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SITE SERVICING STUDY & STORMWATER MANAGEMENT REPORT

RONALD MCDONALD HOUSE
407 SMYTH ROAD
OTTAWA, ONTARIO

REPORT NO. 19111

DECEMBER 16, 2022
REVISED MARCH 17, 2023

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for the proposed 3-storey addition to Ronald McDonald House (RMH), which is used as accommodation for out-of-town sick children and their families. RMH is located on the same property as the Children's Hospital of Eastern Ontario (CHEO) on the private street Ring Road having a municipal address of 407 Smyth Road in Ottawa, Ontario. 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-8 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 (FDC) located at the southeast corner of the proposed addition. There is an existing private fire hydrant located about 7 m north of the existing RMH building that will be relocated to about 43 m unobstructed distance to the proposed FDC, which is less than the maximum 45 m permitted by the Ontario Building Code; therefore, additional private fire hydrants are not required. The relocated fire hydrant will connected to the existing 200 mm watermain at approximately the same location as the existing fire hydrant. There is also a private hydrant located on the opposite side of Ring Road directly across from RMH about 54 m unobstructed distance to the east façade of the proposed addition. It connects to 305 mm private watermain located adjacent to and east of Ring Road

In accordance with City of Ottawa Technical Bulletin ISTB-2021-03, when calculating the required fire flow where pipe sizing is not affected, the Ontario Building Code (OBC) method is to be used. Using the OBC method the required fire flow is calculated to be 9,000 L/min (150 L/s). In accordance with City of Ottawa Technical Bulletin ISTB-2021-03, when the OBC method yields a required fire flow of 9,000 L/min (150 L/s), the Fire Underwriters Survey (FUS) method is to be used instead. Using the FUS method the required fire flow is calculated to be 10,000 L/min (166.7 L/s). Refer to calculations in Appendix B.

The existing buildings and private fire hydrants on the CHEO property, the General Hospital property to the east, and federal lands to the west are serviced via a network of private watermains that connect to the 305 mm municipal watermain on Smyth Road at four locations. (The 200 mm watermain adjacent to RMH connects the private watermain network servicing the federal lands to the private watermain network serving the CHEO and General Hospital properties.) The boundary conditions (based on the City's computer model of the municipal water distribution system) at two of the connection points were provided by the City of Ottawa for the 167.7 L/s fire flow condition indicate hydraulic grade lines (HGLs) of 116.3 m and 119.0 which calculate to 374 kPa (54 psi) and 400 kPa (58 psi). Refer to Appendix B. 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.

CHEO has provided the results of fire hydrant flow test conducted in May and June of 2020 on the four private fire hydrants closest to RMH (refer to Appendix B). Based on these flow test, the calculated flow available at 140 kPa (20 psi) at the hydrant located adjacent to RMH is 1,610 USgpm (6,096 L/min or 102 L/s), and 2,598 USgpm (9,835 L/min or 164 L/s) at the hydrant located on the opposite side of Ring Road

directly across from RMH. Since the available flow is above 5,700 L/min (95 L/s) these two hydrants are considered to be Class AA hydrants.

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

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

Since the two closest fire hydrants are Class AA and are less than 75 m from the existing building and proposed addition, each can contribute 5,700 L/min (95 L/s); therefore, the aggregate flow of these two contributing fire hydrants is 11,400 L/min (190 L/s), which is greater than the required fire flow of 10,000 L/min (166.7 L/s).

2.2 DOMESTIC WATER SUPPLY

To serve its domestic water demand the existing RMH building has a 50 mm water service connecting to the 305 mm watermain adjacent to Ring Road. The existing RMH building also has a 150 mm water service connecting to the 200 mm watermain adjacent to RMH that connects to the existing sprinkler system. The existing 50 mm water service was constructed (in the early 1980s) parallel to two existing sewers; about 1 m from an existing storm sewer and about 2 m from an existing sanitary sewer. Given the current standards requires the water service to have a 2.5 m separation from sewers, this 50 mm water service will be decommissioned. The existing 150 mm water service will be modified and extended to a mechanical room located in the proposed addition. This 150 mm water service will also connect to the domestic water system and will provide an adequate domestic water supply.

As instructed by the City, only the increase in water demand is to be provided; i.e. only the water demand of the proposed addition (because water demand of the existing RMH building is already accounted for in the City's system). As provided by RMH staff the proposed addition is to be designed for a maximum of 104 guests, 14 staff and 22 visitors. Based on Appendix 4-A of the Ottawa Sewer Design Guidelines (OSDG) it is estimated that the guests have a similar water demand as hotel guests; the staff similar to office employees; and the visitors are similar to visitors to an assembly hall. Also as per Appendix 4-A of the OSDG the daily average sewage flow for guest in a motels or hotels with full housekeeping facilities is 225 L/person/day; 75 L/person/day for office workers; and 8 to 36 L/person/day for visitors to an assembly halls. Therefore, assuming that the daily sewage generated is equal to the daily water demand, based on 104 x 225 L/day; 14 x 75 L/day; and 22 x 36 L/day; it is calculated that the daily average water demand is 0.3 L/s. (Refer to calculations in Appendix B.) As per Ottawa Water Design Guidelines the maximum daily demand is 1.5 times the daily average; and the maximum hourly demand is 1.8 times the maximum daily; therefore, the maximum daily demand is calculated to be 0.4 L/s; and the maximum hourly is 0.8 L/s.

To determine water pressure under these demands, boundary conditions (based on the City's computer model of the municipal water distribution system) are required. The boundary conditions in the Smyth

Road 305 mm municipal watermain, provided by the City, indicate a minimum HGL of 122.8 m and a maximum HGL of 130.6 m. Refer to Appendix B. Based on these boundary conditions the pressure at the water meter is calculated to vary between 461 kPa (67 psi) and 537 kPa (78 psi). This is an acceptable range for the proposed development.

3.0 SANITARY SERVICING

Similar to the water demand the design, sanitary sewage flow of the proposed addition is calculated based on Appendix 4-A of the OSDG for hotels guests, office workers and assembly hall visitors: i.e. 104 person at 225 L/person/day; 14 person at 75 L/person/day; and 22 persons at 36 L/person/day. Using a peaking factor of 1.5 (as per the ODDG) the peak flow rate, in the proposed addition, is calculated to be 0.54 L/s. As provided by RMH staff the existing building is designed for a maximum of 48 guests, 4 staff and 8 visitors. Similar to above this calculates to be a peak flow rate of 0.29 L/s in the existing RMH building; for a total peak design flow rate of 0.83 L/s. (Refer to calculations in Appendix C.)

Based on the 2019 water bills the existing peak sewage flow is estimated to be 0.5 L/s. However, based on the water bills it appears that water consumption is almost twice as much from May to September as it is from October to April. It is assumed that this may be due to landscape irrigation, which would not contribute to the sanitary flow generated; therefore, we expect that that the design peak flow of 0.83 L/s (a 0.54 L/s increase) is reasonable.

A Morrison Hershfield (MH) report, dated May 1, 2017, assessed the storm and sanitary sewer capacity at Ottawa Health Sciences Centre (refer to excerpts in Appendix C). With respect to sanitary capacity the MH reports refers to a 2011 JL Richards's capacity assessment which *"indicated that at peak flows in the existing sanitary system was only being used to approximately 5 to 12% of its full capacity. As such, JL Richards concluded that there was more than sufficient capacity in the sanitary sewers for the existing flows. A 25% increase of the existing flows was used for the JL Richards's future conditions analysis. This resulted in approximately 5 to 18% of the available sewer capacity being used at peak flows. Based on the future condition analysis, there is more than sufficient capacity in the sanitary system for the expected post-expansion flows."*

Based on the above, it is expected that there are no sanitary sewer capacity issues within CHEO's property; and that the proposed 0.54 L/s increase in sanitary flow will have an insignificant effect on the CHEO's sanitary sewers and capacity will continue to be not an issue.

The MH report also states that *"the sanitary sewers converge at the north-west corner of the site and eventually connect to the Rideau River Collector Sewer. JL Richards's report identified that the downstream capacity is over 215L/s and 325L/s at the campus outlet of this sewer and downstream of the National Defense Medical Centre respectively. Therefore, there does not appear to be a capacity constraint in the downstream system. New construction on the OHSC campus since 2011 has been minimal, and as such, flows in the sanitary network are expected to be generally unchanged. With no changes to the model input data, the conclusions of a new analysis would be unchanged from the JL Richards study. A new analysis is therefore not justified at this time."*

Based on the above, there does not appear to be any sanitary sewer capacity issues downstream of CHEO's property; and that the proposed 0.54 L/s increase in sanitary flow would have an insignificant effect on the downstream sanitary sewers. However, City of Ottawa staff has indicated that "*there may be limited capacity in the downstream sanitary sewer system. The sanitary demand needs to be coordinated*

with the City Planning Dept. to determine if the existing sanitary sewer system has sufficient capacity to support the proposed rezoning. Provide sanitary demands to the City project manager for coordination." The sanitary sewer calculations were sent to the City; but they have not yet responded.

Two new sanitary sewer connections (150 mm at 2%) are proposed from the existing building and proposed addition. The will connect to the existing sanitary sewer service connection (which is proposed to be re-used) at a new manhole. Existing drawings indicate that the existing sewer connection is 150mm at about 1% (14.43 L/s capacity). It is calculated that existing 150 mm sanitary sewer will be at about 6% capacity; therefore, the design peak flows will be adequately handled by the existing sanitary sewer connection. (Refer to calculations in Appendix C.) A CCTV sewer inspection is recommended to determine the condition of the existing sanitary sewer.

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

It expected that the Rideau Valley Conservation Authority (RVCA) will require an enhanced level of protection with 80% total suspended solids (TSS) removal from the rainwater runoff. To meet the water quality target of 80% TSS removal an oil grit separator (OGS) is proposed to be located downstream of the inlet control devices (ICDs). A CDS Model PMSU2015-4 was selected by the manufacturer based on the manufacturer's software which calculated that it will remove 86% of the TSS. The OGS has an oil capacity of 232 L and a sediment capacity of 0.7 cu.m. Refer to Appendix D.

An Erosion & Sediment Control Plan has been developed to be implemented during construction to filter out construction sediment. Refer to drawing C-4 and notes 2.1 to 2.6 on drawing C-6. In summary: a silt fence barrier is proposed to be installed around the perimeter of the site where runoff will drain off the site; sediment capture filter sock inserts are proposed to be installed in all existing catch basins adjacent to the site and in all new catch basins as they are installed; and any material deposited on a public road is required to be removed.

4.2 QUANTITY CONTROL

As stated in the City's pre-consultation notes, the stormwater management criteria for quantity control are to control the post development peak flows for the 5-year and 100-year storm events to peak flows during the 5-year storm event using a pre-development runoff coefficient, or 0.5, whichever is less; and a 10 minute time of concentration. However, as per the Ottawa Health Sciences Centre (OHSC), Stormwater Master Plan, prepared by Morrison Hershfield, in a report dated July 2019 (refer to excerpts in Appendix D): *"It is recommended that OHSC require that all future developments across the campus adhere to the following criteria:*

- *Peak flows from future development drainage systems shall be controlled to the pre-existing 2-year storm event using stormwater retention measures (e.g. roof storage, cistern, and underground stormwater storage).*
- *Peak flow shall be determined using a C value of 0.5 in accordance with the City of Ottawa Sewer Design Guidelines."*

Therefore, based on runoff coefficient of 0.50, a 10 minute time of concentration; and using the Rational Method; the maximum allowable release rate is calculated to be 40.62 L/s for all storm events. The

Modified Rational Method is used to calculate the required storage volume. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00. Refer to calculations in Appendix D.

Drainage Area I (Uncontrolled Flow Off Site – 505 sq.m.)
Stormwater from the a few areas around the perimeter of the property will drain uncontrolled off site (refer to drawing C-8). The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	5-Year Event	100-Year + 20% (Stress Test)
Maximum Flow Rate	13.89 L/s	7.07 L/s	7.07 L/s

Drainage Area II (Addition Roof – 774 sq.m.)
All four roof drains on the proposed addition roof are to be flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. Each roof drain is to be installed with a single-slotted weir with the slot having a parabolic shape releasing 0.0124 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 six scuppers each a minimum 400 mm wide are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof will 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	100-Year + 20% (Stress Test)
Maximum Release Rate	6.60 L/s	5.00 L/s	7.13 L/s
Maximum Depth at Roof Drains	133 mm	101 mm	144 mm
Maximum Volume Stored	23.70 cu.m.	10.32 cu.m.	29.86 cu.m.

Drainage Area III (1,186 sq.m.)
An inlet control device (ICD) located in the outlet pipe of catch-basin / manhole CB/MH-14 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond in the asphalted area above catch basin CB-13 and CB/MH-14. The ICD will be a vortex style ICD manufactured by Hydrovex or approved equal and shall be sized by the manufacturer for a release rate of 6.00 L/s at 2.42 m. (The City of Ottawa's minimum recommended release rate is 6.00 L/s.) It is calculated that an orifice area of 4,418 sq.mm (75 mm diam.) with a discharge coefficient of 0.197 will achieve the release rate of 6.00 L/s at 2.42 m. Based on this orifice the maximum release rate for the 5-year storm event is calculated to be 5.93 L/s at 2.36 m. During the 100-year + 20% stress test a maximum 2.76 L/s will overflow to Drainage Area IV; for a maximum release rate of 8.77 L/s.

	100-Year Event	5-Year Event	100-Year + 20% (Stress Test)
Maximum Release Rate	6.00 L/s	5.93 L/s	8.77 L/s
Maximum Ponding Elevation	77.46 m	77.40 m	77.47 m
Maximum Volume Stored	36.22 cu.m.	14.05 cu.m.	40.00 cu.m.

Drainage Area IV (1,246 sq.m.)
An ICD located in the outlet pipe of CB/MH-16 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond in the asphalted area above CB-15 and CB/MH-16. The ICD will be a vortex style ICD manufactured by Hydrovex or approved equal and shall be sized by the

manufacturer for a release rate of 7.77 L/s at 2.63 m. It is calculated that an orifice area of 4,418 sq.mm (75 mm diam.) with a discharge coefficient of 0.245 will achieve the release rate of 7.77 L/s at 2.63 m. Based on this orifice the maximum release rate for the 5-year storm event is calculated to be 7.69 L/s at 2.58 m. During the 100-year + 20% stress test a maximum 8.23 L/s will overflow out the north entrance; for a maximum release rate of 16.00 L/s.

	100-Year Event	5-Year Event	100-Year + 20% (Stress Test)
Maximum Release Rate	7.77 L/s	7.69 L/s	16.00 L/s
Maximum Ponding Elevation	77.47 m	77.41 m	77.47 m
Maximum Volume Stored	36.33 cu.m.	13.69 cu.m.	36.33 cu.m.

Drainage Area IV – Including Area IV-A Outside Area of Re-development (1,481 sq.m.)
Including the roof of the existing RMH building (an area not being re-developed and not required to be controlled) during the 100-year event the maximum release rate increases to 14.09 L/s (including 6.32 L/s of overland flow out the north entrance); the maximum ponding elevation and the maximum volume stored remains at 77.47 and 36.33 cu.m. respectively. During the 5-year event the maximum release rate increases to 5.97 L/s (there is no overland flow); the maximum ponding elevation increases to 77.43; and the maximum volume stored increases to 18.64 cu.m. During the 100-year +20% stress test the maximum release rate increases to 25.22 L/s (including 17.44 L/s of overland flow out the north entrance); the maximum ponding elevation and the maximum volume stored remains at 77.47 and 36.33 cu.m. respectively.

Drainage Area V (562 sq.m.)
An ICD located in the outlet pipe of CB/MH-6 will restrict the flow of stormwater and cause it to backup into the upstream sewer pipes; catch basins and manholes. The ICD will be a vortex style ICD manufactured by Hydrovex or approved equal and shall be sized by the manufacturer for a release rate of 6.36 L/s at 0.87 m. It is calculated that an orifice area of 7,854 sq.mm (100 mm diam.) with a discharge coefficient of 0.196 will achieve the release rate of 6.36 L/s at 0.87 m. Based on this orifice the maximum release rate for the 5-year storm event is calculated to be 3.54 L/s at 0.27 m. Since there is underground storage, a release rate equal to 50% of the maximum release rate is used to calculate the required storage volumes.

	100-Year Event	5-Year Event	100-Year + 20% (Stress Test)
Maximum Release Rate	6.36 L/s	3.54 L/s	7.35 L/s
Maximum Ponding Elevation	75.51 m	74.91 m	75.81 m
Maximum Volume Stored	7.23 cu.m.	3.36 cu.m.	8.84 cu.m.

Entire Site

	100-Year Event	5-Year Event	100-Year + 20% (Stress Test)
Pre-development Flow Rate	108.75 L/s	55.10 L/s	n/a
Maximum Allowable Release Rate	40.62 L/s	40.62 L/s	n/a
Maximum Release Rate	40.62 L/s	29.24 L/s	55.92 L/s
Maximum Volume Required	103.49 cu.m.	41.42 cu.m.	115.04 cu.m.
Maximum Volume Stored	103.49 cu.m.	41.42 cu.m..	115.04 cu.m.

The maximum post-development release rate during the 100-year event is calculated to be 40.62 L/s, which is 63% less than the pre-development flow rate and equal to the maximum allowable release rate. To achieve the maximum allowable release rate, a maximum storage volume of 103.49 cu.m. is required and provided. The maximum post-development release rate during the 5-year event is calculated to be 29.24 L/s, which is 47% less than the pre-development flow rate and 28% less than the maximum allowable release rate.

4.3 STORM SERVICING

The existing private storm sewer system will be modified and extended. Some branches of the existing and proposed private storm sewer system will be free flowing. These branches will serve the foundation drains of both buildings; the flow control roof drains of the proposed addition; and two existing catch basins (being relocated) that drain the area to the south of the existing RMH (an area that is not being re-developed and; therefore, does not need to be controlled). The foundation drains of the proposed addition will connect to the foundation drains of the existing building. A backwater valve in the storm drain serving the foundation drains is proposed in the addition. ICDs restrict the flow in the other branches of the private storm sewer system.

Stormwater will be conveyed off the site via an existing private 375 mm storm sewer connecting to at an existing manhole in another private 375 mm private storm sewer located in Ring Road. The unrestricted flowrate resulting from 5-year storm event will produce a peak flow of 94.34 L/s resulting in the last pipe segment being 91% full. However, the flow control roof drains and an inlet control devices (ICDs) will restrict the flow to a maximum flow of 41.16 L/s during the 5-year event so that the last pipe segment will only be 40% full. Since there are currently no stormwater quantity control measures on the subject the post development restricted flow of 41.16 L/s contributing to the existing 375 mm private storm sewer is expected to have a positive impact. Refer to calculations in Appendix D.

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

4. The existing 150 mm water service (which will be modified and extended) will provide an adequate domestic water supply.

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

6. Based on previous studies, there are no sanitary sewer capacity issues within CHEO's property; and that the increase in sanitary flow from the proposed addition will have an insignificant effect on the CHEO's sanitary sewers; and capacity will continue to be not an issue.

7. The post-development sanitary flow rate will be adequately handled by the proposed and existing sanitary sewers. A CCTV sewer inspection is recommended to determine the condition of the existing sanitary sewer.

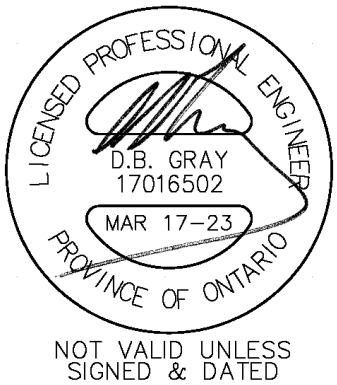
8. There are currently no quality control measures on the subject property but 80% TSS removal is expected to be required. The proposed oil/grit separator (OGS) manhole will remove approximately 86% of TSS from the runoff produced by the drainage area.

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

10. The maximum post-development release rate during the 100-year event is 63% less than the pre-development flow rate and equal to the maximum allowable release rate. The maximum post-development release rate during the 5-year event is 47% less than the pre-development flow rate and 28% less than the maximum allowable release rate.

11. The unrestricted flow rate during the 5-year event will be adequately handled by the proposed storm sewer service.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

PRE-APPLICATION CONSULTATION MEETING NOTES

Date: October 7, 2022

Site Location: **407 Smyth Ronald Mcdonald House (CHEO)**

Type of Development: x Residential (☐ townhomes, ☐ stacked, ☐ singles, ☐ apartments), ☐ Office Space, ☐ Commercial, ☐ Retail, x Institutional, ☐ Industrial, other_____

Owner/Agent: **CHEO**

Assigned Planner: **Melanie Gervais**

Attendees:

Water:

Connection point: Existing private watermain

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

Boundary conditions:
Civil consultant must request boundary conditions from the City's assigned Project Manager prior to submission. Boundary conditions only require the proposed demands (net increase) of the proposed building. The connection to the existing 305mm private watermain will be dealt with similarly to the service connection to a public watermain.

- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:
  - Location of service(s)
  - Type of development and the amount of fire flow required (as per FUS, 2020).
  - Average daily demand: ___ l/s.
  - Maximum daily demand: ___l/s.
  - Maximum hourly daily demand: ___ l/s.
- Fire protection (Fire demand, Hydrant Locations)

Sanitary Sewers:
Connection point: Existing private infrastructure

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

- The designer should be aware there may be limited capacity in the downstream sanitary sewer system. The sanitary demand needs to be coordinated with the City Planning Dept. to determine if the existing sanitary sewer system has sufficient capacity to support the proposed rezoning. Provide sanitary demands to the City project manager for coordination.

Storm Sewers:
Connection point: Existing private infrastructure

Storm Water Management:
Quality Control:

- Rideau Valley Conservation Authority to provide quality control requirements for property.

Quantity Control:

- Allowable Runoff coefficient (C): C = the lesser of the existing pre-development conditions to a maximum of 0.5.
- Time of concentration (Tc): Tc = pre-development; maximum Tc = 10 min
- Allowable flowrate: Control the 100-year/5-year storm events to the existing 5-year storm event.

Ministry of Environment, Conservation and Parks (MECEP)
All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

a. The consultants determine if an approval for sewage works under Section 53 of OWRA is required and determines what type of application. The City's project manager may help confirm and coordinate with the MECP as required.
b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
c. Pre-consultation is not required if applying for standard or additional works (Schedule A of the Agreement) under Transfer Review.
d. Pre-consultation with local District office of MECP is recommended for direct submission.

e. Consultant completes an MECP request form for a pre-consultation. Sends request to moeccottawasewage@ontario.ca
f. ECA applications are required to be submitted online through the MECP portal. A business account required to submit ECA application. For more information visit https://www.ontario.ca/page/environmental-compliance-approval
g. It is unclear if the proposed development will remain as one property. An ECA will be required where the stormwater management services more than one property parcel.

NOTE: Site Plan Approval, or Draft Approval, is required before any Ministry of the Environment and Climate Change (MOECC) application is sent.

General Service Design Comments

- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.
- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.

Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstration minimum separation distances. A watermain crossing table may be provided.

All development applications should be considered for an Environmental Compliance Approval (ECA) by the Ministry of the Environment, Conservation, and Parks (MECP);

a. Consultant determines if an approval for sewage works under Section 53 of OWRA is required. Consultant then determines what type of application is required and the City's project manager confirms. (If the consultant is not clear if an ECA is required, they will work with the City to determine what is required. If the consultant it is still unclear or there is a difference of opinion only then will the City PM approach the MECP.
b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
c. Pre-consultation is not required.
d. Standard Works ToR Draft ECA's are sent to the local MECP office (moeccottawasewage@ontario.ca).for information only
e. Additional ToR draft ECAs require a project summary/design brief and require a response from the local MECP (10 business day window)
f. **Site Plan Approval, or Draft Approval, will be required before an application is sent to the MECP**

Refer to application tables for lists of required supporting plans and studies– ZONING BY-LAW – Municipal servicing

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– SITE PLAN APPLICATION – Municipal servicing

Legend:

The letter **S** indicates that the study or plan is required with application submission.
The letter **M** indicates that the study or plan may be required with application submission.

For information on preparing required studies and plans refer to:

http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

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

Meeting Date: ***2022-Oct-07***

Application Type: ***Site Plan Control***

File Lead: ***Mélanie Gervais***

Engineer/Project Manager: ***Bruce Bramah***

Site Address: 407 Smyth

*Preliminary Assessment: 1☐ 2☐ 3☐ 4☐ 5☐

*One (1) indicates that considerable revisions are required before a planning application is submitted, while five (5) suggest that proposal appears to meet the City's key land use policies and guidelines. This assessment is purely advisory and does not consider technical aspects of the proposal, or in any way guarantee application approval.

It is important to note that the need for additional studies and plans may result during application review. If following the submission of your application it is determined that material that is not identified in this checklist is required to achieve complete application status, in accordance with the Planning Act and Official Plan requirements, City Planning will notify you of outstanding material required within the required 30 day period. Mandatory pre-application consultation will not shorten the City's standard processing timelines, or guarantee that an application will be approved. It is intended to help educate and inform the applicant about submission requirements as well as municipal processes, policies, and key issues in advance of submitting a formal development application. This list is valid for one year following the meeting date. If the application is not submitted within this timeframe the applicant must again pre-consult with the City.

SITE PLAN APPLICATION – MUNICIPAL SERVICING
REQUIRED ENGINEERING STUDIES AND ASSESSMENTS

Notes:

4. Geotechnical Study / Slope Stability Study – required as per Official Plan section 4.8.3. All site plan applications need to demonstrate the soils are suitable for development. A Slope Stability Study may be required with unique circumstances (Schedule K or topography may define slope stability concerns).

10. Erosion and Sediment Control Plan – required with all site plan applications as per Official Plan section 4.7.3.

11. Stormwater Management Report/Brief - required with all site plan applications as per Official Plan section 4.7.6.

14. Noise and Vibration Study – a Noise Study will be required if the noise sensitive development is proposed within 250 metres of an existing or proposed highway or a railway right-of-way, or 100 metres of an arterial or collector roadway or rapid-transit corridor. A Vibration Study will be required if the proposed development is within 75 metres of either an existing or proposed railway ROW. A Noise Study may also be required if the proposed development is adjacent to an existing or proposed stationary noise source.

35. An Impact Assessment of an Adjacent Waste Disposal/Former Landfill Site study is required for development proposals within 500 metres of a solid waste disposal site or other appropriate influence area or former landfill site. For contaminated sites a Record of Site Condition or letter of continued use is required.

39.A Mineral Resource Impact Assessment study is required, as per Official Plan section 3.7.4 adjacent to an unlicensed Limestone Resource or Sand and Gravel Resource Area (very limited uses considered within 500 metres of Limestone Resource Area or 300 metres of Sand and Gravel Resource Area). A study is required

- adjacent to, or within 300 metres of, a licensed pit
- adjacent to, or within 500 metres of, a licensed quarry

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: 407 Smyth Rd (Addition to the Ronald McDonald House)

1 message

Bramah, Bruce <bruce.bramah@ottawa.ca> Tue, Oct 25, 2022 at 2:38 PM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Laurent Brosseau <l.brosseau@dbgrayengineering.com>

Hi Doug,

You are correct, the ECA note is common to all pre consult notes. An ECA should not be applicable based on the proposed works discussed.
Regards,

Bruce Bramah, EIT

Project Manager

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

Development Review - South Branch

City of Ottawa | Ville d'Ottawa

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

613.580.2424 ext./poste 29686, Bruce.Bramah@ottawa.ca

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: October 25, 2022 1:50 PM
To: Bramah, Bruce <bruce.bramah@ottawa.ca>
Cc: Laurent Brosseau <l.brosseau@dbgrayengineering.com>
Subject: 407 Smyth Rd (Addition to the Ronald McDonald House)

Hi Bruce

In the attached Pre-consultation Meeting Notes it is stated; *"All development applications should be considered for an Environmental Compliance Approval, under MECP regulations."*

Is this a standard comment? Because I do not know of any reason that an ECA would be required for the proposed development since:

- the proposed services are located entirely on one property (that includes CHEO);
- it does not connect to a combined sewer; and
- it is not located on industrial lands.

Do you agree?

Regards, Doug

D.B. Gray Engineering Inc.

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

700 Long Point Circle Tel: 613-425-8044

Ottawa, Ontario K1T 4E9 d.gray@dbgrayengineering.com

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APPENDIX B

WATER SERVICING

D.B. Gray Engineering Inc.

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

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

31-Oct-22

Ronald McDonald House, 407 Smyth Road
Ottawa, Ontario

Existing Builidng + Proposed 3-Storey Addition

Water Supply for Firefighting Calculations:

As per "Required Minimum Water Supply Flow Rate" as calculated using the Ontario Building Code - Appendix A - Article A-3.2.5.7 "Water Supply For Fire Fighting".

Fire Protection Water Supply $Q = KVS_{Tot}$

$S_{Tot} = 1.0 + S_{Side1} + S_{Side2} + S_{Side3} + S_{Side1} + S_{Side4}$

	Spatial Coefficient	Exposure Distance m	
S_{Side1}	0.00	50.0	(to Building to the North)
S_{Side2}	0.00	21.0	(to center line of road)
S_{Side3}	0.00	59.0	(to Building to the south)
S_{Side4}	0.19	8.1	(to West property line)
S_{Tot}	1.19	Need not exceed 2	

Clinic, Intake & Adoption Areas:

K (Water Supply Coefficient)

23 As per A-3.2.5.7. Table 1 (Group C Occupancy / Combustible construction with fire separations but with no fire resistance ratings as per OBC 3.2.2.)

V (Building Volume)

	Existing Building cu.m.	Proposed Addition cu.m.	Volume cu.m.
L0	328	808	1136
L1	1587	2484	4071
L2	1379	2462	3841
L3	1346	2420	3766
			12814 cu.m.

Q = KVS_{Tot}

Q = 350,722 L

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

= 150 L/s

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

31-Oct-22
REVISED 28-Nov-22
REVISED 16-Dec-22

Ronald McDonald House, 407 Smyth Road
Ottawa, Ontario

Fire Flow Requirements

Existing Builidng + Proposed 3-Storey Addition

Fire flow requirement as calculated as per Fire Underwriters Survey "Water Supply For Fire Protection".

$F = 220\ C\ A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.5

A = total floor area (all storeys excluding basements at least 50% below grade)

Existing Building	Ground Floor	559 sq.m.
	2nd Floor	475 sq.m.
Proposed Addition	Ground Floor	794 sq.m.
	2nd Floor	778 sq.m.
	3rd Floor	765 sq.m.
	TOTAL FIRE AREA:	3371 sq.m.

F = 19,160 L/min
= 19,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy (1477 sq.m. Apartments)

= 16,150 L/min

40% Reduction for Unsupervised Sprinkler System

= 6,460 L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Construction	Length m	Storeys	Factor
0%	North	> 30m				0
0%	East	> 30m				0
0%	South	> 30m				0
0%	West	> 30m				0
0%	Total Increase for Exposure (maximum 75%)					

= - L/min Increase

= 9,690 L/min
F = 10,000 L/min (rounded off to the nearest 1,000 L/min)
= 166.7 L/s

Elevation at Fire Hydrant 78.15 m ASL

			Static Pressure at Fire Hydrant			
167 l/s FIRE FLOW: (Connection 1)	116.3	m ASL	54	psi	374	kPa

Elevation at Fire Hydrant 78.15 m ASL

			Static Pressure at Fire Hydrant			
167 l/s FIRE FLOW: (Connection 2)	119.0	m ASL	58	psi	400	kPa

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

31-Oct-22
REVISED 28-Nov-22
REVISED 16-Dec-22

Ronald McDonald House, Proposed Addition Only, 407 Smyth Rd Ottawa, Ontario

Water Demand

Guests (daily average as per OSDG Appendix 4-A: Motels-Hotels w/full housekeeping facilities)

	104	persons					
DAILY AVERAGE:	225	litres / person / day					
	16.3	L/min	0.3	L/s	4.3	USgpm	
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per City of Ottawa Water Guidelines)					
	24.4	L/min	0.4	L/s	6	USgpm	
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per City of Ottawa Water Guidelines)					
	43.9	L/min	0.7	L/s	12	USgpm	

Staff (Daily average as per OSDG Appendis 4-A: Employees - Office Workers)

	14	persons					
DAILY AVERAGE:	75	litres / person / day					
	0.7	L/min	0.0	L/s	0.2	USgpm	
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per City of Ottawa Water Guidelines)					
	1.1	L/min	0.0	L/s	0	USgpm	
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per City of Ottawa Water Guidelines)					
	2.0	L/min	0.0	L/s	1	USgpm	

Visitors (Daily average as per OSDG Appendix 4-A: Assembly Halls with varying facilities (range 8 - 36 L/person))

	22	persons					
DAILY AVERAGE:	36	litres / person / day					
	0.6	L/min	0.0	L/s	0.1	USgpm	
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per City of Ottawa Water Guidelines)					
	0.8	L/min	0.0	L/s	0	USgpm	
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per City of Ottawa Water Guidelines)					
	1.5	L/min	0.0	L/s	0	USgpm	

TOTAL DAILY AVERAGE:	17.5	L/min	0.3	L/s	4.6	USgpm
TOTAL MAXIMUM DAILY DEMAND:	26.3	L/min	0.4	L/s	6.9	USgpm
TOTAL MAXIMUM HOURLY DEMAND:	47.3	L/min	0.8	L/s	12.5	USgpm

Elevation of Water Meter:	75.79	m ASL				
Finish Floor Elevation:	74.89	m ASL				
			Static Pressure at Water Meter			
MINIMUM HGL:	122.8	m ASL	67	psi	461	kPa
MAXIMUM HGL:	130.6	m ASL	78	psi	537	kPa

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: Boundary Condition Request - 407 Smyth Rd (Addition to the Ronald McDonald House)

1 message

Bramah, Bruce <bruce.bramah@ottawa.ca> Wed, Nov 23, 2022 at 8:51 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Laurent Brosseau <l.brosseau@dbgrayengineering.com>

Good morning Doug,

The following are boundary conditions, HGL, for hydraulic analysis at 407 Smyth Road (zone 2W2C) assumed to be a connected at the public 305 mm watermain on Smyth Road (see attached PDF for location).

Both Connections:

Min HGL: 122.8 m

Max HGL: 130.6 m

Max Day + FF (166.7 L/s): 116.3 m (Connection 1), 119.0 m (Connection 2)

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.

Thank you,

--

Bruce Bramah, EIT

Project Manager

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

Development Review - South Branch

City of Ottawa | Ville d'Ottawa

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

613.580.2424 ext./poste 29686, Bruce.Bramah@ottawa.ca

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: November 07, 2022 3:33 PM
To: Bramah, Bruce <bruce.bramah@ottawa.ca>
Cc: Laurent Brosseau <l.brosseau@dbgrayengineering.com>
Subject: Boundary Condition Request - 407 Smyth Rd (Addition to the Ronald McDonald House)

Hi Bruce

As you are aware we are working on the Ronald McDonald House.

The existing building and closest existing fire hydrant connect to the existing 200 mm watermain located to the east of the existing building (and extends around to the south of the building). We are proposing to reuse the existing 150 mm water service to service both the existing building and proposed addition. We are proposing to relocat the existing fire hydrant but it will connect to the 200 mm watermain at approximately the same location. Refer to the attached preliminary Site Servicing Plan.

Please provide the boundary conditions at the 200 mm watermain. We have calculated the following expected demands:

Average daily demand: 0.3 L/s.

Maximum daily demand: 0.4 L/s.

Maximum hourly daily demand: 0.8 L/s

Fire Flow demand: 166.7 L/s

Fire Flow + Max Day: 167.1 L/s

The daily demands include only the proposed addition. The fire flows include both the existing building and proposed addition. Our calculations are attached.

As requested, also attached are our sanitary flow calculations. The proposed addition is calculated to generate a peak flow of 0.54 L/s.

Thanks, Doug

D.B. Gray Engineering Inc.

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

700 Long Point Circle Tel: 613-425-8044

Ottawa, Ontario K1T 4E9 d.gray@dbgrayengineering.com

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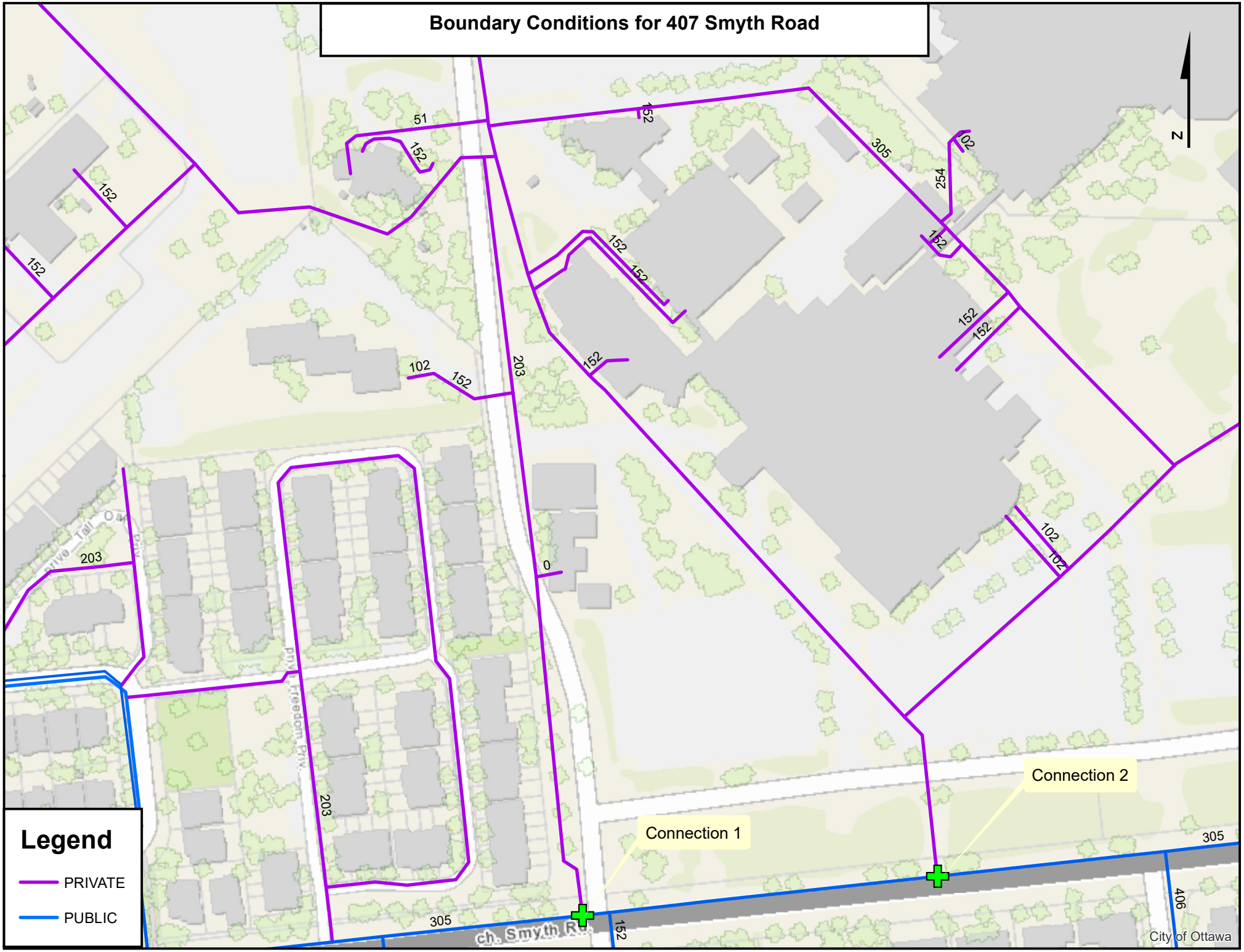
407 Smyth Road November 2022.pdf
1598K


Boundary Conditions for 407 Smyth Road
N
51
152
152
152
152
305
102
254
152
152
152
152
152
152
102
152
203
152
0
203
102
102
203
305
406
Connection 1
Connection 2
Legend
PRIVATE
PUBLIC
City of Ottawa

CLEAN WATER WORKS

Fire Hydrant Inspection Report

FH ID #: ROTEL

Date: 19 / 06 / 20 dd/mm/

W.O. #: 93875

Customer	TOH	Contact	
Site Name	General Campus	Phone #	
Site Address	501 Smyth	P.O. #	
Inspected By	AVR	Make/Model	McAvity M67
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.	1935
Barrel Ext.		Hose Nozzles	
Flange Elev.	Flush	Hydrant Colour	Body: Red Top: Blue

GPS Coordinates (FH)	ROTEL ; see map		
GPS Coordinates (IV)		Flange elevation	Flush
Distance from I. valve	6 m @ 6 o'clock Asphalt	Surface cond.	Grass

Isolation Valve	Yes	No
Visible	✓	
Operates properly		
Cap in place	✓	
Valve open		
Barrel		
Self draining		✓
Water level 100% Dry		✓
plugged		
Ground Flange		
Solid	✓	
Buried		✓
Damaged		✓
Caps and Gaskets		
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant		
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required	✓	
Hydrant marker in place	✓	

Hydro-Static Testing	Yes	No
Prior to opening – underground leak	~~✓~~	✓
Fully open – above ground leak	✓	
Fully open – underground leak		
Fully closed – underground leak	✓	

Flow Testing	
Pitot reading (PSI)	40
Pitot reading (GPM)	1060
Static Pressure (PSI)	62
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	30
Flow @ 20 PSI	2084

Comments: Leaking from bonnet, hydrant nob draining.
↳ Full seals and internal insp.
valve full of debris. Needs to be pumped
and valve checked before repairs

Compliance Report

FLOW MASTER

Fire Hydrant #: ROTEL

Date: June 19, 2020
Work Order #: 93875
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-3562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #: Spring Inspection and Flow Test (#5)

Hydrant Make and Model: McAvity M67
Year Manufactured: 1985
Hydrant Location: Entrance to Rotel
Surface Condition: Grass
Seat Valve Size:
Flange Elevation: Flush
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: 6 m @ 6 o'clock
Surface Condition: Asphalt

Flow Test Results:

Pitot Reading (PSI): 40
Pitot Reading (GPM): 1060
Static Pressure (PSI): 62
Residual Pressure (PSI): 50

Flow @ 20 PSI (GPM): 2084

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☐ ☑
Water Level	100%
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☐ **NO** ☑

O. Reg. 213/07: Fire Code 6.6.5.3., 6.6.5.4, & 6.6.5.5

CLEAN WATER WORKS

Fire Hydrant Inspection Report

FH ID #: RMHC

Date: 19 / 06 / 20 dd/mm/yy

W.O. #: 93875

Customer	TOH	Contact	
Site Name	General Campus	Phone #	
Site Address	501 Smyth	P.O. #	
Inspected By	AVR	Make/Model	Dayle D-67M
Inspection #	1 2 3 4 (5) 6 7 SP	Year of Man.	1933
Barrel Ext.		Hose Nozzles	
Flange Elev.	Flush	Hydrant Colour	Body: Red Top: Blue

GPS Coordinates (FH)	RMHC ; see map		
GPS Coordinates (IV)			
Distance from I. valve	1.5 m @ 3 o'clock (asphalt)	Surface cond.	Grass

Isolation Valve	Yes	No
Visible		✓
Operates properly		
Cap in place		
Valve open		
Barrel		
Self draining	✓	
Water level / Dry		
plugged		
Ground Flange		
Solid	✓	
Buried		✓
Damaged		✓
Caps and Gaskets		
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant		
Colour coded	✓	
Painting required		✓
Lubricate upper stem		✓
Operation satisfactory		
Restoration required	✓	
Hydrant marker in place		✓

Hydro-Static Testing	Yes	No
Prior to opening – underground leak	~~✓~~	✓
Fully open – above ground leak	✓	
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	28
Pitot reading (GPM)	~~28~~ 390
Static Pressure (PSI)	62
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	48
Flow @ 20 PSI	1610

Comments:

Hose nozzle cap is missing lug for wrench, cap not easily removed. Hole in same hose nozzle cap, hydrant not sealed from debris. Hydrant is NOT controlled by valve in pathway (1.5m @ 6 o'clock) Need to locate shut off. Leaking from bonnet → Top seals. No marker

Compliance Report

Fire Hydrant #: RMHC

Date: June 19, 2020
Work Order #: 93875
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth
Inspected by: Andries van Rozen
Inspection #: Spring Inspection and Flow Test (#5)

Hydrant Make and Model: ~~McAvity~~ Daigle D-67M
Year Manufactured: 1983
Hydrant Location: Beside RMHC
Surface Condition: Grass
Seat Valve Size:
Flange Elevation: Flush
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: Unknown
Surface Condition:

Flow Test Results:

Pitot Reading (PSI):	
Pitot Reading (GPM):	
Static Pressure (PSI):	
Residual Pressure (PSI):	
Flow @ 20 PSI (GPM):	

Visual inspection:

	Yes	No
Hydrant Accessible	☑	☐
Caps Present	☑	☐
Caps Easily Removed	☐	☑
Barrel Draining	☑	☐
Water Level		
Painting Required	☐	☑

Hydrant is in Compliance with Ontario Fire Code

YES ☐ **NO** ☑

O. Reg. 213/07 : Fire Code 6.6.5.2 (1) & 6.6.5.2 (2)


914mm STM
INV.74.06(E)
INV.74.27(S)
INV.74.03(N)
45
INV.73.40(E)
INV.74.90(S)
INV.73.38(N)
44
Compliance Report NOT Available
PH328-16
PH328-15
305mm SAN
305mm WM
203mm WM
610mm STM
305mm SAN
PATIO
BENCH
BENCH
200mm STM
150mm SAN
150mm
INV.76.51
109
INV.76.51
108
PH328-22
610mm
305mm

Compliance Report

Fire Hydrant #: PH 328-16

Date: May 06, 2020
Work Order #: 92411
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth Rd
Inspected by: Andries van Rozen
Inspection #: Spring Inspection and Flow Test (#5)

Hydrant Make and Model: ((See master list))
Year Manufactured: ((See master list))
Hydrant Location: ((See map))
Surface Condition: ((See master list))
Seat Valve Size: ((See master list))
Flange Elevation: ((See master list))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See master list))
Surface Condition: ((See master list))

Flow Test Results:

Pitot Reading (PSI): 46
Pitot Reading (GPM): 1140
Static Pressure (PSI): 66
Residual Pressure (PSI): 56

Flow @ 20 PSI (GPM): 2599

Visual inspection:

	Yes / No
Hydrant Accessible	☑ ☐
Caps Present	☑ ☐
Caps Easily Removed	☑ ☐
Barrel Draining	☐ ☑
Water Level	100%
Painting Required	☐ ☑

Hydrant is in Compliance with Ontario Fire Code

YES ☐ NO ☑

O. Reg 213/07: Fire Code 6.6.5.3 & 6.6.5.4 & 6.6.5.5

Fire Hydrant Inspection Report

FH ID #: 328 - 16

Date: 06/05/20 dd/mm/yy

W.O. #: 9241

Customer	TOH	Contact	
Site Name	TOH	Phone #	
Site Address	501 Smyth	P.O. #	
Inspected By	AK	Make/Model	
Inspection #	1 2 3 4 5 6 7 SP	Year of Man.	
Barrel Ext.		Hose Nozzles	
Flange Elev.		Hydrant Colour	Body: Red Top: Blue

GPS Coordinates (FH)			
GPS Coordinates (IV)	UP 083		
Distance from I. valve		Surface cond.	

Isolation Valve	Yes	No
Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open	✓	
Barrel		
Self draining		✓
Water level: Dry		✓
plugged		
Ground Flange		
Solid		
Buried	✓	
Damaged		
Caps and Gaskets		
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant		
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory	✓	
Restoration required	✓	
Hydrant marker in place		✓

Hydro-Static Testing	Yes	No
Prior to opening – underground leak		✓
Fully open – above ground leak		✓
Fully open – underground leak		✓
Fully closed – underground leak		✓

Flow Testing	
Pitot reading (PSI)	46
Pitot reading (GPM)	1140
Static Pressure (PSI)	66
Volume of water used (GPM x total flow min.)	
Residual pressure (PSI)	56
Flow @ 20 PSI	2599

Comments: No marker.

Not draining → Pull socks & check drains

Compliance Report

FLOW MASTER

Fire Hydrant #: PH323-22

Date: May 06, 2020
Work Order #: 92411
Client: The Ottawa Hospital
Contact: David Eastman
Contact Phone: 613-295-8562
Customer PO #:
Site Name: General Campus
Site Address: 501 Smyth Rd
Inspected by: Andries van Rozen
Inspection #: Spring Inspection and Flow Test (#5)

Hydrant Make and Model: ((See master list))
Year Manufactured: ((See master list))
Hydrant Location: ((See map))
Surface Condition: ((See master list))
Seat Valve Size: ((See master list))
Flange Elevation: ((See master list))
Hydrant Colour - Body: Red
- Bonnet: Blue
Valve Location: ((See master list))
Surface Condition: ((See master list))

Flow Test Results:

Pitot Reading (PSI): 50
Pitot Reading (GPM): 1190
Static Pressure (PSI): 64
Residual Pressure (PSI): 54

Flow @ 20 PSI (GPM): 2649

Visual inspection:

	Yes	No
Hydrant Accessible	☑	☐
Caps Present	☑	☐
Caps Easily Removed	☑	☐
Barrel Draining	☐	☐
Water Level		
Painting Required	☐	☑

Hydrant is in Compliance with Ontario Fire Code

YES ☐ **NO** ☑

Hydrant not turning off.

O. Reg 213/07: Fire Code 6.6.4.1 "... hydrants shall be maintained in operating condition.

CFFAN WATER WORKS

Fire Hydrant Inspection Report

FH ID #: PH328-22

Date: 06/05/20 dd/mm/yy

W.O. #: 92411

Customer	TOH	Contact	
Site Name	TOH	Phone #	
Site Address	501 Smyth	P.O. #	
Inspected By	AVK	Make/Model	
Inspection #	1 2 3 4 5 6 7 SP	Year of Man.	
Barrel Ext.		Hose Nozzles	
Flange Elev.		Hydrant Colour	Body: Red / Top: Blue

GPS Coordinates (FH)			
GPS Coordinates (IV)	VP 089		
Distance from I. valve		Surface cond.	

Isolation Valve	Yes	No
Visible	✓	
Operates properly	✓	
Cap in place	✓	
Valve open	✓	
Barrel		
Self draining		
Water level / Dry		
plugged		
Ground Flange		
Solid	✓	
Buried		✓
Damaged		✓
Caps and Gaskets		
Missing		✓
Replaced		✓
Lubricated	✓	

Nozzles and Threads	Yes	No
Loose		✓
Damaged		✓
Leaking		✓
Repaired		✓
Proper nozzle orientation	✓	
Pumper nozzle	✓	
Hydrant		
Colour coded	✓	
Painting required		✓
Lubricate upper stem	✓	
Operation satisfactory		✓
Restoration required	✓	
Hydrant marker in place		✓

Hydro-Static Testing	Yes	No	Flow Testing	
Prior to opening – underground leak		✓	Pitot reading (PSI)	50
Fully open – above ground leak		✓	Pitot reading (GPM)	1190
Fully open – underground leak		✓	Static Pressure (PSI)	64
Fully closed – underground leak			Volume of water used (GPM x total flow min.)	
			Residual pressure (PSI)	54
			Flow @ 20 PSI	2649

Comments: No marker.
Unable to turn off hydrant @ hydrant.
Metal piece of valve disc coming out.
2 x Full seals.

SHUT off at iso valve.
OUT OF SERVICE 20-25938

APPENDIX C

SANITARY SERVICING

MORRISON HERSHFIELD

FINAL REPORT

Ottawa Health Sciences Centre

Storm and Sanitary Sewer Capacity Assessment

Ottawa, Ontario

Presented to:

Pierre de Gagné
Technical Advisory Committee Chair

c/o University of Ottawa
217 – 141 Louis Pasteur
Ottawa, ON K1N 6N5

Report No. 2160501.01 May 1, 2017

\\OTT01FP\DATA1\SHARED\PROJ\2160501\10 DESIGN\REPORTING\SUBMISSIONS\2017-05-01 FINAL\SITE SERVICES ASSESSEMENT MAY 01 2017.DOCX

Hydrologic modelling carried out by the City using SWMHYMO in support of the Alta Vista Hospital Link (AVHL) project included the OHSC campus and the main storm sewers (Delcan, 2014). This modelling determined that the Time of Concentration at the downstream extent of the OHSC sewers (MHST500) was 30 minutes during the 10-year event. (Time of Concentration at a specific location within a sewer system is the sum of the Inlet Time and the travel time through the sewers to that location). Based on this modelling, the new downstream sewers were then designed by Delcan (on behalf of the City) using Rational Method calculations with an Inlet Time of 30 minutes at MHST500.

The current model indicates that travel time from the upstream extents of the OHSC storm sewers to MHST500 is approximately 10 minutes.

Considering the design parameters used for the City's analysis and sizing of the downstream AVHL storm sewers, an Inlet Time of 20 minutes for the existing OHSC storm sewers is considered appropriate and has been used in the current analysis.

Figures 7 to 12 show the capacity of the storm sewer network under existing and future conditions. The spreadsheet models and detailed results for these conditions are included in **Appendix A.**

The total stormwater flow, Q was estimated as the total flow obtained from the Rational Method calculations plus the total restricted flow where quantity controls are installed. Sewer capacity, Q_c, was estimated using the Manning's Formula with a roughness coefficient of 0.013 for smooth-walled pipes (i.e. concrete, PVC) and 0.024 for Corrugated Steel Pipe (CSP) in accordance with the City's Sewer Design Guidelines.

A Q/Q_c ratio less than 1 indicates that a sewer has sufficient capacity for the estimated stormwater flow. A Q/Q_c ratio more than 1 indicates insufficient capacity. The sewer capacity ratio, Q/Q_c, increases with the severity of the capacity shortfall.

The results are discussed in **Section 4** below.

3.2 Sanitary

The 2011 JL Richards's capacity assessment indicated that at peak flows the existing sanitary system was only being used to approximately 5 to 12% of its full capacity. As such, JL Richards concluded that there was more than sufficient capacity in the sanitary sewers for the existing flows.

A 25% increase of the existing flows was used for the JL Richards's future conditions analysis. This resulted in approximately 5 to 18% of the available sewer capacity being used at peak flows. Based on the future condition analysis, there is more than sufficient capacity in the sanitary system for the expected post-expansion flows.

As mentioned in **Section 2**, the sanitary sewers converge at the north-west corner of the site and eventually connect to the Rideau River Collector Sewer. JL Richards's report identified that the downstream capacity is over 215L/s and 325L/s at the campus outlet of this sewer and downstream of the National Defence Medical Centre

respectively. Therefore, there does not appear to be a capacity constraint in the downstream system.

New construction on the OHSC campus since 2011 has been minimal, and as such, flows in the sanitary network are expected to be generally unchanged. With no changes to the model input data, the conclusions of a new analysis would be unchanged from the JL Richards study. A new analysis is therefore not justified at this time.

6. CONCLUSIONS

The existing storm sewer system is over-capacity. New buildings are planned for the OHSC campus as part of the 2010 Master Plan implementation. New buildings would further increase flows to the existing system. Therefore, it is unlikely that approvals for new connections to the existing system would currently be granted by the City of Ottawa.

Peak flow calculations based on the Rational Method were used to complete the storm sewer analysis. Analysis results and new information received from the City regarding the Alta Vista Hospital Link sewers indicate that downstream sewers are not a constraint. Capacity issues arise in both small diameter sewers in parking lots and in sections of the larger trunk sewers.

To address the capacity issues, the following measures are recommended:

Table 5: Summary of Recommendations

Recommended Measure	Budgetary Cost Estimate
1A - Regrading and installing Inlet Control Devices in TOH Main Parking Lot	$106,000
1B - Regrading and installing Inlet Control Devices in TOH Rehab Centre Parking Lot	$97,000
2A - Retrofitting inlet control devices without regrading (CHEO Parking Lot H)	$16,000
3A - Stormwater management quantity control for all new buildings	Note 1
3B - Upsizing storm sewers in combination with Maternal Newborn building construction	$297,000
4A - Upsizing Storm Sewer in CHEO Parking Lot H	$99,000
4B - Upsizing Storm Sewer in CHEO Parking Lot A	$39,000
4C - Upsizing Storm Sewer - Ring Road outside Ronald MacDonald House	$114,000
4D - Upsizing Storm Sewer in TOH main parking lot	$84,000
4E - Upsizing Storm Sewer in TOH main parking lot	$40,000
4F - Upsizing Storm Sewer - Ring Road outside Transalta	$198,000
4G - Lining 1350mm CSP	$393,000
Total (excludes HST)	$1,483,000

Note 1: Stormwater quantity controls are a standard requirement for all buildings which are subject to City of Ottawa Site Plan Control, and should therefore form part of the budgetary estimates for all new buildings.

Opportunities for cost-effective implementation of the recommended measures should be sought whenever external works projects are planned – for example, to allow for sewers to be upsized at the same time as pavement rehabilitation is carried out.

It is anticipated that the City will only expect capacity constraints downstream of a new connection to be resolved prior to granting site plan approval for construction of a new building to proceed. Therefore the phasing and priority of the work should be determined based on the phasing of new building construction.

In the absence of significant changes to the buildings on the OHSC campus since the previous analysis carried out by JL Richards in 2011, the sanitary sewer capacity assessment has not been repeated. Based on the previous analysis, the sanitary sewer system currently has significant available capacity, including capacity for all buildings proposed under the 2010 Master Plan.

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: 407 Smyth Rd
Ronald McDonald House Addition
Ottawa, Ontario

Date: January 23, 2023

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	

Location		Residential													Non-Residential				Infiltration			Q	Sewer Data						
		Individual									Cumulative				Individual			Cumulative	Individual	Cumulative		Total							
		Single	Semi		Apartment				Area	Population	Area	Population	Peaking	Flow Rate	Area	Daily Flow	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached	Duplex	(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	L/ha/day	Factor	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	Q / Q_{Full}
		ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.4	ppu = 2.1	ppu = 3.1	ppu = 1.8																					
Proposed Addition Only																													
Proposed Addition	MH-SA.1								0.0000	0	0.0000	0	3.2	0	0.2944	85,755	1.5	0.44	0.2944	0.2944	0.10	0.54	6	150	147	1.00	0.85	14.43	0.04
		(104 Guests x 225 L/person) + (14 Staff x 75 L/Person)+ (22 Visitors x 36 L/Person)													=	85,755	L/ha/day	(225 L/person/day - daily average as per OSDG Appendix 4-A: Motels-Hotels w/full housekeeping facilities)											
		0.2944 ha																(75 L/person/day - daily average as per OSDG Appendix 4-A: Employees - Office Workers)											
																		(36 L/person/day - daily average as per OSDG Appendix 4-A: Assembly Halls with varying facilities (range 8 - 36 L/person))											
MH-SA.1	MH-SA.2								0.0000	0	0.0000	0	3.2	0	0.0000	0	1.5	0.44	0.0000	0.0000	0.10	0.54	10.8	150	147	1.00	0.85	14.43	0.04
Existing Building Only																													
Existing Building	MH-SA.2								0.0000	0	0.0000	0	3.2	0	0.2944	38,689	1.5	0.20	0.2944	0.2944	0.10	0.29	9.3	150	147	1.00	0.85	14.43	0.02
		(48 Guests x 225 L/person) + (4 Staff x 75 L/Person)+ (8 Visitors x 36 L/Person)													=	38,689	L/ha/day	(225 L/person/day - daily average as per OSDG Appendix 4-A: Motels-Hotels w/full housekeeping facilities)											
		0.2944 ha																(75 L/person/day - daily average as per OSDG Appendix 4-A: Employees - Office Workers)											
																		(36 L/person/day - daily average as per OSDG Appendix 4-A: Assembly Halls with varying facilities (range 8 - 36 L/person))											
EXISTING PIPE																													
MH-SA.2	EXISTING MH								0.0000	0	0.0000	0	3.2	0	0.0000	0	1.5	0.64	0.0000	0.0000	0.19	0.83	43.9	150	147	1.00	0.85	14.43	0.06

APPENDIX D

STORMWATER MANAGEMENT

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

Project Name:	407 Smyth Road	**Engineer:**	**D.G. Gray Engineering**
Location:	Ottawa, ON	**Contact:**	L. Brosseau
OGS #:	OGS	**Report Date:**	14-Mar-23

Area	0.5262	ha	**Rainfall Station #**	215	
Weighted C	0.70		**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%	0.5	0.5	2.6	98.1	9.0
1.0	10.6%	19.8%	1.0	1.0	5.2	97.4	10.3
1.5	9.9%	29.7%	1.5	1.5	7.7	96.6	9.6
2.0	8.4%	38.1%	2.0	2.0	10.3	95.9	8.0
2.5	7.7%	45.8%	2.6	2.6	12.9	95.2	7.3
3.0	5.9%	51.7%	3.1	3.1	15.5	94.4	5.6
3.5	4.4%	56.1%	3.6	3.6	18.1	93.7	4.1
4.0	4.7%	60.7%	4.1	4.1	20.7	92.9	4.3
4.5	3.3%	64.0%	4.6	4.6	23.2	92.2	3.1
5.0	3.0%	67.1%	5.1	5.1	25.8	91.5	2.8
6.0	5.4%	72.4%	6.1	6.1	31.0	90.0	4.8
7.0	4.4%	76.8%	7.2	7.2	36.2	88.5	3.8
8.0	3.5%	80.3%	8.2	8.2	41.3	87.0	3.1
9.0	2.8%	83.2%	9.2	9.2	46.5	85.5	2.4
10.0	2.2%	85.3%	10.2	10.2	51.7	84.1	1.8
15.0	7.0%	92.3%	15.4	15.4	77.5	76.6	5.4
20.0	4.5%	96.9%	20.5	19.8	100.0	67.9	3.1
25.0	1.4%	98.3%	25.6	19.8	100.0	54.4	0.8
30.0	0.7%	99.0%	30.7	19.8	100.0	45.3	0.3
35.0	0.5%	99.5%	35.8	19.8	100.0	38.8	0.2
40.0	0.5%	100.0%	41.0	19.8	100.0	34.0	0.2
45.0	0.0%	100.0%	46.1	19.8	100.0	30.2	0.0
50.0	0.0%	100.0%	51.2	19.8	100.0	27.2	0.0
							90.0

Removal Efficiency Adjustment[2] = 6.5%

Predicted Net Annual Load Removal Efficiency = 83.5%

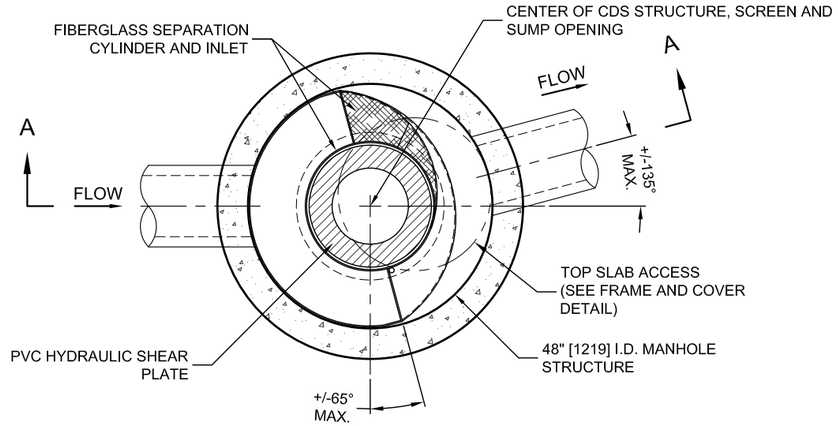
Predicted % Annual Rainfall Treated = 98.8%

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

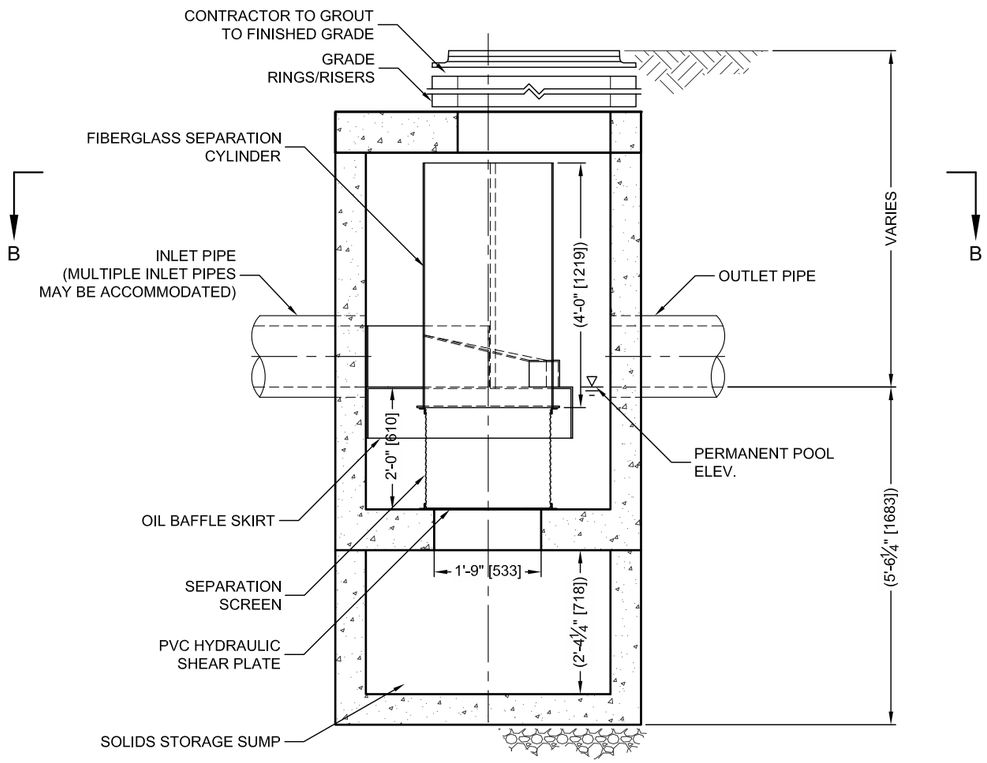
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

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

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



PLAN VIEW B-B
N.T.S.



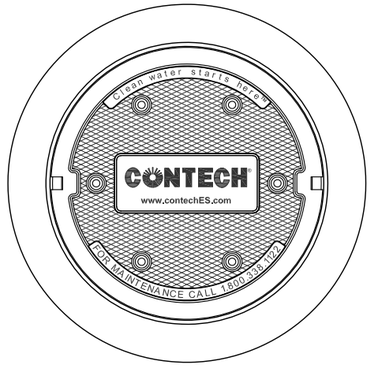
ELEVATION A-A
N.T.S.

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

CDS PMSU2015-4-C DESIGN NOTES

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

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



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

SITE SPECIFIC DATA REQUIREMENTS

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

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

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

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

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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

CDS PMSU2015-4-C INLINE CDS STANDARD DETAIL

MORRISON HERSHFIELD

DRAFT FINAL REPORT

Ottawa Health Sciences Centre

Stormwater Master Plan

Ottawa, Ontario

Presented to:

Kim J. Greenwood, MASc, P.Eng, CCE, FEIC
Director, Clinical Engineering

c/o Children's Hospital of Eastern Ontario (CHEO) & Ottawa Children's Treatment Centre (OCTC)
401 Smyth Road, Rm. 201 OCTC Annex
Ottawa, ON K1H 8L1

Report No. 180398000 July 2019

P:\2018\180398000-OHSC STORM WATER MANAGEMENT STUDY\08. WORKING\REPORT\OHSC STORMWATER MASTER PLAN_JULY 2019.DOCX

6. RECOMMENDATIONS

The following recommendations are provided based on the analysis of the existing and proposed OHSC dual drainage system using the PCSWMM model described previously. The phasing and priority of the recommended work is suggested to be in the order they are presented, with recommendation 4 being optional.

1. **Backflow preventers**

   It is recommended that OHSC ensure that backflow preventers are installed on all building drainage connections to the minor system. The modelling results indicate that elevated HGL conditions exist in the minor system during intense storm events. Backflow preventers ensure that stormwater cannot backup inside of building drainage systems. Without backflow preventers, there is the potential for stormwater to cause damage to buildings and their contents via backflow from the external storm sewer system to the internal building drainage system during intense storm events.

2. **ICD's**

   It is recommended that OHSC install ICD's in accordance with **Figure 8**. Based on the proposed conditions dual drainage analysis, ICD's were determined to be one of two most effective and lowest-cost methods for controlling the HGL in the minor system.

   The total cost of the ICD's proposed is $54,000. A detailed cost estimate is included under **Appendix B** of this report.

3. **Future development stormwater quantity control criteria**

   It is recommended that OHSC require that all future developments across the campus adhere to the following criteria:

   - Peak flows from future development drainage systems shall be controlled to the pre-existing 2-year storm event using stormwater retention measures (e.g. roof storage, cistern, and underground stormwater storage).

   - Peak flow shall be determined using a C value of 0.5 in accordance with the City of Ottawa Sewer Design Guidelines.

   This recommendation combined with recommendation 2 above will serve to control and maintain the minor system performance to the level demonstrated by the proposed conditions model, and gradually decrease the elevation of the HGL in the minor system over time as new buildings across the campus are constructed and existing buildings are redeveloped.

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)	-	-	13.89	-	-
AREA II (Roof)	-	-	6.60	23.70	23.70
AREA III	-	-	6.00	36.22	36.22
AREA IV	-	-	7.77	36.33	36.33
AREA V	-	-	6.36	7.23	7.23
TOTAL	108.75	40.62	40.62	103.49	103.49

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)	-	-	7.07	-	-
AREA II (Roof)	-	-	5.00	10.32	10.32
AREA III	-	-	5.93	14.05	14.05
AREA IV	-	-	7.69	13.69	13.69
AREA V	-	-	3.54	3.36	3.36
TOTAL	55.10	40.62	29.24	41.42	41.42

SUMMARY TABLES
(Continued)

100-YEAR + 20% STRESS TEST					
Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	16.67	-	-
AREA II (Roof)	-	-	7.13	29.86	29.86
AREA III	-	-	8.77	40.00	40.00
AREA IV	-	-	16.00	36.33	36.33
AREA V	-	-	7.35	8.84	8.84
TOTAL	n/a	n/a	55.92	115.04	115.04

November 25, 2022
REVISED March 16, 2023

Ronald McDonald House
407 Smith Road, Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Rational & Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

100-YEAR EVENT

			C
Roof Area:	0	sq.m	1.00
Hard Area:	1,497	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Soft Area:	2,775	sq.m	0.25
Total Catchment Area:	4,272	sq.m	0.51

Bransby Williams Formula (Used when C > 0.40)

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

Sheet Flow Distance (L):	61	m
Slope of Land (Sw):	1	%
Area (A):	0.4272	ha
Time of Concentration (Sheet Flow):	3.8	min
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
100-Year Pre-Development Flow Rate (2.78AiC):	108.75	L/s

5-YEAR EVENT

			C
Roof Area:	0	sq.m	0.90
Hard Area:	1,497	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	2,775	sq.m	0.20
Total Catchment Area:	4,272	sq.m	0.45
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
5-Year Pre-Development Flow Rate (2.78AiC):	55.10	L/s	

2-YEAR EVENT & MAXIMUM ALLOWABLE RELEASE RATE

			C
Roof Area:	0	sq.m	0.90
Hard Area:	1,497	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Soft Area:	2,775	sq.m	0.20
Total Catchment Area:	4,272	sq.m	0.45
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Maximum Allowable Release Rate (2.78AiC):	40.62	L/s	

100-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	203	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	13	sq.m	0.375
Soft Area:	288	sq.m	0.25
Total Catchment Area:	504	sq.m	0.56
Area (A):	504	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.56		
Flow Rate (2.78AiC):	13.89	L/s	

DRAINAGE AREA II (Addition Roof)

(100-YEAR EVENT)

			C
Total Catchment Area:	774	sq.m	1.00

No. of Roof Drains:	4	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drains:	133	mm
Maximum Release Rate:	6.60	L/s

Pond Area:	535	sq.m
Maximum Volume Stored:	23.70	cu.m
Maximum Volume Required:	23.70	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	38.42	6.60	31.82	19.09
15	143	30.75	6.60	24.15	21.73
20	120	25.81	6.60	19.21	23.05
25	104	22.34	6.60	15.74	23.62
30	92	19.77	6.60	13.17	23.70
35	83	17.77	6.60	11.17	23.45
40	75	16.17	6.60	9.57	22.96
45	69	14.86	6.60	8.26	22.29
50	64	13.76	6.60	7.16	21.48
55	60	12.83	6.60	6.23	20.55
60	56	12.03	6.60	5.43	19.53
65	53	11.33	6.60	4.73	18.44
70	50	10.71	6.60	4.11	17.27
75	47	10.17	6.60	3.57	16.05
80	45	9.68	6.60	3.08	14.78
85	43	9.24	6.60	2.64	13.47
90	41	8.85	6.60	2.24	12.12
95	39	8.49	6.60	1.88	10.74
100	38	8.16	6.60	1.55	9.33
105	36	7.85	6.60	1.25	7.89
110	35	7.57	6.60	0.97	6.43
115	34	7.32	6.60	0.72	4.94
120	33	7.08	6.60	0.48	3.43
125	32	6.86	6.60	0.25	1.91
130	31	6.65	6.60	0.05	0.37
135	30	6.45	6.45	0.00	0.00
140	29	6.27	6.27	0.00	0.00
145	28	6.10	6.10	0.00	0.00
150	28	5.94	5.94	0.00	0.00
180	24	5.14	5.14	0.00	0.00
210	21	4.55	4.55	0.00	0.00
240	19	4.09	4.09	0.00	0.00
270	17	3.72	3.72	0.00	0.00
300	16	3.42	3.42	0.00	0.00

DRAINAGE AREA III

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	951	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	235	sq.m	0.25
Total Catchment Area:	1,186	sq.m	0.85

Water Elevation:	77.46	m
Head:	2.42	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-14)	75.05	m
Invert of Outlet Pipe of CB/MH-14:	75.01	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.197	
Maximum Release Rate:	6.00	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-13	275	0.19	17.75	cu.m
CB/MH-14	286	0.19	18.47	cu.m
		Maximum Volume Stored:	36.22	cu.m
		Maximum Volume Required:	36.22	cu.m

DRAINAGE AREA III (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	50.12	6.00	44.12	26.47
15	143	40.11	6.00	34.11	30.70
20	120	33.67	6.00	27.67	33.20
25	104	29.15	6.00	23.15	34.72
30	92	25.79	6.00	19.79	35.62
35	83	23.18	6.00	17.18	36.08
40	75	21.09	6.00	15.09	36.22
45	69	19.38	6.00	13.38	36.13
50	64	17.95	6.00	11.95	35.85
55	60	16.74	6.00	10.74	35.43
60	56	15.69	6.00	9.69	34.88
65	53	14.78	6.00	8.78	34.23
70	50	13.98	6.00	7.98	33.50
75	47	13.27	6.00	7.26	32.69
80	45	12.63	6.00	6.63	31.82
85	43	12.06	6.00	6.06	30.89
90	41	11.54	6.00	5.54	29.91
95	39	11.07	6.00	5.07	28.89
100	38	10.64	6.00	4.64	27.83
105	36	10.25	6.00	4.24	26.74
110	35	9.88	6.00	3.88	25.61
115	34	9.55	6.00	3.54	24.46
120	33	9.23	6.00	3.23	23.28
125	32	8.94	6.00	2.94	22.07
130	31	8.67	6.00	2.67	20.84
135	30	8.42	6.00	2.42	19.60
140	29	8.18	6.00	2.18	18.33
145	28	7.96	6.00	1.96	17.05
150	28	7.75	6.00	1.75	15.74
180	24	6.71	6.00	0.71	7.65
210	21	5.94	5.94	0.00	0.00
240	19	5.34	5.34	0.00	0.00
270	17	4.85	4.85	0.00	0.00
300	16	4.46	4.46	0.00	0.00

DRAINAGE AREA III

Including Area III-A Outside Area of Re-Development

(100-YEAR EVENT)

			C
Roof Area:	33	sq.m	1.00
Hard Area:	951	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	235	sq.m	0.25
Total Catchment Area:	1,219	sq.m	0.86

Water Elevation:	77.47	m
Head:	2.42	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-14)	75.05	m
Invert of Outlet Pipe of CB/MH-14:	75.01	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.197	
Maximum Release Rate:	6.00	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-13	283	0.20	18.55	cu.m
CB/MH-14	295	0.20	19.31	cu.m
		Maximum Volume Stored:	37.87	cu.m
		Maximum Volume Required:	37.87	cu.m

DRAINAGE AREA III (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	51.76	6.00	45.76	27.45
15	143	41.42	6.00	35.42	31.88
20	120	34.77	6.00	28.77	34.52
25	104	30.10	6.00	24.10	36.15
30	92	26.63	6.00	20.63	37.13
35	83	23.94	6.00	17.93	37.66
40	75	21.78	6.00	15.78	37.87
45	69	20.02	6.00	14.01	37.83
50	64	18.54	6.00	12.53	37.60
55	60	17.28	6.00	11.28	37.22
60	56	16.20	6.00	10.20	36.71
65	53	15.26	6.00	9.26	36.10
70	50	14.43	6.00	8.43	35.40
75	47	13.70	6.00	7.69	34.62
80	45	13.04	6.00	7.04	33.78
85	43	12.45	6.00	6.45	32.88
90	41	11.92	6.00	5.91	31.93
95	39	11.43	6.00	5.43	30.93
100	38	10.99	6.00	4.98	29.90
105	36	10.58	6.00	4.58	28.82
110	35	10.20	6.00	4.20	27.72
115	34	9.86	6.00	3.85	26.58
120	33	9.54	6.00	3.53	25.42
125	32	9.24	6.00	3.23	24.24
130	31	8.96	6.00	2.95	23.03
135	30	8.70	6.00	2.69	21.80
140	29	8.45	6.00	2.45	20.55
145	28	8.22	6.00	2.22	19.28
150	28	8.00	6.00	2.00	17.99
180	24	6.93	6.00	0.92	9.98
210	21	6.13	6.00	0.12	1.57
240	19	5.51	5.51	0.00	0.00
270	17	5.01	5.01	0.00	0.00
300	16	4.61	4.61	0.00	0.00

DRAINAGE AREA IV

(100-YEAR EVENT)

			C
Roof Area:	30	sq.m	1.00
Hard Area:	1,011	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	205	sq.m	0.25
Total Catchment Area:	1,246	sq.m	0.88

Water Elevation:	77.47	m
Head:	2.63	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-16)	74.84	m
Invert of Outlet Pipe of CB/MH-16:	74.80	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.245	
Maximum Release Rate:	7.77	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-15	226	0.20	15.07	cu.m
CB/MH-16	319	0.20	21.27	cu.m

Maximum Volume Stored:	36.33	cu.m
Maximum Volume Required:	36.33	cu.m

DRAINAGE AREA IV (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	54.22	7.77	46.45	27.87
15	143	43.39	7.77	35.62	32.06
20	120	36.42	7.77	28.65	34.38
25	104	31.53	7.77	23.76	35.64
30	92	27.90	7.77	20.12	36.22
35	83	25.07	7.77	17.30	36.33
40	75	22.82	7.77	15.05	36.11
45	69	20.97	7.77	13.19	35.62
50	64	19.42	7.77	11.65	34.94
55	60	18.10	7.77	10.33	34.10
60	56	16.97	7.77	9.20	33.12
65	53	15.99	7.77	8.21	32.03
70	50	15.12	7.77	7.35	30.85
75	47	14.35	7.77	6.58	29.59
80	45	13.66	7.77	5.89	28.27
85	43	13.04	7.77	5.27	26.88
90	41	12.48	7.77	4.71	25.44
95	39	11.97	7.77	4.20	23.95
100	38	11.51	7.77	3.74	22.42
105	36	11.08	7.77	3.31	20.85
110	35	10.69	7.77	2.92	19.25
115	34	10.33	7.77	2.55	17.62
120	33	9.99	7.77	2.22	15.95
125	32	9.67	7.77	1.90	14.27
130	31	9.38	7.77	1.61	12.56
135	30	9.11	7.77	1.34	10.82
140	29	8.85	7.77	1.08	9.07
145	28	8.61	7.77	0.84	7.29
150	28	8.38	7.77	0.61	5.50
180	24	7.26	7.26	0.00	0.00
210	21	6.42	6.42	0.00	0.00
240	19	5.77	5.77	0.00	0.00
270	17	5.25	5.25	0.00	0.00
300	16	4.83	4.83	0.00	0.00

DRAINAGE AREA IV

Including Area IV-A Outside Area of Re-Development

(100-YEAR EVENT)

			C
Roof Area:	265	sq.m	1.00
Hard Area:	1,011	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	205	sq.m	0.25
Total Catchment Area:	1,481	sq.m	0.90

Water Elevation:	77.47	m
Head:	2.63	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-16)	74.84	m
Invert of Outlet Pipe of CB/MH-16:	74.80	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.245	
Maximum ICD Release Rate:	7.77	L/s
Maximum Overflow Release Rate:	6.32	L/s
Total Maximum Release Rate:	14.09	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-15	226	0.20	15.07	cu.m
CB/MH-16	319	0.20	21.27	cu.m
		Maximum Volume Stored:	36.33	cu.m
		Maximum Volume Required:	36.33	cu.m

DRAINAGE AREA IV (Continued)

(100-YEAR 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	179	65.88	7.77	0.00	7.77	58.11	34.87
15	143	52.72	7.77	4.58	12.35	40.37	36.33
20	120	44.26	7.77	6.21	13.98	30.28	36.33
25	104	38.32	7.77	6.32	14.09	24.22	36.33
30	92	33.90	7.77	5.94	13.71	20.19	36.33
35	83	30.47	7.77	5.40	13.17	17.30	36.33
40	75	27.73	7.77	4.82	12.59	15.14	36.33
45	69	25.48	7.77	4.25	12.02	13.46	36.33
50	64	23.60	7.77	3.71	11.49	12.11	36.33
55	60	22.00	7.77	3.22	10.99	11.01	36.33
60	56	20.62	7.77	2.76	10.53	10.09	36.33
65	53	19.43	7.77	2.34	10.11	9.32	36.33
70	50	18.37	7.77	1.95	9.72	8.65	36.33
75	47	17.44	7.77	1.59	9.36	8.07	36.33
80	45	16.60	7.77	1.26	9.03	7.57	36.33
85	43	15.85	7.77	0.95	8.72	7.12	36.33
90	41	15.17	7.77	0.67	8.44	6.73	36.33
95	39	14.55	7.77	0.40	8.18	6.37	36.33
100	38	13.99	7.77	0.16	7.93	6.06	36.33
105	36	13.47	7.77	0.00	7.77	5.69	35.87
110	35	12.99	7.77	0.00	7.77	5.22	34.43
115	34	12.55	7.77	0.00	7.77	4.77	32.95
120	33	12.14	7.77	0.00	7.77	4.36	31.43
125	32	11.76	7.77	0.00	7.77	3.98	29.88
130	31	11.40	7.77	0.00	7.77	3.63	28.30
135	30	11.07	7.77	0.00	7.77	3.30	26.70
140	29	10.76	7.77	0.00	7.77	2.98	25.06
145	28	10.46	7.77	0.00	7.77	2.69	23.41
150	28	10.19	7.77	0.00	7.77	2.42	21.74
180	24	8.82	7.77	0.00	7.77	1.05	11.31
210	21	7.80	7.77	0.00	7.77	0.03	0.37
240	19	7.01	7.01	0.00	7.01	0.00	0.00
270	17	6.38	6.38	0.00	6.38	0.00	0.00
300	16	5.86	5.86	0.00	5.86	0.00	0.00

DRAINAGE AREA V

(100-YEAR EVENT)

			C
Roof Area:	16	sq.m	1.00
Hard Area:	118	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	280	sq.m	0.375
Soft Area:	148	sq.m	0.25
Total Catchment Area:	562	sq.m	0.49

Water Elevation:	75.51	m
Head:	0.87	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-6)	74.64	m
Invert of Outlet Pipe of CB/MH-6:	74.59	m
Orifice Diameter:	100	mm
Orifice Area:	7,854	sq.mm
Discharge Coefficient:	0.196	
Maximum Release Rate:	6.36	L/s

CB/MH Storage			
CB/MH	Invert	Size	Volume
CB-1	74.82	0.61	0.26
CB/MH-2	74.76	1.219	0.88
CB/MH-3	74.70	1.219	0.95
CB/MH-4	74.65	1.219	1.01
CB-5	74.63	0.61	0.33
CB/MH-6	74.59	1.219	1.08

Pipe Storage						
From	Invert	To	Invert	Length	Dia.	Volume
CB-1	74.82	CB/MH-2	74.76	14.3	0.25	0.70
CB/MH-2	74.76	CB/MH-3	74.70	14.4	0.25	0.71
CB/MH-3	74.70	CB/MH-4	74.65	11.8	0.25	0.58
CB-5	74.63	PIPE	74.62	2.4	0.25	0.12
CB/MH-4	74.65	CB/MH-6	74.59	12.9	0.25	0.63

Achieved Volume:	7.23	cu.m
Maximum Volume Required:	7.23	cu.m

DRAINAGE AREA V (Continued)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	13.70	3.18	10.52	6.31
15	143	10.96	3.18	7.79	7.01
20	120	9.20	3.18	6.02	7.23
25	104	7.97	3.18	4.79	7.18
30	92	7.05	3.18	3.87	6.97
35	83	6.34	3.18	3.16	6.63
40	75	5.77	3.18	2.59	6.21
45	69	5.30	3.18	2.12	5.72
50	64	4.91	3.18	1.73	5.18
55	60	4.57	3.18	1.40	4.61
60	56	4.29	3.18	1.11	4.00
65	53	4.04	3.18	0.86	3.36
70	50	3.82	3.18	0.64	2.69
75	47	3.63	3.18	0.45	2.01
80	45	3.45	3.18	0.27	1.31
85	43	3.30	3.18	0.12	0.60
90	41	3.15	3.15	0.00	0.00
95	39	3.03	3.03	0.00	0.00
100	38	2.91	2.91	0.00	0.00
105	36	2.80	2.80	0.00	0.00
110	35	2.70	2.70	0.00	0.00
115	34	2.61	2.61	0.00	0.00
120	33	2.52	2.52	0.00	0.00
125	32	2.44	2.44	0.00	0.00
130	31	2.37	2.37	0.00	0.00
135	30	2.30	2.30	0.00	0.00
140	29	2.24	2.24	0.00	0.00
145	28	2.18	2.18	0.00	0.00
150	28	2.12	2.12	0.00	0.00
180	24	1.83	1.83	0.00	0.00
210	21	1.62	1.62	0.00	0.00
240	19	1.46	1.46	0.00	0.00
270	17	1.33	1.33	0.00	0.00
300	16	1.22	1.22	0.00	0.00

5-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	203	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	13	sq.m	0.30
Soft Area:	288	sq.m	0.20
Total Catchment Area:	504	sq.m	0.48
Area (A):	504	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.48		
Flow Rate (2.78AiC):	7.07	L/s	

DRAINAGE AREA II (Addition Roof)

(5-YEAR EVENT)

			C
Total Catchment Area:	774	sq.m	0.90

No. of Roof Drains:	4	
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)
Depth at Roof Drains:	101	mm
Maximum Release Rate:	5.00	L/s

Pond Area:	307	sq.m
Maximum Volume Stored:	10.32	cu.m
Maximum Volume Required:	10.32	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	20.18	5.00	15.17	9.10
15	84	16.18	5.00	11.18	10.06
20	70	13.60	5.00	8.60	10.32
25	61	11.79	5.00	6.79	10.18
30	54	10.44	5.00	5.44	9.79
35	49	9.40	5.00	4.39	9.22
40	44	8.56	5.00	3.55	8.53
45	41	7.87	5.00	2.86	7.73
50	38	7.29	5.00	2.29	6.87
55	35	6.80	5.00	1.80	5.94
60	33	6.38	5.00	1.38	4.95
65	31	6.01	5.00	1.01	3.93
70	29	5.69	5.00	0.68	2.88
75	28	5.40	5.00	0.40	1.79
80	27	5.14	5.00	0.14	0.67
85	25	4.91	4.91	0.00	0.00
90	24	4.70	4.70	0.00	0.00
95	23	4.51	4.51	0.00	0.00
100	22	4.34	4.34	0.00	0.00
105	22	4.18	4.18	0.00	0.00
110	21	4.03	4.03	0.00	0.00
115	20	3.90	3.90	0.00	0.00
120	19	3.77	3.77	0.00	0.00
125	19	3.65	3.65	0.00	0.00
130	18	3.54	3.54	0.00	0.00
135	18	3.44	3.44	0.00	0.00
140	17	3.34	3.34	0.00	0.00
145	17	3.25	3.25	0.00	0.00
150	16	3.17	3.17	0.00	0.00
180	14	2.75	2.75	0.00	0.00
210	13	2.43	2.43	0.00	0.00
240	11	2.19	2.19	0.00	0.00
270	10	1.99	1.99	0.00	0.00
300	9	1.83	1.83	0.00	0.00

DRAINAGE AREA III

(5-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	951	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	0	sq.m	0.30
Soft Area:	235	sq.m	0.20
Total Catchment Area:	1,186	sq.m	0.76

Water Elevation:	77.40	m
Head:	2.36	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-14)	75.05	m
Invert of Outlet Pipe of CB/MH-14:	75.01	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.197	
Maximum Release Rate:	5.93	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-13	142	0.13	6.35	cu.m
CB/MH-14	172	0.13	7.70	cu.m
		Maximum Volume Stored:	14.05	cu.m
		Maximum Volume Required:	14.05	cu.m

DRAINAGE AREA III (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	26.15	5.93	20.23	12.14
15	84	20.97	5.93	15.05	13.54
20	70	17.63	5.93	11.71	14.05
25	61	15.29	5.93	9.36	14.04
30	54	13.54	5.93	7.61	13.70
35	49	12.18	5.93	6.25	13.13
40	44	11.09	5.93	5.16	12.39
45	41	10.20	5.93	4.27	11.53
50	38	9.45	5.93	3.52	10.57
55	35	8.82	5.93	2.89	9.53
60	33	8.27	5.93	2.34	8.43
65	31	7.79	5.93	1.86	7.27
70	29	7.37	5.93	1.44	6.07
75	28	7.00	5.93	1.07	4.83
80	27	6.67	5.93	0.74	3.55
85	25	6.37	5.93	0.44	2.24
90	24	6.10	5.93	0.17	0.91
95	23	5.85	5.85	0.00	0.00
100	22	5.62	5.62	0.00	0.00
105	22	5.42	5.42	0.00	0.00
110	21	5.23	5.23	0.00	0.00
115	20	5.05	5.05	0.00	0.00
120	19	4.89	4.89	0.00	0.00
125	19	4.73	4.73	0.00	0.00
130	18	4.59	4.59	0.00	0.00
135	18	4.46	4.46	0.00	0.00
140	17	4.33	4.33	0.00	0.00
145	17	4.22	4.22	0.00	0.00
150	16	4.11	4.11	0.00	0.00
180	14	3.56	3.56	0.00	0.00
210	13	3.15	3.15	0.00	0.00
240	11	2.83	2.83	0.00	0.00
270	10	2.58	2.58	0.00	0.00
300	9	2.37	2.37	0.00	0.00

DRAINAGE AREA III

Including Area III-A Outside Area of Re-Development

(5-YEAR EVENT)

			C
Roof Area:	33	sq.m	0.90
Hard Area:	951	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	0	sq.m	0.30
Soft Area:	235	sq.m	0.20
Total Catchment Area:	1,219	sq.m	0.77

Water Elevation:	77.41	m
Head:	2.36	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-14)	75.05	m
Invert of Outlet Pipe of CB/MH-14:	75.01	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.197	
Maximum Release Rate:	5.93	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-13	146	0.14	6.69	cu.m
CB/MH-14	178	0.14	8.11	cu.m
		Maximum Volume Stored:	14.79	cu.m
		Maximum Volume Required:	14.79	cu.m

DRAINAGE AREA III (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	27.01	5.93	21.08	12.65
15	84	21.66	5.93	15.73	14.16
20	70	18.21	5.93	12.28	14.74
25	61	15.79	5.93	9.86	14.79
30	54	13.98	5.93	8.05	14.49
35	49	12.58	5.93	6.65	13.96
40	44	11.46	5.93	5.52	13.26
45	41	10.53	5.93	4.60	12.43
50	38	9.76	5.93	3.83	11.49
55	35	9.11	5.93	3.18	10.48
60	33	8.54	5.93	2.61	9.40
65	31	8.05	5.93	2.12	8.26
70	29	7.62	5.93	1.68	7.07
75	28	7.23	5.93	1.30	5.85
80	27	6.89	5.93	0.96	4.59
85	25	6.58	5.93	0.65	3.30
90	24	6.30	5.93	0.37	1.98
95	23	6.04	5.93	0.11	0.64
100	22	5.81	5.81	0.00	0.00
105	22	5.60	5.60	0.00	0.00
110	21	5.40	5.40	0.00	0.00
115	20	5.22	5.22	0.00	0.00
120	19	5.05	5.05	0.00	0.00
125	19	4.89	4.89	0.00	0.00
130	18	4.74	4.74	0.00	0.00
135	18	4.61	4.61	0.00	0.00
140	17	4.48	4.48	0.00	0.00
145	17	4.36	4.36	0.00	0.00
150	16	4.24	4.24	0.00	0.00
180	14	3.68	3.68	0.00	0.00
210	13	3.26	3.26	0.00	0.00
240	11	2.93	2.93	0.00	0.00
270	10	2.67	2.67	0.00	0.00
300	9	2.45	2.45	0.00	0.00

DRAINAGE AREA IV

(5-YEAR EVENT)

			C
Roof Area:	30	sq.m	0.90
Hard Area:	1,011	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	0	sq.m	0.30
Soft Area:	205	sq.m	0.20
Total Catchment Area:	1,246	sq.m	0.78

Water Elevation:	77.41	m
Head:	2.58	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-16)	74.84	m
Invert of Outlet Pipe of CB/MH-16:	74.80	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.245	
Maximum Release Rate:	7.69	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-15	119	0.14	5.71	cu.m
CB/MH-16	167	0.14	7.98	cu.m
		Maximum Volume Stored:	13.69	cu.m
		Maximum Volume Required:	13.69	cu.m

DRAINAGE AREA IV (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	28.33	7.69	20.64	12.38
15	84	22.72	7.69	15.03	13.52
20	70	19.10	7.69	11.41	13.69
25	61	16.55	7.69	8.87	13.30
30	54	14.66	7.69	6.97	12.55
35	49	13.19	7.69	5.50	11.55
40	44	12.01	7.69	4.32	10.38
45	41	11.05	7.69	3.36	9.06
50	38	10.24	7.69	2.55	7.64
55	35	9.55	7.69	1.86	6.14
60	33	8.96	7.69	1.27	4.56
65	31	8.44	7.69	0.75	2.93
70	29	7.98	7.69	0.30	1.24
75	28	7.58	7.58	0.00	0.00
80	27	7.22	7.22	0.00	0.00
85	25	6.90	6.90	0.00	0.00
90	24	6.60	6.60	0.00	0.00
95	23	6.34	6.34	0.00	0.00
100	22	6.09	6.09	0.00	0.00
105	22	5.87	5.87	0.00	0.00
110	21	5.66	5.66	0.00	0.00
115	20	5.47	5.47	0.00	0.00
120	19	5.29	5.29	0.00	0.00
125	19	5.13	5.13	0.00	0.00
130	18	4.97	4.97	0.00	0.00
135	18	4.83	4.83	0.00	0.00
140	17	4.69	4.69	0.00	0.00
145	17	4.57	4.57	0.00	0.00
150	16	4.45	4.45	0.00	0.00
180	14	3.85	3.85	0.00	0.00
210	13	3.41	3.41	0.00	0.00
240	11	3.07	3.07	0.00	0.00
270	10	2.80	2.80	0.00	0.00
300	9	2.57	2.57	0.00	0.00

DRAINAGE AREA IV

Including Area IV-A Outside Area of Re-Development

(5-YEAR EVENT)

			C
Roof Area:	265	sq.m	0.90
Hard Area:	1,011	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	0	sq.m	0.30
Soft Area:	205	sq.m	0.20
Total Catchment Area:	1,481	sq.m	0.80

Water Elevation:	77.43	m
Head:	2.59	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-16)	74.84	m
Invert of Outlet Pipe of CB/MH-16:	74.80	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.245	
Maximum Release Rate:	7.71	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-15	147	0.16	7.77	cu.m
CB/MH-16	205	0.16	10.86	cu.m
		Maximum Volume Stored:	18.64	cu.m
		Maximum Volume Required:	18.64	cu.m

DRAINAGE AREA IV (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	34.45	7.71	26.74	16.04
15	84	27.63	7.71	19.92	17.93
20	70	23.23	7.71	15.52	18.62
25	61	20.14	7.71	12.42	18.64
30	54	17.83	7.71	10.12	18.22
35	49	16.04	7.71	8.33	17.49
40	44	14.61	7.71	6.90	16.56
45	41	13.43	7.71	5.72	15.45
50	38	12.45	7.71	4.74	14.22
55	35	11.61	7.71	3.90	12.88
60	33	10.89	7.71	3.18	11.45
65	31	10.26	7.71	2.55	9.96
70	29	9.71	7.71	2.00	8.40
75	28	9.22	7.71	1.51	6.79
80	27	8.78	7.71	1.07	5.14
85	25	8.39	7.71	0.68	3.45
90	24	8.03	7.71	0.32	1.72
95	23	7.71	7.71	0.00	0.00
100	22	7.41	7.41	0.00	0.00
105	22	7.14	7.14	0.00	0.00
110	21	6.88	6.88	0.00	0.00
115	20	6.65	6.65	0.00	0.00
120	19	6.44	6.44	0.00	0.00
125	19	6.24	6.24	0.00	0.00
130	18	6.05	6.05	0.00	0.00
135	18	5.87	5.87	0.00	0.00
140	17	5.71	5.71	0.00	0.00
145	17	5.56	5.56	0.00	0.00
150	16	5.41	5.41	0.00	0.00
180	14	4.69	4.69	0.00	0.00
210	13	4.15	4.15	0.00	0.00
240	11	3.73	3.73	0.00	0.00
270	10	3.40	3.40	0.00	0.00
300	9	3.13	3.13	0.00	0.00

DRAINAGE AREA V

(5-YEAR EVENT)

			C
Roof Area:	16	sq.m	0.90
Hard Area:	118	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Permeable Paver Area:	280	sq.m	0.30
Soft Area:	148	sq.m	0.20
Total Catchment Area:	562	sq.m	0.42

Water Elevation:	74.91	m
Head:	0.27	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-6)	74.64	m
Invert of Outlet Pipe of CB/MH-6:	74.59	m
Orifice Diameter:	100	mm
Orifice Area:	7,854	sq.mm
Discharge Coefficient:	0.196	
Maximum Release Rate:	3.54	L/s

CB/MH Storage			
CB/MH	Invert	Size	Volume
CB-1	74.82	0.61	0.03
CB/MH-2	74.76	1.219	0.18
CB/MH-3	74.7	1.219	0.25
CB/MH-4	74.65	1.219	0.30
CB-5	74.63	0.61	0.10
CB/MH-6	74.59	1.219	0.37

Pipe Storage						
From	Invert	To	Invert	Length	Dia.	Volume
CB-1	74.82	CB/MH-2	74.76	14.3	0.25	0.32
CB/MH-2	74.76	CB/MH-3	74.7	14.4	0.25	0.49
CB/MH-3	74.7	CB/MH-4	74.65	11.8	0.25	0.56
CB-5	74.63	PIPE	74.62	2.4	0.25	0.12
CB/MH-4	74.65	CB/MH-6	74.59	12.9	0.25	0.63

Achieved Volume:	3.36	cu.m
Maximum Volume Required:	3.36	cu.m

DRAINAGE AREA V (Continued)

(5-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	6.78	1.77	5.01	3.01
15	84	5.44	1.77	3.67	3.30
20	70	4.57	1.77	2.80	3.36
25	61	3.96	1.77	2.19	3.29
30	54	3.51	1.77	1.74	3.13
35	49	3.16	1.77	1.39	2.91
40	44	2.88	1.77	1.11	2.65
45	41	2.65	1.77	0.87	2.36
50	38	2.45	1.77	0.68	2.04
55	35	2.29	1.77	0.52	1.70
60	33	2.14	1.77	0.37	1.34
65	31	2.02	1.77	0.25	0.97
70	29	1.91	1.77	0.14	0.59
75	28	1.82	1.77	0.04	0.20
80	27	1.73	1.73	0.00	0.00
85	25	1.65	1.65	0.00	0.00
90	24	1.58	1.58	0.00	0.00
95	23	1.52	1.52	0.00	0.00
100	22	1.46	1.46	0.00	0.00
105	22	1.41	1.41	0.00	0.00
110	21	1.36	1.36	0.00	0.00
115	20	1.31	1.31	0.00	0.00
120	19	1.27	1.27	0.00	0.00
125	19	1.23	1.23	0.00	0.00
130	18	1.19	1.19	0.00	0.00
135	18	1.16	1.16	0.00	0.00
140	17	1.12	1.12	0.00	0.00
145	17	1.09	1.09	0.00	0.00
150	16	1.07	1.07	0.00	0.00
180	14	0.92	0.92	0.00	0.00
210	13	0.82	0.82	0.00	0.00
240	11	0.74	0.74	0.00	0.00
270	10	0.67	0.67	0.00	0.00
300	9	0.62	0.62	0.00	0.00

100-YEAR + 20% STRESS TEST

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(100-YEAR + 20% STRESS TEST)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	203	sq.m	1.00
Gravel Area:	0	sq.m	0.88
Permeable Paver Area:	13	sq.m	0.38
Soft Area:	288	sq.m	0.25
Total Catchment Area:	504	sq.m	0.56
Area (A):	504	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	214	mm/hr	
Runoff Coeficient (C):	0.56		
Flow Rate (2.78AiC):	16.67	L/s	

DRAINAGE AREA II (Roof)

(100-YEAR + 20% STRESS TEST)

				C		
Total Catchment Area:		774	sq.m	1.00		
No. of Roof Drains:	4					
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)				
Depth at Roof Drains:	144	mm				
Maximum Release Rate:	7.13	L/s		Pond Area:	624	sq.m
				Maximum Volume Stored:	29.86	cu.m
				Maximum Volume Required:	29.86	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	214	46.11	7.13	38.98	23.39
15	171	36.90	7.13	29.77	26.79
20	144	30.97	7.13	23.84	28.61
25	125	26.81	7.13	19.68	29.53
30	110	23.72	7.13	16.59	29.86
35	99	21.32	7.13	14.19	29.80
40	90	19.40	7.13	12.27	29.46
45	83	17.83	7.13	10.70	28.89
50	77	16.51	7.13	9.38	28.15
55	72	15.40	7.13	8.27	27.28
60	67	14.43	7.13	7.30	26.29
65	63	13.59	7.13	6.46	25.21
70	60	12.86	7.13	5.73	24.05
75	57	12.20	7.13	5.07	22.82
80	54	11.62	7.13	4.49	21.54
85	52	11.09	7.13	3.96	20.20
90	49	10.62	7.13	3.49	18.82
95	47	10.18	7.13	3.05	17.40
100	45	9.79	7.13	2.66	15.94
105	44	9.42	7.13	2.29	14.45
110	42	9.09	7.13	1.96	12.93
115	41	8.78	7.13	1.65	11.39
120	39	8.49	7.13	1.36	9.82
125	38	8.23	7.13	1.10	8.23
130	37	7.98	7.13	0.85	6.62
135	36	7.75	7.13	0.62	4.99
140	35	7.53	7.13	0.40	3.34
145	34	7.32	7.13	0.19	1.68
150	33	7.13	7.13	0.00	0.00
180	29	6.17	6.17	0.00	0.00
210	25	5.46	5.46	0.00	0.00
240	23	4.91	4.91	0.00	0.00
270	21	4.47	4.47	0.00	0.00
300	19	4.10	4.10	0.00	0.00

DRAINAGE AREA III

(100-YEAR + 20% STRESS TEST)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	951	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	235	sq.m	0.25
Total Catchment Area:	1,186	sq.m	0.85

Water Elevation:	77.47	m
Head:	2.42	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-14)	75.05	m
Invert of Outlet Pipe of CB/MH-14:	75.01	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.197	
Maximum ICD Release Rate:	6.01	L/s
Maximum Overflow Release Rate:	2.76	L/s
Maximum Release Rate:	8.77	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-13	294	0.20	19.60	cu.m
CB/MH-14	306	0.20	20.40	cu.m
		Maximum Volume Stored:	40.00	cu.m
		Maximum Volume Required:	40.00	cu.m

DRAINAGE AREA III (Continued)

(100-YEAR + 20% STRESS TEST)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Overflow Release Rate (to IV) (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	214	60.15	6.01	0.00	54.14	32.48
15	171	48.13	6.01	0.00	42.13	37.91
20	144	40.41	6.01	1.06	33.33	40.00
25	125	34.98	6.01	2.31	26.67	40.00
30	110	30.95	6.01	2.71	22.22	40.00
35	99	27.82	6.01	2.76	19.05	40.00
40	90	25.31	6.01	2.64	16.67	40.00
45	83	23.26	6.01	2.44	14.81	40.00
50	77	21.54	6.01	2.20	13.33	40.00
55	72	20.08	6.01	1.95	12.12	40.00
60	67	18.83	6.01	1.71	11.11	40.00
65	63	17.73	6.01	1.47	10.26	40.00
70	60	16.77	6.01	1.24	9.52	40.00
75	57	15.92	6.01	1.02	8.89	40.00
80	54	15.16	6.01	0.81	8.33	40.00
85	52	14.47	6.01	0.62	7.84	40.00
90	49	13.85	6.01	0.43	7.41	40.00
95	47	13.28	6.01	0.26	7.02	40.00
100	45	12.77	6.01	0.09	6.67	40.00
105	44	12.29	6.01	0.00	6.28	39.60
110	42	11.86	6.01	0.00	5.85	38.60
115	41	11.45	6.01	0.00	5.45	37.57
120	39	11.08	6.01	0.00	5.07	36.51
125	38	10.73	6.01	0.00	4.72	35.43
130	37	10.41	6.01	0.00	4.40	34.31
135	36	10.10	6.01	0.00	4.10	33.17
140	35	9.82	6.01	0.00	3.81	32.01
145	34	9.55	6.01	0.00	3.54	30.83
150	33	9.30	6.01	0.00	3.29	29.62
180	29	8.05	6.01	0.00	2.04	22.06
210	25	7.12	6.01	0.00	1.11	14.03
240	23	6.40	6.01	0.00	0.39	5.66
270	21	5.83	5.83	0.00	0.00	0.00
300	19	5.35	5.35	0.00	0.00	0.00

DRAINAGE AREA III

Including Area III-A Outside Area of Re-Development

(100-YEAR + 20% STRESS TEST)

			C
Roof Area:	33	sq.m	1.00
Hard Area:	951	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	235	sq.m	0.25
Total Catchment Area:	1,219	sq.m	0.86

Water Elevation:	77.47	m
Head:	2.42	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-14)	75.05	m
Invert of Outlet Pipe of CB/MH-14:	75.01	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.197	
Maximum ICD Release Rate:	6.01	L/s
Maximum Overflow Release Rate:	3.73	L/s
Maximum Release Rate:	9.74	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-13	294	0.20	19.60	cu.m
CB/MH-14	306	0.20	20.40	cu.m
		Maximum Volume Stored:	40.00	cu.m
		Maximum Volume Required:	40.00	cu.m

DRAINAGE AREA III (Continued)

(100-YEAR + 20% STRESS TEST)

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Overflow Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	214	62.11	6.01	0.00	56.10	33.66
15	171	49.71	6.01	0.00	43.70	39.33
20	144	41.73	6.01	2.38	33.33	40.00
25	125	36.12	6.01	3.45	26.67	40.00
30	110	31.96	6.01	3.73	22.22	40.00
35	99	28.73	6.01	3.67	19.05	40.00
40	90	26.14	6.01	3.46	16.67	40.00
45	83	24.02	6.01	3.20	14.81	40.00
50	77	22.25	6.01	2.90	13.33	40.00
55	72	20.74	6.01	2.61	12.12	40.00
60	67	19.44	6.01	2.32	11.11	40.00
65	63	18.31	6.01	2.05	10.26	40.00
70	60	17.32	6.01	1.79	9.52	40.00
75	57	16.44	6.01	1.54	8.89	40.00
80	54	15.65	6.01	1.31	8.33	40.00
85	52	14.94	6.01	1.09	7.84	40.00
90	49	14.30	6.01	0.88	7.41	40.00
95	47	13.72	6.01	0.69	7.02	40.00
100	45	13.18	6.01	0.51	6.67	40.00
105	44	12.70	6.01	0.34	6.35	40.00
110	42	12.25	6.01	0.18	6.06	40.00
115	41	11.83	6.01	0.02	5.80	40.00
120	39	11.44	6.01	0.00	5.43	39.12
125	38	11.08	6.01	0.00	5.07	38.06
130	37	10.75	6.01	0.00	4.74	36.96
135	36	10.43	6.01	0.00	4.43	35.85
140	35	10.14	6.01	0.00	4.13	34.71
145	34	9.86	6.01	0.00	3.86	33.54
150	33	9.60	6.01	0.00	3.60	32.36
180	29	8.31	6.01	0.00	2.31	24.90
210	25	7.36	6.01	0.00	1.35	16.96
240	23	6.61	6.01	0.00	0.60	8.67
270	21	6.02	6.01	0.00	0.01	0.11
300	19	5.53	5.53	0.00	0.00	0.00

DRAINAGE AREA IV

(100-YEAR + 20% STRESS TEST)

			C
Roof Area:	30	sq.m	1.00
Hard Area:	1,011	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	205	sq.m	0.25
Total Catchment Area:	1,246	sq.m	0.88

Water Elevation:	77.47	m
Head:	2.63	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-16)	74.84	m
Invert of Outlet Pipe of CB/MH-16:	74.80	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.245	
Maximum ICD Release Rate:	7.77	L/s
Maximum Overflow Release Rate:	8.23	L/s
Maximum Release Rate:	16.00	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-15	226	0.20	15.07	cu.m
CB/MH-16	319	0.20	21.27	cu.m
Maximum Volume Stored:			36.33	cu.m
Maximum Volume Required:			36.33	cu.m

DRAINAGE AREA IV (Continued)

(100-YEAR + 20% STRESS TEST)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Overflow Release Rate (from III) (L/s)	ICD Release Rate (L/s)	Overflow Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	214	65.06	0.00	7.77	0.00	57.29	34.37
15	171	52.07	0.00	7.77	3.92	40.37	36.33
20	144	43.71	1.06	7.77	6.72	30.28	36.33
25	125	37.84	2.31	7.77	8.15	24.22	36.33
30	110	33.47	2.71	7.77	8.23	20.19	36.33
35	99	30.09	2.76	7.77	7.78	17.30	36.33
40	90	27.38	2.64	7.77	7.11	15.14	36.33
45	83	25.16	2.44	7.77	6.37	13.46	36.33
50	77	23.30	2.20	7.77	5.62	12.11	36.33
55	72	21.73	1.95	7.77	4.90	11.01	36.33
60	67	20.37	1.71	7.77	4.21	10.09	36.33
65	63	19.18	1.47	7.77	3.56	9.32	36.33
70	60	18.14	1.24	7.77	2.96	8.65	36.33
75	57	17.22	1.02	7.77	2.39	8.07	36.33
80	54	16.39	0.81	7.77	1.86	7.57	36.33
85	52	15.65	0.62	7.77	1.37	7.12	36.33
90	49	14.98	0.43	7.77	0.91	6.73	36.33
95	47	14.37	0.26	7.77	0.48	6.37	36.33
100	45	13.81	0.09	7.77	0.07	6.06	36.33
105	44	13.30	0.00	7.77	0.00	5.53	34.82
110	42	12.83	0.00	7.77	0.00	5.05	33.36
115	41	12.39	0.00	7.77	0.00	4.62	31.87
120	39	11.99	0.00	7.77	0.00	4.21	30.34
125	38	11.61	0.00	7.77	0.00	3.84	28.78
130	37	11.26	0.00	7.77	0.00	3.49	27.19
135	36	10.93	0.00	7.77	0.00	3.16	25.58
140	35	10.62	0.00	7.77	0.00	2.85	23.94
145	34	10.33	0.00	7.77	0.00	2.56	22.28
150	33	10.06	0.00	7.77	0.00	2.29	20.59
180	29	8.71	0.00	7.77	0.00	0.94	10.12
210	25	7.70	0.00	7.70	0.00	0.00	0.00
240	23	6.93	0.00	6.93	0.00	0.00	0.00
270	21	6.30	0.00	6.30	0.00	0.00	0.00
300	19	5.79	0.00	5.79	0.00	0.00	0.00

DRAINAGE AREA IV

Including Area IV-A Outside Area of Re-Development

(100-YEAR + 20% STRESS TEST)

			C
Roof Area:	265	sq.m	1.00
Hard Area:	1,011	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	0	sq.m	0.375
Soft Area:	205	sq.m	0.25
Total Catchment Area:	1,481	sq.m	0.90

Water Elevation:	77.47	m
Head:	2.63	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-16)	74.84	m
Invert of Outlet Pipe of CB/MH-16:	74.80	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.245	
Maximum ICD Release Rate:	7.77	L/s
Maximum Overflow Release Rate:	17.44	L/s
Total Maximum Release Rate:	25.22	L/s

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-15	226	0.20	15.07	cu.m
CB/MH-16	319	0.20	21.27	cu.m
		Maximum Volume Stored:	36.33	cu.m
		Maximum Volume Required:	36.33	cu.m

DRAINAGE AREA IV (Continued)

(100-YEAR + 20% STRESS TEST)

Time (min)	i (mm/hr)	2.78AiC (L/s)	Overflow Release Rate (from III) (L/s)	ICD Release Rate (L/s)	Overflow Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	214	79.06	0.00	7.77	10.73	60.56	36.33
15	171	63.27	0.00	7.77	15.13	40.37	36.33
20	144	53.11	2.38	7.77	17.44	30.28	36.33
25	125	45.98	3.45	7.77	17.43	24.22	36.33
30	110	40.68	3.73	7.77	16.44	20.19	36.33
35	99	36.56	3.67	7.77	15.16	17.30	36.33
40	90	33.27	3.46	7.77	13.83	15.14	36.33
45	83	30.57	3.20	7.77	12.54	13.46	36.33
50	77	28.32	2.90	7.77	11.34	12.11	36.33
55	72	26.40	2.61	7.77	10.23	11.01	36.33
60	67	24.75	2.32	7.77	9.21	10.09	36.33
65	63	23.31	2.05	7.77	8.27	9.32	36.33
70	60	22.05	1.79	7.77	7.41	8.65	36.33
75	57	20.92	1.54	7.77	6.62	8.07	36.33
80	54	19.92	1.31	7.77	5.89	7.57	36.33
85	52	19.02	1.09	7.77	5.21	7.12	36.33
90	49	18.20	0.88	7.77	4.59	6.73	36.33
95	47	17.46	0.69	7.77	4.00	6.37	36.33
100	45	16.78	0.51	7.77	3.46	6.06	36.33
105	44	16.16	0.34	7.77	2.96	5.77	36.33
110	42	15.59	0.18	7.77	2.48	5.51	36.33
115	41	15.06	0.02	7.77	2.04	5.27	36.33
120	39	14.56	0.00	7.77	1.75	5.05	36.33
125	38	14.11	0.00	7.77	1.49	4.84	36.33
130	37	13.68	0.00	7.77	1.25	4.66	36.33
135	36	13.28	0.00	7.77	1.02	4.49	36.33
140	35	12.91	0.00	7.77	0.81	4.33	36.33
145	34	12.56	0.00	7.77	0.61	4.18	36.33
150	33	12.23	0.00	7.77	0.42	4.04	36.33
180	29	10.58	0.00	7.77	0.00	2.81	30.36
210	25	9.36	0.00	7.77	0.00	1.59	20.03
240	23	8.42	0.00	7.77	0.00	0.64	9.26
270	21	7.66	0.00	7.66	0.00	0.00	0.00
300	19	7.04	0.00	7.04	0.00	0.00	0.00

DRAINAGE AREA V

(100-YEAR + 20% STRESS TEST)

			C
Roof Area:	16	sq.m	1.00
Hard Area:	118	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Permeable Paver Area:	280	sq.m	0.375
Soft Area:	148	sq.m	0.25
Total Catchment Area:	562	sq.m	0.49

Water Elevation:	75.81	m	75.5117
Head:	1.18	m	
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-6)	74.63	m	
Invert of Outlet Pipe of CB/MH-6:	74.59	m	
Orifice Diameter:	75	mm	
Orifice Area:	4,418	sq.mm	
Discharge Coefficient:	0.346		
Maximum ICD Release Rate:	7.35	L/s	

CB/MH Storage			
CB/MH	Invert	Size	Volume
CB-1	74.82	0.61	0.37
CB/MH-2	74.76	1.219	1.22
CB/MH-3	74.70	1.219	1.29
CB/MH-4	74.65	1.219	1.35
CB-5	74.63	0.61	0.44
CB/MH-6	74.59	1.219	1.42

Pipe Storage						
From	Invert	To	Invert	Length	Dia.	Volume
CB-1	74.82	CB/MH-2	74.76	14.3	0.25	0.70
CB/MH-2	74.76	CB/MH-3	74.70	14.4	0.25	0.71
CB/MH-3	74.70	CB/MH-4	74.65	11.8	0.25	0.58
CB-5	74.63	PIPE	74.62	2.4	0.25	0.12
CB/MH-4	74.65	CB/MH-6	74.59	12.9	0.25	0.63

Achieved Volume:	8.84	cu.m
Maximum Volume Required:	8.84	cu.m

DRAINAGE AREA V (Continued)

(100-YEAR + 20% STRESS TEST)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% ICD Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	214	16.44	3.68	12.77	7.66
15	171	13.16	3.68	9.48	8.53
20	144	11.04	3.68	7.37	8.84
25	125	9.56	3.68	5.89	8.83
30	110	8.46	3.68	4.78	8.61
35	99	7.60	3.68	3.93	8.25
40	90	6.92	3.68	3.24	7.78
45	83	6.36	3.68	2.68	7.24
50	77	5.89	3.68	2.21	6.64
55	72	5.49	3.68	1.81	5.99
60	67	5.15	3.68	1.47	5.30
65	63	4.85	3.68	1.17	4.57
70	60	4.58	3.68	0.91	3.82
75	57	4.35	3.68	0.68	3.04
80	54	4.14	3.68	0.47	2.24
85	52	3.95	3.68	0.28	1.43
90	49	3.79	3.68	0.11	0.59
95	47	3.63	3.63	0.00	0.00
100	45	3.49	3.49	0.00	0.00
105	44	3.36	3.36	0.00	0.00
110	42	3.24	3.24	0.00	0.00
115	41	3.13	3.13	0.00	0.00
120	39	3.03	3.03	0.00	0.00
125	38	2.93	2.93	0.00	0.00
130	37	2.84	2.84	0.00	0.00
135	36	2.76	2.76	0.00	0.00
140	35	2.68	2.68	0.00	0.00
145	34	2.61	2.61	0.00	0.00
150	33	2.54	2.54	0.00	0.00
180	29	2.20	2.20	0.00	0.00
210	25	1.95	1.95	0.00	0.00
240	23	1.75	1.75	0.00	0.00
270	21	1.59	1.59	0.00	0.00
300	19	1.46	1.46	0.00	0.00

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

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STORM SEWER CALCULATIONS

Rational Method — FIVE YEAR EVENT

407 Smyth Rd
Ronald McDonald House Addition
Ottawa, Ontario

March 15, 2023

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
		Roof	Hard	Permeable	Soft							Nominal	Actual			Q_{Full}		
		C = 0.90	C = 0.90	C = 0.30	C = 0.20			Time	Rainfall	Flow	Length	Diameter	Diameter	Slope	Velocity	Capacity	Time	
From	To	(ha)	(ha)	(ha)	(ha)	2.78AC	2.78AC	(min)	Intensity (mm/hr)	Rate (L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	(min)	Q / Q_{Full}
CB-1	CB/MH-2		0.0053	0.0070	0.0027	0.0206	0.0206	10.00	104	2.15	14.3	250	251	0.43	0.80	39.41	0.30	0.05
CB/MH-2	CB/MH-3	0.0016	0.0028	0.0097	0.0030	0.0208	0.0414	10.30	103	4.25	14.4	250	251	0.43	0.80	39.41	0.30	0.11
CB/MH-3	CB/MH-4		0.0037	0.0035	0.0066	0.0158	0.0572	10.60	101	5.79	11.8	250	251	0.43	0.80	39.41	0.25	0.15
CB-5	CB/MH-4			0.0078	0.0025	0.0079	0.0079	10.00	104	0.82	2.4	250	251	0.43	0.80	39.41	0.05	0.02
CB/MH-4	CB/MH-6					0.0000	0.0651	10.85	100	6.51	12.9	250	251	0.43	0.80	39.41	0.27	0.17
CB/MH-6	MH-8					0.0000	0.0651	11.12	99	6.42	1.5	300	299	0.34	0.80	55.89	0.03	0.11
								Flow through ICD:		3.57	1.5	300	299	0.34	0.80	55.89	0.03	0.06
CB-7A	CB/MH-7		0.0067			0.0168	0.0168	10.00	104	1.75	9.6	250	251	2	1.72	85.00	0.09	0.02
CB/MH-7	MH-8	0.0188	0.0142	0.0030	0.0212	0.0969	0.1136	10.09	104	11.78	40.6	250	251	0.43	0.80	39.41	0.85	0.30
MH-8	MH-9					0.0000	0.1787	11.15	98	17.60	40.3	300	299	0.34	0.80	55.89	0.84	0.31
								Restricted Flow:		15.35	40.3	300	299	0.34	0.80	55.89	0.84	0.27
Roof	MH-9	0.0774				0.1937	0.1937	10.00	104	20.18	18.3	200	201	1.00	1.05	33.24	0.29	0.61
						Flow through Flow Controlled Roof Drains:				5.00	18.3	200	201	1.00	1.05	33.24	0.29	0.15
MH-9	MH-10					0.0000	0.3724	11.99	95	35.27	31	300	299	0.34	0.80	55.89	0.65	0.63
								Restricted Flow:		15.35	31	300	299	0.34	0.80	55.89	0.65	0.27
Existing pipe																		
MH-10	MH-11					0.0000	0.3724	12.64	92	34.27	8.4	375	366	0.40	0.99	103.93	0.14	0.33
								Restricted Flow:		20.35	8.4	375	366	0.4	0.99	103.93	0.14	0.20
CB-12	CB/MH-14	0.0107	0.0080		0.0400	0.0690	0.0690	10.00	104	7.19	13.1	250	251	0.43	0.80	39.41	0.27	0.18
CB-13	CB/MH-14		0.0475		0.0186	0.1292	0.1292	10.00	104	13.46	17.2	250	251	0.43	0.80	39.41	0.36	0.34
CB-15	CB/MH-16		0.0321		0.0053	0.0833	0.0833	10.00	104	8.68	21.1	250	251	0.43	0.80	39.41	0.44	0.22
CB/MH-16	CB/MH-14	0.0265	0.0690		0.0152	0.2474	0.3307	10.44	102	33.70	1.5	375	366	1.00	1.56	164.33	0.02	0.21
								Flow through inlet control device:		7.69	1.5	375	366	1	1.56	164.33	0.02	0.05
CB/MH-14	MH-11	0.0033	0.0476		0.0049	0.1301	0.6589	10.46	102	67.10	42.6	375	366	0.65	1.26	132.49	0.56	0.51
								Flow through inlet control device:		5.93	42.6	375	366	0.65	1.26	132.49	0.56	0.04
								Restricted Flow:		20.81	42.6	375	366	0.65	1.26	132.49	0.56	0.16
Existing pipe																		
MH-11	Existing MH					0.0000	1.0313	12.78	91	94.34	21.9	375	366	0.40	0.99	103.93	0.37	0.91
								Restricted Flow:		41.16	21.9	375	366	0.40	0.99	103.93	0.37	0.40
		0.1383	0.2369	0.0310	0.1200	0.5262												
											EXISTING Ring Rd Private STORM SEWER							
												375	366	0.4	0.99	103.93		

APPENDIX E

DEVELOPMENT SERVICING STUDY CHECKLIST

GENERAL

Executive Summary: **N/A**

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

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

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

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

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

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

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

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

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

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: **Included**

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: **N/A**

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**