

URBAN ECOSYSTEMS LIMITED

7050 WESTON ROAD, SUITE 705

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STORMWATER MANAGEMENT REPORT

RIVERSIDE SOUTH RETAIL CENTRE (BLDGS A TO K)

1420 EARL ARMSTRONG ROAD

CITY OF OTTAWA

FILE No: 12007.100

DATE: APRIL 9, 2014

REVISED JULY 20, 2014

revised AUGUST 13, 2014

DATE: APRIL 9,2014
 revised July 20,2014
 revised AUGUST 13, 2014

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1.0 INTRODUCTION

The purpose of this report is to provide recommended grading and drainage proposals with the objective to control storm runoff from the above proposed commercial development. The report provides an analysis of the overall site bounded by Earl Armstrong Road to the north, Limebank Road to the west, proposed Collector Road 'D' to the east and future Transit Road to the south. The property is located within in the Riverside South Community Phase 6, City of Ottawa. The Report also addresses Tributary No. 14, an external drainage area south of the subject property. Details are included in Appendix B to this Report.

In September 2008, Stantec prepared a report entitled, Riverside South Community Master Drainage Plan Update, Final Report. That study established the overall storm drainage strategy for the Riverside South Community and determined parameters for future developments within the community plan.

In January 2012, J.L. Richards & Associates Limited prepared a Design Report for Riverside South Community Phase 6. That study provided further details and design parameters with respect storm drainage of future developments within the study area.

The Stantec and the J.L. Richards studies established maximum allowable runoff from development blocks within the Riverside South Community area, including for the Subject Property. On site detention of excess runoff from the Subject Property will be required in order not to exceed the allowable site release rate.

The intent of this hydrologic evaluation is to outline the proposed stormwater management necessary to satisfy the site storage requirements produced by the occurrence of the 100 year return frequency design storm.

The maximum volume of storm runoff for the site was determined using the modified rational method MRM, as outlined in the American Public Works Association Publication title Practice in Detention of Urban Stormwater Runoff. Copies of the Proposed Site Plan, Site Grading Plan, Servicing Plan and the SWM Drainage Plan are included in the rear pockets of this Report. The rainfall intensities are derived from the City of Ottawa IDF curves

2.0 ALLOWABLE SITE RUNOFF

The Master Drainage Study by Stantec and the Design Report by J.L. Richards established that the maximum allowable post development storm runoff from the subject property shall not exceed 203 L/s/ha for all storms up to and including the 1:100 year event.

All excess runoff shall be detained on site through surface, roof and underground storage.

ALLOWABLE RELEASE RATE

$$\text{Site Area} = 6.54 \text{ ha.} \times 203 \text{ L/s/ha} = 1327 \text{ L/s}$$

3.0 POST-DEVELOPMENT SITE CONDITION

	unit	Total	System A
Total Site Area	(m ²)	65367	65367
Pavement Area	(m ²)	49801	49801
Landscaped Area	(m ²)	496	496
Building Area	(m ²)	10005	10005
Uncontrolled Pavement Area	(m ²)	226	226
Uncontrolled Landscape Area	(m ²)	4839	4839



4.0 EVALUATION OF SITE RUNOFF - SYSTEM A

4.1 Roof Top Storage

Proposed roofs to be equipped with control flow drains.

Model ID: Zurn Control Flo Z-105-5
 Weir Rating 6 USGPM per inch head (0.15 L/s/cm head)
 Quantity: One weir per hopper. Based on manufacturers table, one hopper drains a maximum roof area of 465m² with a maximum head of 10.16 cm

For this building 32 weirs

Total roof outflow is calculated as:

$$Q_{\text{roof}} = 32 \times 0.15 \text{ L/s/cm hd.} \times 10 \text{ cm head} = 48 \text{ L/s}$$

From Appendix - Table 1 maximum storage volumes: required = 401.7 m³
 available = 677.7 m³

As shown, the available storage volume for the roof can easily contain the respective required maximum roof storage volumes.

Note: Peak rate of runoff, eg: $Q = \text{Rain (L/s)}$
 $= 0.95 \times 1.0005 \times \text{mm/hr} \times 2.778$

4.2 Parking Lot Storage and Release Rate

Note: 100 year runoff coefficients:

pavements - C₁₀₀ = C_s x 0.5 + 0.5 = 0.9 x 0.5 + 0.5 = 0.95
 landscaped - C₁₀₀ = 0.25 x 0.5 + 0.5 = 0.625

4.2.1 The composite runoff coefficients for the site, excluding building, are calculated as follows:

$$C_c = \frac{49801 \times 0.95}{49801} + \frac{496 \times 0.625}{496}$$

$$C_c = 0.95$$



4.2.2 Release rate calculations are based on orifice flow formula:

$$Q = C \times A \times (2gH)^{1/2}$$

where,

Q = discharge in m³/s

C = shape coefficient, 0.62 for orifice plate, dimensionless

A = area of orifice in m²

g = acceleration due to gravity in m/s²

H = head from centre of orifice to ponding level in m

Orifice Plate at Existing Storm Manhole

max. ponding level	(m)	92.5
invert of orifice	(m)	88.15
head	(m)	4.125
diameter of orifice	(mm)	450
Q, orifice discharge	(l/s)	887.1

4.2.3 Using the Modified Rational Method, the maximum storage volume required on the parking lot was calculated. As shown in Appendix Table 2 and dwg SP-1, Urban Ecosystems Project No.: 12007.100 the required pond volume was calculated to be 947 m³

Available site storage:

			Surface Pavement Storage=	2490.0 m³
12.3	m -	1050	dia. stm =	10.7 m ³
88.4	m -	900	dia. stm =	56.2 m ³
84.6	m -	750	dia. stm =	37.4 m ³
83.8	m -	675	dia. stm =	30.0 m ³
135	m -	600	dia. stm =	38.2 m ³
162.8	m -	525	dia. stm =	35.2 m ³
112.3	m -	450	dia. stm =	17.9 m ³
22.1	m -	375	dia. stm =	2.4 m ³
275.2	m -	300	dia. stm =	19.5 m ³
552.6	m -	250	dia. stm =	27.1 m ³
189.6	m -	200	dia. stm =	6.0 m ³
1		2400 mm dia mh(@	2 m avg depth) =	9.0 m ³
5		1800 mm dia mh(@	2 m avg depth) =	25.4 m ³
7		1500 mm dia mh(@	2 m avg depth) =	24.7 m ³
25		1200 mm dia mh(@	2 m avg depth) =	56.5 m ³
			Manhole / Pipe Storage=	396.3 m³
Total site storage =			2886.3	m ³

Required Storage	m ³	947
Available Storage	m ³	2886

Therefore, there is sufficient storage in the parking lot to self contain the drainage and control the 100 year runoff to the allowable rate within the site.

Note: Peak runoff rate, $Q = RAIN + Q_{roof}$
 $0.95 \times 5.0297 \times 1 \times 2.778 + 49$

Note:
 Table 3 indicates that the uncontrolled runoff will total 160.7 l/s
 (Landscape = 4839 m² and pavement = 226 m²)



3.0 WATER QUALITY CONTROL

Storm runoff from the subject property will be directed to a proposed 1800 mm dia storm sewer to be constructed on Collector Road 'D'. This storm sewer connects to the existing storm sewers on Earl Armstrong Road and Limebank Road discharging to Riverside South Stormwater Management Pond No. 2, which provides for water quality controls. The Riverside South retail centre development is therefore not required to include onsite stormwater quality features.

7.0 SUMMARY

The following table summarizes the results presented in this report.

SYSTEM		100 YR STM	5 YR STM
orifice size	mm	450	450
total site release rate	L/s	1047.8	895.1
allowable site release rate	L/s	1327.0	1327.0
maximum ponding elevation	m	92.5	92.2
catchbasin elevation	m	92.2	92.2
ponding depth	m	0.3	0
required storage	m ³	947	297
available storage	m ³	2886	396

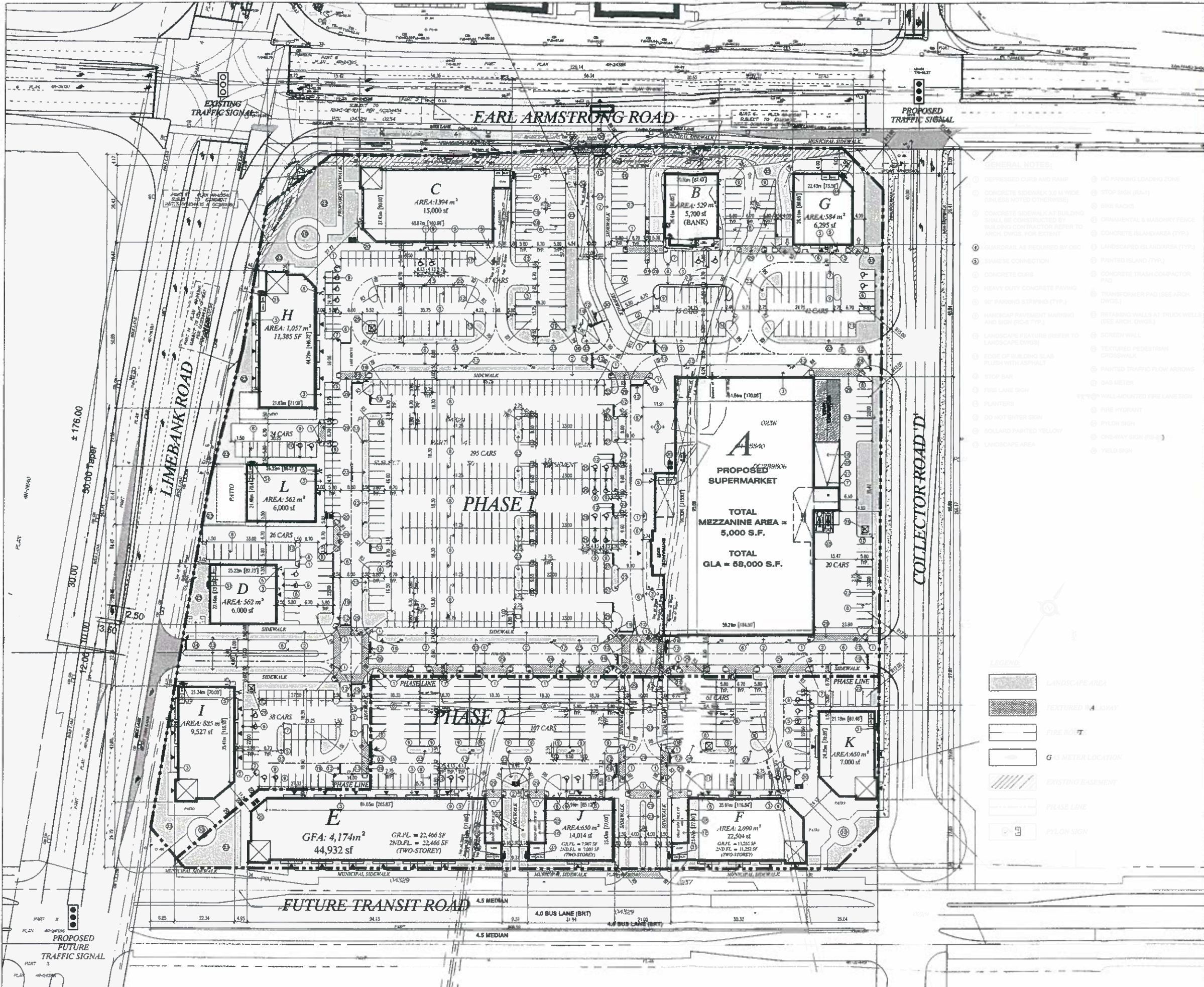
Respectfully submitted,

Urban Ecosystems Limited

Rosario Sacco, P. Eng.



DATE revised AUGUST 13, 2014



TES STATISTICS

PHASE 1 TOTAL AREA = 700,000 SF (15.13 ACRES) (100% OF 7 THA)
 TOTAL GFA = 15,000 SF
 TOTAL 2ND FL OFFICE AREA = 11,365 SF (75% OF 15,133 ACRES)
 TOTAL PARKING PROVIDED = 107 CARS

PHASE 2 TOTAL AREA = 1,000,000 SF (22.82 ACRES) (100% OF 7 THA)
 TOTAL GFA = 117,000 SF (100% OF 100,000 SF)
 TOTAL 2ND FL OFFICE AREA = 80,000 SF (68% OF 117,000 SF)
 TOTAL PARKING PROVIDED = 500 CARS

PHASE 3 TOTAL AREA = 1,000,000 SF (22.82 ACRES) (100% OF 7 THA)
 TOTAL GFA = 117,000 SF (100% OF 100,000 SF)
 TOTAL 2ND FL OFFICE AREA = 80,000 SF (68% OF 117,000 SF)
 TOTAL PARKING PROVIDED = 500 CARS

PHASE 1 BUILDING AREAS

BUILDING	AREA (S.F.)
BUILDING A	58,000
BUILDING B	5,700
BUILDING C	15,000
BUILDING D	6,000
BUILDING E	44,932
BUILDING F	22,504
BUILDING G	6,295
BUILDING H	11,365
BUILDING I	9,527
BUILDING J	14,014
BUILDING K	7,000
BUILDING L	6,000
TOTAL	150,000

PHASE 2 BUILDING AREAS

BUILDING	AREA (S.F.)
BUILDING 1	117,000
BUILDING 2	117,000
BUILDING 3	117,000
BUILDING 4	117,000
BUILDING 5	117,000
BUILDING 6	117,000
BUILDING 7	117,000
BUILDING 8	117,000
BUILDING 9	117,000
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BUILDING 100	117,000
TOTAL	11,700,000

SP-100
DATE ISSUED: 04-18-11

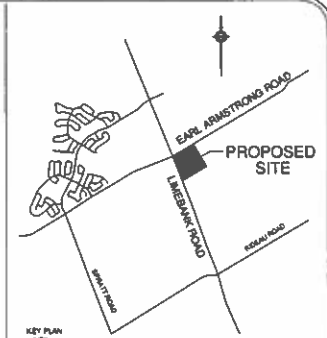
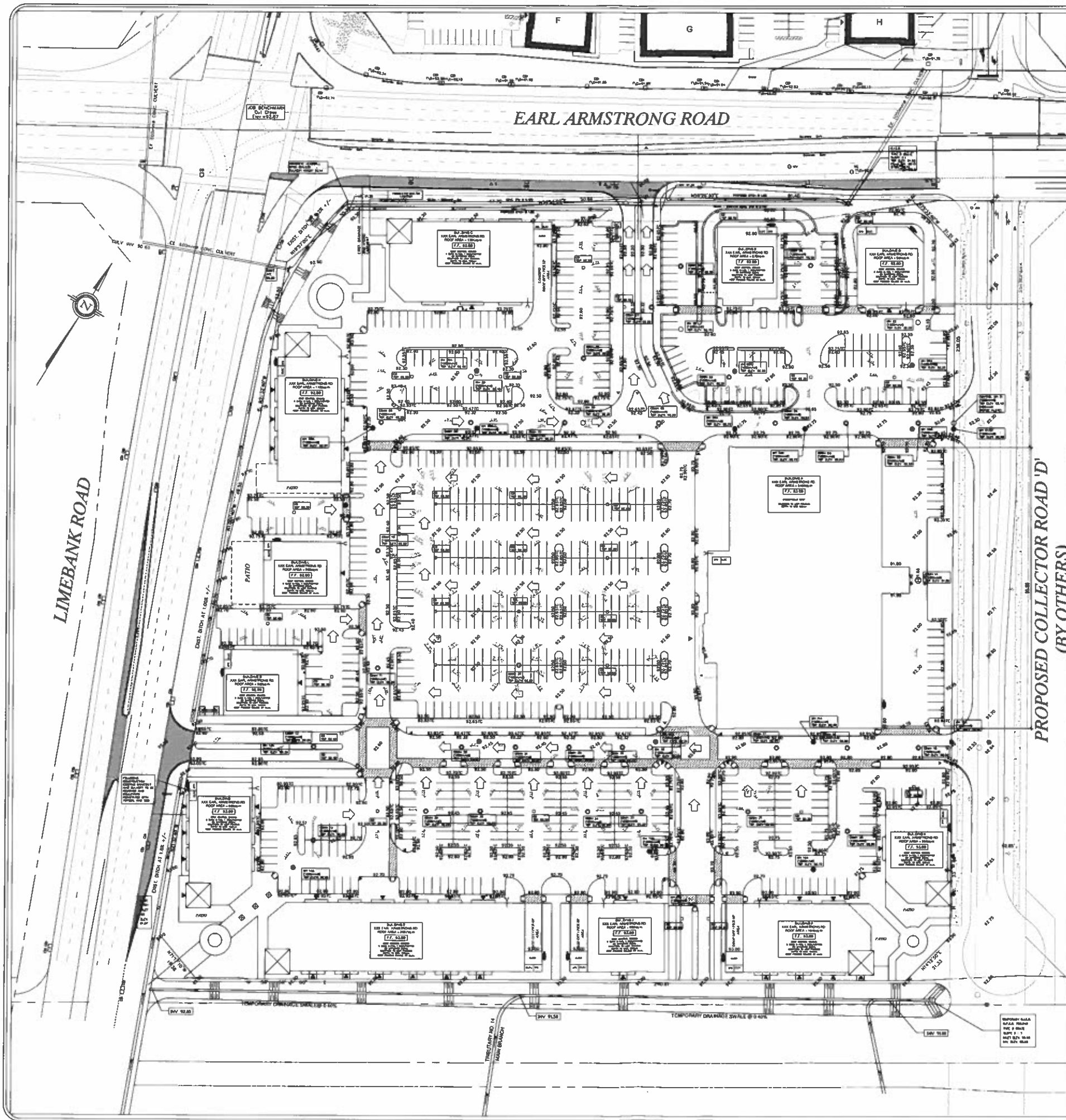
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MASTER SITE PLAN

SCALE: 1/8"=1'-0"

LIMEBANK & EARL ARMSTRONG
 LIMEBANK ROAD & EARL ARMSTRONG ROAD
 OTTAWA, ONTARIO

PETROFF



- CURB TO BE REMOVED
- PROPOSED CURB
- PROPOSED ASPHALT PAVEMENT

- LEGEND**
- OVERLAND FLOW ROUTE
 - DIRECTION AND SLOPE OF SURFACE DRAINAGE

NOTE:
THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING 5 OF 8, NOTES & DETAILS PROJECT 12007

LOCAL WEDGEMARK
CUT CROSS IN CONCRETE TRAFFIC ISLAND AT THE NORTH-EAST CORNER OF EARL ARMSTRONG ROAD AND LIMEBANK ROAD AS ESTABLISHED BY ANNS, O'BRYEN & VOLLEKLEIN LTD. D-1-8

ELEVATION KEY

1. 1.1.1	1.1.1.1	1.1.1.1
1.1.1.1	1.1.1.1	1.1.1.1
1.1.1.1	1.1.1.1	1.1.1.1
1.1.1.1	1.1.1.1	1.1.1.1

APPROVED AS TO FORM IN ACCORDANCE WITH THE REGULATIONS, RULES AND BY-LAWS OF THE PROFESSIONAL ENGINEERS OF ONTARIO AS ESTABLISHED BY THE ENGINEERING ACT AND REGULATIONS THEREUNDER.

ROSARIO SACCO
P. ENG. 1911
Professional Engineer

URSIAN ECOSYSTEMS LIMITED
1000 SHEPPARD AVENUE EAST, SUITE 100
SCARBOROUGH, ONTARIO M1S 1T7
TEL: (416) 291-1111
WWW.URSIAN.COM

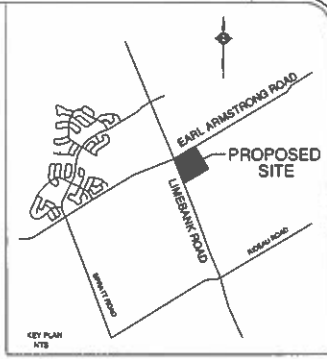
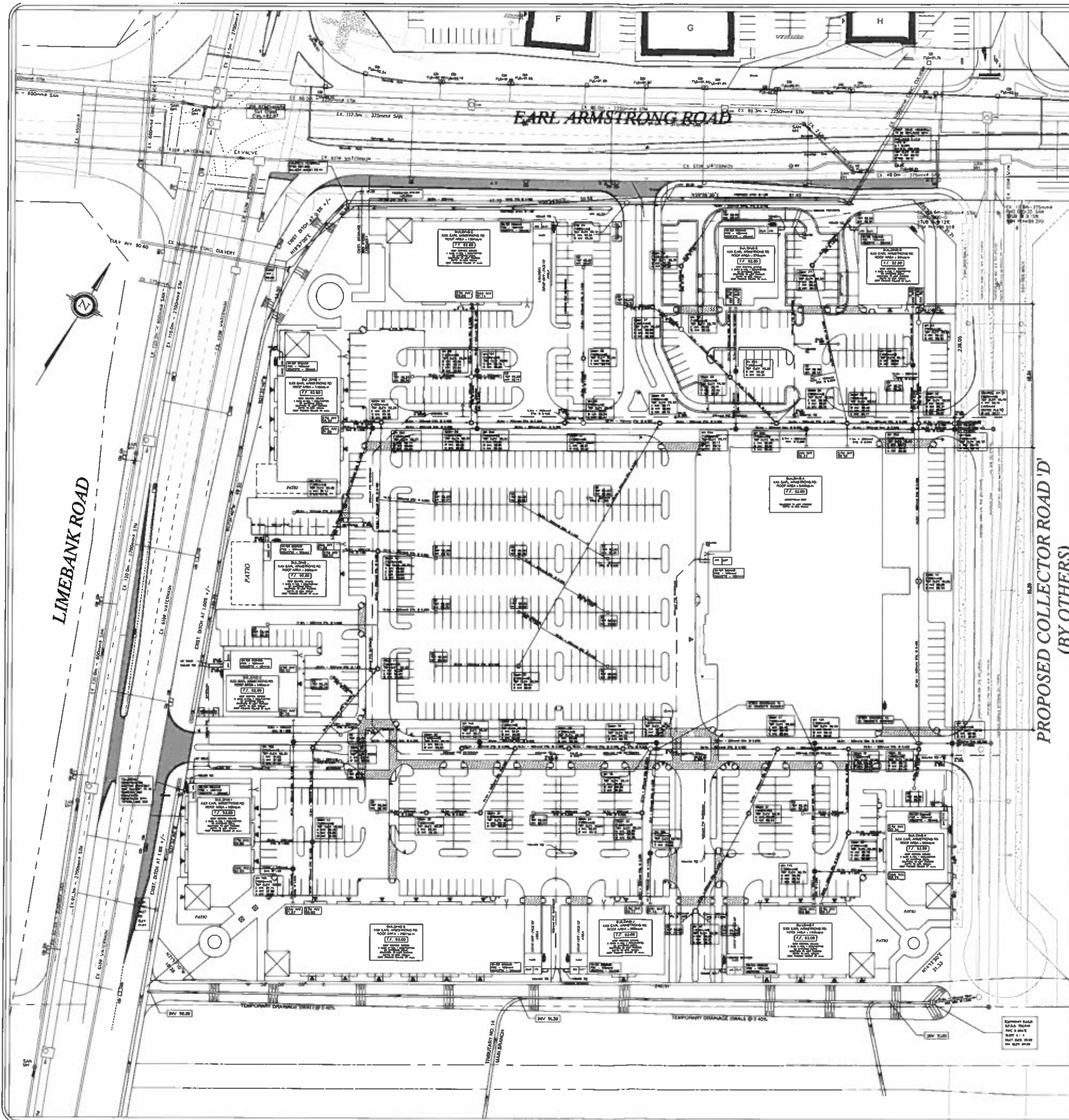
RIVERSIDE SOUTH RETAIL CENTER
CITY OF OTTAWA

MORGUARD INVESTMENTS LTD.
55 CITY CENTER DRIVE
OTTAWA, ONTARIO

FILE No D07-12-14-0067
GRADING PLAN

Designed By: JCC	Date: APR 2014	Checked By: R.S.
Drawn By: JCC	Project No: 12007	Approved By: [Signature]
Scale: 1:300	Sheet No: 10/18	Project No: 12007

14-03 MAY 2014 - 1055



- CURB TO BE REMOVED
- PROPOSED CURB
- PROPOSED ASPHALT PAVEMENT

NOTE:
THIS DRAWING SHALL BE READ
IN CONJUNCTION WITH DRAWING
S OF 8, NOTES & DETAILS
PROJECT 12007

LOCAL BENCHMARK:
CUT CROSS IN CONCRETE TRAFFIC ISLAND AT THE NORTH-EAST
CORNER OF EARL ARMSTRONG ROAD AND LIMEBANK ROAD
AS DETAIL SHOWN BY ANNE, O'BALLIVAN, VOLLEBERG LTD. O.L.B.

ELEVATION @ 27

1. 1.1	1.1	1.1	1.1
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1.1	1.1	1.1	1.1
1.1	1.1	1.1	1.1

APPROVED AS TO FORM & BEHAVIOR WITH
THE WESTERN WALL LAW 1970 & 1971
AND SPECIFICATIONS

URBAN ECOSYSTEMS LIMITED
100 WESTON ROAD, SUITE 100
WILLOWDALE, ONTARIO M2H 1S7
www.urbanecosystems.com
PROJ0001-0001

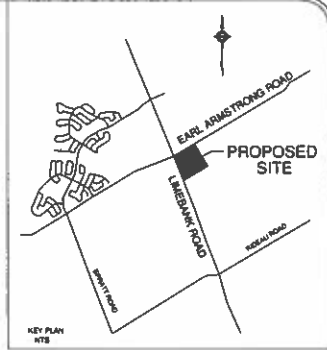
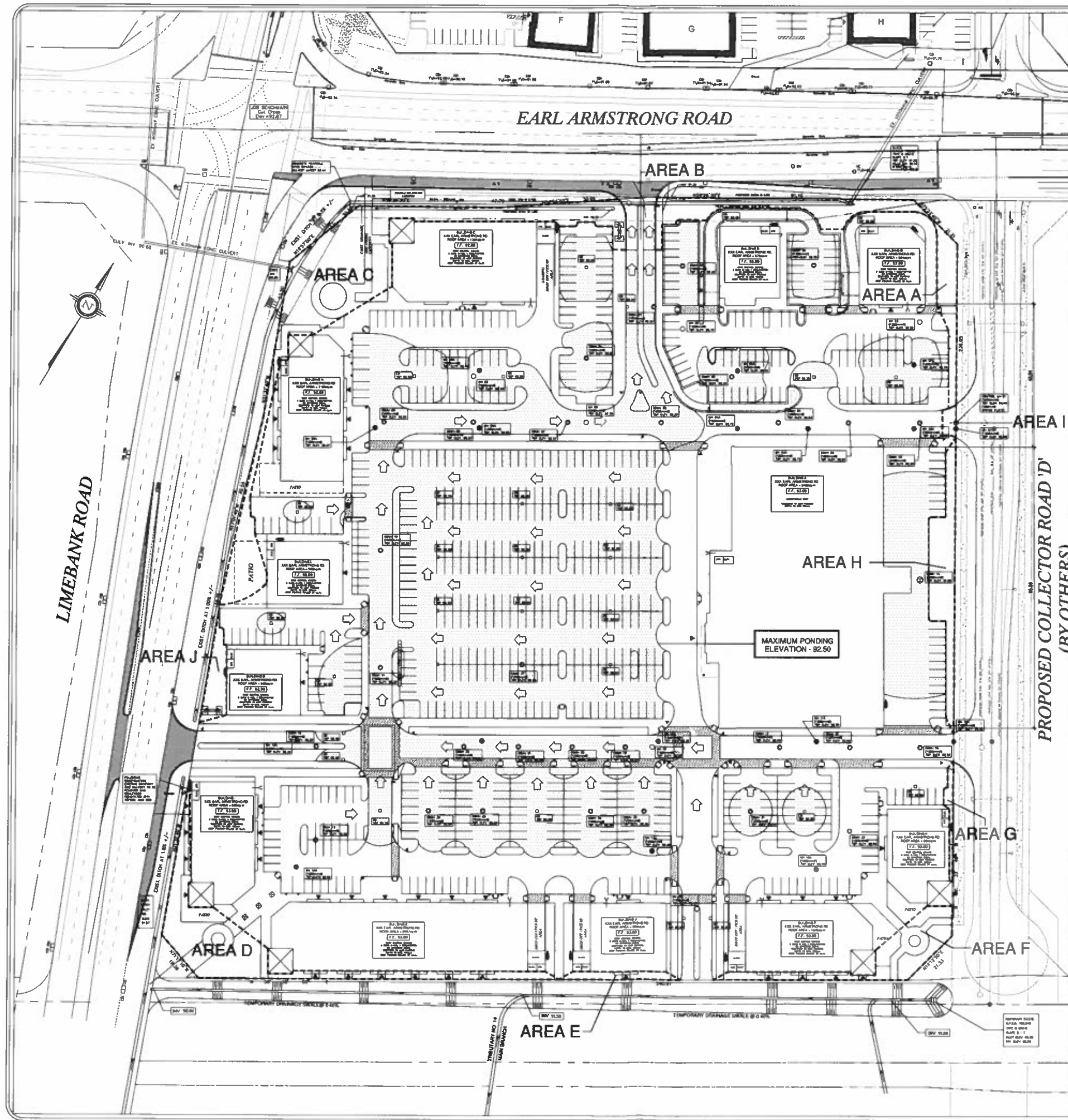
RIVERSIDE SOUTH RETAIL CENTER
CITY OF OTTAWA

MORGUARD INVESTMENTS LTD.
55 CITY CENTER DRIVE
M5S 1A6 (ON CANADA)

FILE NO D07-12-14-0057
SERVICING PLAN

Designed By: EOC	Date: APR 2014	Checked By: R.S.
Drawn By: EOC		Approved By:
Scale: 1:500	Project No: 12007	Drawing No: 2018

10 - P:\0012\VIEW\12007-STIC-PLANING - PL 02 May 2014 - 1055



AREA	SURFACE TYPE
A - 796 sq.m.	UNCONTROLLED LANDSCAPE
B - 183 sq.m.	UNCONTROLLED ASPHALT
C - 2,084 sq.m.	UNCONTROLLED LANDSCAPE
D - 1,063 sq.m.	UNCONTROLLED LANDSCAPE
E - 89 sq.m.	UNCONTROLLED LANDSCAPE
F - 539 sq.m.	UNCONTROLLED LANDSCAPE
G - 68 sq.m.	UNCONTROLLED LANDSCAPE
H - 496 sq.m.	CONTROLLED LANDSCAPE
I - 43 sq.m.	UNCONTROLLED ASPHALT
J - 192 sq.m.	UNCONTROLLED LANDSCAPE
49,854 sq.m.	CONTROLLED ASPHALT
10,005 sq.m.	CONTROLLED BUILDINGS
65,367 sq.m.	TOTAL SITE AREA

SURFACE PONDING VOLUME	
ELEV. 91.70 =	1 cu.m.
ELEV. 91.80 =	8 cu.m.
ELEV. 91.90 =	17 cu.m.
ELEV. 92.00 =	32 cu.m.
ELEV. 92.10 =	49 cu.m.
ELEV. 92.20 =	66 cu.m.
ELEV. 92.30 =	107 cu.m.
ELEV. 92.40 =	148 cu.m.
ELEV. 92.50 =	1,498 cu.m.
TOTAL STORAGE = 2,490 cu.m.	

STORM WATER MANAGEMENT SUMMARY TABLE	
SITE AREA SUMMARY (sq.m.)	
PAVED LANDSCAPED	49,801
ROOF	10,005
UNCONTROLLED PAVED	226
UNCONTROLLED LANDSCAPED	4,839
TOTAL SITE AREA	65,367

ROOF DRAINAGE SYSTEM	
TOTAL ROOF AREA	10,005 sq.m.
PEAK OUTFLOW RATE	48 l/s
TOTAL NO. OF WERS	32
REQUIRED ROOF STORAGE	402 cu.m.
AVAILABLE ROOF STORAGE	678 cu.m.

SITE DRAINAGE SYSTEM - 100 YEAR	
ORIFICE DIAMETER	450 mm
MAXIMUM PONDING ELEV.	98.50 m
MAXIMUM PONDING DEPTH	0.30 m
ORIFICE INVERT	88.15
ORIFICE RELEASE RATE	887.1 l/sec
UNCONTROLLED RELEASE RATE	160.7 l/sec
TOTAL RELEASE RATE	1047.8 l/sec
ALLOWABLE RELEASE RATE	1327.0 l/sec
REQUIRED SITE STORAGE	947 cu.m.
AVAILABLE SITE STORAGE	2,886 cu.m.

LOCAL BENCHMARK: CUT CROSS IN CONCRETE TRAFFIC ISLAND AT THE NORTH-EAST CORNER OF EARL ARMSTRONG ROAD AND LIMEBANK ROAD AS ESTABLISHED BY ANNE O'BULLIVAN VOLLEBROEK LTD. O.L.B.

ELEVATION LIST	
1. 1st Floor	91.70
2. 2nd Floor	91.80
3. 3rd Floor	91.90
4. 4th Floor	92.00
5. 5th Floor	92.10
6. 6th Floor	92.20
7. 7th Floor	92.30
8. 8th Floor	92.40
9. 9th Floor	92.50

APPROVED AS TO FORM IN RELIANCE WITH THE PROFESSIONAL SEAL AND SIGNATURE OF URBAN ECOSYSTEMS LIMITED AS TO DESIGN AND DIMENSIONS.

Director of Engineering: [Signature]

URBAN ECOSYSTEMS LIMITED
 1100 WILSON AVENUE, SUITE 100
 WILSONVILLE, ONTARIO L4N 1A1
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 1 (905) 881-8811

RIVERSIDE SOUTH RETAIL CENTER
 CITY OF OTTAWA

MORGUARD INVESTMENTS LTD.
 55 CITY CENTER DRIVE
 MISSISSAUGA, ONTARIO

FILE No D07-12-14-0067

SWM DRAINAGE PLAN

Designed By: XCC	Date: APR 2014	Checked By: J.R.
Drawn By: XCC	Project No: 12007	Reviewed By:
Scale: 1:500	Sheet No: 3 of 8	

URBAN ECOSYSTEMS LIMITED
7050 WESTON ROAD, SUITE 705
WOODBIDGE, ONTARIO L4L 8G7
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f. (905)856-0698



APPENDIX A

PROJECT: RIVERSIDE SOUTH RETAIL CENTRE (BLDGS A to K)
 MUNICIPALITY: CITY OF OTTAWA
 FILE NO.: 12007.100
 Date: revised AUGUST 13, 2014
 LOCATION: 1420 EARL ARMSTRONG ROAD

URBAN ECOSYSTEMS LIMITED
 7050 WESTON ROAD, SUITE 705
 WOODBRIDGE, ONTARIO L4L 6G7
 uei@urbanecosystems.com
 (905) 856-0629



SITE STORM WATER MANAGEMENT

SUMMARY

	Total	
Site area (sq.m) :	65367	65367
Controlled Pavement area (sq.m) :	49801	49801
Controlled Landscaped area (sq.m) :	496	496
BLDGS B,C,D,E,F,G,H,I,J,K Roof area (sq.m) :	10005	10005
Uncontrolled Pavement area (sq.m.) :	226	226
Uncontrolled Landscape area (sq.m.) :	4839	4839

Includes Building A

SYSTEM A

CONTROLLED	Orifice release rate (l/sec) :	887.1
UNCONTROLLED	Site release rate (l/sec) :	160.7
TOTAL	Site release rate (l/sec) :	1047.8
ALLOWABLE	Site release rate (l/sec) :	1327.0

ROOF DRAINAGE CHARACTERISTICS

Pavement coefficient : 0.95
 Landscape coefficient : 0.625
 Roof area coefficient : 0.95
 Total roof area (sq. m) : 10005
 Total number of roof hoppers : 32
 Total number of weirs : 32
 Max. sloped roof depth (mm) : 50.8
 Max. sloped roof storage (cu.m) : 169.42
 Max. parapit roof storage (cu.m) : 508.25
 Weir rating (l/sec) : 0.15
 Weir area rating (sq. m.) : 465
 Maximum head (cm) : 10.16
 Peak roof outflow rate (l/sec) : 48.8

SITE PLAN CHARACTERISTICS - S Y S T E M S A

Site area (sq.m) : 65367
 Controlled Pavement area (sq.m) : 49801
 Controlled Landscaped area (sq.m) : 496
 Proposed Roof area (sq.m) : 10005
 Rainfall intensity (mm/hr) : 10005
 Rainfall intensity (mm/hr) : 732.951/(6.199+t)^0.810
 1 2yr = 998.071/(6.053+t)^0.814
 1 5yr = 1735.688/(6.014+t)^0.820
 1 100yr = 32 hoppers @ 1 weir = 32
 hoppers @ 2 weir = 0
 Total 32 hoppers

TABLE 1 - ROOF DRAINAGE SYSTEM

Time (min.)	1st ITERATION					2nd ITERATION					3rd ITERATION				
	Rainfall intensity (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
5	242.70	640.84	192.25	14.63	177.62	169.42	8.20	5.16	24.78	7.43	184.82	5.23	7.54	184.72	
10	178.56	471.47	282.88	29.26	253.62	169.42	84.20	5.92	28.42	17.05	265.83	6.04	17.41	265.48	
15	142.99	377.30	339.57	43.89	295.68	169.42	126.26	6.34	30.44	27.40	312.17	6.51	28.11	311.46	
20	119.95	316.72	380.06	58.52	321.54	169.42	152.12	6.60	31.68	38.02	342.04	6.81	39.20	340.86	
25	103.95	274.20	411.30	73.15	338.15	169.42	168.73	6.77	32.48	48.72	362.58	7.01	50.48	360.82	
30	91.87	242.57	436.63	87.78	348.84	169.42	179.43	6.87	32.99	59.39	377.24	7.16	61.84	374.79	
35	82.58	218.04	457.89	102.41	355.48	169.42	186.06	6.98	33.31	69.95	387.94	7.26	73.22	384.67	
40	75.15	198.42	476.20	117.04	359.15	169.42	189.74	6.94	33.49	80.37	395.83	7.34	84.59	391.61	
45	69.05	182.32	492.27	131.67	360.60	169.42	191.18	6.99	33.56	90.60	401.67	7.40	95.92	396.35	
50	63.95	168.87	506.60	146.30	360.29	169.42	190.88	6.99	33.54	100.62	405.97	7.44	107.20	399.40	
55	59.62	157.43	519.52	160.93	358.59	169.42	189.17	6.97	33.46	110.42	409.11	7.48	118.42	401.11	
60	55.89	147.59	531.31	175.56	355.74	169.42	186.32	6.94	33.32	119.96	411.34	7.50	129.57	401.74	
65	52.65	139.01	542.13	190.20	351.94	169.42	182.52	6.90	33.14	129.25	412.89	7.51	140.65	401.48	
70	49.79	131.47	552.16	204.83	347.33	169.42	177.91	6.86	32.92	138.26	413.89	7.52	151.67	400.48	
75	47.26	124.77	561.48	219.46	342.03	169.42	172.61	6.81	32.67	146.99	414.49	7.53	162.64	398.85	
80	44.99	118.79	570.22	234.09	336.13	169.42	166.71	6.75	32.38	155.43	414.78	7.53	173.55	396.67	
85	42.95	113.42	578.42	248.72	329.71	169.42	160.29	6.68	32.07	163.58	414.85	7.53	184.41	394.01	
90	41.11	108.55	586.17	263.35	322.82	169.42	153.41	6.61	31.74	171.42	414.75	7.53	195.23	390.94	
95	39.43	104.12	593.51	277.98	315.53	169.42	146.11	6.54	31.39	178.95	414.56	7.53	206.03	387.48	
100	37.90	100.08	600.48	292.61	307.87	169.42	138.45	6.46	31.03	186.16	414.32	7.53	216.80	383.68	
105	36.50	96.37	607.12	307.24	299.88	169.42	130.46	6.38	30.64	193.05	414.07	7.53	227.56	379.56	
110	35.20	92.95	613.47	321.87	291.60	169.42	122.18	6.30	30.25	199.62	413.84	7.52	238.33	375.14	
115	34.01	89.79	619.54	336.50	283.04	169.42	113.62	6.22	29.84	205.86	413.68	7.52	249.11	370.43	
120	32.89	86.86	625.37	351.13	274.24	169.42	104.82	6.13	29.41	211.77	413.59	7.52	259.91	365.46	
125	31.86	84.13	630.97	365.76	265.21	169.42	95.79	6.04	28.98	217.35	413.62	7.52	270.75	360.22	
130	30.90	81.58	636.36	380.39	255.97	169.42	86.55	5.95	28.54	222.58	413.77	7.52	281.64	354.72	

Roof= RAIN
 = 2.640 x I (l/sec)

Peak roof outflow rate =
 no. of hoppers x weir rating x max. head
 = 48.8 l/sec
 Peak roof outflow volume =
 = 48.8 x time x 60/1000 cu. m.

Roof outflow rate =
 head x weir rating x no. of hoppers
 = head x 4.80 l/sec

Required max. roof storage (cu. m.) : 401.7
 Available roof storage (cu. m.) : 677.7

**SYSTEM A 100 YR STORM
 SITE STORM WATER MANAGEMENT**

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 49801
 Controlled Landscaped area (sq.m) : 496
 Total area - excl. Bldg (sq.m) : 50297
 Composite runoff coefficient : 0.95

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 450
 Area of orifice (sq.m) : 0.15904
 Orifice coefficient : 0.62
 Max. ponding elev. : 92.50
 Catchbasin elev. : 92.20
 Ponding depth. : 0.30
 Orifice invert : 88.15
 Orifice center line elev. : 88.375
 Head (m) : 4.125
 Orifice release rate (l/sec) : 887.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)
10	178.56	2410.94	1446.57	532.25	914.31
15	142.89	1939.13	1745.22	798.38	946.83
20	119.95	1635.60	1962.73	1064.51	898.22
25	103.85	1422.57	2133.86	1330.64	803.22

Required site storage (cu. m) : 947
 Available site storage (cu. m) : 2886
 SEE DRAWING SP-1

$$Q_{site} = RAIN + Q_{roof} = 13.229 \times I + 48.8 \text{ l/sec}$$

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
10	178.56	160.67
15	142.89	128.58
20	119.95	107.93

Peak runoff (l/sec) : 160.7

**UNCONTROLLED
 SITE CHARACTERISTICS**

Uncontrolled Pavement area (sq.m.) : 226
 Uncontrolled Landscaped area (sq.m.) : 4839
 Total area (sq.m) : 5065
 Composite runoff coefficient : 0.640

**SYSTEM A 100 YR STORM
 SITE SUMMARY**

Orifice release rate (l/sec) : 887.1
 Uncontrolled release rate (l/sec) : 160.7
 Total site release rate (l/sec) : 1047.8
 Allowable site release rate (l/sec) : 1327.0

PROJECT: RIVERSIDE SOUTH RETAIL CENTRE (BLDGS A to K)
MUNICIPALITY: CITY OF OTTAWA
JOB NO.: 12007.100
DATE: revised AUGUST 13, 2014
LOCATION: 1420 EARL ARMSTRONG ROAD

SYSTEM A 5 YR STORM
SITE STORM WATER MANAGEMENT

ROOF DRAINAGE CHARACTERISTICS

SITE PLAN CHARACTERISTICS - S Y S T E M S A

Pavement coefficient : 0.9
Landscape coefficient : 0.25
Roof area coefficient : 0.95

Total roof area (sq. m) : 10005
Total number of roof hoppers : 32
Total number of weirs : 32

Max. sloped roof depth (mm) : 50.8
Max. sloped roof storage (cu.m) : 169.42
Max. parapit roof storage (cu.m) : 508.25

Weir rating (l/sec) : 0.15
Weir area rating (sq. m.) : 465
Maximum head (cm) : 10.16
Peak roof outflow rate (l/sec) : 48.8

32 hoppers @ 1 weir = 32
0 hoppers @ 2 weir = 0
Total 32 hoppers

TABLE 1 - ROOF DRAINAGE SYSTEM

Time (min.)	1st ITERATION				2nd ITERATION				3rd ITERATION					
	Rainfall intensity (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)
5	141.18	372.77	111.83	14.63	97.20	97.20	-72.22	2.19	10.53	3.16	108.67	2.65	3.82	108.01
10	104.19	275.11	165.07	29.26	135.81	135.81	-33.61	3.74	17.93	10.76	154.31	4.48	12.89	152.18
15	83.56	220.63	198.56	43.89	154.67	154.67	-14.75	4.49	21.55	19.40	179.16	5.18	22.37	176.20
20	70.25	185.49	222.59	58.52	164.07	164.07	-5.35	4.87	23.36	28.03	194.56	5.33	30.71	191.88
25	60.90	160.79	241.19	73.15	168.03	168.03	-1.38	5.02	24.12	36.18	205.01	5.44	39.14	202.05
30	53.93	142.39	256.30	87.78	168.52	168.52	-0.90	5.04	24.21	43.58	212.72	5.51	47.63	208.67
35	48.52	128.11	269.02	102.41	166.61	166.61	-2.81	4.97	23.85	50.08	218.95	5.58	56.20	212.83
40	44.18	116.67	280.00	117.04	162.95	162.95	-6.46	4.82	23.14	55.54	224.45	5.63	64.86	215.14
45	40.63	107.28	289.65	131.67	157.97	157.97	-11.45	4.62	22.19	59.91	229.74	5.68	73.65	216.00
50	37.65	99.42	298.26	146.30	151.96	151.96	-17.46	4.38	21.03	63.10	235.16	5.74	82.61	215.65
55	35.12	92.74	306.04	160.93	145.11	145.11	-24.31	4.11	19.72	65.07	240.97	5.80	91.80	214.25
60	32.94	86.98	313.14	175.56	137.58	137.58	-31.84	3.81	18.27	65.79	247.36	5.86	101.24	211.90
65	31.04	81.97	319.68	190.20	129.48	129.48	-39.94	3.48	16.72	65.21	254.47	5.93	111.01	208.67
70	29.37	77.55	325.73	204.83	120.90	120.90	-48.52	3.14	15.07	63.31	262.42	6.01	121.15	204.58
75	27.89	73.64	331.37	219.46	111.91	111.91	-57.51	2.78	13.35	60.07	271.30	6.10	131.72	199.64
80	26.56	70.13	336.65	234.09	102.56	102.56	-66.86	2.41	11.55	55.46	281.19	6.20	142.78	193.87
85	25.37	66.98	341.62	248.72	92.90	92.90	-76.52	2.02	9.70	49.47	292.15	6.31	154.39	187.23
90	24.29	64.13	346.31	263.35	82.96	82.96	-86.46	1.62	7.79	42.08	304.23	6.43	166.60	179.71
95	23.31	61.54	350.76	277.98	72.78	72.78	-96.64	1.22	5.84	33.28	317.48	6.56	179.48	171.28
100	22.41	59.16	354.98	292.61	62.38	62.38	-107.04	0.80	3.84	23.05	331.93	6.70	193.08	161.90
105	21.58	56.99	359.02	307.24	51.78	51.78	-117.64	0.38	1.81	11.39	347.62	6.86	207.48	151.53
110	20.82	54.98	362.87	321.87	41.00	41.00	-128.42	-0.05	-0.26	-1.72	364.58	7.03	222.73	140.13
115	20.12	53.12	366.56	336.50	30.06	30.06	-139.36	-0.49	-2.36	-16.28	382.84	7.21	238.90	127.66
120	19.47	51.40	370.10	351.13	18.97	18.97	-150.45	-0.93	-4.49	-32.31	402.41	7.41	256.05	114.05
125	18.86	49.80	373.50	365.76	7.74	7.74	-161.68	-1.38	-6.64	-49.82	423.32	7.62	274.24	99.26
130	18.29	48.31	376.78	380.39	-3.61	-3.61	-173.03	-1.84	-8.82	-68.80	445.58	7.84	293.54	83.24

Roof= RAIN = 2.640 x I (l/sec)

Peak roof outflow rate = no. of hoppers x weir rating x max. head = 48.8 l/sec

Peak roof outflow volume = 48.8 x time x 60/1000 cu. m.

Required max. roof storage (cu. m.) : 216.0
Available roof storage (cu. m.) : 677.7

Roof outflow rate = head x weir rating x no. of hoppers = head x 4.80 l/sec

**SYSTEM A 5 YR STORM
 SITE STORM WATER MANAGEMENT**

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 49801
 Controlled Landscaped area (sq.m) : 496
 Total area - excl. Bldg (sq.m) : 50297
 Composite runoff coefficient : 0.89

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 450
 Area of orifice (sq.m) : 0.15904
 Orifice coefficient : 0.62
 Max. ponding elev. : 92.20
 Catchbasin elev. : 92.20
 Ponding depth. : 0.00
 Orifice invert : 88.15
 Orifice center line elev. : 88.375
 Head (m) : 3.825
 Orifice release rate (l/sec) : 854.2

NO SURFACE PONDING

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)
10	104.19	1349.69	809.81	512.53	297.28
15	83.56	1092.04	982.83	768.80	214.03
20	70.25	925.90	1111.08	1025.07	86.01
25	60.90	809.10	1213.64	1281.34	-67.69

Required site storage (cu. m) : 297
 Available site storage (cu. m) : 396
 SEE DRAWING SP-1

$$Q_{site} = RAIN + Groof = 12.486 \times I + 48.8 \text{ l/sec}$$

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
10	104.19	40.90
15	83.56	32.80
20	70.25	27.58

Peak runoff (L/sec) : 40.9

**UNCONTROLLED
 SITE CHARACTERISTICS**

Uncontrolled Pavement area (sq.m.) : 226
 controlled Landscaped area (sq.m.) : 4839
 Total area (sq.m) : 5065
 Composite runoff coefficient : 0.279

**SYSTEM A 5 YR STORM
 SITE SUMMARY**

Orifice release rate (l/sec) : 854.2
 Uncontrolled release rate (l/sec) : 40.9
 Total site release rate (l/sec) : 895.1
 Allowable site release rate (l/sec) : 1327.0

Urban Ecosystems Limited
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uel@urbanecosystems.com
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APPENDIX B

Tributary No. 14

Approximately 68.14 ha of upstream lands to the south, are currently draining through the Subject property via Tributary No. 14. Ultimately, the storm runoff from this area will be controlled as established through the Riverside South Community Master Drainage Area Plan. The storm drainage will be collected in local storm sewers and conveyed to the sewers on Limebank Road, ultimately discharging to Riverside South Stormwater Management Pond No. 2.

The peak flows from the upstream 68.14 ha of undeveloped lands, based on pasture lands and an estimated time to peak of 1.73 hours, were calculated to be 1.719 m³/s. It is noted that this flow is significantly higher than what was reported in the Riverside South Community Master Drainage Plan, primarily due to a shorter time to peak. An External Storm Drainage Area Plan, Drawing 8 of 8, is included in the rear pocket.

In the interim, it is proposed that a temporary interceptor swale will be constructed, south of the Subject Property, conveying all storm flows from the undeveloped upstream lands, discharging to the road side ditch along Limebank Road. Two existing ditch inlet catchbasins on the east side of Limebank Road, connected to the 2,700 mm diameter storm sewer, will capture approximately 1,000 l/s of the storm flows from the area south of the Subject Property.

Excess flows, being approximately 719 l/s, will be conveyed through a temporary overflow swale flowing east along the south boundary of the Subject Property, to a proposed ditch inlet catchbasin connected to the proposed 1800 mm diameter storm sewer on Collector Road D. Copies of the Site Grading Plan and External Storm Drainage Area Plan are included in the rear pockets of this report.

Rideau Valley Conservation Authority has confirmed that Tributary no. 14 is approved in principle to be enclosed. Prior to commencing any construction on this Subject Property, including grading or any site alteration works, Morguard Investments Limited will file an application under Ontario Regulation 174/06 Section 28 with Rideau Valley Conservation Authority, for a Permit to enclose/alter Tributary No. 14.

PreOtt

SSSSS W W M M H H Y Y M M 000 999 999 =====
S W W W MM MM H H Y Y MM MM O O 9 9 9 9
SSSSS W W W M M M H H H H Y M M M O O ## 9 9 9 9 Ver 4.05
S W W M M H H Y M M O O 9999 9999 Sept 2011
SSSSS W W M M H H Y M M 000 9 9 9 9
Stormwater Management Hydrologic Model 999 999 =====

***** SWMHYMO Ver/4.05 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 836-3884 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****

+++++++ Licensed user: The Sernas Group ++++++++
+++++++ whitby SERIAL#:2637819 ++++++++
+++++++

***** ++++++ PROGRAM ARRAY DIMENSIONS ++++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 105408 *****
***** Max. number of flow points : 105408 *****

***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****

***** ID: Hydrograph IDentification numbers, (1-10). *****
***** NYHD: Hydrograph reference numbers, (6 digits or characters). *****
***** AREA: Drainage area associated with hydrograph, (ac.) or (ha.). *****
***** QPEAK: Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s). *****
***** TpeakDate_hh:mm is the date and time of the peak flow. *****
***** R.V.: Runoff Volume of simulated hydrograph, (in) or (mm). *****
***** R.C.: Runoff Coefficient of simulated hydrograph, (ratio). *****
***** *: see WARNING or NOTE message printed at end of run. *****
***** **: see ERROR message printed at end of run. *****

.....

***** SUMMARY OUTPUT *****

* DATE: 2014-06-10 TIME: 15:29:25 RUN COUNTER: 000270 *

* Input filename: C:\DDRIVE~1\PreOtt.dat *
* Output filename: C:\DDRIVE~1\PreOtt.out *
* Summary filename: C:\DDRIVE~1\PreOtt.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *

PreOtt

```

*****
# Project Name: [Riverside Ottawa]   Project Number: [8811895.400]
# Date       : 07-22-2004
# Modeller   : [Ken Chow]
# Company    : GHD
# License #  : 2640114
*****
** END OF RUN : 1

```

RUN:COMMAND#

002:0001-----

```

-
START
  [TZERO = .00 hrs on 0]
  [METOUT= 2 (1=imperial, 2=metric output)]
  [NSTORM= 2 ]
  [NRUN = 2 ]
*****
# Project Name: [Riverside Ottawa]   Project Number: [8811895.400]
# Date       : 07-22-2004
# Modeller   : [Ken Chow]
# Company    : GHD
# License #  : 2640114
*****

```

002:0002-----

```

-
MASS STORM
  Filename = C:\D DRIVE\24SCSII.mst
  Comment = 24 hour SCS II storm mass curve
  [SDT= 2.00:SDUR= 24.00:PTOT= 103.20]

```

002:0003-----ID:NHYD-----AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.

```

-
DESIGN NASHYD      01:200      63.30      2.056 No_date      13:22      51.59
.500
  [CN= 72.0: N= 3.00]
  [Tp= 1.37:DT= 2.00]

```

002:0004-----ID:NHYD-----AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.

```

-
PRINT HYD          01:200      63.30      2.056 No_date      13:22      51.59
n/a

```

002:0005-----ID:NHYD-----AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.

```

-
DESIGN NASHYD      01:200      63.30      1.719 No_date      13:48      51.59
.500
  [CN= 72.0: N= 3.00]
  [Tp= 1.73:DT= 2.00]

```

002:0006-----ID:NHYD-----AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.

-

n/a PRINT HYD 01:200 PreOtt 63.30 1.719 No_date 13:48 51.59

002:0007-----

- FINISH-----

--

** WARNINGS / ERRORS / NOTES

simulation ended on 2014-06-10 at 15:29:25

=====

==

PreOtt

2 Metric units

```
*****
*# Project Name: [Riverside Ottawa] Project Number: [8811895.400]
*# Date : 07-22-2004
*# Modeller : [Ken Chow]
*# Company : GHD
*# License # : 2640114
*****
START TZERO=[0.0], METOUT=[2], NSTORM=[2], NRUN=[2]
*-----|-----
* SCS 24 hours distribution
* Parameters taken from IDF curve parameters provided by City of Ottawa
* Sewer Guidelines October 2012
*-----|-----
*100 year event
*-----|-----
*
MASS STORM PTOTAL=[103.2] (mm), CSDT=[2] (min),
CURVE_FILENAME=["C:\D DRIVE\24SCSII.mst"]
*****
* EXTERNAL AREAS based on Row Crops and a Tp of 1.37
*
DESIGN NASHYD ID=[1], NHYD=["200"], DT=[2]min, AREA=[63.3] (ha),
DWF=[0] (cms), CN/C=[72], TP=[1.37]hrs,
RAINFALL=[ , , , ] (mm/hr), END=-1
*
PRINT HYD ID=[1], # OF PCYCLES=[-1]
*
*****
* EXTERNAL AREAS based on Pasture and a Tp of 1.73
*
DESIGN NASHYD ID=[1], NHYD=["200"], DT=[2]min, AREA=[63.3] (ha),
DWF=[0] (cms), CN/C=[72], TP=[1.73]hrs,
RAINFALL=[ , , , ] (mm/hr), END=-1
*
PRINT HYD ID=[1], # OF PCYCLES=[-1]
*
FINISH
```

PreOtt

```

=====
SSSSS W W M M H H Y Y M M 000 999 999 =====
S W W W MM MM H H Y Y MM MM O O 9 9 9 9
SSSSS W W W M M M H H H H Y M M M O O ## 9 9 9 9 Ver 4.05
S W W M M H H Y M M O O 9999 9999 Sept 2011
SSSSS W W M M H H Y M M 000 9 9 9 9 =====
Stormwater Management Hydrologic Model 999 999 =====

```

```

*****
***** SWMHYMO Ver/4.05 *****
***** A single event and continuous hydrologic simulation model *****
***** based on the principles of HYMO and its successors *****
***** OTTHYMO-83 and OTTHYMO-89. *****
***** Distributed by: J.F. Sabourin and Associates Inc. *****
***** Ottawa, Ontario: (613) 836-3884 *****
***** Gatineau, Quebec: (819) 243-6858 *****
***** E-Mail: swmhymo@jfsa.Com *****
*****

```

```

+++++
+++++ Licensed user: The Sernas Group +++++
+++++ whitby SERIAL#:2637819 +++++
+++++

```

```

*****
***** +++++ PROGRAM ARRAY DIMENSIONS +++++ *****
***** Maximum value for ID numbers : 10 *****
***** Max. number of rainfall points: 105408 *****
***** Max. number of flow points : 105408 *****
*****

```

```

***** D E T A I L E D O U T P U T *****
*****
* DATE: 2014-06-10 TIME: 15:29:25 RUN COUNTER: 000270 *
* Input filename: C:\DDRIVE~1\PreOtt.dat *
* Output filename: C:\DDRIVE~1\PreOtt.out *
* Summary filename: C:\DDRIVE~1\PreOtt.sum *
* User comments: *
* 1: _____ *
* 2: _____ *
* 3: _____ *
*****

```

001:0001

```

*****
** Project Name: [Riverside Ottawa] Project Number: [8811895.400]
** Date : 07-22-2004
** Modeller : [Ken chow]
** Company : GHD
** License # : 2640114
*****
** END OF RUN : 1

```

PreOtt

| START | Project dir.: C:\DDRIVE~1\
----- Rainfall dir.: C:\DDRIVE~1\

TZERO = .00 hrs on 0
METOUT= 2 (output = METRIC)
NRUN = 002
NSTORM= 2
1=-----
2=ibution

002:0002-----

*# Project Name: [Riverside Ottawa] Project Number: [8811895.400]
*# Date : 07-22-2004
*# Modeller : [Ken Chow]
*# Company : GHD
*# License # : 2640114

002:0002-----

* Parameters taken from IDF curve parameters provided by City of Ottawa
* Sewer Guidelines October 2012
*100 year event
*

| MASS STORM |
Ptotal=103.20 mm

Filename: C:\D DRIVE\24SCSII.mst
Comments: 24 hour SCS II storm mass curve

Duration of storm = 24.00 hrs
Mass curve time step = 12.00 min
Selected storm time step = 2.00 min
Volume of derived storm = 103.20 mm

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
.03	1.032	6.03	2.064	12.03	20.640	18.03	1.548
.07	1.032	6.07	2.064	12.07	20.640	18.07	1.548
.10	1.032	6.10	2.064	12.10	20.640	18.10	1.548
.13	1.032	6.13	2.064	12.13	20.640	18.13	1.548
.17	1.032	6.17	2.064	12.17	20.640	18.17	1.548
.20	1.032	6.20	2.064	12.20	20.640	18.20	1.548
.23	1.032	6.23	2.064	12.23	12.900	18.23	1.548
.27	1.032	6.27	2.064	12.27	12.900	18.27	1.548
.30	1.032	6.30	2.064	12.30	12.900	18.30	1.548
.33	1.032	6.33	2.064	12.33	12.900	18.33	1.548
.37	1.032	6.37	2.064	12.37	12.900	18.37	1.548
.40	1.032	6.40	2.064	12.40	12.900	18.40	1.548
.43	1.032	6.43	2.064	12.43	9.288	18.43	2.064
.47	1.032	6.47	2.064	12.47	9.288	18.47	2.064
.50	1.032	6.50	2.064	12.50	9.288	18.50	2.064
.53	1.032	6.53	2.064	12.53	9.288	18.53	2.064
.57	1.032	6.57	2.064	12.57	9.288	18.57	2.064
.60	1.032	6.60	2.064	12.60	9.288	18.60	2.064

				PreOtt				
.63	1.032	6.63	2.064	12.63	8.772	18.63	1.548	
.67	1.032	6.67	2.064	12.67	8.772	18.67	1.548	
.70	1.032	6.70	2.064	12.70	8.772	18.70	1.548	
.73	1.032	6.73	2.064	12.73	8.772	18.73	1.548	
.77	1.032	6.77	2.064	12.77	8.772	18.77	1.548	
.80	1.032	6.80	2.064	12.80	8.772	18.80	1.548	
.83	1.032	6.83	2.064	12.83	6.192	18.83	1.548	
.87	1.032	6.87	2.064	12.87	6.192	18.87	1.548	
.90	1.032	6.90	2.064	12.90	6.192	18.90	1.548	
.93	1.032	6.93	2.064	12.93	6.192	18.93	1.548	
.97	1.032	6.97	2.064	12.97	6.192	18.97	1.548	
1.00	1.032	7.00	2.064	13.00	6.192	19.00	1.548	
1.03	1.032	7.03	2.064	13.03	5.160	19.03	2.064	
1.07	1.032	7.07	2.064	13.07	5.160	19.07	2.064	
1.10	1.032	7.10	2.064	13.10	5.160	19.10	2.064	
1.13	1.032	7.13	2.064	13.13	5.160	19.13	2.064	
1.17	1.032	7.17	2.064	13.17	5.160	19.17	2.064	
1.20	1.032	7.20	2.064	13.20	5.160	19.20	2.064	
1.23	1.032	7.23	2.064	13.23	5.160	19.23	1.548	
1.27	1.032	7.27	2.064	13.27	5.160	19.27	1.548	
1.30	1.032	7.30	2.064	13.30	5.160	19.30	1.548	
1.33	1.032	7.33	2.064	13.33	5.160	19.33	1.548	
1.37	1.032	7.37	2.064	13.37	5.160	19.37	1.548	
1.40	1.032	7.40	2.064	13.40	5.160	19.40	1.548	
1.43	1.032	7.43	2.064	13.43	5.160	19.43	2.064	
1.47	1.032	7.47	2.064	13.47	5.160	19.47	2.064	
1.50	1.032	7.50	2.064	13.50	5.160	19.50	2.064	
1.53	1.032	7.53	2.064	13.53	5.160	19.53	2.064	
1.57	1.032	7.57	2.064	13.57	5.160	19.57	2.064	
1.60	1.032	7.60	2.064	13.60	5.160	19.60	2.064	
1.63	1.032	7.63	2.064	13.63	5.160	19.63	1.548	
1.67	1.032	7.67	2.064	13.67	5.160	19.67	1.548	
1.70	1.032	7.70	2.064	13.70	5.160	19.70	1.548	
1.73	1.032	7.73	2.064	13.73	5.160	19.73	1.548	
1.77	1.032	7.77	2.064	13.77	5.160	19.77	1.548	
1.80	1.032	7.80	2.064	13.80	5.160	19.80	1.548	
1.83	1.032	7.83	2.064	13.83	5.160	19.83	2.064	
1.87	1.032	7.87	2.064	13.87	5.160	19.87	2.064	
1.90	1.032	7.90	2.064	13.90	5.160	19.90	2.064	
1.93	1.032	7.93	2.064	13.93	5.160	19.93	2.064	
1.97	1.032	7.97	2.064	13.97	5.160	19.97	2.064	
2.00	1.032	8.00	2.064	14.00	5.160	20.00	2.064	
2.03	1.032	8.03	3.096	14.03	3.096	20.03	1.548	
2.07	1.032	8.07	3.096	14.07	3.096	20.07	1.548	
2.10	1.032	8.10	3.096	14.10	3.096	20.10	1.548	
2.13	1.032	8.13	3.096	14.13	3.096	20.13	1.548	
2.17	1.032	8.17	3.096	14.17	3.096	20.17	1.548	
2.20	1.032	8.20	3.096	14.20	3.096	20.20	1.548	
2.23	1.032	8.23	3.096	14.23	3.096	20.23	1.548	
2.27	1.032	8.27	3.096	14.27	3.096	20.27	1.548	
2.30	1.032	8.30	3.096	14.30	3.096	20.30	1.548	
2.33	1.032	8.33	3.096	14.33	3.096	20.33	1.548	
2.37	1.032	8.37	3.096	14.37	3.096	20.37	1.548	
2.40	1.032	8.40	3.096	14.40	3.096	20.40	1.548	
2.43	1.032	8.43	3.096	14.43	3.096	20.43	1.032	
2.47	1.032	8.47	3.096	14.47	3.096	20.47	1.032	
2.50	1.032	8.50	3.096	14.50	3.096	20.50	1.032	
2.53	1.032	8.53	3.096	14.53	3.096	20.53	1.032	
2.57	1.032	8.57	3.096	14.57	3.096	20.57	1.032	
2.60	1.032	8.60	3.096	14.60	3.096	20.60	1.032	
2.63	1.032	8.63	3.096	14.63	3.096	20.63	1.548	
2.67	1.032	8.67	3.096	14.67	3.096	20.67	1.548	
2.70	1.032	8.70	3.096	14.70	3.096	20.70	1.548	

				PreOtt				
2.73	1.032	8.73	3.096	14.73	3.096	20.73	1.548	
2.77	1.032	8.77	3.096	14.77	3.096	20.77	1.548	
2.80	1.032	8.80	3.096	14.80	3.096	20.80	1.548	
2.83	1.032	8.83	3.096	14.83	3.096	20.83	1.548	
2.87	1.032	8.87	3.096	14.87	3.096	20.87	1.548	
2.90	1.032	8.90	3.096	14.90	3.096	20.90	1.548	
2.93	1.032	8.93	3.096	14.93	3.096	20.93	1.548	
2.97	1.032	8.97	3.096	14.97	3.096	20.97	1.548	
3.00	1.032	9.00	3.096	15.00	3.096	21.00	1.548	
3.03	1.032	9.03	3.096	15.03	2.580	21.03	1.032	
3.07	1.032	9.07	3.096	15.07	2.580	21.07	1.032	
3.10	1.032	9.10	3.096	15.10	2.580	21.10	1.032	
3.13	1.032	9.13	3.096	15.13	2.580	21.13	1.032	
3.17	1.032	9.17	3.096	15.17	2.580	21.17	1.032	
3.20	1.032	9.20	3.096	15.20	2.580	21.20	1.032	
3.23	1.032	9.23	3.096	15.23	2.580	21.23	1.548	
3.27	1.032	9.27	3.096	15.27	2.580	21.27	1.548	
3.30	1.032	9.30	3.096	15.30	2.580	21.30	1.548	
3.33	1.032	9.33	3.096	15.33	2.580	21.33	1.548	
3.37	1.032	9.37	3.096	15.37	2.580	21.37	1.548	
3.40	1.032	9.40	3.096	15.40	2.580	21.40	1.548	
3.43	1.032	9.43	3.096	15.43	2.580	21.43	1.032	
3.47	1.032	9.47	3.096	15.47	2.580	21.47	1.032	
3.50	1.032	9.50	3.096	15.50	2.580	21.50	1.032	
3.53	1.032	9.53	3.096	15.53	2.580	21.53	1.032	
3.57	1.032	9.57	3.096	15.57	2.580	21.57	1.032	
3.60	1.032	9.60	3.096	15.60	2.580	21.60	1.032	
3.63	1.032	9.63	3.096	15.63	2.580	21.63	1.548	
3.67	1.032	9.67	3.096	15.67	2.580	21.67	1.548	
3.70	1.032	9.70	3.096	15.70	2.580	21.70	1.548	
3.73	1.032	9.73	3.096	15.73	2.580	21.73	1.548	
3.77	1.032	9.77	3.096	15.77	2.580	21.77	1.548	
3.80	1.032	9.80	3.096	15.80	2.580	21.80	1.548	
3.83	1.032	9.83	3.096	15.83	2.580	21.83	1.032	
3.87	1.032	9.87	3.096	15.87	2.580	21.87	1.032	
3.90	1.032	9.90	3.096	15.90	2.580	21.90	1.032	
3.93	1.032	9.93	3.096	15.93	2.580	21.93	1.032	
3.97	1.032	9.97	3.096	15.97	2.580	21.97	1.032	
4.00	1.032	10.00	3.096	16.00	2.580	22.00	1.032	
4.03	2.064	10.03	5.676	16.03	2.580	22.03	1.032	
4.07	2.064	10.07	5.676	16.07	2.580	22.07	1.032	
4.10	2.064	10.10	5.676	16.10	2.580	22.10	1.032	
4.13	2.064	10.13	5.676	16.13	2.580	22.13	1.032	
4.17	2.064	10.17	5.676	16.17	2.580	22.17	1.032	
4.20	2.064	10.20	5.676	16.20	2.580	22.20	1.032	
4.23	2.064	10.23	5.676	16.23	2.580	22.23	1.548	
4.27	2.064	10.27	5.676	16.27	2.580	22.27	1.548	
4.30	2.064	10.30	5.676	16.30	2.580	22.30	1.548	
4.33	2.064	10.33	5.676	16.33	2.580	22.33	1.548	
4.37	2.064	10.37	5.676	16.37	2.580	22.37	1.548	
4.40	2.064	10.40	5.676	16.40	2.580	22.40	1.548	
4.43	2.064	10.43	5.676	16.43	2.580	22.43	1.032	
4.47	2.064	10.47	5.676	16.47	2.580	22.47	1.032	
4.50	2.064	10.50	5.676	16.50	2.580	22.50	1.032	
4.53	2.064	10.53	5.676	16.53	2.580	22.53	1.032	
4.57	2.064	10.57	5.676	16.57	2.580	22.57	1.032	
4.60	2.064	10.60	5.676	16.60	2.580	22.60	1.032	
4.63	2.064	10.63	5.676	16.63	2.580	22.63	1.548	
4.67	2.064	10.67	5.676	16.67	2.580	22.67	1.548	
4.70	2.064	10.70	5.676	16.70	2.580	22.70	1.548	
4.73	2.064	10.73	5.676	16.73	2.580	22.73	1.548	
4.77	2.064	10.77	5.676	16.77	2.580	22.77	1.548	
4.80	2.064	10.80	5.676	16.80	2.580	22.80	1.548	

			PreOtt				
4.83	2.064	10.83	5.676	16.83	1.548	22.83	1.032
4.87	2.064	10.87	5.676	16.87	1.548	22.87	1.032
4.90	2.064	10.90	5.676	16.90	1.548	22.90	1.032
4.93	2.064	10.93	5.676	16.93	1.548	22.93	1.032
4.97	2.064	10.97	5.676	16.97	1.548	22.97	1.032
5.00	2.064	11.00	5.676	17.00	1.548	23.00	1.032
5.03	2.064	11.03	7.740	17.03	1.548	23.03	1.032
5.07	2.064	11.07	7.740	17.07	1.548	23.07	1.032
5.10	2.064	11.10	7.740	17.10	1.548	23.10	1.032
5.13	2.064	11.13	7.740	17.13	1.548	23.13	1.032
5.17	2.064	11.17	7.740	17.17	1.548	23.17	1.032
5.20	2.064	11.20	7.740	17.20	1.548	23.20	1.032
5.23	2.064	11.23	11.352	17.23	2.064	23.23	1.032
5.27	2.064	11.27	11.352	17.27	2.064	23.27	1.032
5.30	2.064	11.30	11.352	17.30	2.064	23.30	1.032
5.33	2.064	11.33	11.352	17.33	2.064	23.33	1.032
5.37	2.064	11.37	11.352	17.37	2.064	23.37	1.032
5.40	2.064	11.40	11.352	17.40	2.064	23.40	1.032
5.43	2.064	11.43	27.348	17.43	1.548	23.43	1.548
5.47	2.064	11.47	27.348	17.47	1.548	23.47	1.548
5.50	2.064	11.50	27.348	17.50	1.548	23.50	1.548
5.53	2.064	11.53	27.348	17.53	1.548	23.53	1.548
5.57	2.064	11.57	27.348	17.57	1.548	23.57	1.548
5.60	2.064	11.60	27.348	17.60	1.548	23.60	1.548
5.63	2.064	11.63	56.760	17.63	2.064	23.63	1.032
5.67	2.064	11.67	56.760	17.67	2.064	23.67	1.032
5.70	2.064	11.70	56.760	17.70	2.064	23.70	1.032
5.73	2.064	11.73	56.760	17.73	2.064	23.73	1.032
5.77	2.064	11.77	56.760	17.77	2.064	23.77	1.032
5.80	2.064	11.80	56.760	17.80	2.064	23.80	1.032
5.83	2.064	11.83	116.100	17.83	1.548	23.83	1.032
5.87	2.064	11.87	116.100	17.87	1.548	23.87	1.032
5.90	2.064	11.90	116.100	17.90	1.548	23.90	1.032
5.93	2.064	11.93	116.100	17.93	1.548	23.93	1.032
5.97	2.064	11.97	116.100	17.97	1.548	23.97	1.032
6.00	2.064	12.00	116.100	18.00	1.548	24.00	1.032

002:0003

* EXTERNAL AREAS based on Row Crops and a Tp of 1.37

*

DESIGN NASHYD	Area (ha)=	63.30	Curve Number (CN)=	72.00
01:200 DT= 2.00	Ia (mm)=	1.500	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	1.370		

Unit Hyd Qpeak (cms)= 1.765

PEAK FLOW (cms)= 2.056 (i)

TIME TO PEAK (hrs)= 13.367

RUNOFF VOLUME (mm)= 51.591

TOTAL RAINFALL (mm)= 103.200

RUNOFF COEFFICIENT = .500

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0004

PreOtt

*

PRINT HYD	AREA	(ha)=	63.300
ID=01 (200)	QPEAK	(cms)=	2.056 (i)
DT= 2.00 PCYC=-1	TPEAK	(hrs)=	13.367
	VOLUME	(mm)=	51.591

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0005

*

* EXTERNAL AREAS based on Pasture and a Tp of 1.73

*

DESIGN NASHYD	Area	(ha)=	63.30	Curve Number (CN)=72.00
01:200 DT= 2.00	Ia	(mm)=	1.500	# of Linear Res.(N)= 3.00
	U.H. Tp	(hrs)=	1.730	

Unit Hyd Qpeak (cms)= 1.398

PEAK FLOW (cms)= 1.719 (i)
 TIME TO PEAK (hrs)= 13.800
 RUNOFF VOLUME (mm)= 51.591
 TOTAL RAINFALL (mm)= 103.200
 RUNOFF COEFFICIENT = .500

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0006

*

PRINT HYD	AREA	(ha)=	63.300
ID=01 (200)	QPEAK	(cms)=	1.719 (i)
DT= 2.00 PCYC=-1	TPEAK	(hrs)=	13.800
	VOLUME	(mm)=	51.591

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

002:0007

*

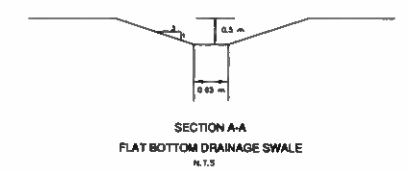
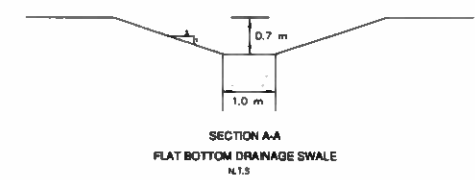
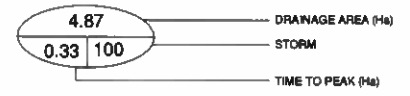
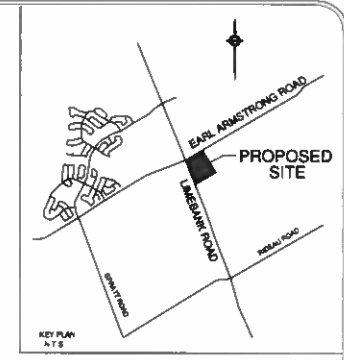
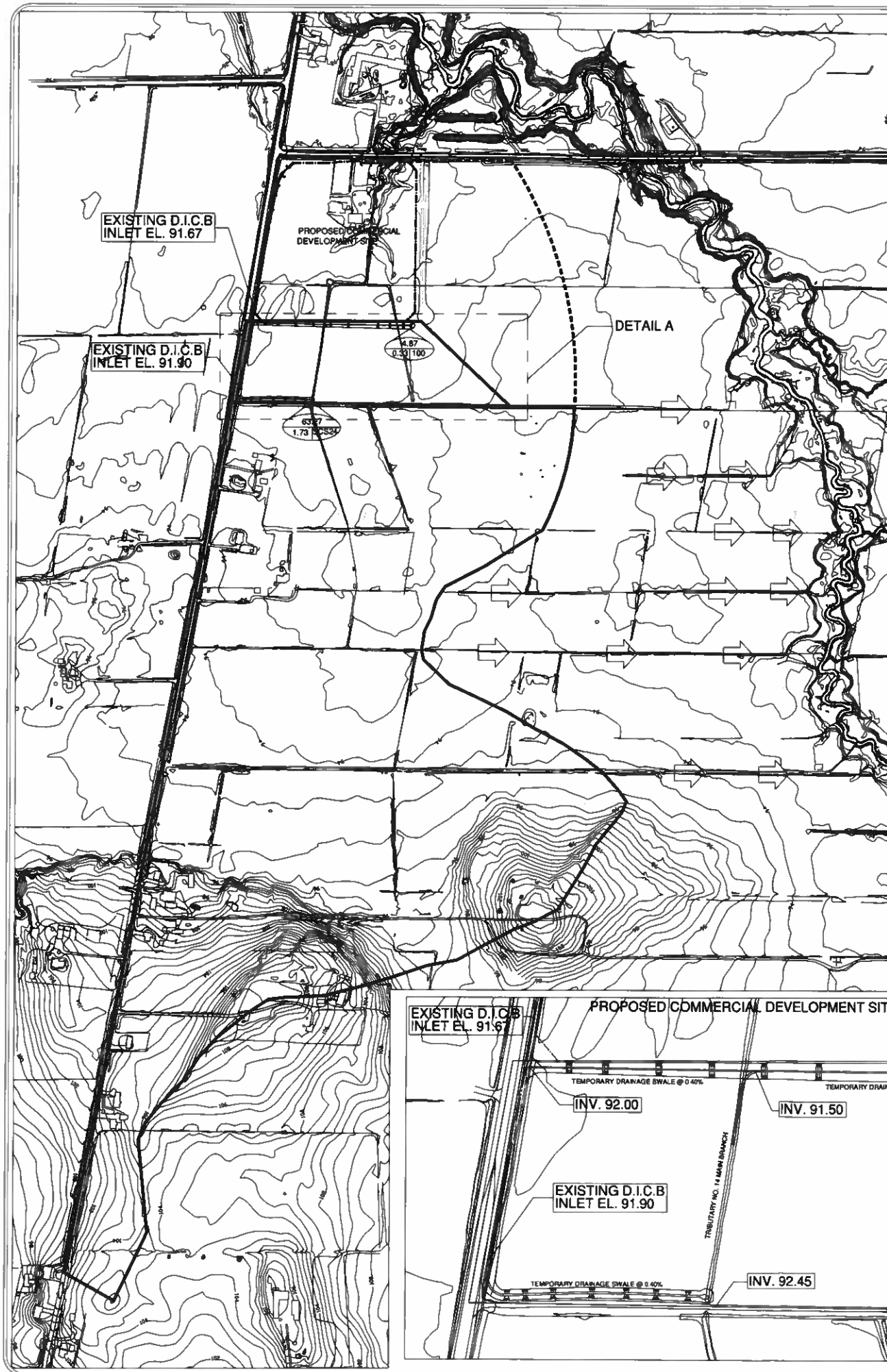
FINISH

**

WARNINGS / ERRORS / NOTES

Simulation ended on 2014-06-10 at 15:29:25

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NOTE:
THIS DRAWING SHALL BE READ
IN CONJUNCTION WITH DRAWING
4 OF 8, EROSION & SEDIMENT
CONTROL PLAN, AND DRAWING
5 OF 8, NOTES & DETAILS
PROJECT 12007

LOCAL BENCHMARK
CUT CROSS IN CONCRETE TRAFFIC ISLAND AT THE NORTH-EAST
CORNER OF EARL ARMSTRONG ROAD AND LAMBKIN ROAD
AS ESTABLISHED BY AMER, ORILLIWAY, YOUNGBURG LTD. O.L.S.

ELEVATION 81.67

1	DATE	BY	CHKD
2	APP. DATE	BY	CHKD
3	APP. DATE	BY	CHKD
4	APP. DATE	BY	CHKD
5	APP. DATE	BY	CHKD
6	APP. DATE	BY	CHKD
7	APP. DATE	BY	CHKD
8	APP. DATE	BY	CHKD
9	APP. DATE	BY	CHKD
10	APP. DATE	BY	CHKD

APPROVED AS TO FORM IN ACCORDANCE WITH THE PROFESSIONAL SEAL AND SIGNATURE OF THE ENGINEER REGISTERED IN THE PROVINCE OF ONTARIO.

Director of Engineering Date

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FILE No D07-12-14-0067
**EXTERNAL STORM
DRAINAGE AREA PLAN**

Designed By: XXX Date: APR 2014 Checked By: R.E.
Drawn By: XXX
Scale: 1:3000 Project No: 12007 Drawing No: 8 of 8

13 - P:\URBAN\12007\12007-SETC_PL_A4.dwg - P.L. 23 May 2014 - 10:55