D.B. Gray Engineering Inc.

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

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SITE SERVICING STUDY & STORMWATER MANAGEMENT REPORT

393 MCARTHUR AVENUE
OTTAWA, ONTARIO

REPORT NO. 21111

JUNE 15, 2022

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for the proposed 6-storey mixed-use building comprised of 66 residential apartment units and partial ground floor commercial located at 393 McArthur Avenue in Ottawa, Ontario. The property is currently vacant. Refer to Pre-Application Consultation meeting notes in Appendix A.

This report forms part of the servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-4 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

The proposed building will have a sprinkler system with the fire department connection located at the SW corner of the building. There is an existing municipal Class AA fire hydrant located at the intersection of McArthur Avenue and Brant Street. It is 35 m unobstructed distance to the proposed fire department connection, which is less than the maximum 45 m permitted by the Ontario Building Code; therefore, a private fire hydrant is not required.

As per City of Ottawa Technical Bulletin ISTB-2021-03, when calculating the required fire flow where pipe sizing is not affected, the Ontario Building Code Method is to be used. Using the Ontario Building Code Method the required fire flow was calculated to be 9,000 L/min (150 L/s). As per City of Ottawa Technical Bulletin ISTB-2021-03, 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 was calculated to be 13,000 L/min (216.7 L/s). Refer to calculations in Appendix B.

The boundary conditions in the 400 mm McArthur Avenue municipal watermain provided by the City of Ottawa for the 216.7 L/s fire flow at the subject property indicate a hydraulic grade line (HGL) of 111.4 m. Refer to Appendix B. This HGL calculates to 484 kPa (70 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.

As per 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. As per 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 two closest existing municipal fire hydrants are Class AA and are within 75 m of the proposed building. One is located at the intersection of McArthur Avenue and Brant Street. The other is located between 401 McArthur Avenue and 407 McArthur Avenue. Each can contribute 5,700 L/min (95 L/s). There is a third existing municipal Class AA fire hydrant within 150 m of the proposed building located between 371 McArthur Avenue and 373 McArthur Avenue. It 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 13,000 L/min (216.7 L/s).

2.2 DOMESTIC WATER SUPPLY

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

As per

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

based on the 53 – 1 bedroom apartment units, 13 – 2 bedroom apartment units and partial ground floor commercial representing 25% of the property, the average daily demand was calculated to be 0.4 L/s, the maximum daily demand was calculated to be 2.3 L/s and the maximum hourly demand was calculated to be 3.4 L/s. Refer to calculations in Appendix B.

The boundary conditions in the 150 mm Belisle Street municipal watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 109.5 m and a maximum HGL of 118.5 m. Refer to Appendix B. Based on these boundary conditions the pressure at the water meter is calculated to vary between 440 kPa (64 psi) and 529 kPa (77 psi). This is an acceptable range for the proposed development.

3.0 SANITARY SERVICING

As per

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

based on the 53 – 1 bedroom apartment units, 13 – 2 bedroom apartment units and partial ground floor commercial representing 25% of the property, the post-development sanitary flow rate was calculated to be 1.12 L/s. A 150 mm sanitary sewer service at 2% slope (21.54 L/s capacity) is proposed to service the development. At the design flow rate the sanitary sewer service will only be at 5% of its capacity. The proposed 150 mm sanitary sewer service will connect to the existing 200 mm Belisle Street municipal sanitary sewer, which at 0.33% slope has a capacity of 18.84 L/s. Refer to calculations in Appendix C. The 1.12 L/s post-development increase in flow is expected to have an acceptable impact on the 200 mm Belisle Street municipal sanitary sewer.

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

The Rideau Valley Conservation Authority has stated: *"Based on the site plan provided, there are less than 6 parking spaces. Therefore, the RVCA would not require additional on-site water quality measures save and except best management practices."* Refer to Appendix D. As such, no permanent stormwater quality control measures are proposed.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-2 and notes 2.1 to 2.8 on drawing C-4. Sediment capture filter sock inserts are to be installed in all existing and proposed catch-basins adjacent to and within the site, and any material deposited on the public road is to be removed.

4.2 QUANTITY CONTROL

It was calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.61. The individual runoff coefficients were each increased by 25% to a maximum of 1.00 to calculate the pre-development conditions during the 100-year event. Using the Bransby Williams Formula the pre-development time of concentration was calculated to be 5 minutes. Using the Rational Method with a time of concentration of 10 minutes, the pre-development flow rates were calculated to be 55.45 L/s during the 100-year event and 26.02 L/s during the 5-year event.

The original stormwater quantity control criterion was to control the post-development 100-year peak flow rate to the pre-development 2-year peak flow rate using a calculated pre-development runoff coefficient not more than 0.50 and a calculated pre-development time of concentration not less than 10 minutes. In consultation with City of Ottawa staff it was agreed that controlling the post-development peak flows with the use of flow control roof drains would suffice due to site limitations. 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 – 675 sq.m)
Other than roof storage, stormwater from the property will drain uncontrolled off site. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event
Maximum Flow Rate	29.78 L/s	15.57 L/s

Drainage Area II (Roof North of Penthouse – 157 sq.m)
The roof drain is to be a flow control type roof drain which will restrict the flow of stormwater and cause it to pond on the roof. The roof drain is to be installed with a single-parabolic slotted weir and release 0.01242 L/s/mm (5 USgpm/in). The roof drain is to be a Watts with an Accutrol Weir RD-100-A1 or approved equal. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of 2 scuppers each a minimum 230 mm wide are to be installed 150 mm above the roof drain. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers or 200 mm depth at the roof drain. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	1.60 L/s	1.20 L/s
Maximum Depth at Roof Drain	129 mm	97 mm
Maximum Volume Stored	4.40 cu.m	1.87 cu.m

Drainage Area III (Roof South of Penthouse – 639 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. 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 equal. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of 6 scuppers each a minimum 310 mm wide are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers or 200 mm depth at the roof drains. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	3.62 L/s	2.77 L/s
Maximum Depth at Roof Drains	146 mm	112 mm
Maximum Volume Stored	23.36 cu.m	10.53 cu.m

Summary

The maximum post-development release rate during the 100-year event was calculated to be 35.00 L/s, which is 37% less than the pre-development flow rate during the 100-year event. A maximum storage volume of 27.76 cu.m is required and provided. The maximum post-development release rate during the 5-year event was calculated to be 19.54 L/s, which is 25% less than the pre-development flow rate during the 5-year event. The post-development reduction in flow is expected to have a positive impact on the 300 mm Belisle Street municipal storm sewer.

	100-Year Event	5-Year Event
Pre-Development Flow Rate	55.45 L/s	26.02 L/s
Maximum Release Rate	35.00 L/s	19.54 L/s
Maximum Volume Required	27.76 cu.m	12.40 cu.m
Maximum Volume Stored	27.76 cu.m	12.40 cu.m

4.3 STORM SERVICING

The peak unrestricted roof flow rate during the 5-year event was calculated to be 20.75 L/s. A 250 mm storm sewer service at 2% slope (84.10 L/s capacity) is proposed to service the building. At the peak unrestricted 5-year flow rate the storm sewer service would only be at 25% of its capacity. The peak restricted roof flow rate during the 5-year event was calculated to be 3.97 L/s. At the peak restricted 5-year flow rate the storm sewer service will only be at 5% of its capacity. Refer to calculations in Appendix D. The proposed 250 mm storm sewer service will connect to the proposed private storm sewer system.

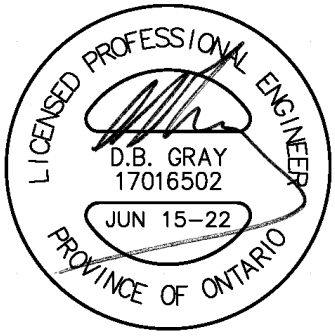
The peak unrestricted flow rate draining into the private storm sewer system during the 5-year event was calculated to be 27.73 L/s. A 250 mm storm sewer at 0.43% slope (39.00 L/s capacity) is proposed to connect to the existing 300 mm Belisle Street municipal storm sewer, which at 0.32% slope has a capacity of 54.70 L/s. At the peak unrestricted 5-year flow rate the proposed 250 mm storm sewer would only be at 71% of its capacity. The peak restricted flow rate draining into the private storm sewer system during the 5-year event was calculated to be 11.01 L/s. At the peak restricted 5-year flow rate the proposed 250 mm storm sewer will only be at 28% of its capacity. Refer to calculations in Appendix D.

The foundation drains will drain to a storm sump and be pumped to the storm building drain.

5.0 CONCLUSIONS

1. A private fire hydrant is not required.
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 rate will be adequately handled by the proposed sanitary sewer service.
5. The post-development increase in sanitary flow is expected to have an acceptable impact on the existing municipal sanitary sewer.
6. The Rideau Valley Conservation Authority does not require permanent stormwater quality control measures. As such, no permanent measures are proposed.
7. An Erosion & Sediment Control Plan has been developed to be implemented during construction.
8. The post-development reduction in stormwater flow is expected to have a positive impact on the existing municipal storm sewer.
9. The unrestricted flow rates during the 5-year event will be adequately handled by the proposed storm sewer service and private storm sewer system.

Prepared by D.B. Gray Engineering Inc.



NOT VALID UNLESS
SIGNED & DATED

APPENDIX A

PRE-APPLICATION CONSULTATION MEETING NOTES

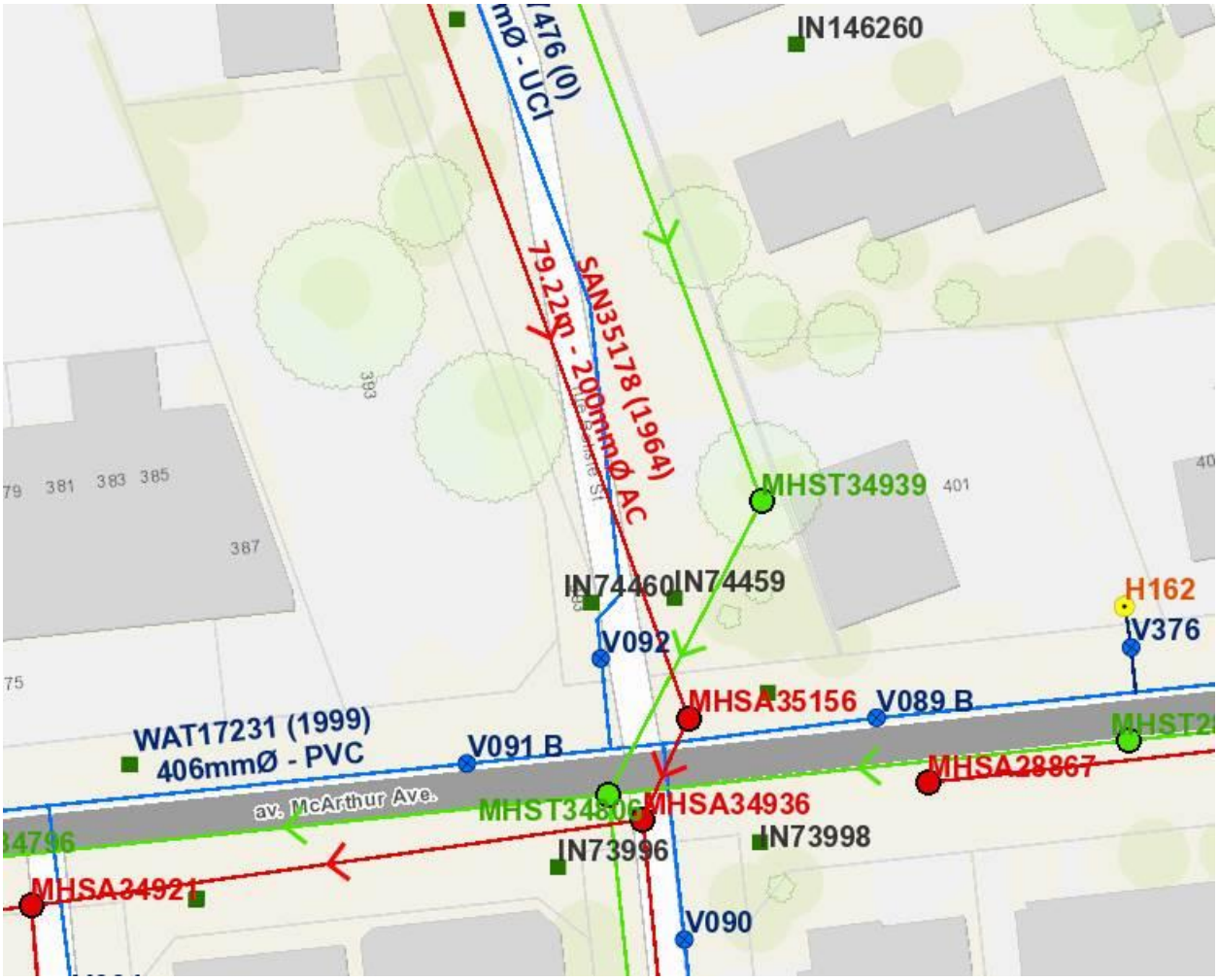
Engineering Comments: Reza Bakhit

General:

- It is the sole responsibility of the consultant to investigate the location of existing underground utilities in the proposed servicing area and submit a request for locates to avoid conflict(s). The location of existing utilities and services shall be documented on an **Existing Conditions Plan**.
- Any easements on the subject site shall be identified and respected by any development proposal and shall adhere to the conditions identified in the easement agreement. A **legal survey plan** shall be provided and all easements shall be shown on the engineering plans.
- Concerns about roadway drainage spilling into the underground parking garage. Please make sure that the entrances to the underground garage is 0.30m higher than the spill point on the street. Entrance should not be located within a sag (low point) in the road.
- A deep excavation and dewatering operations have the potential to cause damages to the neighboring adjacent buildings/ City infrastructure. Document that construction activities (excavation, dewatering, vibrations associated with construction, etc.) will not have an impact on any adjacent buildings and infrastructure.

- Reference documents for information purposes :
  - Ottawa Sewer Design Guidelines (October 2012)
  - Technical Bulletin PIEDTB-2016-01
  - Technical Bulletins ISTB-2018-01, ISTB-2018-02 and ISTB-2018-03.
  - 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 Accessibility Design Standards (2012) (City recommends development be in accordance with these standards on private property)
  - Ottawa Standard Tender Documents (latest version)
  - Ontario Provincial Standards for Roads & Public Works (2013)
  - 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) 580-424 x.44455).

Please note that this is the applicant responsibility to refer to the latest applicable guidelines while preparing reports and studies.



This image is for schematic purposes only.

Stormwater Management Criteria and Information:

- **Water Quantity Control:** In the absence of area specific SWM criteria please control post-development runoff from the subject site, up to and including the **100-year storm event**, to **a 2-year pre-development level.** The pre-development runoff coefficient will need to be determined **as per existing conditions** but in no case more than 0.5. [**If 0.5 applies it needs to be clearly demonstrated in the report that the pre-development runoff coefficient is greater than 0.5**]. The time of concentration (T_c) used to determine the pre-development condition shall be 20min or can be calculated. [*T_c of 20 minutes should be used for all pre-development calculations without engineering justification, Tc should not be less than 10 min. since IDF curves become unrealistic at less than 10 min; T_c of 10 minutes shall be used for all post-development calculations*].
- Any storm events greater than the established **2-year allowable** release rate, up to and including the **100-year storm event**, shall be detained on-site. The SWM

measures required to avoid impact on downstream sewer system will be subject to review.

- Please note that foundation drainage is to be independently connected to sewermain unless being pumped with appropriate back up power, sufficient sized pump and back flow prevention. **It is recommended that the foundation drainage system be drained by a sump pump connection to the storm sewer to minimize risk of basement flooding as it will provide the best protection from the uncontrolled sewer system compared to relying on the backwater valve.**
- **Water Quality Control:** Please consult with the local conservation authority (RVCA) regarding water quality criteria prior to submission of a Site Plan Control Proposal application to establish any water quality control restrictions, criteria and measures for the site. Correspondence and clearance shall be provided in the Appendix of the report.
- Please note that as per *Technical Bulletin PIEDTB-2016-01 section 8.3.11.1 (p.12 of 14)* **there shall be no surface ponding on private parking areas during the 2-year storm rainfall event**.
- **Underground Storage:** Please note that the Modified Rational Method for storage computation in the Sewer Design Guidelines was originally intended to be used for above ground storage (i.e. parking lot) where the change in head over the orifice varied from 1.5 m to 1.2 m (assuming a 1.2 m deep CB and a max ponding depth of 0.3 m). This change in head was small and hence the release rate fluctuated little, therefore there was no need to use an average release rate.
  When underground storage is used, the release rate fluctuates from a maximum peak flow based on maximum head down to a release rate of zero. This difference is large and has a significant impact on storage requirements. **We therefore require that an average release rate equal to 50% of the peak allowable rate shall be applied to estimate the required volume. Alternatively, the consultant may choose to use a submersible pump in the design to ensure a constant release rate.**
  In the event that there is a disagreement from the designer regarding the required storage, The City will require that the designer demonstrate their rationale utilizing dynamic modelling, that will then be reviewed by City modellers in the Water Resources Group.
- Please note that the minimum orifice dia. for a plug style **ICD is 83mm and the minimum flow rate from a vortex ICD is 6 L/s** in order to reduce the likelihood of plugging.
- Post-development site grading shall match existing property line grades in order to minimize disruption to the adjacent residential properties. A **topographical plan of survey** shall be provided as part of the submission and a note provided on the plans.
- Please provide a **Pre-Development Drainage Area Plan** to define the pre-development drainage areas/patterns. **Existing drainage patterns shall be maintained and discussed as part of the proposed SWM solution**.

- **If rooftop control** and storage is proposed as part of the SWM solutions sufficient details (Cl. 8.3.8.4) shall be discussed and document in the report and on the plans. Roof drains are to be connected downstream of any incorporated ICDs within the SWM system and not to the foundation drain system. Provide a **Roof Drain Plan** as part of the submission.
- Investigate the implementation of LID features (i.e. permeable IPS) to reduce runoff however no credit shall be given in terms of stormwater management.

Storm Sewer:

- A 300 mm dia. CONC Combined sewer (1964) is available within **Belisle St.**
- A 450 mm dia. CONC Combined sewer (1963) is available within **McArthur Ave.**

Sanitary Sewer:

- A 200 mm dia. AC Sanitary sewer is available within **Belisle St.**
- A 300 mm dia. CONC Sanitary sewer is available within **McArthur Ave.**
- **An analysis and demonstration that there is sufficient/adequate residual capacity to accommodate any increase in wastewater flows in the receiving and downstream wastewater system is required to be provided**. Needs to be demonstrated that there is adequate capacity to support any increase in wastewater flow.
- Please apply the wastewater design flow parameters *in Technical Bulletin PIEDTB-2018-01.*
- Sanitary sewer monitoring maintenance hole is required to be installed at the property line (on the private side of the property) as per City of Ottawa Sewer-Use By-Law 2003-514 (14) *Monitoring Devices*.
- A backwater valve is required on the sanitary service for protection.

Water :

- A 406 mm dia. PVC watermain (2006) is available within **McArthur Ave.**
- A 152 mm dia. UCI watermain (1955) is available within **Belisle St.**
- Existing residential service to be blanked at the main.
- **Water Supply Redundancy:** Residential buildings with a basic day demand greater than 50m^3/day (0.57 L/s) are required to be connected to a minimum of two water services separated by an isolation valve to avoid a vulnerable service area as per the *Ottawa Design Guidelines - Water Distribution, WDG001, July 2010 Clause 4.3.1 Configuration.* The basic day demand for this site not expected to exceed 50m^3/day.
- Please **review Technical Bulletin ISTB-2018-0**, maximum fire flow hydrant capacity is provided in Section 3 Table 1 of Appendix I. A **hydrant coverage figure** shall be provided and **demonstrate there is adequate fire protection for the proposal**. Two or more public hydrants are anticipated to be required to handle fire flow.

- Boundary conditions are required to confirm that the require fire flows can be achieved as well as availability of the domestic water pressure on the City street in front of the development. Use Table 3-3 of the MOE Design Guidelines for Drinking-Water System to determine Maximum Day and Maximum Hour peaking factors for 0 to 500 persons and use Table 4.2 of the Ottawa Design Guidelines, Water Distribution for 501 to 3,000 persons. Please provide the following information to the City of Ottawa via email to request water distribution network boundary conditions for the subject site. Please note that once this information has been provided to the City of Ottawa it takes approximately 5-10 business days to receive boundary conditions.
    - Type of Development and Units
    - Site Address
    - A plan showing the proposed water service connection location.
    - **Average Daily Demand** (L/s)
    - **Maximum Daily Demand** (L/s)
    - **Peak Hour Demand** (L/s)
    - **Fire Flow** (L/min)

[*Fire flow demand requirements shall be based on* ***Fire Underwriters Survey (FUS)*** *Water Supply for Public Fire Protection 1999*]
Exposure separation distances shall be defined on a figure to support the FUS calculation and required fore flow (RFF).

- **Hydrant capacity shall be assessed to demonstrate the RFF can be achieved**. Please identify which hydrants are being considered to meet the RFF on a fire hydrant coverage plan as part of the boundary conditions request.

Snow Storage:

- Any portion of the subject property which is intended to be used for permanent or temporary snow storage shall be as shown on the approved site plan and grading plan. Snow storage shall not interfere with approved grading and drainage patters or servicing. Snow storage areas shall be setback from the property lines, foundations, fencing or landscaping a minimum of 1.5m. Snow storage areas shall not occupy driveways, aisles, required parking spaces or any portion of a road allowance. If snow is to be removed from the site please indicate this on the plan(s).

Required Engineering Plans and Studies:
PLANS:

- Existing Conditions and Removals Plan
- Site Servicing Plan
- Grade Control and Drainage Plan
- Erosion and Sediment Control Plan
- Pre-Development Drainage Area Plan
- Post-Development Drainage Area Plan
- Roof Drainage Plan

- Topographical Plan of Survey
- Legal Survey Plan
- Site Lighting Plan

REPORTS:

- Site Servicing and Stormwater Management Report
- Geotechnical Study/Investigation
- Noise Control Study (assessment of stationery and transportation noise) (due to proximity (within 100m) of an existing arterial road.
- Phase I ESA
- Phase II ESA (Depending on recommendations of Phase I ESA)
- Site lighting certificate

Please refer to the **City of Ottawa Guide to Preparing Studies and Plans [Engineering]:**
https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#gravity-pipe-design-guidelines
Please ensure you are using current guidelines, by-laws and standards.

Phase One Environmental Site Assessment:

- A Phase I ESA is required to be completed in accordance with Ontario Regulation 153/04 in support of this development proposal to determine the potential for site contamination. Depending on the Phase I recommendations a Phase II ESA may be required.
- The Phase I ESA shall provide all the required Environmental Source Information as required by O. Reg. 153/04. ERIS records are available to public at a reasonable cost and need to be included in the ESA report to comply with O.Reg. 153/04 and the Official Plan. The City will not be in a position to approve the Phase I ESA without the inclusion of the ERIS reports.
- Official Plan Section 4.8.4:

https://ottawa.ca/en/city-hall/planning-and-development/official-plan-and-master-plans/official-plan/volume-1-official-plan/section-4-review-development-applications#4-8-protection-health-and-safety

Geotechnical Investigation:

- A Geotechnical Study/Investigation shall be prepared in support of this development proposal.
- Reducing the groundwater level in this area can lead to potential damages to surrounding structures due to excessive differential settlements of the ground. The impact of groundwater lowering on adjacent properties needs to be discussed and investigated to ensure there will be no short term and long term damages associated with lowering the groundwater in this area.
- Geotechnical Study shall be consistent with the **Geotechnical Investigation and Reporting Guidelines for Development Applications**.

https://documents.ottawa.ca/sites/default/files/documents/cap137602.pdf

Noise Study:

- A Noise Control Detailed Study is required as the subject site is within an **arterial road** that is considered a surface transportation noise source. Any existing and/or new stationary noise sources shall be identified and analyzed.
- Please note that an environmental noise assessment of any stationary noise sources (Stationary Noise Assessment) of the proposed development will be required to determine the affects of any proposed roof top units, etc. for this building as this noise may subject the tenants/owners of the upper level of the residential building, and the surrounding neighbours, to static noise levels that are beyond the acceptable limits.
- Noise Study shall be consistent with the City's **Environmental Noise Control Guidelines**.

https://documents.ottawa.ca/sites/default/files/documents/enviro_noise_guide_en.pdf

Exterior Site Lighting:

- Any proposed light fixtures (both pole-mounted and wall mounted) must be part of the approved Site Plan. All external light fixtures must meet the criteria for Full Cut-off Classification as recognized by the Illuminating Engineering Society of North America (IESNA or IES), and must result in minimal light spillage onto adjacent properties (as a guideline, 0.5 fc is normally the maximum allowable spillage). In order to satisfy these criteria, the please provide the City with a **Site Lighting Plan, and Certification (Statement) Letter** from an acceptable professional engineer stating that the design is compliant.

Please note that these comments are considered preliminary based on the information available to date and therefore maybe amended as additional details become available and presented to the City. It is the responsibility of the applicant to verify the above information. The applicant may contact me for follow-up questions related to engineering/infrastructure prior to submission of an application if necessary.

APPENDIX B

WATER SERVICING

D.B. Gray Engineering Inc.

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

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February 14, 2022

393 McArthur Avenue

6 Storey Mixed Use Building

Ottawa, Ontario

FIRE FLOW CALCULATIONS

OBC Method

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

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)	
$S_{Side\ 1}$	0.5	5	(to north property line)
$S_{Side\ 2}$	0	11	(to centerline of Belisle Street)
$S_{Side\ 3}$	0	13	(to centerline of McArthur Street)
$S_{Side\ 4}$	0.5	0	(to west property line)
S_{Total}	2.0		

Group C (Residential) Occupancy

K_1 = Water supply coefficient, as per OBC A-3.2.5.7. Table 1
= 16 Building is of noncombustible construction with fire separations without fire resistance ratings.

V_1 = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
Penthouse	95.0	3.30	314
6th Floor	802.5	3.00	2,408
5th Floor	802.5	3.00	2,408
4th Floor	972.5	3.00	2,918
3rd Floor	972.5	3.00	2,918
2nd Floor	972.5	3.00	2,918
1st Floor	718.0	4.00	2,872
			16,753

Q_1 = 536,096 L

Group E (Commercial) Occupancy

K_2 = Water supply coefficient, as per OBC A-3.2.5.7. Table 1

= 27 Building is of noncombustible construction with fire separations without fire resistance ratings.

V_2 = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
1st Floor	232.0	4.00	928

Q_2 = 50,112 L

Q_{Total} = $Q_1 + Q_2$

= 586,208 L

= 9,000 L/min as per OBC A-3.2.5.7. Table 2

= 150 L/s

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

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d.gray@dbgrayengineering.com

March 22, 2022

393 McArthur Avenue

Ottawa, Ontario

FIRE FLOW CALCULATIONS
FUS Method

Proposed 6 Storey Mixed Use Building

F = Required fire flow in litres per minutes
= 220 C A $^{0.5}$

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

A = Total floor area in square meters (including all storeys but excluding basements at least 50% below grade)

393 McArthur Avenue

Penthouse:	95.0	sq.m
6th Floor:	802.5	sq.m
5th Floor:	802.5	sq.m
4th Floor:	972.5	sq.m
3rd Floor:	972.5	sq.m
2nd Floor:	972.5	sq.m
1st Floor:	950.0	sq.m
Total Fire Area:	5567.5	sq.m

F = 13,132 L/min
= 13,000 L/min (rounded to nearest 1000 L/min)

-14% Charge for Noncombustible Occupancy
-15% Charge for Limited Combustible Occupancy (5335.5 sq.m Residential)
15% Charge for Free Burning Occupancy (232.0 sq.m Commercial)

= 11,213 L/min

30% Credit for sprinkler system designed as per NFPA 13
10% Credit for standard water supply for both the sprinkler system and fire department hose lines

= 4,485 L/min

Charge	Side	Separation	Construction	Length	Storeys	Length • Height
17%	North	3.1 to 10m	Wood Frame	10	2	20
8%	East	20.1 to 30m	Wood Frame	14	1	14
8%	South	20.1 to 30m	Wood Frame	18	1	18
22%	West	0 to 3m	Ordinary	19	2	38

55% Total Exposure Charge

= 6,167 L/min Exposure Increase

= 12,894 L/min

= 13,000 L/min (rounded to nearest 1000 L/min)

= 216.7 L/s

216.7 L/s Fire Flow: 111.4 m ASL

Elevation at Fire Hydrant: 62.0 m ASL

Static Pressure at Fire Hydrant: 49.4 m 484 kPa 70 psi

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Request for Boundary Conditions - 393 McArthur Avenue

1 message

Bakhit, Reza <reza.bakhit@ottawa.ca> Tue, Mar 22, 2022 at 7:13 AM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Ryan,

The following are boundary conditions, HGL, for hydraulic analysis at 393 McArthur Avenue (zone 1E) assumed to be connected to the 406 mm watermain on McArthur (see attached PDF for location).

Minimum HGL: 109.5 m

Maximum HGL: 118.5 m

Mas Day + FF (216.7 L/s): 111.4 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,

Reza Bakhit, P.Eng, C.E.T

Project Manager

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

Development Review - Centeral Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca

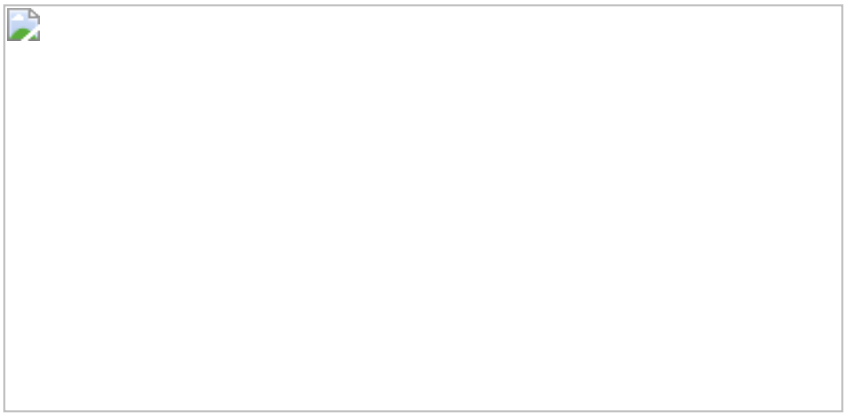
Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: Friday, March 11, 2022 12:06 PM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 393 McArthur Avenue

Hi Reza,

They would use fire hydrants connected to the McArthur Avenue watermain to fight the fire so can you provide the boundary conditions for the 400 mm McArthur Avenue watermain for the 216.7 L/s fire flow?

Thanks,



On Fri, Mar 11, 2022 at 11:30 AM Bakhit, Reza <reza.bakhit@ottawa.ca> wrote:

> Hi Ryan,
>
> Sorry for delay.
>
> The following are boundary conditions, HGL, for hydraulic analysis at 393 McArthur Avenue (zone 1E) assumed to be connected to the 152 mm watermain on Belisle Street (see attached PDF for location).
>
> Minimum HGL: 109.5 m
>
> Maximum HGL: 118.5 m
>
> Available fire flow at 20 psi: 66 L/s, assuming a ground elevation of 62.5 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.

Thanks,

Reza Bakhit, P.Eng, C.E.T

Project Manager

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

Development Review - Centeral Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca

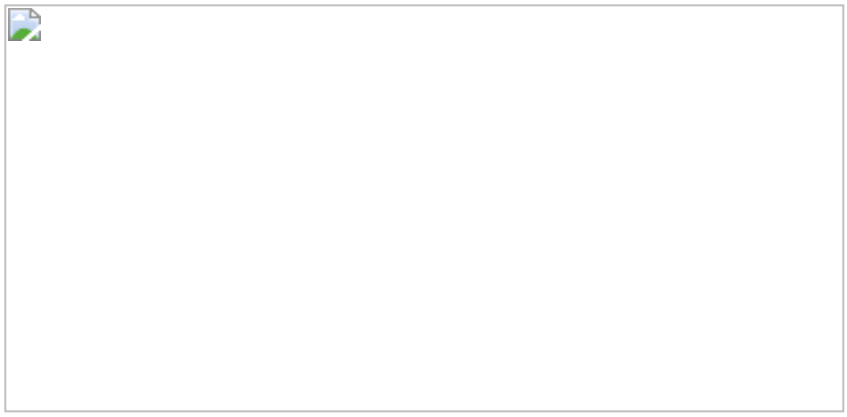
Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: Friday, March 11, 2022 10:51 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 393 McArthur Avenue

Hi Reza,

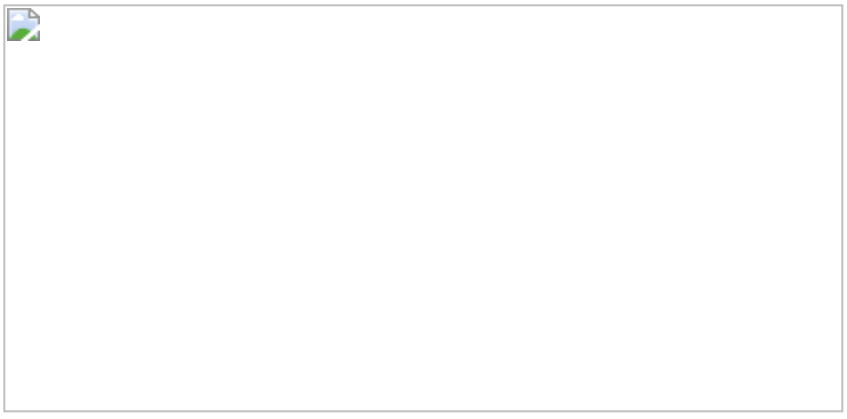
Just following up on this request. Do you have an idea when we can expect to receive the boundary conditions?

Thanks,



On Mon, Feb 14, 2022 at 3:39 PM Ryan Faith <r.faith@dbgrayengineering.com> wrote:

> Hi Reza,
>
> Please provide the boundary conditions for the 150 mm Belisle Street watermain at 393 McArthur Avenue. Location of connection will be in the NE corner of the property. We have calculated the following expected demands:
>
> Average daily demand: 0.4 L/s
>
> Maximum daily demand: 2.3 L/s
>
> Maximum hourly demand: 3.4 L/s
>
> Fire flow demand: 216.7 L/s (FUS)
>
> Fire flow + maximum daily demand: 219 L/s
>
> Calculations are attached.
>
> Thanks,



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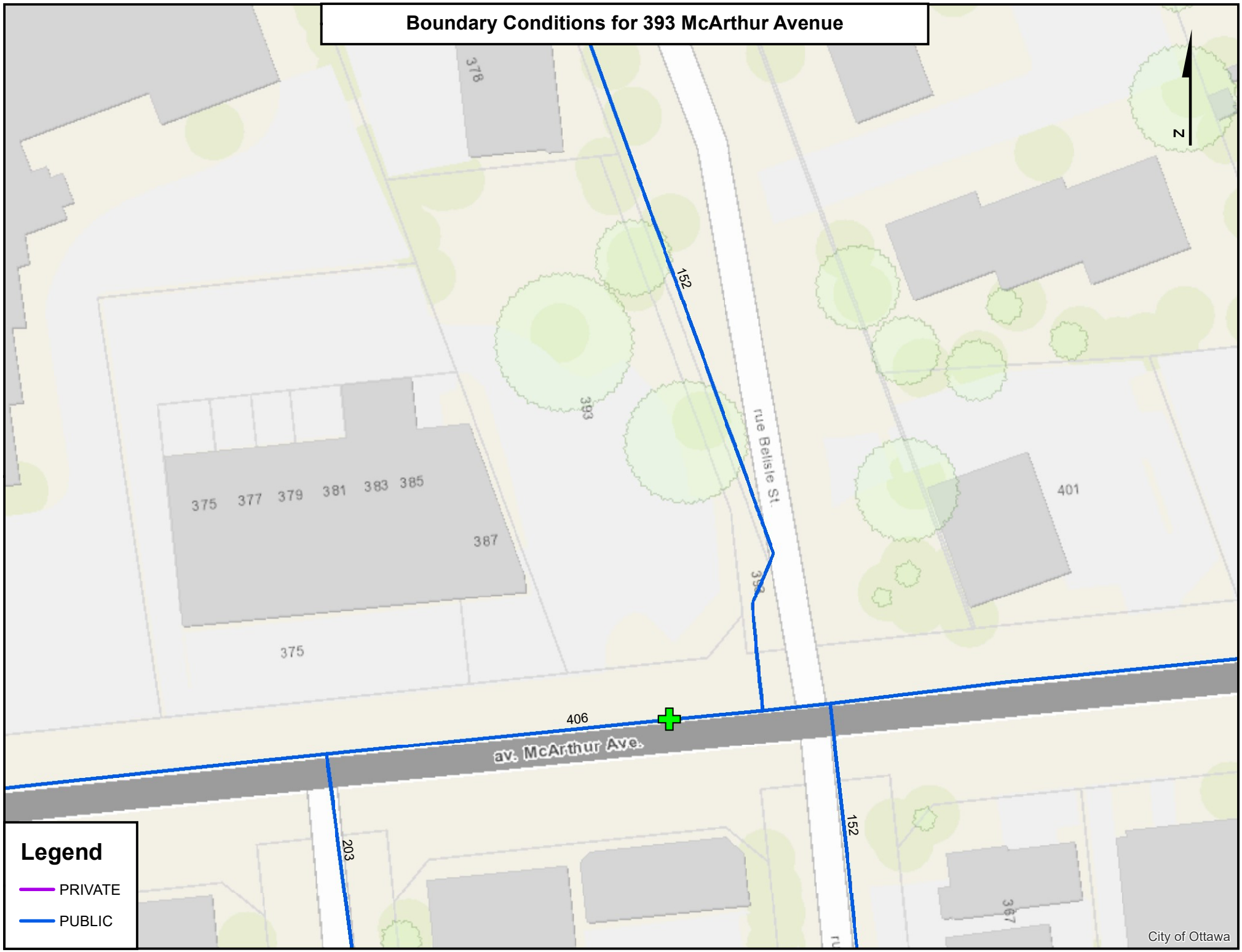
393 McArthur Avenue March 2022.pdf
908K


Boundary Conditions for 393 McArthur Avenue
N
378
152
393
rue Bellsle St.
401
375 377 379 381 383 385
387
375
406
av. McArthur Ave.
203
152
367
Legend
PRIVATE
PUBLIC
City of Ottawa

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

March 11, 2022

393 McArthur Avenue
6 Storey Mixed Use Building
66 Apartment Units / Ground Floor Commercial
Ottawa, Ontario

WATER DEMAND CALCULATIONS

Apartments	Number of Units	Persons per Unit	Population
1 Bedroom	53	1.4	74
2 Bedroom	13	2.1	27
3 Bedroom	0	3.1	0
Total:	66		102

Residential Average Daily Demand: 280 L/capita/day

19.7 L/min | 0.3 L/s | 5.2 USGPM

Residential Maximum Daily Demand: 6.8 (Peaking factor for a population of 102 interpolated from Table 3-3 MOE Design Guidelines for Drinking Water Systems)

133.4 L/min | 2.2 L/s | 35.2 USGPM

Residential Maximum Hourly Demand: 10.2 (Peaking factor for a population of 102 interpolated from Table 3-3 MOE Design Guidelines for Drinking Water Systems)

201.1 L/min | 3.4 L/s | 53.1 USGPM

Commercial Average Daily Demand:	0.036775	ha (25% of 1,471 sq.m)				
	28,000	L/ha/day				
	1,030	L/day				
	8	hour day				
	2.1	L/min	0.04	L/s	0.6	USGPM
Commercial Maximum Daily Demand:	1.5	(Peaking factor as per City of Ottawa Water Design Guidelines)				
	3.2	L/min	0.1	L/s	0.9	USGPM
Commercial Maximum Hourly Demand:	1.8	(Peaking factor as per City of Ottawa Water Design Guidelines)				
	5.8	L/min	0.1	L/s	1.5	USGPM
Total Average Daily Demand:	21.9	L/min	0.4	L/s	5.8	USGPM
Total Maximum Daily Demand:	136.6	L/min	2.3	L/s	36.1	USGPM
Total Maximum Hourly Demand:	206.9	L/min	3.4	L/s	54.7	USGPM
Elevation of Water Meter:	64.57	m ASL				
Finished Floor Elevation:	63.67	m ASL				
Minimum HGL:	109.5	m ASL				
Static Pressure at Water Meter:	44.9	m	440	kPa	64	psi
Maximum HGL:	118.5	m ASL				
Static Pressure at Water Meter:	53.9	m	529	kPa	77	psi

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Request for Boundary Conditions - 393 McArthur Avenue

1 message

Bakhit, Reza <reza.bakhit@ottawa.ca> Fri, Mar 11, 2022 at 11:30 AM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Ryan,

Sorry for delay.

The following are boundary conditions, HGL, for hydraulic analysis at 393 McArthur Avenue (zone 1E) assumed to be connected to the 152 mm watermain on Belisle Street (see attached PDF for location).

Minimum HGL: 109.5 m

Maximum HGL: 118.5 m

Available fire flow at 20 psi: 66 L/s, assuming a ground elevation of 62.5 m

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

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Thanks,

Reza Bakhit, P.Eng, C.E.T

Project Manager

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

Development Review - Centeral Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca

Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: Friday, March 11, 2022 10:51 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 393 McArthur Avenue

Hi Reza,

Just following up on this request. Do you have an idea when we can expect to receive the boundary conditions?

Thanks,

Ryan Faith

D.B. Gray Engineering Inc.

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

700 Long Point Circle 613-425-8044
Ottawa, Ontario r.faith@dbgrayengineering.com

On Mon, Feb 14, 2022 at 3:39 PM Ryan Faith <r.faith@dbgrayengineering.com> wrote:

> Hi Reza,
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> Please provide the boundary conditions for the 150 mm Belisle Street watermain at 393 McArthur Avenue. Location of connection will be in the NE corner of the property. We have calculated the following expected demands:
>
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> Maximum daily demand: 2.3 L/s
>
> Maximum hourly demand: 3.4 L/s
>
> Fire flow demand: 216.7 L/s (FUS)
>
> Fire flow + maximum daily demand: 219 L/s

Calculations are attached.

Thanks,

Ryan Faith

D.B. Gray Engineering Inc.

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

700 Long Point Circle 613-425-8044
Ottawa, Ontario r.faith@dbgrayengineering.com

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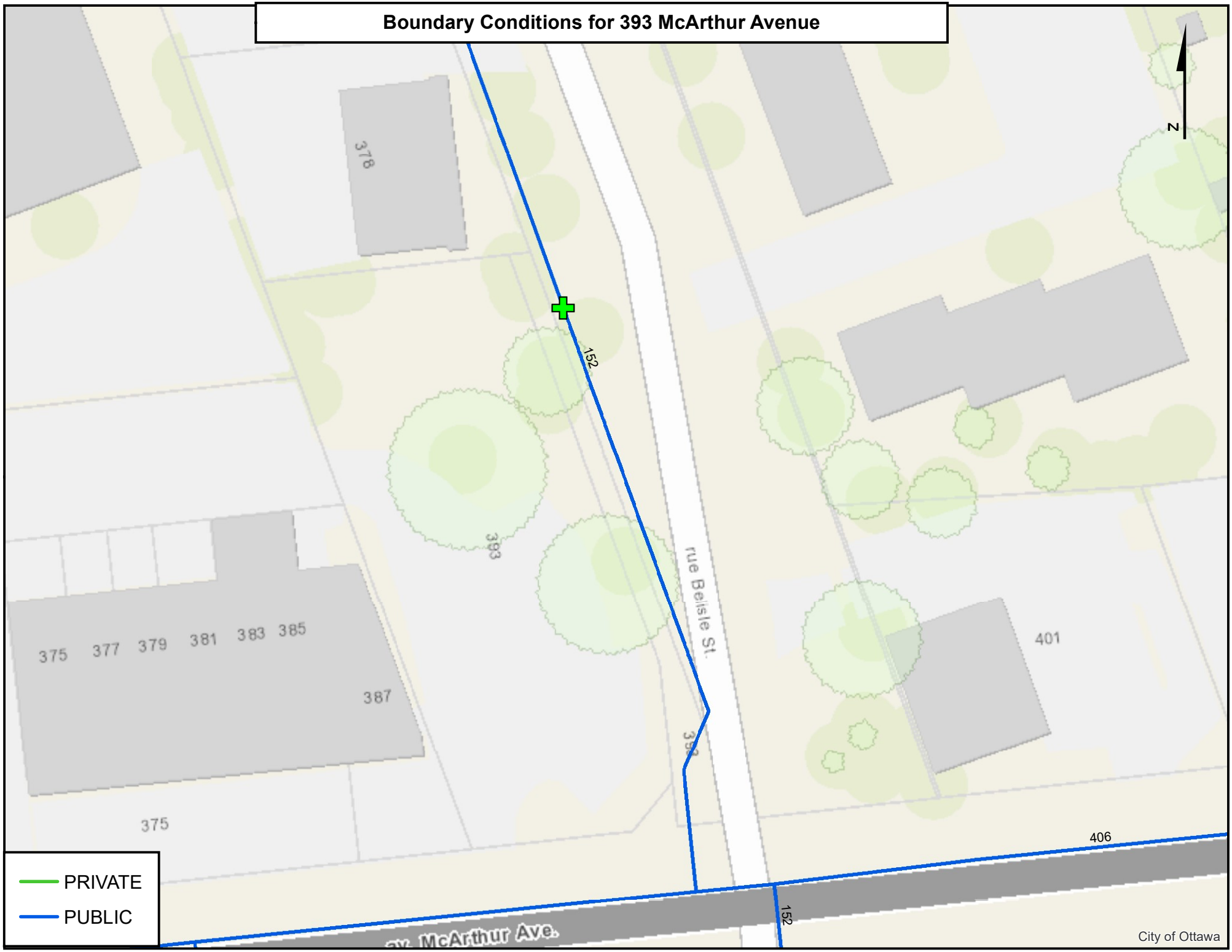
393 McArthur Avenue February 2022.pdf
863K

Boundary Conditions for 393 McArthur Avenue



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: 393 McArthur Avenue
6-Storey Mixed-Use Building
66 Apartment Units / Partial Ground Floor Commercial
Ottawa, Ontario

Date: June 15, 2022

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

		Residential													Commercial				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual	Cumulative			Individual	Cumulative		Total							
Location		Single	Semi		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	Duplex	(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																					
Proposed Building	Existing 200 SAN				53	13			0.110325	101.5	0.110325	101.5	3.2	1.05	0.036775	0.036775	1.5	0.02	0.1471	0.1471	0.05	1.12	9.3	150	150	2	1.22	21.54	0.05
																							Existing 200 mm Belisle Street Municipal Sanitary Sewer:		200	200	0.33	0.60	18.84	

APPENDIX D

STORMWATER MANAGEMENT

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: RVCA Stormwater Management Comments - 393 McArthur Avenue

1 message

Jamie Batchelor <jamie.batchelor@rvca.ca> Tue, Apr 5, 2022 at 9:33 AM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Good Morning Ryan,

Based on the site plan provided, there are less than 6 parking spaces. Therefore, the RVCA would not require additional on-site water quality measures save and except best management practices.

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: Tuesday, April 5, 2022 8:43 AM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: RVCA Stormwater Management Comments - 393 McArthur Avenue

Hi Jamie,

We are working on a proposed 6 storey apartment building on 1471 sq.m of land at 393 McArthur Avenue in Ottawa.

Please comment on the stormwater management for the site.

I have attached a site plan for your reference.

Thanks,

Ryan Faith

D.B. Gray Engineering Inc.

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

700 Long Point Circle 613-425-8044
Ottawa, Ontario r.faith@dbgrayengineering.com

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: 393 McArthur Avenue

1 message

Bakhit, Reza <reza.bakhit@ottawa.ca> Fri, Dec 17, 2021 at 3:31 PM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Good afternoon Ryan,

I agree with your proposal. Please control the roof portion only and drain the uncontrolled portion towards the ROW. Also as a reminder to submit BC based on OCB calculation .

Have a nice weekend,

Reza Bakhit, P.Eng, C.E.T

Project Manager

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

Development Review - Centeral Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2400 ext./poste 19346, reza.bakhit@ottawa.ca

Please note: Given the current pandemic, I will be working from home until further notice; reaching me by email is the easiest. I will be checking my voicemail, just not as frequently as I normally would be.

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: Thursday, December 16, 2021 11:36 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: 393 McArthur Avenue

Hi Reza,

Similar to your notes on 216 McArthur Avenue, would it be acceptable to the City to control the roof only and let the remainder of the site drain uncontrolled to the ROW. The reason I ask is they have a depressed driveway to underground parking off the at grade parking at the north end of the site, which makes ponding with freeboard near impossible. I have attached the latest drawings for your reference.

Thanks,

Ryan Faith

D.B. Gray Engineering Inc.

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

700 Long Point Circle 613-425-8044
Ottawa, Ontario r.faith@dbgrayengineering.com

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SUMMARY TABLES

ONE HUNDRED YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	29.78	-	-
AREA II (Roof North of Penthouse)	-	1.60	4.40	4.40
AREA III (Roof South of Penthouse)	-	3.62	23.36	23.36
TOTAL	55.45	35.00	27.76	27.76

FIVE YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	15.57	-	-
AREA II (Roof North of Penthouse)	-	1.20	1.87	1.87
AREA III (Roof South of Penthouse)	-	2.77	10.53	10.53
TOTAL	26.02	19.54	12.40	12.40

June 15, 2022

393 McArthur Avenue

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS

Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

ONE HUNDRED YEAR EVENT

			C
Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	45	sq.m	1.00
Gravel Area:	1,145	sq.m	0.875
Landscaped Area:	281	sq.m	0.25
Total Catchment Area:	1,471	sq.m	0.76

Bransby Williams Formula

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

Sheet Flow Distance (L):	60	m
Slope of Land (Sw):	0.5	%
Area (A):	0.1471	ha
Time of Concentration (Sheet Flow):	5	min
Area (A):	1,471	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.76	
100 Year Pre-Development Flow Rate (2.78AiC):	55.45	L/s

FIVE YEAR EVENT

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	45	sq.m	0.90
Gravel Area:	1,145	sq.m	0.70
Landscaped Area:	281	sq.m	0.20
Total Catchment Area:	1,471	sq.m	0.61
Area (A):	1,471	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.61		
5 Year Pre-Development Flow Rate (2.78AiC):	26.02	L/s	

ONE HUNDRED YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	320	sq.m	1.00
Asphalt/Concrete Area:	255	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	100	sq.m	0.25
Total Catchment Area:	675	sq.m	0.89
Area (A):	675	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.89		
Flow Rate (2.78AiC):	29.78	L/s	

DRAINAGE AREA II (Roof North of Penthouse)

(ONE HUNDRED YEAR EVENT)

			C
Total Catchment Area:	157	sq.m	1.00

No. of Roof Drains: 1
Slots per Wier: 1 0.01242 L/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 129 mm

Maximum Release Rate: 1.60 L/s Pond Area: 103 sq.m

Maximum Volume Stored: 4.40 cu.m

Maximum Volume Required: 4.40 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	7.79	1.60	6.20	3.72
15	143	6.24	1.60	4.64	4.18
20	120	5.24	1.60	3.64	4.37
25	104	4.53	1.60	2.94	4.40
30	92	4.01	1.60	2.41	4.34
35	83	3.60	1.60	2.01	4.22
40	75	3.28	1.60	1.68	4.04
45	69	3.01	1.60	1.42	3.83
50	64	2.79	1.60	1.20	3.59
55	60	2.60	1.60	1.01	3.32
60	56	2.44	1.60	0.84	3.04
65	53	2.30	1.60	0.70	2.74
70	50	2.17	1.60	0.58	2.42
75	47	2.06	1.60	0.47	2.10
80	45	1.96	1.60	0.37	1.76
85	43	1.87	1.60	0.28	1.42
90	41	1.79	1.60	0.20	1.07
95	39	1.72	1.60	0.12	0.71
100	38	1.65	1.60	0.06	0.35
105	36	1.59	1.59	0.00	0.00
110	35	1.54	1.54	0.00	0.00
115	34	1.48	1.48	0.00	0.00
120	33	1.44	1.44	0.00	0.00

DRAINAGE AREA III (Roof South of Penthouse)

(ONE HUNDRED YEAR EVENT)

			C
Total Catchment Area:	639	sq.m	1.00

No. of Roof Drains: 2

Slots per Wier: 1 0.01242 L/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drains: 146 mm

Maximum Release Rate: 3.62 L/s Pond Area: 481 sq.m

Maximum Volume Stored: 23.36 cu.m

Maximum Volume Required: 23.36 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	31.72	3.62	28.10	16.86
15	143	25.38	3.62	21.77	19.59
20	120	21.31	3.62	17.69	21.23
25	104	18.45	3.62	14.83	22.25
30	92	16.32	3.62	12.70	22.87
35	83	14.67	3.62	11.05	23.21
40	75	13.35	3.62	9.73	23.36
45	69	12.27	3.62	8.65	23.36
50	64	11.36	3.62	7.74	23.23
55	60	10.59	3.62	6.98	23.02
60	56	9.93	3.62	6.31	22.73
65	53	9.35	3.62	5.74	22.37
70	50	8.84	3.62	5.23	21.96
75	47	8.39	3.62	4.78	21.50
80	45	7.99	3.62	4.38	21.01
85	43	7.63	3.62	4.01	20.47
90	41	7.30	3.62	3.69	19.91
95	39	7.01	3.62	3.39	19.32
100	38	6.73	3.62	3.12	18.70
105	36	6.48	3.62	2.87	18.06
110	35	6.25	3.62	2.64	17.41
115	34	6.04	3.62	2.42	16.73
120	33	5.84	3.62	2.23	16.04

FIVE YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE YEAR EVENT)

			C
Roof Area:	320	sq.m	0.90
Asphalt/Concrete Area:	255	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	100	sq.m	0.20
Total Catchment Area:	675	sq.m	0.80
Area (A):	675	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.80		
Flow Rate (2.78AiC):	15.57	L/s	

DRAINAGE AREA II (Roof North of Penthouse)

(FIVE YEAR EVENT)

			C
Total Catchment Area:	157	sq.m	0.90

No. of Roof Drains: 1
Slots per Wier: 1 0.01242 L/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 97 mm

Maximum Release Rate: 1.20 L/s Pond Area: 58 sq.m

Maximum Volume Stored: 1.87 cu.m

Maximum Volume Required: 1.87 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	4.09	1.20	2.89	1.74
15	84	3.28	1.20	2.08	1.87
20	70	2.76	1.20	1.56	1.87
25	61	2.39	1.20	1.19	1.79
30	54	2.12	1.20	0.92	1.65
35	49	1.91	1.20	0.71	1.48
40	44	1.74	1.20	0.54	1.28
45	41	1.60	1.20	0.40	1.07
50	38	1.48	1.20	0.28	0.84
55	35	1.38	1.20	0.18	0.59
60	33	1.29	1.20	0.09	0.34
65	31	1.22	1.20	0.02	0.07
70	29	1.15	1.15	0.00	0.00
75	28	1.10	1.10	0.00	0.00
80	27	1.04	1.04	0.00	0.00
85	25	1.00	1.00	0.00	0.00
90	24	0.95	0.95	0.00	0.00
95	23	0.92	0.92	0.00	0.00
100	22	0.88	0.88	0.00	0.00
105	22	0.85	0.85	0.00	0.00
110	21	0.82	0.82	0.00	0.00
115	20	0.79	0.79	0.00	0.00
120	19	0.76	0.76	0.00	0.00

DRAINAGE AREA III (Roof South of Penthouse)

(FIVE YEAR EVENT)

			C
Total Catchment Area:	639	sq.m	0.90

No. of Roof Drains: 2

Slots per Wier: 1 0.01242 L/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drains: 112 mm

Maximum Release Rate: 2.77 L/s Pond Area: 283 sq.m

Maximum Volume Stored: 10.53 cu.m

Maximum Volume Required: 10.53 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	16.66	2.77	13.89	8.33
15	84	13.36	2.77	10.59	9.53
20	70	11.23	2.77	8.46	10.15
25	61	9.74	2.77	6.96	10.44
30	54	8.62	2.77	5.85	10.53
35	49	7.76	2.77	4.98	10.47
40	44	7.06	2.77	4.29	10.30
45	41	6.50	2.77	3.72	10.05
50	38	6.02	2.77	3.25	9.74
55	35	5.62	2.77	2.84	9.38
60	33	5.27	2.77	2.49	8.98
65	31	4.96	2.77	2.19	8.54
70	29	4.70	2.77	1.92	8.08
75	28	4.46	2.77	1.69	7.59
80	27	4.25	2.77	1.47	7.08
85	25	4.06	2.77	1.28	6.54
90	24	3.88	2.77	1.11	6.00
95	23	3.73	2.77	0.95	5.43
100	22	3.58	2.77	0.81	4.86
105	22	3.45	2.77	0.68	4.27
110	21	3.33	2.77	0.56	3.67
115	20	3.22	2.77	0.44	3.06
120	19	3.11	2.77	0.34	2.45

D.B. Gray Engineering Inc.

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

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STORM SEWER CALCULATIONS

Rational Method

FIVE YEAR EVENT

Project: 393 McArthur Avenue
6-Storey Mixed-Use Building
Ottawa, Ontario

Date: June 15, 2022

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
		Roof C = 0.90	Hard C = 0.90	Gravel C = 0.70	Soft C = 0.20			Time	Rainfall Intensity	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}
Roof	CB/MH-1	0.0796				0.1992	0.1992	10.00	104	20.75	6.6	250	250	2	1.71	84.10	0.06	0.25
							Flow through flow control roof drains:			3.97	6.6	250	250	2	1.71	84.10	0.06	0.05
CB/MH-1	MH-2	0.0085	0.0185		0.0005	0.0678	0.2670	10.06	104	27.73	35.8	250	250	0.43	0.79	39.00	0.75	0.71
								Restricted upstream flow:		11.01	35.8	250	250	0.43	0.79	39.00	0.75	0.28
							Existing 300 mm Belisle Street Municipal Storm Sewer:					300	300	0.32	0.77	54.70		

APPENDIX E

DEVELOPMENT SERVICING STUDY CHECKLIST

GENERAL

Executive Summary: **N/A**

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

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

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

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

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

Confirmation of conformance with higher level studies: **N/A**

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

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

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

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

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

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

Reference to geotechnical studies: **Included**

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

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

WATER SERVICING

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

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

Identification of system constraints: **Included**

Identification of boundary conditions: **Included**

Confirmation of adequate domestic supply: **Included**

Confirmation of adequate fire flow: **Included**

Check of high pressures: **Included**

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

Address reliability requirements: **N/A**

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

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

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

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

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

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

SANITARY SERVICING

Summary of proposed design criteria: **Included**

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

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

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

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

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

Description of proposed sewer network: **Included**

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

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

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

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

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

STORMWATER MANAGEMENT & STORM SERVICING

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

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

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

Water quantity control objective: **Included**

Water quality control objective: **Included**

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

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

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

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

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

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

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

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

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

Proposed minor and major systems: **N/A**

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

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

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

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

100-year flood levels and major flow routing: **N/A**

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

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

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

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

APPROVAL AND PERMIT REQUIREMENTS

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

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

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

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

CONCLUSIONS

Clearly stated conclusions and recommendations: **Included**

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

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