▪ Ottawa Standard Tender Documents (latest version); ▪ Please refer to other applicable Guidelines (provincial and federal); ▪ Site Alteration (By-law No. 2018-164) | City of Ottawa; ▪ Sewer Connection (By-law No. 2003-513) | City of Ottawa; ▪ Sewer Use (By-law No. 2003-514) | City of Ottawa; ▪ Building (By-law No. 2014-220) | City of Ottaw; ▪ Community Benefits Charge By-law (By-law No. 2022-307) | City of Ottawa; ▪ Delegation of Authority (By-law No. 2023-67) | City of Ottawa; ▪ Encroachments on City Highways (By-law No. 2003-446) | City of Ottawa; ▪ Fence (By-law No. 2003-462) | City of Ottawa; ▪ Fire Routes (By-law No. 2003-499) | City of Ottawa; ▪ Integrated Orléans Community Improvement Plan (By-law No. 2021-284) | City of Ottawa; ▪ Integrated Orléans Community Improvement Plan (By-law No. 2021-285) | City of Ottawa; ▪ Montreal Road Community Improvement Plan (By-law No. 2019-224) | City of Ottaw; ▪ Montreal Road Community Improvement Plan Area (By-law No. 2019-213) | City of Ottawa; ▪ Noise (By-law No. 2017-255) | City of Ottaw; ▪ Private Approach (By-law No. 2003-447) | City of Ottawa; ▪ Road Activity (By-law No. 2003-445) | City of Ottawa; ▪ Site Plan Control (By-law No. 2014 - 256) | City of Ottawa; ▪ Tree Protection (By-law No. 2020-340) | City of Ottawa; ▪ Water (By-law No. 2019-74) | City of Ottawa; ▪ Zoning (By-law No. 2008-250) | City of Ottawa;

Minimum Drawing and File Requirements	Plans are to be submitted on standard A1 size (594mm x 841mm) sheets, utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400, or 1:500). With all submitted hard copies provide individual PDF of the DWGs and for reports please provide one PDF file of the reports. All PDF documents are to be unlocked and flattened.
	Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455 Please refer to GeoOttawa with the Water and Wastewater Infrastructure turned on to determine what servicing is available for this site: https://maps.ottawa.ca/geoottawa/

Should you have any questions or require additional information, please contact me directly.

Regards,

Oleksandr (Alex) Polyak, B.Eng., P.Eng

Project Manager, Infrastructure Approvals, Development Review East Branch | Gestionnaire de projet, Direction de l'examen des projets d'aménagement – Est.

Planning, Real Estate and Economic Development Department | Direction générale de la planification, des biens immobiliers et du développement économique

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APPENDIX B

WATER SERVICING

D.B. Gray Engineering Inc.

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

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May 6, 2024

2506 Innes Road

Building A

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
= 1.0 Type III Ordinary Construction

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

3rd Floor:	547.5	sq.m
2nd Floor:	590	sq.m
1st Floor:	565	sq.m
Basement Floor:	524.5	sq.m
	2,227	sq.m

RFF = 10,382 L/min
= 10,000 L/min (rounded to nearest 1,000 L/min)

Occupancy and Contents Adjustment Factor
-15% Limited Combustible Contents

= -1,500 L/min Occupancy and Contents Adjustment Factor

RFF = 8,500 L/min

Automatic Sprinkler Protection Credit

	0%	No automatic sprinkler system
=	0	L/min Automatic Sprinkler Protection Credit

Exposure Adjustment Charge

Side	Charge	Distance	Construction	Length	Storeys	Factor
North	0%	over 30 m				
East	10%	3.1 m to 10 m	Type III	15	1	15
South	0%	over 30 m				
West	9%	10.1 m to 20 m	Type III	30	3	90

	19%	Exposure Adjustment Charge
=	1,615	L/min Exposure Adjustment Charge

RFF =	10,115	L/min
=	10,000	L/min (rounded to nearest 1,000 L/min)
=	166.7	L/s

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May 6, 2024

2506 Innes Road

Building B

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
= 1.0 Type III Ordinary Construction

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

3rd Floor:	657.0	sq.m
2nd Floor:	715	sq.m
1st Floor:	680	sq.m
Basement Floor:	629.4	sq.m
	2,681	sq.m

RFF = 11,392 L/min
= 11,000 L/min (rounded to nearest 1,000 L/min)

Occupancy and Contents Adjustment Factor
-15% Limited Combustible Contents

= -1,650 L/min Occupancy and Contents Adjustment Factor

RFF = 9,350 L/min

Automatic Sprinkler Protection Credit

	0%	No automatic sprinkler system
=	0	L/min Automatic Sprinkler Protection Credit

Exposure Adjustment Charge

Side	Charge	Distance	Construction	Length	Storeys	Factor
North	0%	over 30 m				
East	12%	10.1 m to 20 m	Type V	15	3	45
South	0%	over 30 m				
West	16%	3.1 m to 10 m	Type V	10	3	30

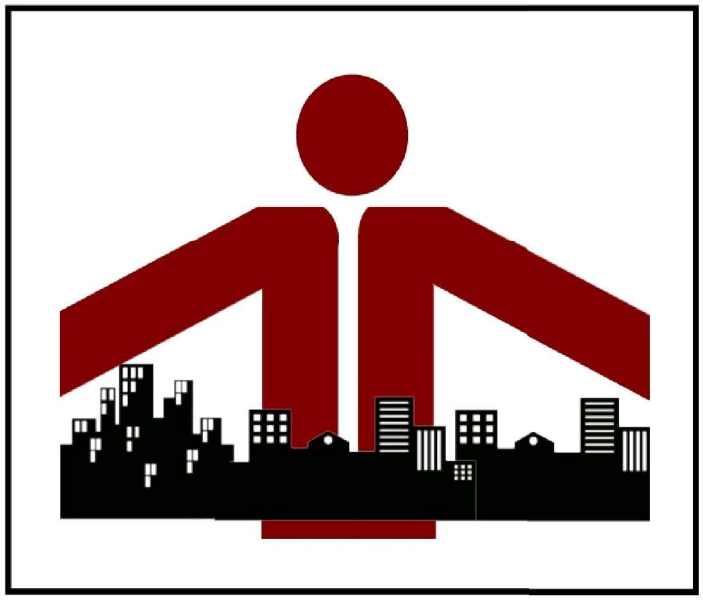
	28%	Exposure Adjustment Charge
=	2,618	L/min Exposure Adjustment Charge

RFF =	11,968	L/min
=	12,000	L/min (rounded to nearest 1,000 L/min)
=	200	L/s

WATER SUPPLY
FOR
PUBLIC FIRE PROTECTION

A Guide to Recommended Practice in Canada

2020



Fire Underwriters Survey

Construction Coefficient (C)

Note that the construction typology used by the insurance industry and public fire protection differs from the terms of reference in the National Building Code of Canada (NBC).

The following Construction Types and Coefficients are used in the required fire flow formula:

C = 1.5 for **Type V** Wood Frame Construction
= 0.8 for **Type IV-A** Mass Timber Construction
= 0.9 for **Type IV-B** Mass Timber Construction
= 1.0 for **Type IV-C** Mass Timber Construction
= 1.5 for **Type IV-D** Mass Timber Construction
= 1.0 for **Type III** Ordinary Construction
= 0.8 for **Type II** Noncombustible Construction
= 0.6 for **Type I** Fire Resistive Construction

When determining the predominate Construction Coefficient of a building, the following reference terms are used by fire underwriters and fire departments.

Wood Frame Construction (Type V)
A building is considered to be of Wood Frame construction (Type V) when structural elements, walls, arches, floors, and roofs are constructed entirely or partially of wood or other material.

Note: Includes buildings with exterior wall assemblies that are constructed with any materials that do not have a fire resistance rating that meets the acceptance criteria of CAN/ULC-S114. May include exterior surface brick, stone, or other masonry materials where they do not meet the acceptance criteria.

Mass Timber (Type IV)
Mass timber construction, including Encapsulated Mass Timber, Heavy Timber and other forms of Mass Timber are considered as one of the following sub-types relating to the fire resistance ratings of assemblies as follows:

- Type IV-A (Encapsulated Mass Timber)
    - A building is considered to be of Mass Timber Type IV-A (Encapsulated Mass Timber) construction when structural elements, walls, arches, and floors have a minimum 2-hour fire resistance rating and the roof has a minimum 1 hour fire resistance rating. Additionally all elements of the building must meet the requirements set out for Encapsulated Mass Timber Construction within the 2020 National Building Code of Canada . For types of mass timber construction that do not fully meet these criteria, treat as Type IV-B, Type IV-C or Type IV-D.
- Type IV-B (Rated Mass Timber)
    - A building is considered to be of Mass Timber Type IV-B (Rated Mass Timber) construction when the building assemblies include mass timber construction elements and all structural elements, exterior walls, interior bearing walls and roof have a minimum 1-hour fire resistance rating.

- Type IV-C (Ordinary Mass Timber)
    - A building is considered to be of Mass Timber Type IV-C (Partially Rated Mass Timber) construction when exterior walls are of Mass Timber construction with a minimum 1-hour fire resistance rating. Other structural elements, interior bearing walls and the roof may not have a fire resistance rating.
- Type IV-D (Un-Rated Mass Timber)
    - A building is considered to be of Mass Timber Type IV-D (Un-Rated Mass Timber) construction when exterior walls do not have a minimum 1-hour fire resistance rating, regardless of the fire resistance rating of other structural elements, interior bearing walls and the roof.

Ordinary Construction (Type III also known as joisted masonry)

A building is considered to be of Ordinary construction (Type III) when exterior walls are of masonry construction (or other approved material) with a minimum 1-hour fire resistance rating, but where other elements such as interior walls, arches, floors and/or roof do not have a minimum 1 hour fire resistance rating.

Noncombustible Construction (Type II)

A building is considered to be of Noncombustible construction (Type II) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 1-hour fire resistance rating and are constructed with noncombustible materials.

Fire-Resistive Construction (Type I)

A building is considered to be of Fire-resistive construction (Type I) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 2-hour fire resistance rating, and all materials used in the construction of the structural elements, walls, arches, floors, and roofs are constructed with noncombustible materials.

Items of Note Regarding Construction Coefficients

i. Unprotected noncombustible construction (example unprotected steel) should be considered within ordinary construction or noncombustible construction based on the minimum fire resistance rating of the structural elements, exterior walls, and interior bearing walls;
    - If minimum fire resistance rating of exterior walls is 1 hr, apply Ordinary Construction Coefficient (1.0)
    - If minimum fire resistance rating of all structural elements, walls, arches, floors, and roofs is 1 hr, apply Noncombustible Construction Coefficient (0.8).

ii. If a building cannot be defined within a single Construction Coefficient, the Construction Coefficient is determined by the predominate Construction Coefficient that makes up more than 66% or over of the Total Floor Area.

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May 6, 2024

2506 Innes Road

44 Stacked Townhomes

Ottawa, Ontario

WATER DEMAND CALCULATIONS

	Number of Units	Persons per Unit	Population
1 Bedroom:	0	1.4	0
2 Bedroom:	44	2.1	92.4
3 Bedroom:	0	3.1	0
Average:	0	1.8	0
Total:	44		92.4

Average Daily Demand:	280	L/capita/day				
	18.0	L/min	0.3	L/s	4.7	USgpm
Maximum Daily Demand:	7.1	(Peaking factor for a population of 92.4 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	127.7	L/min	2.1	L/s	33.7	USgpm
Maximum Hourly Demand:	10.7	(Peaking factor for a population of 92.4 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	192.5	L/min	3.2	L/s	50.8	USgpm

Elevation of Water Meter:	74.72	m				
Basement Floor Elevation:	73.82	m				
Minimum HGL:	110.0	m				
Static Pressure at Water Meter:	35.3	m	346	kPa	50	psi
Maximum HGL:	117.4	m				
Static Pressure at Water Meter:	42.7	m	418	kPa	61	psi

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Request for Boundary Conditions - 2506 Innes Road

1 message

Polyak, Alex <alex.polyak@ottawa.ca> Thu, Dec 7, 2023 at 11:29 AM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>, "Fadel, Rafic" <rafic.fadel@ottawa.ca>

Good afternoon Ryan,

A fire flow demand of 283.3 L/s did not meet the required 20psi residual pressure. Please reduce the fire flow demand and resubmit a new Boundary Condition Request.

The following are boundary conditions, HGL, for hydraulic analysis at 2506 Innes Road, (zone 1E) assumed to connected to the 406 mm watermain on Innes Road (see attached PDF for location).

Minimum HGL: 110.0 m

Maximum HGL: 117.4 m

Available Fire Flow at 20 psi: 239.0 L/s, assuming ground elevation of 75.2 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.

Regards,

Oleksandr (Alex) Polyak, B.Eng., C.E.T., P.Eng.

Project Manager, Infrastructure Approvals, Development Review East Branch | Gestionnaire de projet, Direction de l'examen des projets d'aménagement – Est.

Planning, Real Estate and Economic Development Department | Direction générale de la planification, des biens immobiliers et du développement économique

City of Ottawa | Ville d'Ottawa

110 Laurier Ave., 4th Fl East, Ottawa ON K1P 1J1

Email: alex.polyak@ottawa.ca

Cell : 613-857-4380

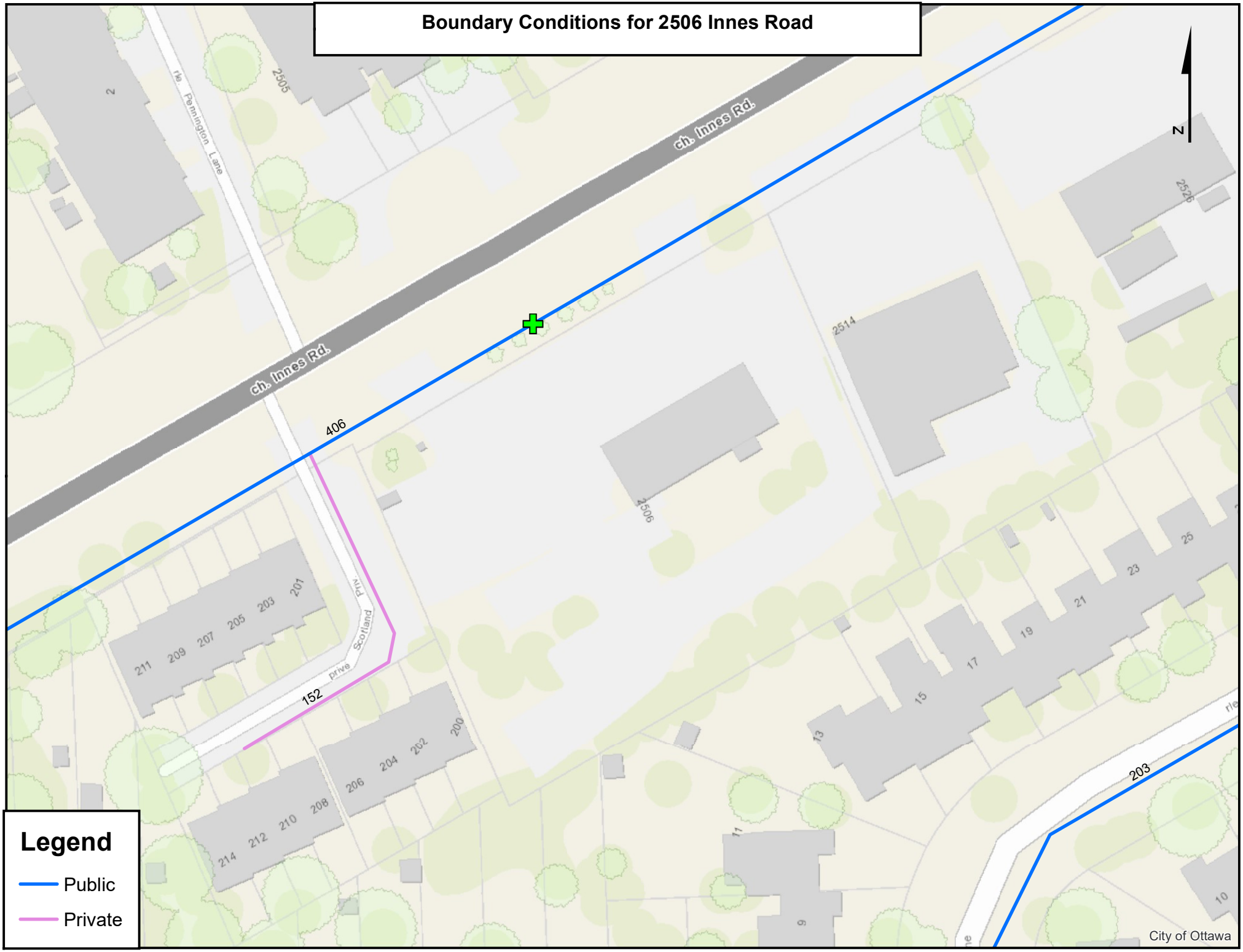
www.Ottawa.ca

'

'

2506 Innes Road November 2023.pdf
937K

Boundary Conditions for 2506 Innes Road



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

Project: 2506 Innes Road
44 Stacked Townhomes
Ottawa, Ontario

Date: May 6, 2024

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													Light Industrial				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																					
Existing Building	Existing 450 SAN														0.3948	0.3948	7.5	1.20	0.3948	0.3948	0.13	1.33							
MH-SA.1	MH-SA.3					12			0.0987	25.2	0.0987	25.2	3.2	0.26					0.0987	0.0987	0.03	0.29	25.6	200	200	0.32	0.59	18.55	2%
MH-SA.2	MH-SA.3					20			0.1974	42.0	0.1974	42.0	3.2	0.44					0.1974	0.1974	0.07	0.50	42.4	200	200	0.32	0.59	18.55	3%
MH-SA.3	MH-SA.4					12			0.0987	25.2	0.3948	92.4	3.2	0.96					0.0987	0.3948	0.13	1.09	18.6	200	200	0.32	0.59	18.55	6%
MH-SA.4	Existing 450 SAN								0.0000	0.0	0.3948	92.4	3.2	0.96					0.0000	0.3948	0.13	1.09	31.9	200	200	0.32	0.59	18.55	6%
																							Existing 450 mm Innes Road Municipal Sanitary Sewer:						
																							450	456	0.29	0.97	159.05		

APPENDIX D

STORMWATER MANAGEMENT

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 to Innes Road)	-	-	6.18	-	-
AREA II (Uncontrolled Flow Off Site to Rear)	-	-	2.23	-	-
AREA III	-	-	48.76	77.31	77.31
TOTAL	129.60	57.18	57.18	77.31	77.31

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 to Innes Road)	-	-	3.17	-	-
AREA II (Uncontrolled Flow Off Site to Rear)	-	-	1.04	-	-
AREA III	-	-	48.35	23.91	23.91
TOTAL	66.77	57.18	52.56	23.91	23.91

May 6, 2024

2506 Innes Road

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS

Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

DRAINAGE AREA A (Uncontrolled Flow Off Site to Innes Road)

(100-YEAR EVENT)

			C
Roof Area:	245	sq.m	1.00
Hard Area:	1,920	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	453	sq.m	0.25
Total Catchment Area:	2,618	sq.m	0.87

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

Sheet Flow Distance (L):	45	m
Slope of Land (Sw):	1	%
Area (A):	0.2618	ha
Time of Concentration (Sheet Flow):	3	min
Area (A):	2,618	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.87	
Flow Rate (2.78AiC):	113.09	L/s

DRAINAGE AREA B (Uncontrolled Flow Off Site to Rear)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	0	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	1,330	sq.m	0.25
Total Catchment Area:	1,330	sq.m	0.25

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

Sheet Flow Distance (L):	15	m
Slope of Land (Sw):	1	%
Area (A):	0.1330	ha
Time of Concentration (Sheet Flow):	1	min
Area (A):	1,330	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.25	
Flow Rate (2.78AiC):	16.51	L/s

DRAINAGE AREA A (Uncontrolled Flow Off Site to Innes Road)

(5-YEAR EVENT)

			C
Roof Area:	245	sq.m	0.90
Hard Area:	1,920	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	453	sq.m	0.20
Total Catchment Area:	2,618	sq.m	0.78
Area (A):	2,618	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.78		
Flow Rate (2.78AiC):	59.06	L/s	

DRAINAGE AREA B (Uncontrolled Flow Off Site to Rear)

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	0	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	1,330	sq.m	0.20
Total Catchment Area:	1,330	sq.m	0.20
Area (A):	1,330	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.20		
Flow Rate (2.78AiC):	7.70	L/s	

MAXIMUM ALLOWABLE RELEASE RATE

(5-YEAR EVENT)

			C
Roof Area:	245	sq.m	0.90
Hard Area:	1,920	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	1,783	sq.m	0.20
Total Catchment Area:	3,948	sq.m	0.58
Area (A):	3,948	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.5		
Flow Rate (2.78AiC):	57.18	L/s	

POST-DEVELOPMENT CONDITIONS

DRAINAGE AREA I (Uncontrolled Flow Off Site to Innes Road)

(100-YEAR EVENT)

			C
Roof Area:	90	sq.m	1.00
Hard Area:	10	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	98	sq.m	0.25
Total Catchment Area:	198	sq.m	0.63
Area (A):	198	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.63		
Flow Rate (2.78AiC):	6.18	L/s	

DRAINAGE AREA II (Uncontrolled Flow Off Site to Rear)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	0	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	180	sq.m	0.25
Total Catchment Area:	180	sq.m	0.25
Area (A):	180	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.25		
Flow Rate (2.78AiC):	2.23	L/s	

DRAINAGE AREA III

(100-YEAR EVENT)

			C
Roof Area:	1,050	sq.m	1.00
Hard Area:	2,280	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	240	sq.m	0.25
Total Catchment Area:	3,570	sq.m	0.95

Water Elevation:	75.22	m
Head:	2.95	m
Centroid of ICD Orifice:	72.27	m
Invert of Outlet Pipe of CB/MH-9:	72.21	m
Orifice Diameter:	116	mm
Orifice Area:	10,505	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	48.76	L/s

CB/MH	Top Area	Depth	Volume	
CB-4	386	0.16	20.53	cu.m
CB/MH-5	288	0.16	15.30	cu.m
CB-6	417	0.16	22.18	cu.m
CB/MH-7	313	0.16	16.64	cu.m
CB/MH-8	57	0.07	1.33	cu.m
CB/MH-9	57	0.07	1.33	cu.m
		Maximum Volume Stored:	77.31	cu.m
		Maximum Volume Required:	77.31	cu.m

DRAINAGE AREA III (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	168.28	48.76	119.51	71.71
15	143	134.67	48.76	85.90	77.31
20	120	113.04	48.76	64.28	77.14
25	104	97.87	48.76	49.10	73.65
30	92	86.58	48.76	37.81	68.07
35	83	77.82	48.76	29.06	61.02
40	75	70.82	48.76	22.05	52.93
45	69	65.07	48.76	16.31	44.04
50	64	60.27	48.76	11.51	34.52
55	60	56.19	48.76	7.43	24.51
60	56	52.68	48.76	3.91	14.08
65	53	49.62	48.76	0.85	3.32
70	50	46.92	46.92	0.00	0.00
75	47	44.53	44.53	0.00	0.00
80	45	42.40	42.40	0.00	0.00
85	43	40.48	40.48	0.00	0.00
90	41	38.74	38.74	0.00	0.00

POST-DEVELOPMENT CONDITIONS

DRAINAGE AREA III

(STRESS TEST EVENT)

			C
Roof Area:	1,050	sq.m	1.00
Hard Area:	2,280	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	240	sq.m	0.25
Total Catchment Area:	3,570	sq.m	0.95

Water Elevation:	75.23	m
Head:	2.96	m
Centroid of ICD Orifice:	72.27	m
Invert of Outlet Pipe of CB/MH-9:	72.21	m
Orifice Diameter:	116	mm
Orifice Area:	10,505	sq.mm
Discharge Coefficient:	0.61	
Maximum ICD Release Rate:	48.85	L/s
Maximum Overflow Release Rate:	8.24	L/s
Total Maximum Release Rate:	57.09	L/s

CB/MH	Top Area	Depth	Volume	
CB-4	438	0.17	24.82	cu.m
CB/MH-5	326	0.17	18.49	cu.m
CB-6	473	0.17	26.80	cu.m
CB/MH-7	355	0.17	20.12	cu.m
CB/MH-8	76	0.08	2.02	cu.m
CB/MH-9	76	0.08	2.02	cu.m
		Maximum Volume Stored:	94.27	cu.m
		Maximum Volume Required:	94.27	cu.m

DRAINAGE AREA III (Continued)

(STRESS TEST EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Overflow Release Rate (L/s)	Total Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	214	201.93	48.85	0.00	48.85	153.08	91.85
15	171	161.60	48.85	8.00	56.85	104.75	94.27
20	144	135.65	48.85	8.24	57.09	78.56	94.27
25	125	117.44	48.85	5.74	54.59	62.85	94.27
30	110	103.89	48.85	2.67	51.52	52.37	94.27
35	99	93.39	48.85	0.00	48.85	44.54	93.53
40	90	84.98	48.85	0.00	48.85	36.13	86.72
45	83	78.09	48.85	0.00	48.85	29.24	78.95
50	77	72.33	48.85	0.00	48.85	23.48	70.43
55	72	67.43	48.85	0.00	48.85	18.58	61.31
60	67	63.21	48.85	0.00	48.85	14.36	51.70
65	63	59.54	48.85	0.00	48.85	10.69	41.68
70	60	56.31	48.85	0.00	48.85	7.46	31.32
75	57	53.44	48.85	0.00	48.85	4.59	20.66
80	54	50.88	48.85	0.00	48.85	2.03	9.75
85	52	48.58	48.58	0.00	48.58	0.00	0.00
90	49	46.49	46.49	0.00	46.49	0.00	0.00

POST-DEVELOPMENT CONDITIONS

DRAINAGE AREA I (Uncontrolled Flow Off Site to Innes Road)

(5-YEAR EVENT)

			C
Roof Area:	90	sq.m	0.90
Hard Area:	10	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	98	sq.m	0.20
Total Catchment Area:	198	sq.m	0.55
Area (A):	198	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.55		
Flow Rate (2.78AiC):	3.17	L/s	

DRAINAGE AREA II (Uncontrolled Flow Off Site to Rear)

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	0	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	180	sq.m	0.20
Total Catchment Area:	180	sq.m	0.20
Area (A):	180	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.20		
Flow Rate (2.78AiC):	1.04	L/s	

DRAINAGE AREA III

(5-YEAR EVENT)

			C
Roof Area:	1,050	sq.m	0.90
Hard Area:	2,280	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	240	sq.m	0.20
Total Catchment Area:	3,570	sq.m	0.85

Water Elevation:	75.17	m
Head:	2.90	m
Centroid of ICD Orifice:	72.27	m
Invert of Outlet Pipe of CB/MH-9:	72.21	m
Orifice Diameter:	116	mm
Orifice Area:	10,505	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	48.35	L/s

CB/MH	Top Area	Depth	Volume	
CB-4	180	0.11	6.56	cu.m
CB/MH-5	134	0.11	4.89	cu.m
CB-6	195	0.11	7.09	cu.m
CB/MH-7	146	0.11	5.32	cu.m
CB/MH-8	4	0.02	0.03	cu.m
CB/MH-9	4	0.02	0.03	cu.m
		Maximum Volume Stored:	23.91	cu.m
		Maximum Volume Required:	23.91	cu.m

DRAINAGE AREA III (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	88.20	48.35	39.85	23.91
15	84	70.73	48.35	22.39	20.15
20	70	59.47	48.35	11.12	13.35
25	61	51.55	48.35	3.20	4.81
30	54	45.65	45.65	0.00	0.00
35	49	41.07	41.07	0.00	0.00
40	44	37.40	37.40	0.00	0.00
45	41	34.39	34.39	0.00	0.00
50	38	31.87	31.87	0.00	0.00
55	35	29.73	29.73	0.00	0.00
60	33	27.89	27.89	0.00	0.00

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

Project Name: 2506 Innes Rd.
Location: Ottawa, ON
OGS #: OGS

Engineer: **D.B. Gray Engineering Inc.**
Contact: Ryan Faith
Report Date: 2-May-24

Area	0.3570	ha	**Rainfall Station #**	215	
Weighted C	0.85		**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	2.1	98.2	9.0
1.0	10.6%	19.8%	0.8	0.8	4.3	97.6	10.4
1.5	9.9%	29.7%	1.3	1.3	6.4	97.0	9.6
2.0	8.4%	38.1%	1.7	1.7	8.5	96.4	8.1
2.5	7.7%	45.8%	2.1	2.1	10.6	95.8	7.4
3.0	5.9%	51.7%	2.5	2.5	12.8	95.2	5.7
3.5	4.4%	56.1%	3.0	3.0	14.9	94.6	4.1
4.0	4.7%	60.7%	3.4	3.4	17.0	94.0	4.4
4.5	3.3%	64.0%	3.8	3.8	19.1	93.4	3.1
5.0	3.0%	67.1%	4.2	4.2	21.3	92.8	2.8
6.0	5.4%	72.4%	5.1	5.1	25.5	91.5	4.9
7.0	4.4%	76.8%	5.9	5.9	29.8	90.3	3.9
8.0	3.5%	80.3%	6.7	6.7	34.0	89.1	3.2
9.0	2.8%	83.2%	7.6	7.6	38.3	87.9	2.5
10.0	2.2%	85.3%	8.4	8.4	42.6	86.7	1.9
15.0	7.0%	92.3%	12.7	12.7	63.8	80.6	5.6
20.0	4.5%	96.9%	16.9	16.9	85.1	74.5	3.4
25.0	1.4%	98.3%	21.1	19.8	100.0	66.0	1.0
30.0	0.7%	99.0%	25.3	19.8	100.0	55.0	0.4
35.0	0.5%	99.5%	29.5	19.8	100.0	47.1	0.2
40.0	0.5%	100.0%	33.7	19.8	100.0	41.2	0.2
45.0	0.0%	100.0%	38.0	19.8	100.0	36.7	0.0
50.0	0.0%	100.0%	42.2	19.8	100.0	33.0	0.0
							91.7

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 85.2%

Predicted Annual Rainfall Treated = 99.4%

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 and scaling based on original manufacturer model and product specifications.

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

STORM SEWER CALCULATIONS

Rational Method

2-YEAR EVENT

Project: 2506 Innes Road
44 Stacked Townhomes
Ottawa, Ontario

Date: May 6, 2024

Manning's Roughness Coefficient: 0.013

		Individual					Cumulative				Sewer Data							
Location		Roof C = 0.90	Hard C = 0.90	Gravel C = 0.70	Soft C = 0.20			Time	Rainfall Intensity	Q Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	Time	
From	To	(ha)	(ha)	(ha)	(ha)	2.78AC	2.78AC	(min)	(mm/hr)	(L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	(min)	Q / Q_{Full}
CB/MH-1	CB/MH-2	0.0185	0.0085		0.0035	0.0695	0.0695	10.00	77	5.34	31.4	250	250	0.432	0.80	39.09	0.66	14%
CB/MH-2	MH-3	0.0095	0.0070		0.0020	0.0424	0.1119	10.66	74	8.32	19.3	250	250	0.432	0.80	39.09	0.40	21%
MH-3	CB/MH-5					0.0000	0.1119	11.06	73	8.16	14.6	250	250	0.432	0.80	39.09	0.31	21%
CB-4	CB/MH-5		0.0335		0.0075	0.0880	0.0880	10.00	77	6.76	23.8	250	250	0.432	0.80	39.09	0.50	17%
CB/MH-5	CB/MH-7	0.0075	0.0515		0.0020	0.1487	0.3486	11.37	72	25.07	16.8	250	250	0.432	0.80	39.09	0.35	64%
CB-6	CB/MH-7	0.0140	0.0485		0.0015	0.1572	0.1572	10.00	77	12.07	23.8	250	250	0.432	0.80	39.09	0.50	31%
CB/MH-7	CB/MH-8	0.0180	0.0455		0.0020	0.1600	0.6658	11.72	71	47.13	14.8	250	250	0.63	0.96	47.20	0.26	100%
CB/MH-8	CB/MH-9	0.0095	0.0115		0.0015	0.0534	0.7192	11.97	70	50.32	10.3	300	300	0.34	0.80	56.39	0.22	89%
CB/MH-9	MH-10	0.0280	0.0220		0.0040	0.1273	0.8465	12.19	69	58.67	4.7	300	300	1.56	1.71	120.78	0.05	49%
							Flow through inlet control device:			48.76	4.7	300	300	1.56	1.71	120.78	0.05	40%
MH-10	675 ST					0.0000	0.8465	12.24	69	58.55	11.4	300	300	1.56	1.71	120.78	0.11	48%
								Restricted upstream flow:		48.76	11.4	300	300	1.56	1.71	120.78	0.11	40%
										Existing 675 mm Innes Road Municipal Storm Sewer:		675	685	0.31	1.32	486.74		