MINTO / CANDEREL

STORMWATER MANAGEMENT SERVICING REPORT
UPPER WEST CONDOMINIUM
485 RICHMOND ROAD, OTTAWA

Project: 32385-5.2.2

JULY 2012
NOVEMBER 2012
REVISED MAY 2013

IBI GROUP

TABLE OF CONTENTS

List of Figures

List of Appendices

1. INTRODUCTION

Minto and Carederel 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 3474 m^2 or 0.3474 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 Upper West, 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 sewer and conveyed to the existing 250 mm diameter storm sewer located immediately north of the subject site.

2. EXISTING CONDITIONS

2.1 Approach

The design criterion for this site requires that post-development runoff must not exceed the 1:5 yr event based on the existing site runoff coefficient of 0.78 and a time of concentration of 20 min pre-development conditions. The estimated allowable release rate is 52.92 l/s. The detailed calculation is included in **Appendix A**. Based on the 100 year uncontrolled post-development flows, the City of Ottawa's requirements cannot be met by the proposed development unless on-site storage is provided

3. POST DEVELOPMENT

3.1 Approach

In an effort to determine the amount of required on-site storage, the site has been divided into 3 drainage areas (Areas A-C). The locations of the 3 study areas are illustrated in **figure 2**. The owner has indicated that under-ground storage via cistern is possible. 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** as well as **Figure 3** the stormwater management schematic.

3.2 Area-A

Runoff from Area A will be released uncontrolled and captured by the existing storm sewer pipes adjacent to the site in Richmond Road. Area A covers 260 m^2 and the estimated uncontrolled 100 year release rate (Q_A) is 6.85 l/s at a runoff coefficient of 0.79.

3.3 Area-B

Runoff from Area B will be released uncontrolled and captured by the existing storm sewer pipes adjacent to the site. Area A covers 722 m^2 and the estimated uncontrolled 100 year release rate (Q_B) is 19.50 l/s at a runoff coefficient of 0.81.

3.4 Area-C

The owner has indicated that under-ground storage via cistern is possible. Runoff from Area C will be captured by an under-ground cistern. Area C covers 2500 m^2 the estimated uncontrolled 100 year release rate (Q_C) is 66.69 l/s at a runoff coefficient of 0.80.

3.5 Cistern Storage

The runoff generated by Areas C (total area 2500 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:

- $Q_{Cistern} = Q_{max} - (Q_A + Q_B)$
- $Q_{super\ pipe} = 52.92\ l/s - (6.85\ l/s + 19.50\ l/s) = 26.57\ l/s$

To meet the allowable release rate of 26.57 l/s, the required cistern volume for the 100 year storm event was determined to be 48.15 m^3. Detailed calculations are presented in **Appendix A**. The orifice for the cistern would be restricted to 26.57 l/s. The attenuated flow will be discharged directly into the existing storm sewer system located on NCC property immediately north of the site.

The cistern would provide 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 is 52.92 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 into the existing storm sewers adjacent to the site at a rate of 6.85 l/s.
- The flow from Area B would discharge into the existing storm sewers adjacent to the site at a rate of 19.50 l/s.
- The flow from Area C would discharge into an under-ground cistern at flow rate of 69.94 l/s.
- The flow and volumes from the cistern would be restricted by an orifice placed at the outlet controlling the flow to 26.57 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 48.15 m^3 of storage.

5. PROPOSED STORM WATER MANAGEMENT PLAN

The proposed development will have a negligible effect on the performance of the existing storm sewer system. It is proposed that the existing drainage patterns remain essentially unchanged. A minor amount of runoff will continue to outlet to the 600mm diameter storm sewer in Richmond Road and some runoff will flow to the west of the subject site to an existing 750mm diameter storm sewer which is located south 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.

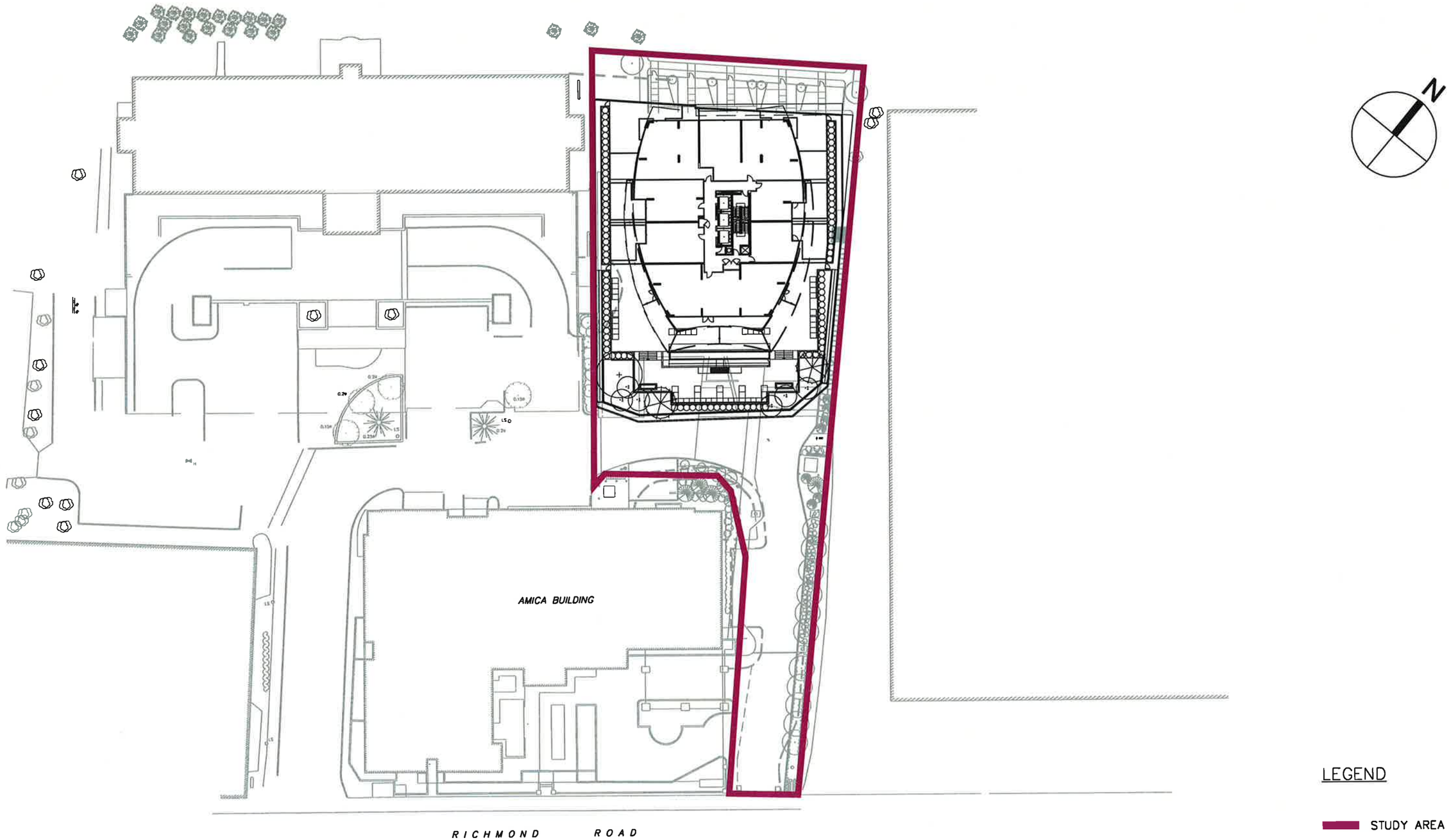
Our analysis indicates that, with the recommended on site storage, post development runoff will match existing conditions and therefore will have no negative impact on the existing outlet storm sewer.

Report by:

IBI GROUP

Michel Beauchemin C.E.T.

Peter Spal, P.Eng



J:\32385-485Richmond\5.9 Drawings\59civil\current\swm\32385-proposed-2013-04.dwg Sheet Set: ####

Plot Style: ---- Plot Scale: 1:1 Plotted At: May. 10, 13 9:45 AM Printed By: MICHEL BEAUCHEMIN Last Saved By: MBEAUCHEMIN Last Saved At: May. 9, 13

IBI GROUP

Scale

N.T.S.

Project Title

minto CANDEREL

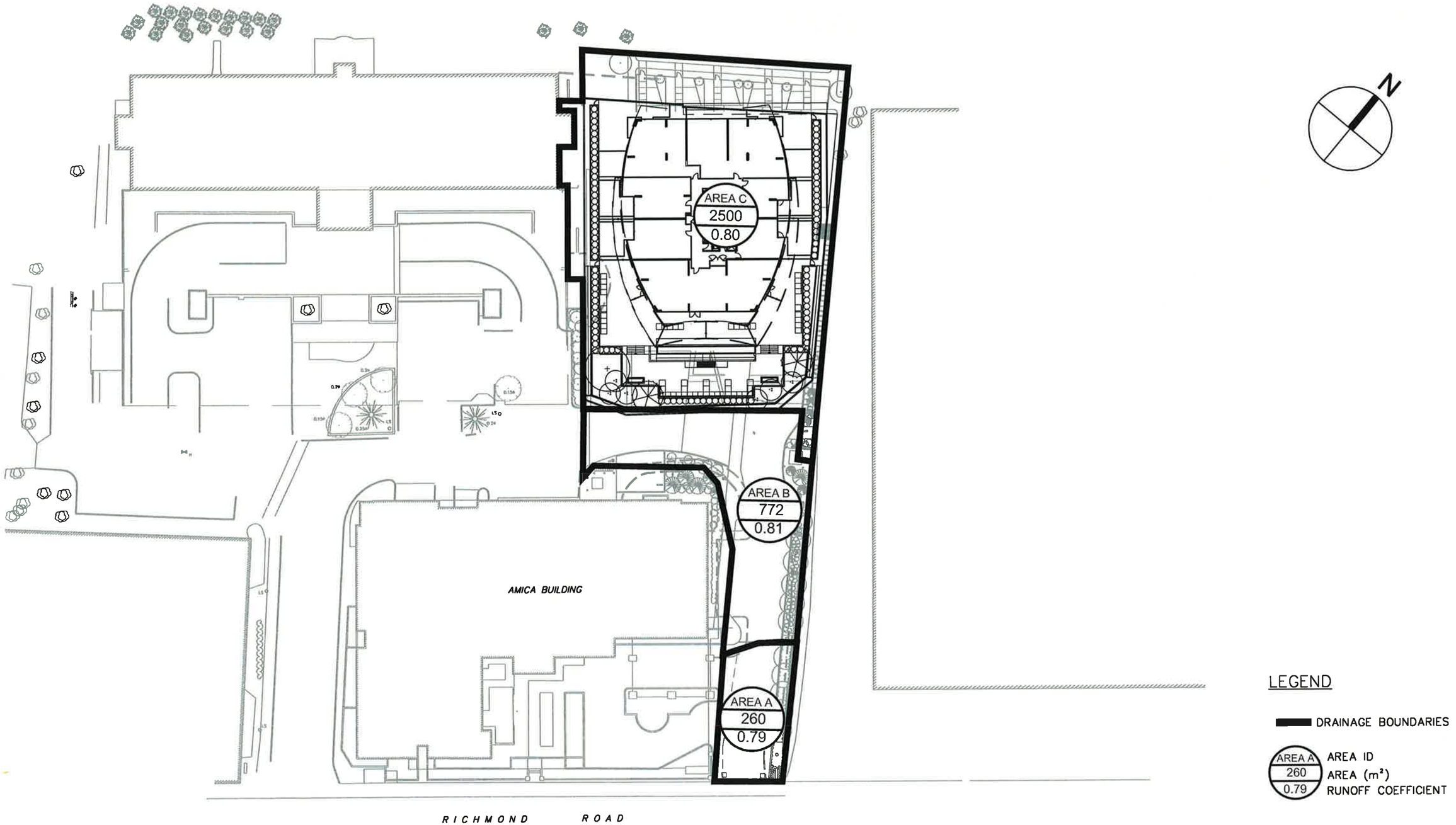
UPPER WEST CONDOMINIUM

Drawing Title

STUDY AREA

Sheet No.

FIGURE 1



J:\32385--485Richmond\5.9 Drawings\59civil\current\swm\32385--proposed--2013--04.dwg Sheet Set: ####

Plot Style: ---- Plot Scale: 1:1 Plotted At: May. 10, 13 9:46 AM Printed By: MICHEL BEAUCHEMIN Last Saved By: MBEAUCHEMIN Last Saved At: May. 9, 13

IBI GROUP

Scale: N.T.S.

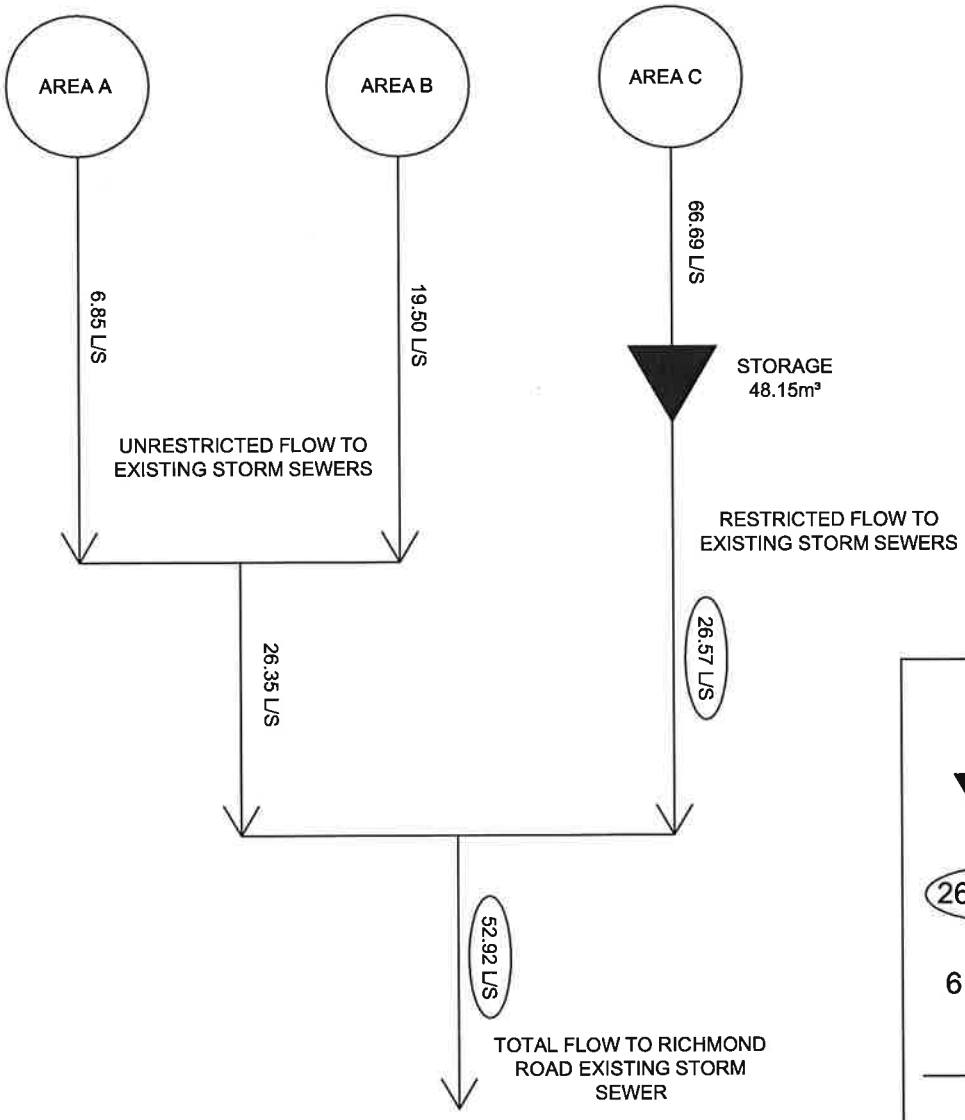
Project Title: UPPER WEST CONDOMIUM

Drawing Title: POST DEVELOPMENT SWM DRAINAGE BOUNDARIES

Sheet No.: FIGURE 2

APPENDIX A

Stormwater Management Calculations
Figure 3 – SWM Schematic



LEGEND

- CISTERN STORAGE
- 26.57 L/S — RESTRICTED FLOW RATE
- 6.85 L/S — UNRESTRICTED FLOW RATE
- CONNECTIVITY

J:\32385-485Richmond\5.9 Drawings\59civil\current\swm\32385-proposed-2013-04.dwg Layout Name: Layout1

Plot Style: ----- Plot Scale: 1:1 Plotted At: May. 10, 13 9:46 AM Printed By: MICHEL BEAUCHEMIN Last Saved By: MBEAUCHEMIN Last Saved At: May. 9, 13

IBI GROUP

UPPER WEST CONDOMINIUM

SWM SCHEMATIC

PROJECT No. 32385
DATE: 2013/04/30
SCALE: N.T.S.

FIGURE 3

Stormwater Management - 5 Year Existing Conditions

Time of Concentration = 20 min

Area = 3474 m^2

Runoff Coefficient (C) = Asphalt (2645 m^2) 0.9

Grass (0 m^2) 0.2

Shrubs (829 m2) 0.4

$$\frac{[(2645 \times 0.9) + (0 \times 0.2) + (829 \times 0.4)]}{3474}$$

Runoff Coefficient (C) = 0.78

Intensity - 5 Year event storm

20 min Tc $i5_{yr}=998.071/(T+6.053)^{0.814}$ = 70.25 mm/hr

Restricted Flowrate

$Q_{max\ allowable}$ = 2.78*A*C*i= **52.92 l/s**

Stormwater Management - 100 Year Post-Development Conditions

Time of Concentration = 20 min

Area = 3474 m^2

Runoff Coefficient (C) = Asphalt (2841 m^2) 0.9

Grass (0 m^2) 0.2

Shrubs (633 m2) 0.4

$$\frac{[(2645 \times 0.9) + (0 \times 0.2) + (829 \times 0.4)]}{3474}$$

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= **92.68 l/s**

Stormwater Management - Post-development Area A

Time of Concentration = 20 min

Area = 260 m^2

Runoff Coefficient (C) = Asphalt (203 m^2) 0.9

Grass (0 m^2) 0.2

Shrubs (57 m2) 0.4

$$\frac{[(203 \times 0.9) + (0 \times 0.2) + (57 \times 0.4)]}{260}$$

Runoff Coefficient (C) = 0.79

Intensity - 100 year storm event

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

Post Development Uncontrolled

$Q_{100\,A}$ = 2.78*A*C*i= **6.85 l/s**

Stormwater Management - Post-development Area B

Time of Concentration = 20 min

Area = 722 m^2

Runoff Coefficient (C) =	Asphalt (599 m^2)	0.9
	Grass (0 m^2)	0.2
	Shrubs (123 m2)	0.4

$$\frac{[(599 \times 0.9) + (0 \times 0.2) + (123 \times 0.4)]}{722}$$

Runoff Coefficient (C) = 0.81

Intensity - 100 year storm event

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

Post Development Uncontrolled

$Q_{100\ B}$ = 2.78*A*C*i= **19.50 l/s**

Stormwater Management - Post-development Area C

Time of Concentration = 20 min

Area = 2500 m^2

Runoff Coefficient (C) =	Asphalt (2047 m^2)	0.9
	Grass (0 m^2)	0.2
	Shrubs (453 m2)	0.4

$$\frac{[(2047 \times 0.9) + (0 \times 0.2) + (453 \times 0.4)]}{2500}$$

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

Post Development Uncontrolled

$Q_{100\ C}$ = 2.78*A*C*i= **66.69 l/s**

Stormwater Management - Post-development Cistern Controlled 100 Year Flow

Controlled 100 year flow		**Total Area**	2500 m^2		
Area (ha)	0.2500				
*C=	0.80	Relase Rate (l/s)	26.57		
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	134.94	26.57	108.37	32.51
10	178.56	99.28	26.57	72.71	43.63
15	142.89	79.45	26.57	52.88	47.59
20	119.95	66.69	26.57	40.12	**48.15**
25	103.85	57.74	26.57	31.17	46.75
30	91.87	51.08	26.57	24.51	44.12
35	82.58	45.91	26.57	19.34	40.62
40	75.15	41.78	26.57	15.21	36.51
45	69.05	38.39	26.57	11.82	31.92
50	63.95	35.56	26.57	8.99	26.97
55	59.62	33.15	26.57	6.58	21.72
60	55.89	31.08	26.57	4.51	16.23
65	52.65	29.27	26.57	2.70	10.54

Cistern Storage Volume = 48.15 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