MINTO / CANDEREL

STORMWATER MANAGEMENT SERVICING REPORT
485 RICHMOND ROAD, OTTAWA

Project: 32385-5.2.2

JULY 2012
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REVISED MAY 2013
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IBI GROUP

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1. INTRODUCTION

Minto and Canderel have proposed a residential high rise building that includes condominiums and underground parking at 485 Richmond Street. The surrounding area includes a mix of office and residential. The total site area is 3304 m^2 or 0.33 ha. The location of the study area is illustrated within **Figure 1**.

This report presents the proposed stormwater management solution to service the development. The stormwater management system has been developed in accordance with the City of Ottawa Sewer Design Guidelines (November 2004) and LEED Canada-NC 6.1 Green Building Rating System.

1.1 Site Servicing

Site servicing for the proposed development was outlined within the report "Conceptual Site Servicing Study, Stormwater Site Management Plan Erosion and Sedimentation Control Plan, 485 Richmond Road" by IBI group, July 2013. That report concluded that existing infrastructure adjacent to the site has sufficient available capacity to service the proposed development. Appropriate extensions from an existing sanitary sewer, storm sewer and watermain will adequately service the proposed high rise building. Among other items the Site Servicing Study report recommended that the runoff from the developed site be captured in a new 250 mm diameter storm service sewer and conveyed to an existing 250 mm diameter storm sewer located immediately north of the subject site.

2. EXISTING CONDITIONS

2.1 Existing Drainage Datterns

Surface runoff from the existing site flows in one of three different directions. **Figure 2** indicates these areas and respective runoff directions. Runoff from the 0.022ha Area A flows to existing catch basins which connect to a trunk sewer in Richmond Road. Runoff from the centre of the site, identified as the 0.055ha Area B drains to the west of the property. Runoff from the majority of the site, identified as 0.275ha Area C on **Figure 2**, drains into a an existing site catch basin which in turn outlets to an existing 250 mm diameter storm sewer. That sewer eventually connects to the lower reaches of the same trunk sewer that runoff from Area A and B connect.

The existing 250 mm diameter outlet sewer is a pvc pipe constructed at a slope of 0.80% which has a capacity of 53.75 l/s.

2.2 Design Criteria

The design criterion for this site requires that post-development runoff must not exceed 90% of the full flow capacity of the proposed outlet sewer. That sewer is a 250 mm diameter pvc pipe constructed at a slope of 0.80% which has a capacity of 53.75 l/s. Therefore the allowable release rate for the proposed development is about 48.38 l/s. The design criteria also stipulates that runoff from the post-development 1:100 year storm event must connect to the outlet sewer

3. POST DEVELOPMENT PLAN

3.1 Approach

The post development plan assumes that, the site has been divided into 5 drainage areas (Areas A-E). The locations of the 5 study areas are illustrated in **figure 3**. The following sections provide a brief summary of the proposed quantity stormwater management plan for the site. Detailed calculations of the runoff rates for the various sub-catchment areas are included in **Appendix A** and **Figure 4** shows the proposed stormwater management schematic.

3.2 Area-A

Area A will be unchanged from existing conditions and therefore no new stormwater management is proposed for this area. Runoff from Area A will be released uncontrolled off-site and captured by the existing storm sewer pipes adjacent to the site on Richmond Road. Area A covers 224 m^2 and the estimated uncontrolled 100 year release rate (Q_A) is 5.75 l/s at a runoff coefficient of 0.77. For the purposes of future stormwater management for the site, runoff from Area A is considered neutral and will not be included in any future calculations.

3.3 Area-B

Runoff from Area B will be released uncontrolled and captured by the existing 250 mm diameter storm sewer on NNC property located immediately north of the subject site. Area B covers 688 m^2 and the estimated uncontrolled 100 year release rate (Q_B) is 17.44 l/s at a runoff coefficient of 0.76.

3.4 Area-C

Area C represents the area covered by the building footprint including the roof and podium. Area C covers 1975 m^2 and the estimated uncontrolled 100 year release rate (Q_C) is 54.66 l/s at a runoff coefficient of 0.83. Runoff from Area C will be released to the existing 250 mm diameter storm sewer but will need to be controlled prior to release.

3.5 Area-D

Runoff from Area D will be released uncontrolled and captured by the existing 250 mm diameter storm sewer on NNC property located immediately north of the subject site. Area D covers 523 m^2 and the estimated uncontrolled 100 year release rate (Q_D) is 13.69 l/s at a runoff coefficient of 0.77.

3.6 Area-E

Runoff from Area E will be released uncontrolled off-site and captured by the existing trunk storm sewer pipes located to the west of the site. Area E covers 97 m^2 and the estimated uncontrolled 100 year release rate (Q_E) is 2.91 l/s at a runoff coefficient of 0.90. For the purposes of future stormwater management for the site, runoff from Area E is considered neutral and will not be included in any future calculations.

3.7 Analysis

Surface runoff from drainage Areas A and E are proposed to drain uncontrolled off site. Runoff from Area A eventually drains to a 675 mm diameter storm sewer in Richmond Road and the post development proposal is to retain the existing drainage pattern so there is no impact to runoff for this Area.

Surface runoff from Area E is also proposed to drain uncontrolled off site. Runoff from Area E eventually drains to a 900 mm diameter trunk sewer located west of the Amica building. Since the post development area

proposed to drain westward is significantly smaller than the pre development area (0.010 ha vs 0.055 ha) there again will be no impact to this drainage proposal.

Runoff from Areas B,C, and D are proposed to outlet to the existing 250 mm diameter storm sewer located north of the site. As previously discussed the available capacity in that sewer is 48.38 l/s but the total estimated uncontrolled runoff from Areas A,B, and C is 85.79 l/s (B= 17.44 l/s, C= 54.66 l/s , D = 13.69 l/s). It is therefore proposed to collect runoff from the building in an internal cistern and control its release flow prior to leaving the building. The fallowing section reviews the sizing and release design elements for the proposed cistern.

3.8 Cistern Storage

The runoff generated by Areas C (total area 1975 m^2) would be discharged and attenuated into an under-ground cistern. Outflow from the cistern would be controlled with an orifice. The volume was calculated by determining the remaining allowable flow from the site using the following equation:

- $Q_{Cistern} = Q_{max} - (Q_B + Q_D)$
- $Q_{super\ pipe} = 48.38\ l/s - (17.44\ l/s + 13.69\ l/s) = 17.25\ l/s$

To meet the allowable release rate of 17.25 l/s, the required cistern volume for the 100 year storm event was determined to be 45.11 m^3. Detailed calculations are presented in **Appendix A**. The cistern orifice would be designed to restrict the release rate to 17.25 l/s. The attenuated flow will be discharged directly into the existing storm sewer system located on NCC property immediately north of the site.

Included in the cistern total storage is an allowance of 12.0 m^3 of static storage to meet LEED Canada-NC 6.1 Green Building Rating System requirements. The stored stormwater would be used for on-site irrigation. The required storage levels would be controlled by an orifice placed at the outlet of the cistern. Detailed calculations of the required static storage are presented in **Appendix A.**

4. SUMMARY OF THE DESIGN CALCULATIONS

- The maximum allowable release rate from the site into the existing 250 mm diameter storm sewer is 48.38 l/s based on existing conditions. An under-ground cistern would be provided to meet the City of Ottawa requirements.
- The flow from Area A would discharge uncontrolled into the existing storm sewers on Richmond Road at a rate of 5.75 l/s. This matches existing conditions.
- The flow from Area B would discharge uncontrolled into the existing storm sewer on NNC property located immediately north of the subject site at a rate of 17.44 l/s.
- The flow from Area C would discharge into an under-ground cistern at flow rate of 54.66 l/s.
- The flow from Area D would discharge uncontrolled into the existing storm sewer on NNC property located immediately north of the subject site at a rate of 13.69 l/s.
- The flow from Area E would discharge uncontrolled into the existing trunk storm sewers west of the site at a rate of 2.91 l/s. That flow rate is less than the existing conditions.
- The flow and volumes from the cistern would be restricted by an orifice placed at the outlet controlling the flow to 17.25 l/s. The outflow from the cistern storage would discharge into the existing storm sewer on NNC property located immediately north of the subject site. The cistern would provide 45.11 m^3 of storage, including a LEED allowance of 12.0 m^3.

5. PROPOSED STORM WATER MANAGEMENT PLAN

The proposed development will have a negligible effect on the performance of the existing storm sewer system. With minor exceptions, it is proposed that the existing drainage patterns remain essentially unchanged. A minor amount of runoff will continue to outlet to the 675 mm diameter storm sewer in Richmond Road and some runoff will flow to the west of the subject site to an existing 900 mm diameter storm sewer which is located north west of the Amica building. The balance of the site runoff will be directed via a new site storm sewer system to the existing 250mm diameter storm sewer located immediately north of the site. The subject site is the only area connected to that sewer.

Additionally, to ensure there is no impact from external surface runoff entering the new site, a small retaining wall is proposed to be constructed near the north east corner of the site. That wall will confine external runoff from east of the site to the existing drainage ditch.

Our analysis indicates that, with the recommended on site storage, post development runoff will be about 10% less than the current outlet capacity and therefore will have no negative impact on the existing outlet storm sewer.

Report by:

IBI GROUP

Michel Beauchemin C.E.T.

Jim Moffatt, P.Eng.

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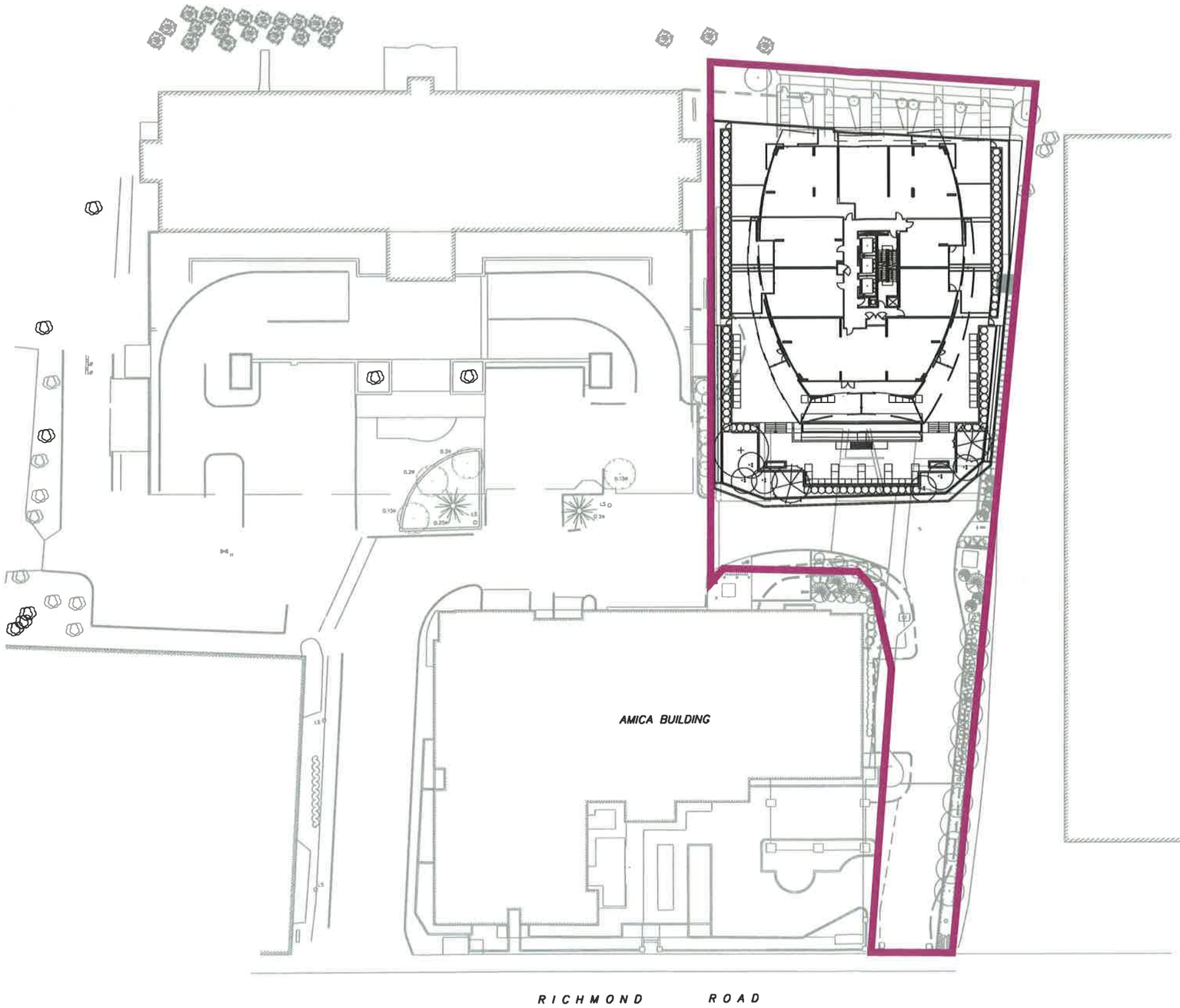

LEGEND

STUDY AREA

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Scale

N.T.S.

Project Title

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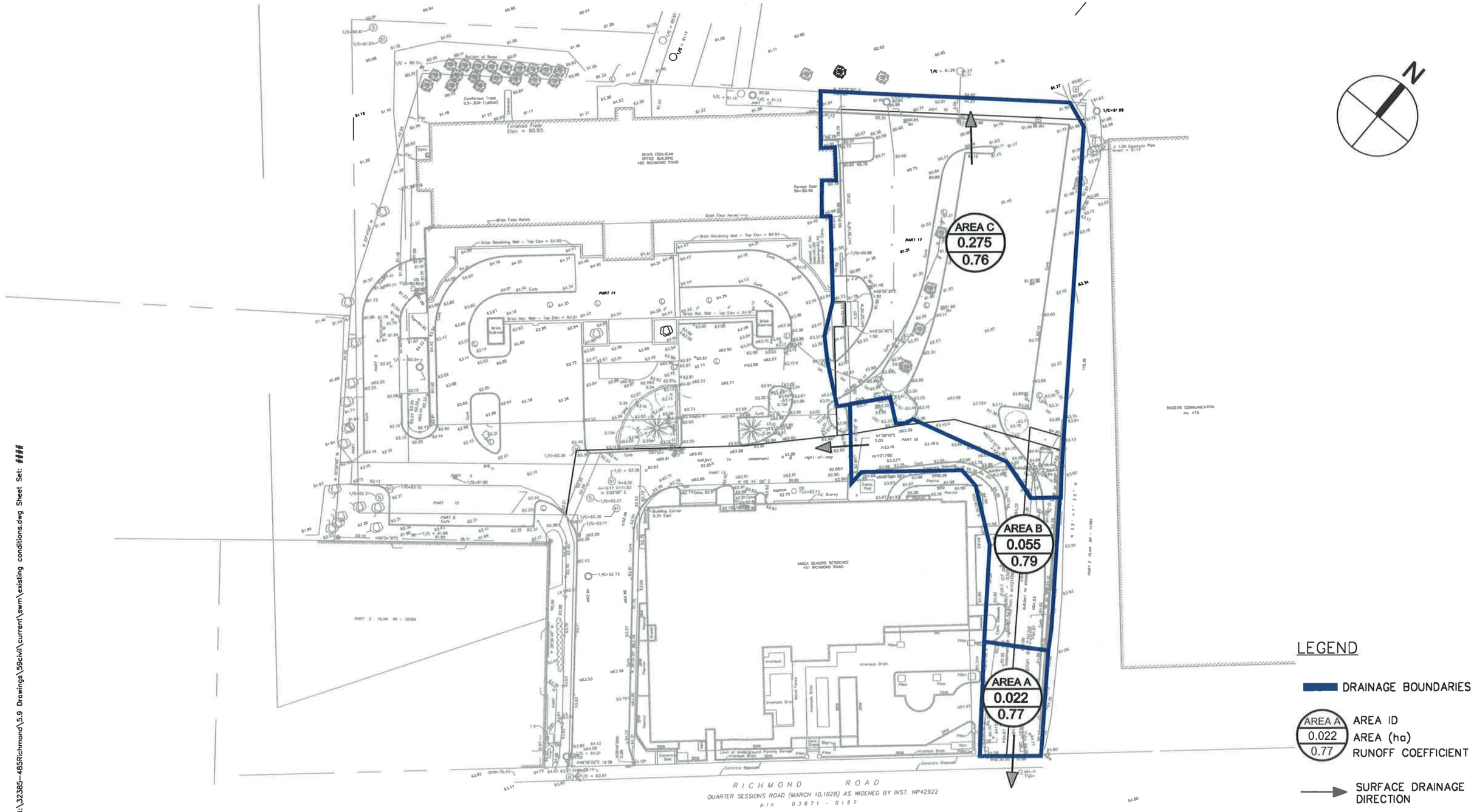
485 RICHMOND ROAD

Drawing Title

STUDY AREA

Sheet No.

FIGURE 1



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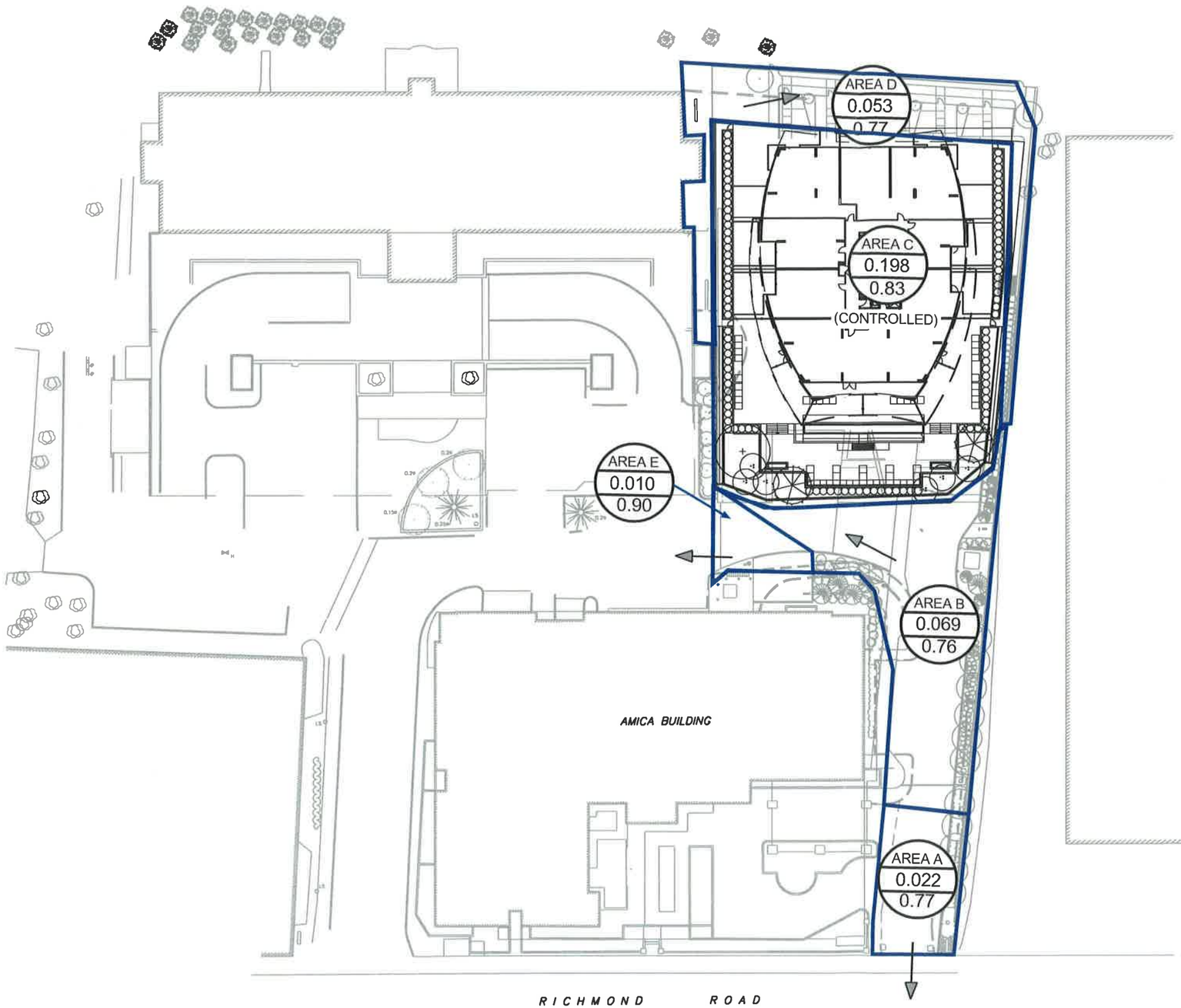
EXISTING CONDITIONS
SWM DRAINAGE BOUNDARIES

Sheet No.

FIGURE 2



LEGEND

- DRAINAGE BOUNDARIES
- AREA ID / AREA (ha) / RUNOFF COEFFICIENT (AREA A / 0.022 / 0.77)
- SURFACE DRAINAGE DIRECTION

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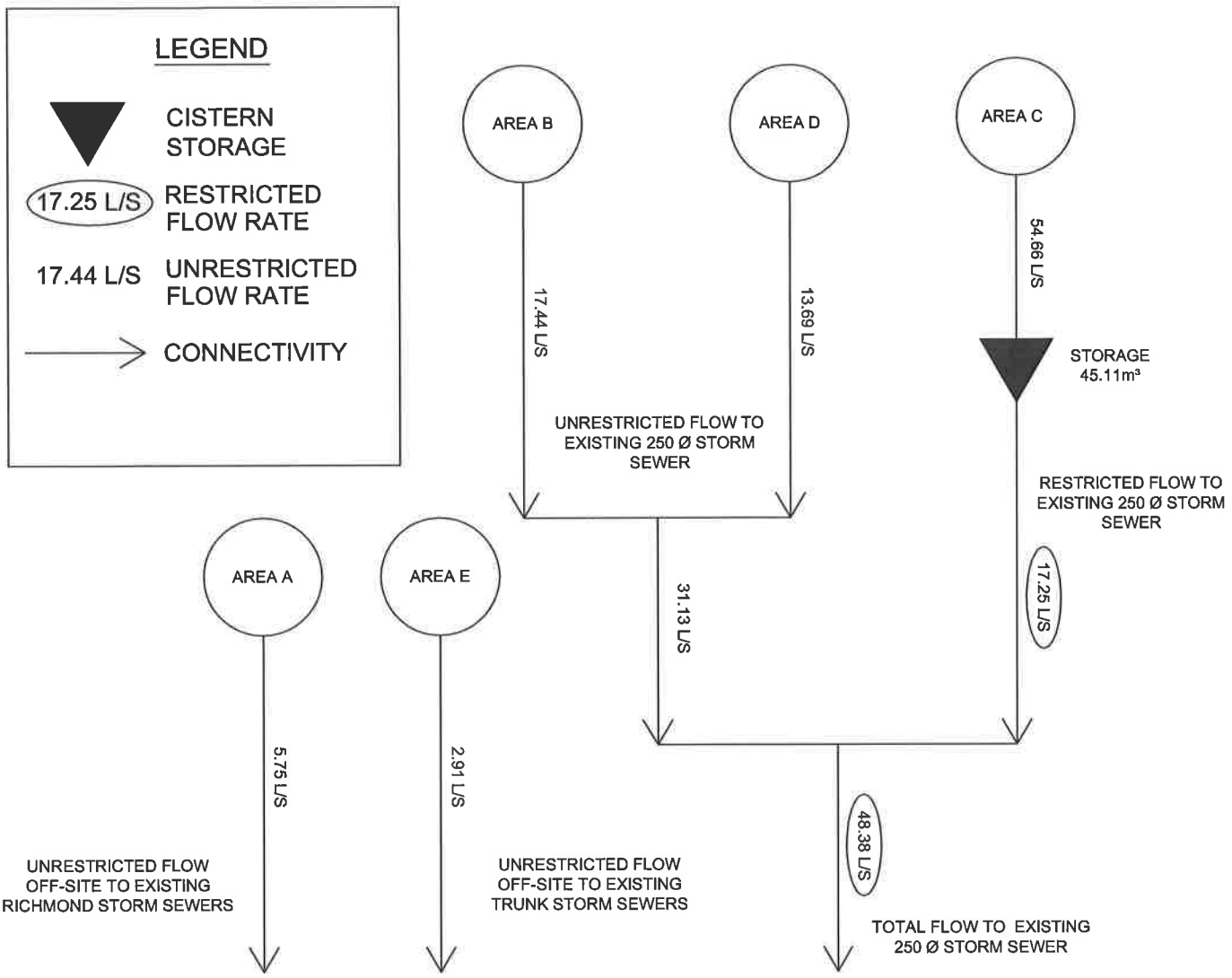
Drawing Title: POST DEVELOPMENT SWM DRAINAGE BOUNDARIES

Sheet No.: FIGURE 3

APPENDIX A

Stormwater Management Calculations

Figure 3 – SWM Schematic



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485 RICHMOND ROAD

SWM SCHEMATIC

PROJECT No. 32385
DATE: 2013/04/30
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FIGURE 4

Stormwater Management - 5 Year Existing Conditions - Area C Only

Time of Concentration = 20 min

Area = 2750 m^2

Runoff Coefficient (C) = Asphalt (1966 m^2) 0.9
Grass (0 m^2) 0.2
Shrubs (784m2) 0.4

$$\frac{[(1966 \times 0.9) + (0 \times 0.2) + (784 \times 0.4)]}{2750}$$

Runoff Coefficient (C) = 0.76

Intensity - 5 Year event storm
20 min Tc $i5_{yr}=998.071/(T+6.053)^{0.814}$ = 70.25 mm/hr

Existing Flowrate Area C
$Q_{Existing}$ = 2.78*A*C*i= **40.82 l/s**

Stormwater Management - 100 Year Post-Development Conditions

Time of Concentration = 20 min

Area = 3304 m^2

Runoff Coefficient (C) = Asphalt (2671 m^2) 0.9
Grass (0 m^2) 0.2
Shrubs (633 m2) 0.4

$$\frac{[(2671 \times 0.9) + (0 \times 0.2) + (829 \times 0.4)]}{3304}$$

Runoff Coefficient (C) = 0.8

Intensity - 100 year storm event
20 min Tc $i_{100yr}=1735.688/(T+6.014)^{0.82}$ = 119.95 mm/hr

Restricted Flowrate
$Q_{max\ allowable}$ = 2.78*A*C*i= **88.14 l/s**

Stormwater Management - Post-development Area A

Time of Concentration = 20 min

Area = 224 m^2

Runoff Coefficient (C) =	Asphalt (167 m^2)	0.9
	Grass (0 m^2)	0.2
	Shrubs (24 m2)	0.4

$$\frac{[(167 \times 0.9) + (0 \times 0.2) + (57 \times 0.4)]}{224}$$

Runoff Coefficient (C) = 0.77

Intensity - 100 year storm event

20 min Tc $i_{100yr}=1735.688/(T+6.014)^{0.82}$ = 119.95 mm/hr

Post Development Uncontrolled To Richmond Road

$Q_{100\,A}$ = 2.78*A*C*i= **5.75 l/s**

Stormwater Management - Post-development Area B

Time of Concentration = 20 min

Area = 688 m^2

Runoff Coefficient (C) = Asphalt (495m^2) 0.9

Grass (0 m^2) 0.2

Shrubs (193 m2) 0.4

$$\frac{[(495 \times 0.9) + (0 \times 0.2) + (193 \times 0.4)]}{688}$$

Runoff Coefficient (C) = 0.76

Intensity - 100 year storm event

20 min Tc $i_{100yr}=1735.688/(T+6.014)^{0.82}$ = 119.95 mm/hr

Post Development Uncontrolled To Existing 2500 mm Diameter Storm Sewer

$Q_{100\ B}$ = 2.78*A*C*i= **17.44 l/s**

Stormwater Management - Post-development Area C

Time of Concentration = 20 min

Area = 1975 m^2

Runoff Coefficient (C) = Asphalt (1708 m^2) 0.9

Grass (0 m^2) 0.2

Shrubs (257 m2) 0.4

$$\frac{[(1708 \times 0.9) + (0 \times 0.2) + (257 \times 0.4)]}{1975}$$

Runoff Coefficient (C) = 0.83

Intensity - 100 year storm event

20 min Tc $i_{100yr}=1735.688/(T+6.014)^{0.82}$ = 119.95 mm/hr

Post Development Uncontrolled Into Proposed Cistern

$Q_{100\,C}$ = 2.78*A*C*i= **54.66 l/s**

Stormwater Management - Post-development Area D

Time of Concentration = 20 min

Area = 533 m^2

Runoff Coefficient (C) =	Asphalt (387 m^2)	0.9
	Grass (0 m^2)	0.2
	Shrubs (146 m2)	0.4

$$\frac{[(387 \times 0.9) + (0 \times 0.2) + (146 \times 0.4)]}{533}$$

Runoff Coefficient (C) = 0.77

Intensity - 100 year storm event

20 min Tc $i_{100yr}=1735.688/(T+6.014)^{0.82}$ = 119.95 mm/hr

Post Development Uncontrolled To Existing 2500 mm Diameter Storm Sewer

$Q_{100\,C}$ = 2.78*A*C*i= **13.69 l/s**

Stormwater Management - Post-development Area E

Time of Concentration = 20 min

Area = 97 m^2

Runoff Coefficient (C) =	Asphalt (97 m^2)	0.9
	Grass (0 m^2)	0.2
	Shrubs (0 m2)	0.4
	$\frac{[(97 \times 0.9) + (0 \times 0.2) + (0 \times 0.4)]}{97}$	
Runoff Coefficient (C) =		**0.9**

Intensity - 100 year storm event

20 min Tc $i_{100yr}=1735.688/(T+6.014)^{0.82}$ = 119.95 mm/hr

Post Development Uncontrolled To Existing Off-Site Storm Sewer

$Q_{100\,C}$ = 2.78*A*C*i= **2.91 l/s**

Stormwater Management - Post-development Cistern Controlled 100 Year Flow

Controlled 100 year flow		**Total Area**	1975 m^2		
Area (ha)	0.1975				
*C=	0.83	Relase Rate (l/s)	17.25		
Tc Variable (min)	***i (mm/hour)***	***Qp Qp=2.78xAxCxi l/s (l/s)***	***Qm (l/s)***	***Qp-Qm (l/s)***	***Volume (m^3)***
5	242.70	110.60	17.25	93.35	28.01
10	178.56	81.37	17.25	64.12	38.47
15	142.89	65.12	17.25	47.87	43.08
20	119.95	54.66	17.25	37.41	44.90
25	103.85	47.32	17.25	30.07	**45.11**
30	91.87	41.87	17.25	24.62	44.31
35	82.58	37.63	17.25	20.38	42.80
40	75.15	34.24	17.25	16.99	40.79
45	69.05	31.47	17.25	14.22	38.39
50	63.95	29.14	17.25	11.89	35.68
55	59.62	27.17	17.25	9.92	32.74
60	55.89	25.47	17.25	8.22	29.60
65	52.65	23.99	17.25	6.74	26.29

Cistern Storage Volume = 45.11 m^3

Runoff Volume Reduction for Leed Credit.

Intensity - 2 Year event storm
20 min Tc $i2_{yr}$=732.95 51.59 mm/hr

Total Rainfall at Critical Time of 20 mins =
51.59mm/hr / 60mins x 20mins =
17.2mm

Reduction Due to Runoff Losses =
17.2mm x C =
17.2mm x 0.80 =
13.8mm

Reduction of Runoff Volume by 25 % =
13.8 mm x 0.25 =
3.45mm

Required Static Volume to Meet 25 % reduction =
3.45mm x A =
3.455mm x 3474m =
12 m^3