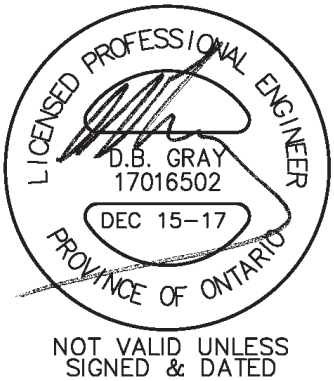
# SERVICING BRIEF &
# STORMWATER MANAGEMENT REPORT

## 2887 Riverside Drive
## Ottawa, Ontario

Report No. 15042

June 9, 2017
Revised September 8, 2017
Revised December 21, 2017





D. B. G R A Y  E N G I N E E R I N G  I N C.

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

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# SERVICING BRIEF &
# STORMWATER MANAGEMENT REPORT

## 2887 Riverside Drive
## Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a 3,313 sq.m. property at 2887 Riverside Drive in Ottawa. A four-storey residential / office building is proposed for the Youth Services Bureau (YSB). An existing three-storey office building (formerly a residential dwelling) will remain.

This report forms part of the stormwater management design for the proposed development. Refer to drawing C-1 to C-3 also prepared by D. B. Gray Engineering Inc.

### WATER SUPPLY FOR FIREFIGHTING:

There is an existing fire hydrant in the municipal Riverside drive right-of-way south of the subject property, located approximately 40 m unobstructed walking distance from the proposed fire department connection. Since it less than the required 45m an on-site fire hydrant is not required.

A fire flow of 167 l/s (10,000 L/min) is required, as calculated as per the Fire Underwriter Survey "Water Supply For Fire Protection".

The boundary conditions received from the city ( based on the city's computer model of the municipal water distribution system) includes the HGL of 121.6 m during the 167 l/s fire flow conditions at the subject location which calculates to be 373 kPa (54 psi). Since the pressure is above 138 kPa (20 psi) there is an adequate water supply for firefighting.

### WATER SERVICE:

The proposed building will have a sprinkler system. To service the sprinklers a 150mm water service is proposed. The proposed water service will connect to an existing 300mm municipal watermain in Riverside Drive.

Based on the City of Ottawa Water Distribution Design Guidelines for residential properties (33 one-bedroom apartment units / 1.4 persons per unit and 6 two-bedroom apartment units / 2.1 persons per unit – 350 l/person/day) and Ministry of the Environment Design Guidelines for peaking factors the daily average flow is 0.2 l/s with a maximum daily and maximum hourly demand of 2.0 and 3.0 l/s respectively. The 150mm service will be adequate for the domestic demand.

To determine water pressure under these demands, boundary conditions, based on the City of Ottawa computer simulation of the water distribution system, at the subject location, are required. In summary, we required the boundary conditions for the subject area based on the following:

Average Daily Demand: 0.2 l/s.
Maximum Daily Demand: 2.0 l/s.
Maximum Hourly Demand: 3.0 l/s
Fire Flow Demand: 166.7 l/s
Maximum Daily + Fire Flow Demand: 168.7 l/s

Based on the boundary conditions received from the city, the minimum HGL (hydraulic grade line) is 123.4 m and the maximum is 138.6 m. With these HGLs the water pressure at the water meter is calculated to vary from 423 kPa to 572 kPa (61 to 83psi). This is an acceptable range of pressures for the proposed development. However, since it is calculated that the water pressure can be above 80 psi at times an on-site pressure check is recommended to determine if a pressure reducing valve (PRV) is required.

SANITARY SERVICE:

Based on the City of Ottawa Sewer Design Guidelines for a residential property (33 one-bedroom apartment units / 1.4 persons per unit and 6 two-bedroom apartment units / 2.1 persons per unit – 350 l/person/day – 4.0 peaking factor) and for a commercial property (50,000 l/ ha / day and a 1.5 peaking factor); and a 0.28 l/s/ha infiltration flow the post development flow is calculated to be 1.43 l/s.

This flow will be adequately handled by the proposed sanitary sewer service connection (150mm at 1% - 15.9 l/s capacity). The 1.43 l/s in sanitary flows contributing to the existing 250mm sanitary sewer is expected to have an acceptable impact given its expected capacity of 73.4 l/s. (250mm at 1.4%).

STORMWATER MANAGEMENT:

Water Quality:

The Rideau Valley Conservation Authority (RVCA) commented:
*"The amount of parking spaces propose (7) would just fall within the threshold in which we would typically look for onsite quality control. However, in this case you are not increasing the parking but rather reducing the amount of parking from 15 spaces to 7 which is considered to be a net gain. The stormwater from this site would also travel more than 1.4 km to the downstream outlet at Sawmill Creek. Given the distance from the outlet combined with the improvements proposed of the site, and the scope of the project, it is the RVCA's opinion that this proposal would not require additional onsite*

*water quality treatment in the form of a specific water quality target as long as only 7 parking spaces are proposed."*

No permanent on-site quality control measures are proposed.

An erosion and sediment control plan has been developed to be implemented during construction, (see notes 2.1 to 2.6 on drawing C-3). In summary: to filter out construction sediment a silt fence barrier will be installed adjacent to the north, east, west and part of the south property line; sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site and all new catch basins as they are installed; and geotextile fabric mud mats will be install at all points of egress to public roads

Water Quantity:

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 2-year storm event using a pre-development runoff coefficient or runoff coefficient of 0.40, whichever is less; and the calculated time of concentration, but not less than 10 minutes. It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.50. Using the Airport Formula for sheet flow, it is calculated that the existing time of concentration is 11.1 minutes. Therefore based on runoff coefficient of 0.40 and a time of concentration of 11.1 minutes and using the Rational Method; the maximum allowable release rate is 26.86 l/s for all storm events.

However as per the Sawmill Creek Subwatershed Study Update peak flows at the more frequent storm events are required to be further reduced for downstream erosion control. As per Table C-2 & Figure C-9 of the study, and given the limited post development pervious area (C = 0.54), the required stormwater detention volume is 300 cu.m. / ha and the peak release rate is 3.8 l / s / ha. The subject lands are 0.3133 ha in area so the required detention volume is 99.39 cu.m. and peak release rate is 1.26 l/s.

Although only about half of the site is being redeveloped at this time, the proposed design will control the runoff from about two-thirds of the site. It would be difficult to control the other one-third of the site given that these areas are located at the perimeter of the property and the half of the site not being and therefore the above criteria cannot be achieved. During the two-year event the flow from the uncontrolled areas calculates to be 12.52 l/s. This flow rate exceeds the required release rate of 1.26 l/s. In an attempt to move towards the objective of the study we are proposing to use a small Hydrovex ICD to control the remainder of the site to 1.845 l/s, which will require a total of on-site storage of 33.55 cu.m. during the two-year event.

The proposed design reduces the post-development flow rate for all storm events by approximately 60% of the pre-development flow rate.

Calculations are based on the Rational Method. The runoff coefficients for the 100 year event are increased by 25% to maximum 1.00.

Stormwater will be stored within the development on the roof of the proposed building and on the surface of the parking area and in a stormwater detention area (a depressed grassed area).

Drainage Area I (Uncontrolled Flow Off Site – 1,238 sq.m.):
As previously mentioned the runoff from the perimeter of the developed part of the site and the part of the site not being redeveloped will be allowed to flow uncontrolled off the site. The flow from is calculated at 10 minutes concentration.

| | 100-year | 5-year | 2-year |
|---|---|---|---|
| The maximum flow rate: | 33.38 l/s | 16.99 l/s | 12.52 l/s |

Drainage Area II (Roof – 662 sq.m.):
Both roof drains will be a flow control type which will restrict the flow and cause the storm water to pond on the roof. The roof drains will discharge onto the surface drain into a catch basin in Drainage Area III. (Therefore we add the flow released from roof drains to the runoff in Drainage Area III.). All flow control type roof drains shall be installed with a parabolic shaped slotted weir (1 slot per weir drain at 0.0124 l/s per mm per slot - 5 USgpm per inch per slot) Watts roof drain with a Watts Accutrol Weir RD-100-A1 or equal. The roof drains shall be installed at the low points of the roof which shall be 150mm lower than the perimeter of the roof. As per the Ontario Building Code scuppers shall be installed so that the maximum depth of water on the roof cannot exceed 150mm:

| | 100-year | 5-year | 2-year |
|---|---|---|---|
| The maximum release rate: | 4.96 l/s | 3.77 l/s | 3.31 l/s |
| The maximum ponding depth: | 133 mm | 101 mm | 89 mm |
| The maximum stored volume: | 21.50 cu.m. | 9.47 cu.m. | 6.37 cu.m. |

Drainage Area IV (1,413 sq.m.):
An inlet control device (ICD) located at the outlet pipe of catch basin / manhole CB/MH-2 will control the release of stormwater from the site. The ICD will restrict the flow and force the stormwater to back up into the stormwater detention area and onto the surface of the parking area above three catch basins. Stormwater released through the ICD will be conveyed off the site via a 200mm storm sewer into a proposed 450mm municipal storm sewer in Riverside Drive. The ICD shall be a Hydrovex "40SVHV Vertical Vortex Flow Regulator" and shall be sized by the manufacturer for a discharge rate of 1.89 l/s at 2.21 m head. It is calculated that an orifice area of 1,257 sq.mm. (40 mm in diameter) and a discharge coefficient of 0.229 will restrict the outflow rate to 1.89 l/s at 2.21 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 1.89 l/s at 2.12 m and 1.84 l/s at 2.09 m for the 2-year event.

| | 100-year | 5-year | 2-year |
|---|---|---|---|
| The maximum release rate: | 1.85 l/s | 0.42 l/s | 0.36 l/s |
| The maximum ponding depth: (parking area) | 150 mm | 60 mm | 30 mm |

| | | | |
|---|---|---|---|
| The maximum ponding depth: (stormwater detention area) | 600 mm | 510 mm | 210 mm |
| The maximum stored volume: | 89.60 cu.m. | 39.76 cu.m. | 27.17 cu.m. |

Entire Site (3,313 sq.m.):

| | 100-year | 5-year | 2-year |
|---|---|---|---|
| The maximum release rate: | 35.28 l/s | 18.84 l/s | 14.36 l/s |
| The maximum stored volume: | 111.11 cu.m. | 49.23 cu.m. | 33.55 cu.m. |
| Reduction from pre-development flows | 62% | 58% | 57% |

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 36.5 l/s. However the flow control roof drains and an inlet control device (ICD) located at the outlet pipe of catch basin / manhole CB/MH-2 will restrict the flow. The restricted flow calculates to a maximum flow of 1.9 l/s during the one in five storm event which will be adequately handled by a proposed storm sewer (200mm at 0.58% - 26.1 l/s capacity)

Stormwater will be conveyed off the site via a 200mm storm sewer connecting to a 450mm municipal storm sewer located in Riverside Drive having a capacity of 351.9 l/s (1.4% slope). The 1.9 l/s in stormwater flows contributing to the existing 450mm municipal storm sewer is expected to have a positive impact given flow off the site is currently uncontrolled.

CONCLUSIONS:

1. There is an adequate water supply for firefighting.
2. The existing water pressure is adequate for the proposed development.
3. Since it is calculated that the water pressure may be above 80 psi at times it is recommended that an on-site test be conducted to determine if a pressure reducing valve (PRV) is required to be installed
4. The proposed water service connection is adequately sized to serve the development.
5. The expected sanitary sewage flow rate will be adequately handled by the proposed sanitary sewer service connection.
6. The sanitary flow contributing to the existing municipal sanitary sewer is expected to have a negligible impact.
7. The RVCA does not require additional onsite water quality treatment and no permanent measures are proposed.
8. An erosion and sediment control plan has been developed to be implemented during construction.
9. The proposed design reduces the post-development flow rate for all storm events by approximately 60% of the pre-development flow rate.
10. The restricted flowrate produced by a one in five-year storm event will be adequately handled by the proposed storm sewer connection.
11. The stormwater flow contributing to the existing municipal storm sewer is expected to have a positive impact.

15-May-17
REVISED 23-May-17
REVISED 1-Nov-17

# PROPOSED NEW FOUR STOREY BUILDING

## 2887 RIVERSIDE DRIVE

## Ottawa, Ontario

## Fire Flow Requirements

Fire Protection Water Supply

$F = 220\ C\ A^{0.5}$

F = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.5 for wood frame construction (combustible construction)
= 1.0 for ordinary construction (masonary wall, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected structural components)
= 0.6 for non-combustible construction (protected structural components, floor and roof)

= 1.36 Coefficient - 752 sq.m. non-combustible construction (unprotected structural components) + 1983 sq.m. wood frame construction - C=((752x0.8)+(661x3x1.5))/2735

| | | |
|---|---|---|
| GROUND FLOOR | 501 | sq.m. |
| FIRST FLOOR | 660 | sq.m. |
| SECOND FLOOR | 660 | sq.m. |
| THIRD FLOOR | 660 | sq.m. |
| Floor Area: | 2482 | sq.m. |

F = 14,891 L/min
= 15,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Change for Limited-combustible

= 12,750 L/min

-50% Reduction for Sprinkler Protection

= 6,375 L/min

Added to above Contents Fire Hazard for Separation Exposed Buildings

| | | |
|---|---|---|
| 20% | Side N | 3.1 to 10m |
| 15% | Side E | 10.1 to 20m |
| 25% | Side S | 0 to 3m |
| 0% | Side W | > 45m |

60% Total Increase for Exposure (maximum 75%)

= 10,200 L/min

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

= 166.7 l/s Required fire flow requirement as per Fire Underwriter Survey

2.0 l/s Maximum Daily Domestic Demand

168.7 l/s Required Minimum Water Supply Flow Rate (MAX DAY + FIRE FLOW)

---

| | | | | | | |
|---|---|---|---|---|---|---|
| Elevation at Fire Hydrant: | 83.60 | m ASL | | | | |
| | | | Static Pressure at Fire Hydrant | | | |
| 167 l/s FIRE FLOW: | 121.6 | m ASL | 854 | psi | 373 | kPa |

15-May-17

REVISED 23-May-17

# 2887 RIVERSIDE Dr

# 4 STOREY APARTMENT BUILDING

# Ottawa, Ontario

## Water Demand

| | Number of Units | Persons Per Unit | Population |
|---|---|---|---|
| UNIT TYPE: | | | |
| Single Family: | 0 | 3.4 | 0 |
| Semi- detached: | 0 | 2.7 | 0 |
| Duplex: | 0 | 2.3 | 0 |
| Townhouse: | 0 | 2.7 | 0 |
| APARTMENTS: | | | |
| Bachelor | 0 | 1.4 | 0 |
| 1 Bedroom: | 33 | 1.4 | 46 |
| 2 Bedroom: | 6 | 2.1 | 13 |
| 3 Bedroom: | 0 | 3.1 | 0 |
| Average Aptarment: | 0 | 1.8 | 0 |
| | | TOTAL: | 59 |

DAILY AVERAGE

350 litres / person / day

14.3 l / min 0.2 l / sec 3.8 USgpm

MAXIMUM DAILY DEMAND 8.4 (Peaking Factor for a equivalent population of 59: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)

120.0 l / min 2.0 l / sec 31.7 USgpm

MAXIMUM HOURLY DEMAND 12.6 (Peaking Factor for a equivalent population of 57: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)

180.7 l / min 3.0 l / sec 47.7 USgpm

---

Elevation of Water Meter: 80.23 m ASL

Approximate Floor Elevation: 79.33 m ASL

| | | | Static Pressure at Water Meter | | |
|---|---|---|---|---|---|
| MINIMUM HGL: | 123.4 | m ASL | 61 | psi | 423 kPa |
| MAXIMUM HGL: | 138.6 | m ASL | 83 | psi | 572 kPa |

Douglas Gray <d.gray@dbgrayengineering.com>

# RE: 2887 Riverside Dr - Boundary Conditions

1 message

**Oram, Cody** <Cody.Oram@ottawa.ca> Tue, May 23, 2017 at 9:53 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Lucio Renna <l.renna@dbgrayengineering.com>

The following are boundary conditions, HGL, for hydraulic analysis at 2887 Riverside (zone 2C) assumed to be connected to the 305 mm on Riverside Dr. (see attached PDF for location).

Minimum HGL = 123.4 m

Maximum HGL = 138.6 m

Max Day (2.00 L/s) + Fire Flow (166.7 L/s) = 121.6 m (Scenario 1)

Max Day (2.00 L/s) + Fire Flow (216.7 L/s) = 118.2 m (Scenario 2)

The maximum pressure is estimated to be above 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.

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

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

Regards,

**Cody Oram**, P.Eng. Senior Engineer

Development Review, South Services

Planning, Infrastructure and Economic Development Department | Services de planification, d'infrastructure et de développement économique

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 **13422**, fax/téléc:613-580-2576, cody.oram@ottawa.ca

**From:** Douglas Gray [mailto:d.gray@dbgrayengineering.com]
**Sent:** Tuesday, May 16, 2017 11:01 AM
**To:** Oram, Cody <Cody.Oram@ottawa.ca>
**Cc:** Lucio Renna <l.renna@dbgrayengineering.com>
**Subject:** Re: 2887 Riverside Dr - Boundary Conditions

Hi Cody

A preliminary Site Servicing Plan is attached showing a water service (150mm) enter near the NW corner of the proposed building.

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

On Tue, May 16, 2017 at 8:40 AM, Oram, Cody <Cody.Oram@ottawa.ca> wrote:

> Hi Lucio,
>
> Can you send me a sketch showing the proposed connection location?
>
> Thank you,
>
> Cody
>
> **From:** Lucio Renna [mailto:l.renna@dbgrayengineering.com]
> **Sent:** Monday, May 15, 2017 10:31 AM
> **To:** Oram, Cody <Cody.Oram@ottawa.ca>

**Cc:** Douglas Gray <d.gray@dbgrayengineering.com>
**Subject:** 2887 Riverside Dr - Boundary Conditions

Hi Cody,

Could you please provide the boundary conditions at 2887 Riverside Dr? I have calculated the following expected demands for the site based on a Residential Apartment building at 2887 Riverside Dr. Calculations are attached.

Scenario 1:

Average daily demand: 0.24 l/s.

Maximum daily demand: 2.00 l/s.

Maximum hourly daily demand: 3.01 l/s

Fire Flow demand: 166.7 l/s

Fire Flow + Max Day: 168.7 l/s

Scenario 2:

Average daily demand: 0.24 l/s.

Maximum daily demand: 2.00 l/s.

Maximum hourly daily demand: 3.01 l/s

Fire Flow demand: 216.7 l/s

Fire Flow + Max Day: 218.7 l/s

Sincerely,

Lucio Renna

D. B. GRAY ENGINEERING INC.

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

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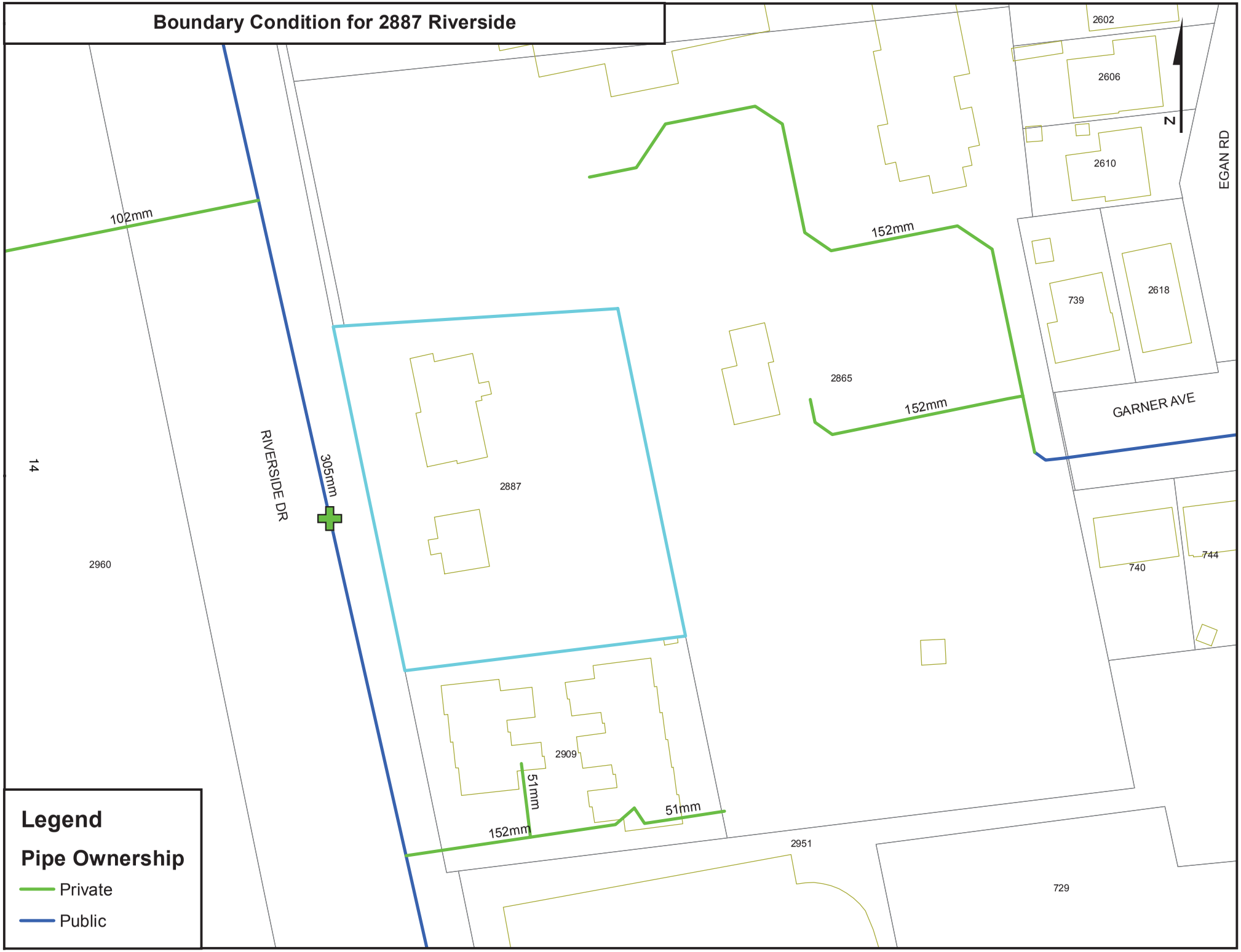
**2887 Riverside May 2017.pdf**
102K


Boundary Condition for 2887 Riverside
102mm
RIVERSIDE DR
305mm
14
2960
2887
2865
152mm
152mm
2602
2606
2610
EGAN RD
N
739
2618
GARNER AVE
740
744
2909
51mm
51mm
152mm
2951
729
Legend
Pipe Ownership
Private
Public

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## SANITARY SEWER DESIGN FORM

Average Daily Flows:
- Residential: 350 l / capita / day
- Commercial: 50,000 l / ha / day
- Instituational: 50,000 l / ha / day
- Light Industrial: 35,000 l / ha / day
- Heavy Industrial: 55,000 l / ha / day

Peaking Factor:
- Residential (Harmon Equation): $P.F. = 1 + \frac{14}{4 + P^{0.5}}$
- P = Population / 1000
- Commercial & Institutional: 1.5
- Industrial: As per Ottawa Guidelines Appendix 4-B

Infiltration Allowance: 0.28 l / s / ha

Project: 2887 Riverside Drive

Designed By: DBG

21-Dec-17

Page: 1 of 1

| LOCATION | | | Section | | | | | | | | Cumulative Residential | | Section Non-Residential | | | Cumulative | | | | SEWER DATA | | | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Single Family | Semi / Townhouse | Duplex / Triplex | Apartments (average) | Apartments (1 Bed.) | Apartments (2 Bed.) | Apartments (3 Bed.) | Residential Area | | | | | | Area | Sewage Flow | Infiltration Flow | Total Flow | n = 0.013 | | | | | | | | |
| STREET | FROM | TO | ppu = 3.4 | ppu = 2.7 | ppu = 2.3 | ppu = 1.8 | ppu = 1.4 | ppu = 2.1 | ppu = 3.1 | | Pop. | Peaking Factor | Area | Flow | Peaking Factor | | | | | Type of Pipe | Dia. Actual | Dia. Nom. | Slope | Length | Capacity | Velocity | Ratio | |
| | | | No. of Units | No. of Units | No. of Units | No. of Units | No. of Units | No. of Units | No. of Units | ha | | | ha | l/ha/day | | ha | l/s | l/s | l/s | | (mm) | (mm) | (%) | (m) | (l/s) | (m/s) | Q/Qfull | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Building | 250 SAN in Riverside | | | | | 33 | 6 | | 0.331 | 59 | 4.0 | 0.331 | 50,000 | 1.5 | 0.663 | 1.24 | 0.19 | 1.43 | PVC SDR 28 | 152.4 | 150 | 1.00 | 24.3 | 15.9 | 0.87 | 0.09 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | MUNICIPAL SANITARY SEWER IN RIVERSIDE DR | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | 254.0 | 250 | 1.400 | | 73.4 | 1.45 | | |

# STORMWATER MANAGEMENT CALCULATIONS

The orifice calculations are based on the following formula:

$$Q = C_d \times A_o \sqrt{2gh} \times 1000$$

where:

- $Q$ = flowrate in litres per second
- $C_d$ = coefficient of discharge
- $A_o$ = orifice area in sq.m.
- $g$ = 9.81 m/s2
- $h$ = head above orifice in meters

Flow control roof drain calculations are based on the following formula:

$$Q = N \times S \times d \times F$$

where:

- $Q$ = flowrate in litres per second
- $N$ = number of roof drains
- $S$ = slots per weir
- $d$ = pond depth at roof drain in mm
- $F$ = flowrate through each slot
  0.0124 litres per second per mm pond depth (5 USgpm per inch)

Storage calculations on the roof and parking area are based on the following formula for volume of a cone:

$$V = (A \times d)/3$$

where:

- $V$ = volume in cu.m.
- $A$ = ponding area in sq.m.
- $d$ = ponding depth in meters

d = ponding depth in meters

# Tables

## ONE HUNDRED YEAR EVENT

| Drainage Area | Pre-development Flow Rate | Release Rate (Control to 2-Year C=0.40) | Maximum Allowable Release Rate (Erosion Reduction) | Maximum Release Rate | Maximum Volume Required (Erosion Reduction) | Maximum Stored Volume Required |
|---|---|---|---|---|---|---|
| | l/s | l/s | l/s | l/s | cu.m. | cu.m. |
| AREA I (Uncontrolled flow off site) | - | - | - | 33.38 | - | - |
| AREA II (Roof) | - | - | - | 4.96 | - | 21.50 |
| AREA III | - | - | - | 1.89 | - | 89.60 |
| TOTAL (AREA I + III) | 93.31 | 26.86 | 1.26 | 35.28 | 99.39 | 111.11 |

## FIVE YEAR EVENT

| Drainage Area | Pre-development Flow Rate | Release Rate (Control to 2-Year C=0.40) | Maximum Allowable Release Rate (Erosion Reduction) | Maximum Release Rate | Maximum Volume Required (Erosion Reduction) | Maximum Stored Volume Required |
|---|---|---|---|---|---|---|
| | l/s | l/s | l/s | l/s | cu.m. | cu.m. |
| AREA I (Uncontrolled flow off site) | - | - | - | 16.99 | - | - |
| AREA II (Roof) | - | - | - | 3.77 | - | 9.47 |
| AREA III | - | - | - | 1.85 | - | 39.76 |
| TOTAL | 45.18 | 26.86 | 1.26 | 18.84 | 99.39 | 49.23 |

## TWO YEAR EVENT

| Drainage Area | Pre-development Flow Rate | Release Rate (Control to 2-Year C=0.40) | Maximum Allowable Release Rate (Erosion Reduction) | Maximum Release Rate | Maximum Volume Required (Erosion Reduction) | Maximum Stored Volume Required |
|---|---|---|---|---|---|---|
| | l/s | l/s | l/s | l/s | cu.m. | cu.m. |
| AREA I (Uncontrolled flow off site) | - | - | - | 12.52 | - | - |
| AREA II (Roof) | - | - | - | 3.31 | - | 6.37 |
| AREA IV | - | - | - | 1.84 | - | 27.17 |
| TOTAL | 33.33 | 26.86 | 1.26 | 14.36 | 99.39 | 33.55 |

7-Jun-17
16-Aug-17
REVISED 21-Dec-17

# 2887 Riverside Drive
# Ottawa, Ontario

# STORM WATER MANAGEMENT CALCULATIONS

# ONE HUNDRED YEAR EVENT

## Pre-development Conditions

| | | | C |
|---|---|---|---|
| Roof Area: | 313 | sq.m. | 1.00 |
| Asphalt/Concrete Area: | 1089 | sq.m. | 1.00 |
| Landscaped Area: | 1911 | sq.m. | 0.25 |
| Total Catchment Area | 3313 | sq.m. | 0.57 |

| | | |
|---|---|---|
| Area (A): | 3313 | sq.m. |
| Time of Concentration: | 10.0 | min. (see below - not less than 10 minutes) |
| Rainfall Intensity (i): | 179 | mm/hr (100 year event) |
| Runoff Coeficient (C): | 0.57 | see above |
| Flow Rate (2.78AiC): | 93.31 | l/s |

Time of Concentration:

Airport Formula

$$Tc = \frac{3.26\,(1.1 - C)\,(L)^{1/2}}{Sw^{0.33}} \quad \text{min}$$

| | | |
|---|---|---|
| Runoff Coefficient (C): | 0.57 | see above |
| Sheet Flow Distance (L): | 50 | m |
| Slope of Land (Sw): | 2.0 | % |
| Time of Concentration (Sheet Flow): | 9.8 | min |

## Maximum Allowable Release Rate

(Based on controling to a 2-year storm event using the lesser of C=0.40 or C-value of the pre-development Conditions and a calculated time of concentration not less than 10minutes)

| | | | C |
|---|---|---|---|
| Roof Area: | 313 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 1089 | sq.m. | 0.90 |
| Landscaped Area: | 1911 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.50 |

| | | |
|---|---|---|
| Area (A): | 3313 | sq.m. |
| Time of Concentration: | 11.1 | min. (see 2-year event - not less than 10 min.) |
| Rainfall Intensity (i): | 73 | mm/hr (2 year event) |
| Runoff Coeficient (C): | 0.40 | C= 0.40 or Pre-development Conditions (see above) |
| Maximum Allowable Release Rate (2.78AiC): | 26.86 | l/s |

## Maximum Allowable Release Rate

(Based on "substantial reduction in post-development erosive impulse as required by Sawmill Creek Subwatershed Study Appedix Table C-2 & Figure C-9)

Post Development Conditions

(Imperviousness Using Five-Year C-Values)

| | | | C |
|---|---|---|---|
| Roof Area: | 874 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 961 | sq.m. | 0.90 |
| Landscaped Area: | 1478 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.59 |

| | | | |
|---|---|---|---|
| 59% | Imperviousness: | 3.8 | l/s/hectare |
| | | 0.3313 | hectares |
| Maximum Permitted Release Rate: | | 1.26 | l/s |
| 59% | Imperviousness: | 300 | cu.m./hectare |
| | | 0.3313 | hectares |
| Minimum Storage Volume: | | 99.39 | cu.m. |

# DRAINAGE AREA I (Uncontrolled Flow Off Site):

(ONE HUNDRED YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 182 | sq.m. | 1.00 |
| Asphalt/Concrete Area: | 302 | sq.m. | 1.00 |
| Landscaped Areas: | 754 | sq.m. | 0.25 |
| Total Catchment Area | 1238 | sq.m. | 0.54 |

| | | |
|---|---|---|
| Area (A): | 1238 | sq.m. |
| Time of Concentration: | 10 | min. |
| Rainfall Intensity (i): | 179 | mm/hr (100 year event) |
| Runoff Coeficient (C): | 0.54 | |
| Flow Rate (2.78AiC): | 33.38 | l/s |

# DRAINAGE AREA II (Roof):

(ONE HUNDRED YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 662 | sq.m. | 1.00 |
| Paved Area: | 0 | sq.m. | 1.00 |
| Landscaped Areas: | 0 | sq.m. | 0.25 |
| Total Catchment Area | 662 | sq.m. | 1.00 |

No. of Roof Drains: 3

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 133 mm

Maximum Release Rate 4.96 l/s

Pond Area: 484 sq.m.

Achieved Vol: 21.50 cu.m.

Max. Vol. Required: 21.50 cu.m.

| Time | i | 2.78AiC | Release Rate | Stored Rate | Stored Volume |
|---|---|---|---|---|---|
| min. | mm/hr | l/s | l/s | l/s | cu.m. |
| 5 | 243 | 44.67 | 4.96 | 39.71 | 11.91 |
| 10 | 179 | 32.86 | 4.96 | 27.90 | 16.74 |
| 15 | 143 | 26.30 | 4.96 | 21.34 | 19.20 |
| 20 | 120 | 22.08 | 4.96 | 17.11 | 20.54 |
| 25 | 104 | 19.11 | 4.96 | 14.15 | 21.23 |
| 30 | 92 | 16.91 | 4.96 | 11.95 | 21.50 |
| 35 | 83 | 15.20 | 4.96 | 10.24 | 21.50 |
| 40 | 75 | 13.83 | 4.96 | 8.87 | 21.29 |
| 45 | 69 | 12.71 | 4.96 | 7.75 | 20.92 |
| 50 | 64 | 11.77 | 4.96 | 6.81 | 20.43 |
| 55 | 60 | 10.97 | 4.96 | 6.01 | 19.84 |
| 60 | 56 | 10.29 | 4.96 | 5.33 | 19.17 |
| 65 | 53 | 9.69 | 4.96 | 4.73 | 18.44 |
| 70 | 50 | 9.16 | 4.96 | 4.20 | 17.65 |
| 75 | 47 | 8.70 | 4.96 | 3.74 | 16.81 |
| 80 | 45 | 8.28 | 4.96 | 3.32 | 15.93 |
| 85 | 43 | 7.91 | 4.96 | 2.94 | 15.02 |
| 90 | 41 | 7.57 | 4.96 | 2.61 | 14.07 |
| 95 | 39 | 7.26 | 4.96 | 2.30 | 13.09 |
| 100 | 38 | 6.98 | 4.96 | 2.02 | 12.09 |
| 105 | 36 | 6.72 | 4.96 | 1.76 | 11.07 |
| 110 | 35 | 6.48 | 4.96 | 1.52 | 10.02 |
| 115 | 34 | 6.26 | 4.96 | 1.30 | 8.96 |
| 120 | 33 | 6.05 | 4.96 | 1.09 | 7.87 |
| 125 | 32 | 5.86 | 4.96 | 0.90 | 6.78 |
| 130 | 31 | 5.69 | 4.96 | 0.73 | 5.66 |
| 135 | 30 | 5.52 | 4.96 | 0.56 | 4.54 |
| 140 | 29 | 5.37 | 4.96 | 0.40 | 3.40 |
| 145 | 28 | 5.22 | 4.96 | 0.26 | 2.25 |
| 150 | 28 | 5.08 | 4.96 | 0.12 | 1.09 |
| 180 | 24 | 4.40 | 4.40 | 0.00 | 0.00 |
| 210 | 21 | 3.89 | 3.89 | 0.00 | 0.00 |
| 240 | 19 | 3.50 | 3.50 | 0.00 | 0.00 |
| 270 | 17 | 3.18 | 3.18 | 0.00 | 0.00 |
| 300 | 16 | 2.92 | 2.92 | 0.00 | 0.00 |
| 330 | 15 | 2.71 | 2.71 | 0.00 | 0.00 |
| 360 | 14 | 2.53 | 2.53 | 0.00 | 0.00 |
| 390 | 13 | 2.37 | 2.37 | 0.00 | 0.00 |
| 420 | 12 | 2.23 | 2.23 | 0.00 | 0.00 |
| 450 | 11 | 2.11 | 2.11 | 0.00 | 0.00 |
| 480 | 11 | 2.00 | 2.00 | 0.00 | 0.00 |
| 510 | 10 | 1.91 | 1.91 | 0.00 | 0.00 |
| 540 | 10 | 1.82 | 1.82 | 0.00 | 0.00 |
| 570 | 9 | 1.74 | 1.74 | 0.00 | 0.00 |
| 600 | 9 | 1.67 | 1.67 | 0.00 | 0.00 |

# DRAINAGE AREA III

(ONE HUNDRED YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 30 | sq.m. | 1.00 |
| Asphalt/Concrete Area: | 659 | sq.m. | 1.00 |
| Landscaped Areas: | 724 | sq.m. | 0.25 |
| Total Catchment Area | 1413 | sq.m. | 0.62 |

| | | |
|---|---|---|
| Water Elevation: | 82.02 | m |
| Invert of Outlet Pipe MH-2: | 79.81 | m |
| Head: | 2.21 | m |
| Orifice Diameter | 40 | mm |
| Orifice Area: | 1257 | sq.mm. |
| Coefficient of Discharge: | 0.229 | |
| Maximum Orifice Release Rate: | 1.89 | l/s |

Surface Storage Above Catch Basin

| | Area sq.m. | Depth m | | |
|---|---|---|---|---|
| CB-4 | 139 | 0.15 | 6.95 | cu.m. |
| CB/MH-3 | 238 | 0.15 | 11.90 | cu.m. |
| CB/MH-2 | 115 | 0.15 | 5.75 | cu.m. |
| CB-5 | 335 | 0.60 | 65.00 | cu.m. |
| Volume achieved | | | 89.60 | cu.m. |
| Max. Vol. Required (see below): | | | 89.60 | cu.m. |

| Time min. | i mm/hr | 2.78AiC l/s | Roof Release Rate l/s | Total Inflow l/s | Release Rate l/s | Stored Rate l/s | Stored Volume cu.m. |
|---|---|---|---|---|---|---|---|
| 5 | 243 | 58.70 | 4.96 | 63.66 | 1.89 | 61.77 | 18.53 |
| 10 | 179 | 43.19 | 4.96 | 48.15 | 1.89 | 46.25 | 27.75 |
| 15 | 143 | 34.56 | 4.96 | 39.52 | 1.89 | 37.63 | 33.86 |
| 20 | 120 | 29.01 | 4.96 | 33.97 | 1.89 | 32.08 | 38.49 |
| 25 | 104 | 25.12 | 4.96 | 30.08 | 1.89 | 28.18 | 42.27 |
| 30 | 92 | 22.22 | 4.96 | 27.18 | 1.89 | 25.29 | 45.51 |
| 35 | 83 | 19.97 | 4.96 | 24.93 | 1.89 | 23.04 | 48.38 |
| 40 | 75 | 18.17 | 4.96 | 23.13 | 1.89 | 21.24 | 50.98 |
| 45 | 69 | 16.70 | 4.96 | 21.66 | 1.89 | 19.77 | 53.37 |
| 50 | 64 | 15.47 | 4.96 | 20.43 | 1.89 | 18.53 | 55.60 |
| 55 | 60 | 14.42 | 4.96 | 19.38 | 1.89 | 17.49 | 57.71 |
| 60 | 56 | 13.52 | 4.96 | 18.48 | 1.89 | 16.58 | 59.71 |
| 65 | 53 | 12.73 | 4.96 | 17.69 | 1.89 | 15.80 | 61.62 |
| 70 | 50 | 12.04 | 4.96 | 17.00 | 1.89 | 15.11 | 63.45 |
| 75 | 47 | 11.43 | 4.96 | 16.39 | 1.89 | 14.50 | 65.23 |
| 80 | 45 | 10.88 | 4.96 | 15.84 | 1.89 | 13.95 | 66.95 |
| 85 | 43 | 10.39 | 4.96 | 15.35 | 1.89 | 13.45 | 68.62 |
| 90 | 41 | 9.94 | 4.96 | 14.90 | 1.89 | 13.01 | 70.25 |
| 95 | 39 | 9.54 | 4.96 | 14.50 | 1.89 | 12.60 | 71.84 |
| 100 | 38 | 9.17 | 4.96 | 14.13 | 1.89 | 12.23 | 73.40 |
| 105 | 36 | 8.83 | 4.96 | 13.79 | 1.89 | 11.89 | 74.93 |
| 110 | 35 | 8.51 | 4.96 | 13.47 | 1.89 | 11.58 | 76.43 |
| 115 | 34 | 8.22 | 4.96 | 13.18 | 1.89 | 11.29 | 77.91 |
| 120 | 33 | 7.96 | 4.96 | 12.92 | 1.89 | 11.02 | 79.36 |
| 125 | 32 | 7.71 | 4.96 | 12.67 | 1.89 | 10.77 | 80.79 |
| 130 | 31 | 7.47 | 4.96 | 12.43 | 1.89 | 10.54 | 82.21 |
| 135 | 30 | 7.26 | 4.96 | 12.22 | 1.89 | 10.32 | 83.60 |
| 140 | 29 | 7.05 | 4.96 | 12.01 | 1.89 | 10.12 | 84.98 |
| 145 | 28 | 6.86 | 4.96 | 11.82 | 1.89 | 9.92 | 86.35 |
| 150 | 28 | 6.68 | 4.96 | 11.64 | 1.89 | 9.74 | 87.70 |
| 180 | 24 | 5.78 | 4.40 | 10.18 | 1.89 | 8.29 | 89.49 |
| 210 | 21 | 5.11 | 3.89 | 9.01 | 1.89 | 7.11 | 89.60 |
| 240 | 19 | 4.60 | 3.50 | 8.09 | 1.89 | 6.20 | 89.29 |
| 270 | 17 | 4.18 | 3.18 | 7.37 | 1.89 | 5.47 | 88.64 |
| 300 | 16 | 3.84 | 2.92 | 6.77 | 1.89 | 4.87 | 87.73 |
| 330 | 15 | 3.56 | 2.71 | 6.27 | 1.89 | 4.37 | 86.61 |
| 360 | 14 | 3.32 | 2.53 | 5.84 | 1.89 | 3.95 | 85.32 |
| 390 | 13 | 3.11 | 2.37 | 5.48 | 1.89 | 3.58 | 83.87 |
| 420 | 12 | 2.93 | 2.23 | 5.16 | 1.89 | 3.27 | 82.30 |
| 450 | 11 | 2.77 | 2.11 | 4.88 | 1.89 | 2.99 | 80.62 |
| 480 | 11 | 2.63 | 2.00 | 4.63 | 1.89 | 2.74 | 78.84 |
| 510 | 10 | 2.50 | 1.91 | 4.41 | 1.89 | 2.52 | 76.97 |
| 540 | 10 | 2.39 | 1.82 | 4.21 | 1.89 | 2.32 | 75.03 |
| 570 | 9 | 2.29 | 1.74 | 4.03 | 1.89 | 2.14 | 73.02 |
| 600 | 9 | 2.19 | 1.67 | 3.86 | 1.89 | 1.97 | 70.95 |

# FIVE YEAR EVENT

## Pre-development Conditions

| | | | C |
|---|---|---|---|
| Roof Area: | 313 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 1089 | sq.m. | 0.90 |
| Landscaped Area: | 1911 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.50 |

| | | |
|---|---|---|
| Area (A): | 3313 | sq.m. |
| Time of Concentration: | 11.1 | min. (see below - not less than 10 minutes) |
| Rainfall Intensity (i): | 99 | mm/hr (5 year event) |
| Runoff Coeficient (C): | 0.50 | see above |
| Flow Rate (2.78AiC): | 45.18 | l/s |

Time of Concentration:

Airport Formula

$$Tc = \frac{3.26\,(1.1 - C)\,(L)^{1/2}}{Sw^{0.33}} \quad \text{min}$$

| | | |
|---|---|---|
| Runoff Coefficient (C): | 0.50 | see above |
| Sheet Flow Distance (L): | 50 | m |
| Slope of Land (Sw): | 2.0 | % |
| Time of Concentration (Sheet Flow): | 11.1 | min |

## Maximum Allowable Release Rate

(Based on controling to a 2-year storm event using the lesser of C=0.40 or C-value of the pre-development Conditions and a calculated time of concentration not less than 10minutes)

| | | | C |
|---|---|---|---|
| Roof Area: | 313 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 1089 | sq.m. | 0.90 |
| Landscaped Area: | 1911 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.50 |

| | | |
|---|---|---|
| Area (A): | 3313 | sq.m. |
| Time of Concentration: | 11.1 | min. (see above - not less than 10 min.) |
| Rainfall Intensity (i): | 73 | mm/hr (2 year event) |
| Runoff Coeficient (C): | 0.40 | C= 0.40 or Pre-development Conditions (see above) |
| Maximum Permitted Release Rate (2.78AiC): | 26.86 | l/s |

## Maximum Allowable Release Rate

(Based on "substantial reduction in post-development erosive impulse as required by Sawmill Creek Subwatershed Study Appedix Table C-2 & Figure C-9)

Post Development Conditions

(Imperviousness Using Five-Year C-Values)

| | | | C |
|---|---|---|---|
| Roof Area: | 874 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 961 | sq.m. | 0.90 |
| Landscaped Area: | 1478 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.59 |

| | | | |
|---|---|---|---|
| 59% | Imperviousness: | 3.8 | l/s/hectare |
| | | 0.3313 | hectares |
| Maximum Permitted Release Rate: | | 1.26 | l/s |
| 59% | Imperviousness: | 300 | cu.m./hectare |
| | | 0.3313 | hectares |
| Minimum Storage Volume: | | 99.39 | cu.m. |

# DRAINAGE AREA I (Uncontrolled Flow Off Site):

(FIVE YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 182 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 302 | sq.m. | 0.90 |
| Landscaped Areas: | 754 | sq.m. | 0.20 |
| Total Catchment Area | 1238 | sq.m. | 0.47 |

| | | |
|---|---|---|
| Area (A): | 1238 | sq.m. |
| Time of Concentration: | 10 | min. |
| Rainfall Intensity (i): | 104 | mm/hr (5 year event) |
| Runoff Coeficient (C): | 0.47 | |
| Flow Rate (2.78AiC): | 16.99 | l/s |

# DRAINAGE AREA II (Roof):

(FIVE YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 662 | sq.m. | 0.90 |
| Paved Area: | 0 | sq.m. | 0.90 |
| Landscaped Areas: | 0 | sq.m. | 0.20 |
| Total Catchment Area | 662 | sq.m. | 0.90 |

No. of Roof Drains: 3

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 101 mm

Maximum Release Rate 3.77 l/s

Pond Area: 280 sq.m.

Achieved Vol: 9.47 cu.m.

Max. Vol. Required: 9.47 cu.m.

| Time | i | 2.78AiC | Release Rate | Stored Rate | Stored Volume |
|---|---|---|---|---|---|
| min. | mm/hr | l/s | l/s | l/s | cu.m. |
| 5 | 141 | 23.38 | 3.77 | 19.61 | 5.88 |
| 10 | 104 | 17.26 | 3.77 | 13.48 | 8.09 |
| 15 | 84 | 13.84 | 3.77 | 10.07 | 9.06 |
| 20 | 70 | 11.64 | 3.77 | 7.86 | 9.43 |
| 25 | 61 | 10.09 | 3.77 | 6.31 | 9.47 |
| 30 | 54 | 8.93 | 3.77 | 5.16 | 9.28 |
| 35 | 49 | 8.04 | 3.77 | 4.26 | 8.95 |
| 40 | 44 | 7.32 | 3.77 | 3.54 | 8.51 |
| 45 | 41 | 6.73 | 3.77 | 2.96 | 7.98 |
| 50 | 38 | 6.24 | 3.77 | 2.46 | 7.39 |
| 55 | 35 | 5.82 | 3.77 | 2.04 | 6.74 |
| 60 | 33 | 5.46 | 3.77 | 1.68 | 6.06 |
| 65 | 31 | 5.14 | 3.77 | 1.37 | 5.33 |
| 70 | 29 | 4.86 | 3.77 | 1.09 | 4.58 |
| 75 | 28 | 4.62 | 3.77 | 0.85 | 3.80 |
| 80 | 27 | 4.40 | 3.77 | 0.63 | 3.00 |
| 85 | 25 | 4.20 | 3.77 | 0.43 | 2.18 |
| 90 | 24 | 4.02 | 3.77 | 0.25 | 1.34 |
| 95 | 23 | 3.86 | 3.77 | 0.09 | 0.49 |
| 100 | 22 | 3.71 | 3.71 | 0.00 | 0.00 |
| 105 | 22 | 3.57 | 3.57 | 0.00 | 0.00 |
| 110 | 21 | 3.45 | 3.45 | 0.00 | 0.00 |
| 115 | 20 | 3.33 | 3.33 | 0.00 | 0.00 |
| 120 | 19 | 3.22 | 3.22 | 0.00 | 0.00 |
| 125 | 19 | 3.12 | 3.12 | 0.00 | 0.00 |
| 130 | 18 | 3.03 | 3.03 | 0.00 | 0.00 |
| 135 | 18 | 2.94 | 2.94 | 0.00 | 0.00 |
| 140 | 17 | 2.86 | 2.86 | 0.00 | 0.00 |
| 145 | 17 | 2.78 | 2.78 | 0.00 | 0.00 |
| 150 | 16 | 2.71 | 2.71 | 0.00 | 0.00 |
| 180 | 14 | 2.35 | 2.35 | 0.00 | 0.00 |
| 210 | 13 | 2.08 | 2.08 | 0.00 | 0.00 |
| 240 | 11 | 1.87 | 1.87 | 0.00 | 0.00 |
| 270 | 10 | 1.70 | 1.70 | 0.00 | 0.00 |
| 300 | 9 | 1.57 | 1.57 | 0.00 | 0.00 |
| 330 | 9 | 1.45 | 1.45 | 0.00 | 0.00 |
| 360 | 8 | 1.35 | 1.35 | 0.00 | 0.00 |
| 390 | 8 | 1.27 | 1.27 | 0.00 | 0.00 |
| 420 | 7 | 1.20 | 1.20 | 0.00 | 0.00 |
| 450 | 7 | 1.13 | 1.13 | 0.00 | 0.00 |
| 480 | 6 | 1.07 | 1.07 | 0.00 | 0.00 |
| 510 | 6 | 1.02 | 1.02 | 0.00 | 0.00 |
| 540 | 6 | 0.98 | 0.98 | 0.00 | 0.00 |
| 570 | 6 | 0.94 | 0.94 | 0.00 | 0.00 |
| 600 | 5 | 0.90 | 0.90 | 0.00 | 0.00 |

# DRAINAGE AREA III

(FIVE YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 30 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 659 | sq.m. | 0.90 |
| Landscaped Areas: | 724 | sq.m. | 0.20 |
| Total Catchment Area | 1413 | sq.m. | 0.54 |

Water Elevation: 81.93 m

Invert of Outlet Pipe MH-2: 79.81 m

Head: 2.12 m

Orifice Diameter 40 mm

Orifice Area: 1257 sq.mm.

Coefficient of Discharge: 0.229

Maximum Orifice Release Rate: 1.85 l/s

Surface Storage Above Catch Basin

| | Area sq.m. | Depth m | | |
|---|---|---|---|---|
| CB-4 | 20 | 0.06 | 0.37 | cu.m. |
| CB/MH-3 | 33 | 0.06 | 4.46 | cu.m. |
| CB/MH-2 | 16 | 0.06 | 0.30 | cu.m. |
| CB-5 | 314 | 0.51 | 34.63 | cu.m. |
| Volume achieved | | | 39.76 | cu.m. |

Max. Vol. Required (see below): 39.76 cu.m.

| Time min. | i mm/hr | 2.78AiC l/s | Roof Release Rate l/s | Total Inflow l/s | Release Rate l/s | Stored Rate l/s | Stored Volume cu.m. |
|---|---|---|---|---|---|---|---|
| 5 | 141 | 30.02 | 3.77 | 33.79 | 1.85 | 31.94 | 9.58 |
| 10 | 104 | 22.16 | 3.77 | 25.93 | 1.85 | 24.08 | 14.45 |
| 15 | 84 | 17.77 | 3.77 | 21.54 | 1.85 | 19.69 | 17.72 |
| 20 | 70 | 14.94 | 3.77 | 18.71 | 1.85 | 16.86 | 20.23 |
| 25 | 61 | 12.95 | 3.77 | 16.72 | 1.85 | 14.87 | 22.30 |
| 30 | 54 | 11.47 | 3.77 | 15.24 | 1.85 | 13.39 | 24.10 |
| 35 | 49 | 10.32 | 3.77 | 14.09 | 1.85 | 12.24 | 25.70 |
| 40 | 44 | 9.40 | 3.77 | 13.17 | 1.85 | 11.32 | 27.16 |
| 45 | 41 | 8.64 | 3.77 | 12.41 | 1.85 | 10.56 | 28.51 |
| 50 | 38 | 8.01 | 3.77 | 11.78 | 1.85 | 9.93 | 29.78 |
| 55 | 35 | 7.47 | 3.77 | 11.24 | 1.85 | 9.39 | 30.98 |
| 60 | 33 | 7.01 | 3.77 | 10.78 | 1.85 | 8.93 | 32.13 |
| 65 | 31 | 6.60 | 3.77 | 10.38 | 1.85 | 8.52 | 33.23 |
| 70 | 29 | 6.25 | 3.77 | 10.02 | 1.85 | 8.17 | 34.30 |
| 75 | 28 | 5.93 | 3.77 | 9.70 | 1.85 | 7.85 | 35.33 |
| 80 | 27 | 5.65 | 3.77 | 9.42 | 1.85 | 7.57 | 36.33 |
| 85 | 25 | 5.39 | 3.77 | 9.17 | 1.85 | 7.31 | 37.31 |
| 90 | 24 | 5.16 | 3.77 | 8.94 | 1.85 | 7.09 | 38.26 |
| 95 | 23 | 4.96 | 3.77 | 8.73 | 1.85 | 6.88 | 39.19 |
| 100 | 22 | 4.76 | 3.71 | 8.48 | 1.85 | 6.62 | 39.74 |
| 105 | 22 | 4.59 | 3.57 | 8.16 | 1.85 | 6.31 | 39.76 |
| 110 | 21 | 4.43 | 3.45 | 7.88 | 1.85 | 6.02 | 39.75 |
| 115 | 20 | 4.28 | 3.33 | 7.61 | 1.85 | 5.76 | 39.73 |
| 120 | 19 | 4.14 | 3.22 | 7.36 | 1.85 | 5.51 | 39.68 |
| 125 | 19 | 4.01 | 3.12 | 7.13 | 1.85 | 5.28 | 39.61 |
| 130 | 18 | 3.89 | 3.03 | 6.92 | 1.85 | 5.07 | 39.52 |
| 135 | 18 | 3.78 | 2.94 | 6.72 | 1.85 | 4.87 | 39.42 |
| 140 | 17 | 3.67 | 2.86 | 6.53 | 1.85 | 4.68 | 39.30 |
| 145 | 17 | 3.57 | 2.78 | 6.36 | 1.85 | 4.50 | 39.17 |
| 150 | 16 | 3.48 | 2.71 | 6.19 | 1.85 | 4.34 | 39.02 |
| 180 | 14 | 3.02 | 2.35 | 5.36 | 1.85 | 3.51 | 37.91 |
| 210 | 13 | 2.67 | 2.08 | 4.75 | 1.85 | 2.90 | 36.49 |
| 240 | 11 | 2.40 | 1.87 | 4.27 | 1.85 | 2.42 | 34.83 |
| 270 | 10 | 2.19 | 1.70 | 3.89 | 1.85 | 2.04 | 33.00 |
| 300 | 9 | 2.01 | 1.57 | 3.58 | 1.85 | 1.72 | 31.02 |
| 330 | 9 | 1.86 | 1.45 | 3.31 | 1.85 | 1.46 | 28.94 |
| 360 | 8 | 1.74 | 1.35 | 3.09 | 1.85 | 1.24 | 26.75 |
| 390 | 8 | 1.63 | 1.27 | 2.90 | 1.85 | 1.05 | 24.49 |
| 420 | 7 | 1.54 | 1.20 | 2.73 | 1.85 | 0.88 | 22.16 |
| 450 | 7 | 1.45 | 1.13 | 2.59 | 1.85 | 0.73 | 19.76 |
| 480 | 6 | 1.38 | 1.07 | 2.45 | 1.85 | 0.60 | 17.32 |
| 510 | 6 | 1.31 | 1.02 | 2.34 | 1.85 | 0.48 | 14.82 |
| 540 | 6 | 1.26 | 0.98 | 2.23 | 1.85 | 0.38 | 12.29 |
| 570 | 6 | 1.20 | 0.94 | 2.14 | 1.85 | 0.28 | 9.72 |
| 600 | 5 | 1.15 | 0.90 | 2.05 | 1.85 | 0.20 | 7.12 |

# TWO YEAR EVENT

## Pre-development Conditions

| | | | C |
|---|---|---|---|
| Roof Area: | 313 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 1089 | sq.m. | 0.90 |
| Landscaped Area: | 1911 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.50 |

| | | |
|---|---|---|
| Area (A): | 3313 | sq.m. |
| Time of Concentration: | 11.1 | min. (see below - not less than 10 minutes) |
| Rainfall Intensity (i): | 73 | mm/hr (2 year event) |
| Runoff Coeficient (C): | 0.50 | see above |
| Flow Rate (2.78AiC): | 33.33 | l/s |

Time of Concentration: (Sheet Flow to Bank St.)

Airport Formula

$$Tc = \frac{3.26\,(1.1 - C)\,(L)^{1/2}}{Sw^{0.33}} \quad \text{min}$$

| | | |
|---|---|---|
| Runoff Coefficient (C): | 0.50 | see above |
| Sheet Flow Distance (L): | 50 | m |
| Slope of Land (Sw): | 2.0 | % |
| Time of Concentration (Sheet Flow): | 11.1 | min |

## Maximum Allowable Release Rate

(Based on controling to a 2-year storm event using the lesser of C=0.40 or C-value of the pre-development Conditions and a calculated time of concentration not less than 10minutes)

| | | | C |
|---|---|---|---|
| Roof Area: | 313 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 1089 | sq.m. | 0.90 |
| Landscaped Area: | 1911 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.50 |

| | | |
|---|---|---|
| Area (A): | 3313 | sq.m. |
| Time of Concentration: | 11.1 | min. (see above - not less than 10 min.) |
| Rainfall Intensity (i): | 73 | mm/hr (2 year event) |
| Runoff Coeficient (C): | 0.40 | C= 0.40 or Pre-development Conditions (see above) |
| Maximum Permitted Release Rate (2.78AiC): | 26.86 | l/s |

## Maximum Allowable Release Rate

(Based on "substantial reduction in post-development erosive impulse as required by Sawmill Creek Subwatershed Study Appedix Table C-2 & Figure C-9)

Post Development Conditions

(Imperviousness Using Five-Year C-Values)

| | | | C |
|---|---|---|---|
| Roof Area: | 874 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 961 | sq.m. | 0.90 |
| Landscaped Area: | 1478 | sq.m. | 0.20 |
| Total Catchment Area | 3313 | sq.m. | 0.59 |

| | | | |
|---|---|---|---|
| 59% | Imperviousness: | 3.8 | l/s/hectare |
| | | 0.3313 | hectares |
| Maximum Permitted Release Rate: | | 1.26 | l/s |
| 59% | Imperviousness: | 300 | cu.m./hectare |
| | | 0.3313 | hectares |
| Minimum Storage Volume: | | 99.39 | cu.m. |

# DRAINAGE AREA I (Uncontrolled Flow Off Site):

(TWO YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 182 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 302 | sq.m. | 0.90 |
| Landscaped Areas: | 754 | sq.m. | 0.20 |
| Total Catchment Area | 1238 | sq.m. | 0.47 |

| | | |
|---|---|---|
| Area (A): | 1238 | sq.m. |
| Time of Concentration: | 10 | min. |
| Rainfall Intensity (i): | 77 | mm/hr (2 year event) |
| Runoff Coeficient (C): | 0.47 | |
| Flow Rate (2.78AiC): | 12.52 | l/s |

# DRAINAGE AREA II (Roof):

(TWO YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 662 | sq.m. | 0.90 |
| Paved Area: | 0 | sq.m. | 0.90 |
| Landscaped Areas: | 0 | sq.m. | 0.20 |
| Total Catchment Area | 662 | sq.m. | 0.90 |

No. of Roof Drains: 3

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 89 mm

Maximum Release Rate 3.31 l/s

Pond Area: 215 sq.m.

Achieved Vol: 6.37 cu.m.

Max. Vol. Required: 6.37 cu.m.

| Time | i | 2.78AiC | Release Rate | Stored Rate | Stored Volume |
|---|---|---|---|---|---|
| min. | mm/hr | l/s | l/s | l/s | cu.m. |
| 5 | 104 | 17.15 | 3.31 | 13.85 | 4.15 |
| 10 | 77 | 12.72 | 3.31 | 9.41 | 5.65 |
| 15 | 62 | 10.23 | 3.31 | 6.92 | 6.23 |
| 20 | 52 | 8.62 | 3.31 | 5.31 | 6.37 |
| 25 | 45 | 7.48 | 3.31 | 4.17 | 6.26 |
| 30 | 40 | 6.63 | 3.31 | 3.33 | 5.99 |
| 35 | 36 | 5.97 | 3.31 | 2.67 | 5.60 |
| 40 | 33 | 5.44 | 3.31 | 2.14 | 5.13 |
| 45 | 30 | 5.01 | 3.31 | 1.70 | 4.59 |
| 50 | 28 | 4.64 | 3.31 | 1.34 | 4.01 |
| 55 | 26 | 4.33 | 3.31 | 1.03 | 3.39 |
| 60 | 25 | 4.07 | 3.31 | 0.76 | 2.74 |
| 65 | 23 | 3.83 | 3.31 | 0.53 | 2.06 |
| 70 | 22 | 3.63 | 3.31 | 0.32 | 1.35 |
| 75 | 21 | 3.45 | 3.31 | 0.14 | 0.63 |
| 80 | 20 | 3.28 | 3.28 | 0.00 | 0.00 |
| 85 | 19 | 3.14 | 3.14 | 0.00 | 0.00 |
| 90 | 18 | 3.01 | 3.01 | 0.00 | 0.00 |
| 95 | 17 | 2.88 | 2.88 | 0.00 | 0.00 |
| 100 | 17 | 2.77 | 2.77 | 0.00 | 0.00 |
| 105 | 16 | 2.67 | 2.67 | 0.00 | 0.00 |
| 110 | 16 | 2.58 | 2.58 | 0.00 | 0.00 |
| 115 | 15 | 2.49 | 2.49 | 0.00 | 0.00 |
| 120 | 15 | 2.41 | 2.41 | 0.00 | 0.00 |
| 125 | 14 | 2.34 | 2.34 | 0.00 | 0.00 |
| 130 | 14 | 2.27 | 2.27 | 0.00 | 0.00 |
| 135 | 13 | 2.20 | 2.20 | 0.00 | 0.00 |
| 140 | 13 | 2.14 | 2.14 | 0.00 | 0.00 |
| 145 | 13 | 2.08 | 2.08 | 0.00 | 0.00 |
| 150 | 12 | 2.03 | 2.03 | 0.00 | 0.00 |
| 180 | 11 | 1.76 | 1.76 | 0.00 | 0.00 |
| 210 | 9 | 1.56 | 1.56 | 0.00 | 0.00 |
| 240 | 8 | 1.40 | 1.40 | 0.00 | 0.00 |
| 270 | 8 | 1.28 | 1.28 | 0.00 | 0.00 |
| 300 | 7 | 1.18 | 1.18 | 0.00 | 0.00 |
| 330 | 7 | 1.09 | 1.09 | 0.00 | 0.00 |
| 360 | 6 | 1.02 | 1.02 | 0.00 | 0.00 |
| 390 | 6 | 0.95 | 0.95 | 0.00 | 0.00 |
| 420 | 5 | 0.90 | 0.90 | 0.00 | 0.00 |
| 450 | 5 | 0.85 | 0.85 | 0.00 | 0.00 |
| 480 | 5 | 0.81 | 0.81 | 0.00 | 0.00 |
| 510 | 5 | 0.77 | 0.77 | 0.00 | 0.00 |
| 540 | 4 | 0.74 | 0.74 | 0.00 | 0.00 |
| 570 | 4 | 0.70 | 0.70 | 0.00 | 0.00 |
| 600 | 4 | 0.68 | 0.68 | 0.00 | 0.00 |

# DRAINAGE AREA III

(TWO YEAR EVENT)

| | | | C |
|---|---|---|---|
| Roof Area: | 30 | sq.m. | 0.90 |
| Asphalt/Concrete Area: | 659 | sq.m. | 0.90 |
| Landscaped Areas: | 724 | sq.m. | 0.20 |
| Total Catchment Area | 1413 | sq.m. | 0.54 |

Water Elevation: 81.90 m

Invert of Outlet Pipe MH-2: 79.81 m

Head: 2.09 m

Orifice Diameter 40 mm

Orifice Area: 1257 sq.mm.

Coefficient of Discharge: 0.229

Maximum Orifice Release Rate: 1.84 l/s

Surface Storage Above Catch Basin

| | Area sq.m. | Depth m | | |
|---|---|---|---|---|
| CB-4 | 4 | 0.03 | 0.03 | cu.m. |
| CB/MH-3 | 7 | 0.03 | 2.03 | cu.m. |
| CB/MH-2 | 3 | 0.03 | 0.03 | cu.m. |
| CB-5 | 308 | 0.21 | 25.08 | cu.m. |
| | | Volume achieved | 27.17 | cu.m. |

Max. Vol. Required (see below): 27.17 cu.m.

| Time min. | i mm/hr | 2.78AiC l/s | Roof Release Rate l/s | Total Inflow l/s | Release Rate l/s | Stored Rate l/s | Stored Volume cu.m. |
|---|---|---|---|---|---|---|---|
| 5 | 104 | 22.02 | 3.31 | 25.33 | 1.84 | 23.49 | 7.05 |
| 10 | 77 | 16.33 | 3.31 | 19.64 | 1.84 | 17.80 | 10.68 |
| 15 | 62 | 13.13 | 3.31 | 16.44 | 1.84 | 14.60 | 13.14 |
| 20 | 52 | 11.06 | 3.31 | 14.37 | 1.84 | 12.53 | 15.04 |
| 25 | 45 | 9.60 | 3.31 | 12.91 | 1.84 | 11.07 | 16.61 |
| 30 | 40 | 8.51 | 3.31 | 11.82 | 1.84 | 9.98 | 17.97 |
| 35 | 36 | 7.67 | 3.31 | 10.98 | 1.84 | 9.14 | 19.18 |
| 40 | 33 | 6.99 | 3.31 | 10.30 | 1.84 | 8.46 | 20.29 |
| 45 | 30 | 6.43 | 3.31 | 9.74 | 1.84 | 7.90 | 21.32 |
| 50 | 28 | 5.96 | 3.31 | 9.27 | 1.84 | 7.43 | 22.29 |
| 55 | 26 | 5.56 | 3.31 | 8.87 | 1.84 | 7.03 | 23.21 |
| 60 | 25 | 5.22 | 3.31 | 8.53 | 1.84 | 6.69 | 24.08 |
| 65 | 23 | 4.92 | 3.31 | 8.23 | 1.84 | 6.39 | 24.92 |
| 70 | 22 | 4.66 | 3.31 | 7.97 | 1.84 | 6.13 | 25.73 |
| 75 | 21 | 4.43 | 3.31 | 7.73 | 1.84 | 5.89 | 26.52 |
| 80 | 20 | 4.22 | 3.28 | 7.50 | 1.84 | 5.66 | 27.17 |
| 85 | 19 | 4.03 | 3.14 | 7.17 | 1.84 | 5.33 | 27.16 |
| 90 | 18 | 3.86 | 3.01 | 6.86 | 1.84 | 5.02 | 27.12 |
| 95 | 17 | 3.70 | 2.88 | 6.59 | 1.84 | 4.75 | 27.06 |
| 100 | 17 | 3.56 | 2.77 | 6.33 | 1.84 | 4.49 | 26.97 |
| 105 | 16 | 3.43 | 2.67 | 6.10 | 1.84 | 4.26 | 26.86 |
| 110 | 16 | 3.31 | 2.58 | 5.89 | 1.84 | 4.05 | 26.73 |
| 115 | 15 | 3.20 | 2.49 | 5.69 | 1.84 | 3.85 | 26.58 |
| 120 | 15 | 3.10 | 2.41 | 5.51 | 1.84 | 3.67 | 26.41 |
| 125 | 14 | 3.00 | 2.34 | 5.34 | 1.84 | 3.50 | 26.23 |
| 130 | 14 | 2.91 | 2.27 | 5.18 | 1.84 | 3.34 | 26.04 |
| 135 | 13 | 2.83 | 2.20 | 5.03 | 1.84 | 3.19 | 25.83 |
| 140 | 13 | 2.75 | 2.14 | 4.89 | 1.84 | 3.05 | 25.62 |
| 145 | 13 | 2.67 | 2.08 | 4.76 | 1.84 | 2.92 | 25.39 |
| 150 | 12 | 2.61 | 2.03 | 4.63 | 1.84 | 2.79 | 25.15 |
| 180 | 11 | 2.26 | 1.76 | 4.02 | 1.84 | 2.18 | 23.54 |
| 210 | 9 | 2.00 | 1.56 | 3.56 | 1.84 | 1.72 | 21.69 |
| 240 | 8 | 1.80 | 1.40 | 3.21 | 1.84 | 1.37 | 19.67 |
| 270 | 8 | 1.64 | 1.28 | 2.92 | 1.84 | 1.08 | 17.51 |
| 300 | 7 | 1.51 | 1.18 | 2.69 | 1.84 | 0.85 | 15.24 |
| 330 | 7 | 1.40 | 1.09 | 2.49 | 1.84 | 0.65 | 12.89 |
| 360 | 6 | 1.31 | 1.02 | 2.32 | 1.84 | 0.48 | 10.46 |
| 390 | 6 | 1.23 | 0.95 | 2.18 | 1.84 | 0.34 | 7.97 |
| 420 | 5 | 1.16 | 0.90 | 2.06 | 1.84 | 0.22 | 5.43 |
| 450 | 5 | 1.09 | 0.85 | 1.95 | 1.84 | 0.11 | 2.84 |
| 480 | 5 | 1.04 | 0.81 | 1.85 | 1.84 | 0.01 | 0.21 |
| 510 | 5 | 0.99 | 0.77 | 1.76 | 1.76 | 0.00 | 0.00 |
| 540 | 4 | 0.95 | 0.74 | 1.68 | 1.68 | 0.00 | 0.00 |
| 570 | 4 | 0.91 | 0.70 | 1.61 | 1.61 | 0.00 | 0.00 |
| 600 | 4 | 0.87 | 0.68 | 1.55 | 1.55 | 0.00 | 0.00 |

# D.B. GRAY ENGINEERING INC.

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
dbgray@rogers.com

STORM SEWER COMPUTATION FORM

RATIONAL METHOD Q = 2.78 A I R FIVE YEAR EVENT

n = 0.013

PROJECT: 2887 Riverside Dr.

Designed By: DBG

Date: ########

Page: 1 of 1

| LOCATION | | | AREA (ha) | | | | Individual 2.78 A R | Accum. 2.78 A R | Time of Conc. (min) | Rainfall Intensity I (mm/hr) | Peak Flow Q (l/s) | SEWER DATA | | | | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hard Surface | Gravel | Grass / Landscape | Roof | | | | | | | | | | | | | | | |
| STREET | FROM | TO | R = 0.90 | R = 0.70 | R = 0.20 | R = 0.90 | | | | | | Type of Pipe | Dia. Actual (mm) | Dia. Nom. (mm) | Slope (%) | Length (m) | Capacity (l/s) | Velocity (m/s) | Time of Flow (min) | Ratio Q/Qfull | |
| | CB-4 | CB/MH-3 | 0.0066 | | | 0.0642 | 0.177 | 0.177 | 10.00 | 104.2 | 18.5 | PVC SDR 35 | 203.4 | 200 | 0.58 | 16.8 | 26.1 | 0.80 | 0.35 | 0.71 | |
| | | | | | | | | | | | 5.5 | PVC SDR 35 | 203.4 | 200 | 0.58 | 16.8 | 26.1 | 0.80 | 0.35 | 0.21 | FLOW THROUGH FLOW CONTROL ROOF DRAINS |
| | CB-5 | CB/MH-3 | 0.0134 | | 0.0724 | 0.0018 | 0.078 | 0.078 | 10.00 | 104.2 | 8.2 | PVC SDR 35 | 203.4 | 200 | 0.58 | 8.2 | 26.1 | 0.80 | 0.17 | 0.31 | |
| | CB/MH-3 | CB/MH-2 | 0.0198 | | | | 0.050 | 0.305 | 10.35 | 102.4 | 31.2 | PVC SDR 35 | 203.4 | 200 | 0.58 | 26.2 | 26.1 | 0.80 | 0.54 | 1.20 | |
| | CB/MH-2 | MH-1 | 0.0261 | | | 0.0012 | 0.068 | 0.373 | 10.89 | 99.7 | 37.2 | PVC SDR 35 | 203.4 | 200 | 0.58 | 20.8 | 26.1 | 0.80 | 0.43 | 1.42 | |
| | | | | | | | | | | | 1.9 | | 203.4 | 200 | 0.58 | 20.8 | 26.1 | 0.80 | 0.43 | 0.07 | FLOW THROUGH ICD |
| | MH-1 | Existing 450 ST in Riverside | | | | | 0.000 | 0.373 | 11.32 | 97.7 | 36.5 | PVC SDR 35 | 203.4 | 200 | 0.58 | 18.0 | 26.1 | 0.80 | 0.37 | 1.40 | |
| | | | | | | | | | | | 1.9 | PVC SDR 35 | 203.4 | 200 | 0.58 | 18.0 | 26.1 | 0.80 | 0.37 | 0.07 | FLOW THROUGH ICD |
| | | | | | | | | | | | | | EXISTING 450 ST IN RIVERSIIDE DRIVE | | | | | | | | |
| | | | | | | | | | | | | | 457.2 | 450 | 1.40 | | 351.9 | 2.14 | | | |

Gmail by Google

**Douglas Gray <d.gray@dbgrayengineering.com>**

# RE: 2887 Riverside Dr

1 message

**Jamie Batchelor** <jamie.batchelor@rvca.ca> Tue, May 23, 2017 at 2:30 PM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Lucio Renna <l.renna@dbgrayengineering.com>

Hi Doug,

The amount of parking spaces propose (7) would just fall within the threshold in which we would typically look for onsite quality control. However, in this case you are not increasing the parking but rather reducing the amount of parking from 15 spaces to 7 which is considered to be a net gain. The stormwater from this site would also travel more than 1.4 km to the downstream outlet at Sawmill Creek. Given the distance from the outlet combined with the improvements proposed of the site, and the scope of the project, it is the RVCA's opinion that this proposal would not require additional onsite water quality treatment in the form of a specific water quality target as long as only 7 parking spaces are proposed. Therefore, in this particular instance we would recommend that on-site Best Management Practices are implemented as part of the stormwater management plan.

If you have any questions do not hesitate to contact me.

**From:** Douglas Gray [mailto:d.gray@dbgrayengineering.com]
**Sent:** Tuesday, May 23, 2017 7:13 AM
**To:** Jamie Batchelor <jamie.batchelor@rvca.ca>
**Cc:** Lucio Renna <l.renna@dbgrayengineering.com>
**Subject:** Re: 2887 Riverside Dr

Hi Jamie

Have you had a chance to review this project?

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

On Tue, May 16, 2017 at 10:59 AM, Douglas Gray <d.gray@dbgrayengineering.com> wrote:

> Hi Jamie
>
> Preliminary drawings are attached.
>
> About 20 parking spaces are proposed in an underground parking garage. Existing surface parking is proposed to be reduced from about 15 spaces to 7 spaces. There are three existing entrances that will remain.
>
> 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

On Tue, May 16, 2017 at 8:35 AM, Jamie Batchelor <jamie.batchelor@rvca.ca> wrote:

> Hi Doug,
>
> Would you be able to provide some additional details such as how many parking spaces are proposed, laneways, etc..
>
> **From:** Douglas Gray [mailto:d.gray@dbgrayengineering.com]
> **Sent:** Monday, May 15, 2017 5:39 PM
> **To:** Jamie Batchelor <jamie.batchelor@rvca.ca>
> **Cc:** Lucio Renna <l.renna@dbgrayengineering.com>
> **Subject:** 2887 Riverside Dr

Hi Jamie

We are working on a proposed four-storey 39 unit Youth Homeless Shelter for the Youth Services Bureau located on 3313 sq.m. of land at 2887 Riverside Dr in Ottawa.

We have been informed by city staff that the property is included in Sawmill Creek Subwatershed Study,

Attached is a location map.

Please comment concerning the stormwater management for this site.

Regards, Doug

D. B. G R A Y E N G I N E E R I N G I N C.

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

700 Long Point Circle Tel: 613-425-8044

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

**City of Ottawa Servicing Study Checklist**

**General Content**

**Executive Summary (for large reports only):** not applicable

**Date and revision number of the report:** see page 1 of Servicing Brief and Stormwater Management Report

**Location map and plan showing municipal address, boundary, and layout of proposed development:** see drawings C-1 to C-3

**Plan showing the site and location of all existing services:** see drawings C-1 to C-3

**Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere:** not applicable

**Summary of Pre-consultation Meetings with City and other approval agencies:** not available

**Reference and confirm conformance to higher level studies and reports ( Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria:** not applicable

**Statement of objectives and servicing criteria:** see page 1 of Servicing Brief and Stormwater Management Report

**Identification of existing and proposed infrastructure available in the immediate area:** see drawings C-1 to C-3

**Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development ( Reference can be made to the Natural Heritage Studies, if available).** see drawings C-1 to C-3

**Concept level master grading plan to confirm existing and proposed grades in the development and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths:** not applicable

**Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts:** not applicable

**Proposed phasing of the development, if applicable:** not applicable

**Reference to geotechnical studies and recommendations concerning servicing: s**ee note 1.5 on drawing C-1

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

- **Metric scale:** included
- **North arrow:** included
    - **(including construction North):** not included
- **Key Plan:** included

- **Name and contact information of applicant and property owner:** not available
- **Property limits**: included
    - **including bearings and dimensions:** not included
- **Existing and proposed structures and parking areas:** included
- **Easements, road widening and rights-of-way:** included
- **Adjacent street names:** included

**Development Servicing Report: Water**

**Confirm consistency with Master Servicing Study, if available:** not applicable

**Availability of public infrastructure to service proposed development**: see page 2 of Servicing Brief and Stormwater Management Report

**Identification of system constraints:** see page 2 of Servicing Brief Servicing Brief and Stormwater Management Report

**Confirmation of adequate domestic supply and pressure:** see page 2 of Servicing Brief and Stormwater Management Report

**Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow locations throughout the development:** see page 2 & 3 and 8 to 10 of Servicing Brief and Stormwater Management Report

**Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves:** see page 3 of Servicing Brief and Stormwater Management Report

**Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design:** not applicable

**Address reliability requirements such as appropriate location of shut-off valves:** not applicable

**Check on the necessity of a pressure zone boundary modification:.** not applicable

**Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range:** not applicable

**Description of the proposed water distribution network, including locations of proposed connections to the existing systems, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions:** not applicable

**Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation:** not applicable

**Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines:** see page 2 of Servicing Brief and Stormwater Management Report

**Provision of a model schematic showing the boundary conditions locations, streets , parcels, and building locations for reference:** not applicable

**Development Servicing Report: Wastewater**

**Summary of proposed design criteria:** see page 3 of Servicing Brief and Stormwater Management Report

**(Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure):** not applicable

**Confirm consistency with Master Servicing Study and /or justification for deviations:** not applicable

**Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and conditions of sewers:** not applicable

**Descriptions of existing sanitary sewer available for discharge of wastewater from proposed development:** see page 3 of Servicing Brief and Stormwater Management Report

**Verify available capacity in downstream sanitary sewer and / or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable):** not applicable

**Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix C) format.** see page 11 of Servicing Brief and Stormwater Management Report

**Description of proposed sewer network including sewers, pumping stations, and forcemains:** see page 3 of Servicing Brief and Stormwater Management Report

**Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality):** not applicable

**Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development:** not applicable

**Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity:** not applicable

**Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding:** not applicable

**Special considerations such as contamination, corrosive environment etc:** not applicable

**Development Servicing Report: Stormwater Checklist**

**Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property):** see page 4 of Servicing Brief and Stormwater Management Report

**Analysis of available capacity in existing public infrastructure.** not applicable

**A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern:** see drawing C-2

**Water quality control objective (e/g/ controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects:** see Servicing Brief and Stormwater Management Report

**Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements:** Servicing Brief and Stormwater Management Report

**Descriptions of the references and supporting information.**
**Set-back from private sewage disposal systems.** not applicable

**Watercourse and hazard lands setbacks:** not applicable

**Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed:** the pre-application consultation record is not yet been issued

**Confirm consistency with sub-waterched and Master Servicing Study, if applicable study exists:** not applicable

**Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).** see drawings C-1 to C-3 and Servicing Brief and Stormwater Management Report

**Identification of watercourses within the proposed development and how watercourses will be protected, or , if necessary, altered by the proposed development with applicable approvals.** see drawings C-1 to C-3 and Servicing Brief and Stormwater Management Report

**Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions:** see Servicing Brief and Stormwater Management Report

**Any proposed diversion of drainage catchment areas from one outlet to another. :** not applicable

**Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities. :** not applicable

**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:** not applicable

**Identification of potential impacts to receiving watercourses:** Servicing Brief and Stormwater Management Report

**Identification of municipal drains and related approval requirements. :** not applicable

**Descriptions of how the conveyance and storage capacity will be achieved for the development:** see page 4 to 7 of Servicing Brief and Stormwater Management Report

**100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading:**

**Inclusion of hydraulic analysis including hydraulic grade line elevations. :** not applicable

**Description of approach to erosion and sediment control during construction for the protection of receiving watercourses of drainage corridors: s**ee notes 2.1 to 2.6 on drawing C-3

**Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplains elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current:** not applicable

**Identification of fill constraints related to floodplain and geotechnical investigation. :** not applicable

**Approval and Permit Requirements: Checklist**

**The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:**

**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 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:** see page 29 of Servicing Brief and Stormwater Management Report

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

**Changes to Municipal Drains. :** not applicable

**Other permits (National Capital commission, Parks Canada, public Works and Government Services Canada, Ministry of transportation etc.) :** not applicable

**Conclusion Checklist**

**Clearly stated conclusions and recommendations:** see page 7 of Servicing Brief and Stormwater Management Report

**Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.**

**All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario:** included