Appendix A
Drawings

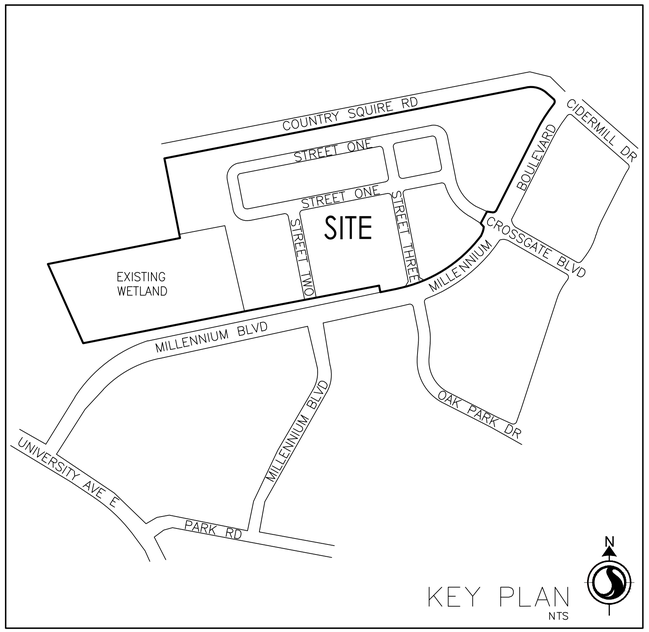
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ACTIVA HOLDINGS INC.

400 MILLENNIUM BOULEVARD
WATERLOO, ONTARIO

REVISED DRAFT PLAN SUBMISSION
OCTOBER 2024

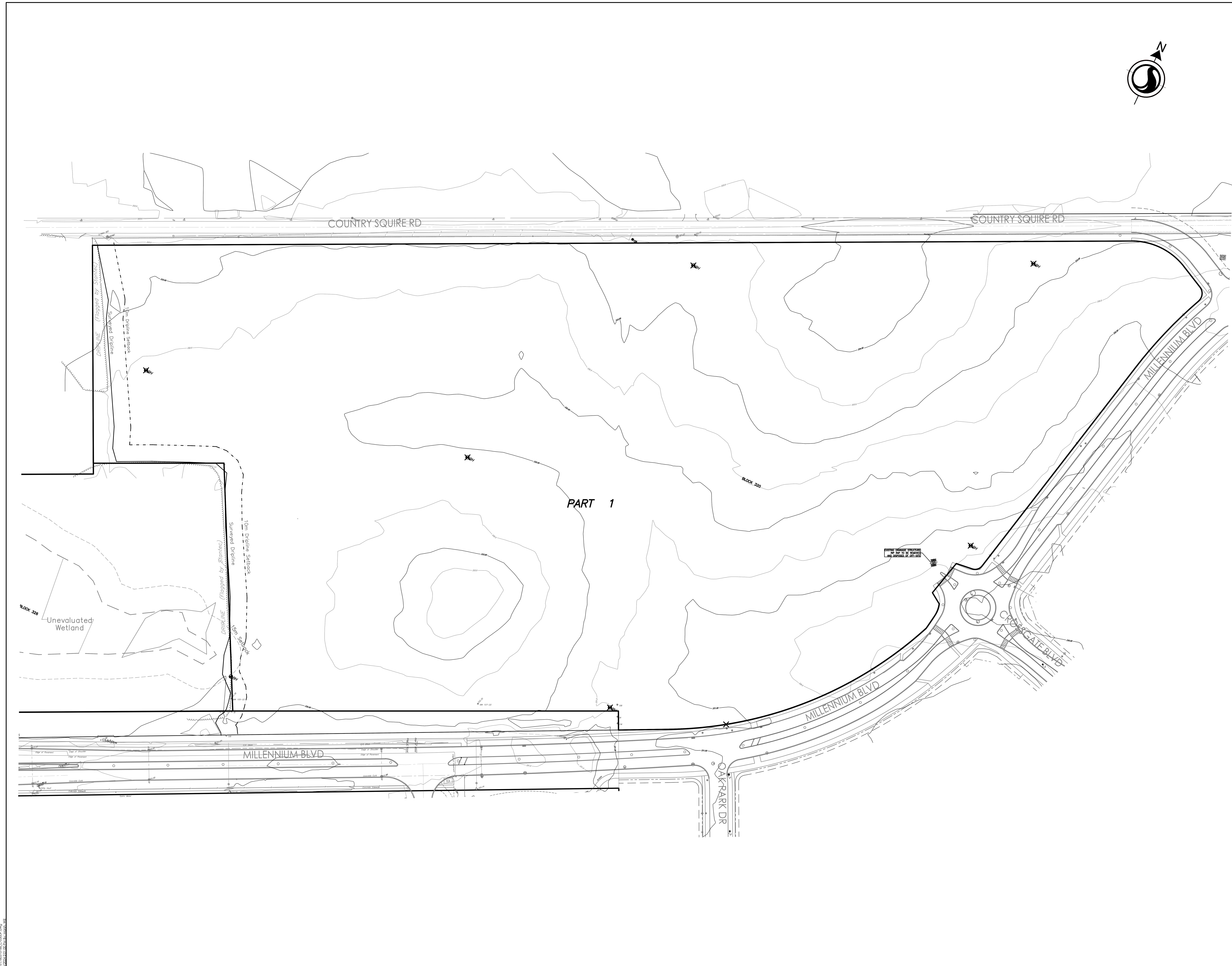
Project Number: 160310788



INDEX

SHEET NO.	DESCRIPTION
C–050	EXISTING CONDITIONS & REMOVALS PLAN
C–100	GENERAL SERVICING PLAN
C–110	STORM SEWER CATCHMENT AREA PLAN
C–120	SANITARY SEWER CATCHMENT AREA PLAN
C–200	PLAN & PROFILE – STREET '1' STA. 0+000 TO 0+275
C–201	PLAN & PROFILE – STREET '1' STA. 0+275 TO 0+500
C–202	PLAN & PROFILE – STREET '1' STA. 0+500 TO 0+700
C–203	PLAN & PROFILE – STREET '1' STA. 0+700 TO 0+975
C–204	PLAN & PROFILE – STREET '2' STA. 0+000 TO 0+200
C–205	PLAN & PROFILE – STREET '3' STA. 0+000 TO 0+275
C–400	GENERAL GRADING PLAN

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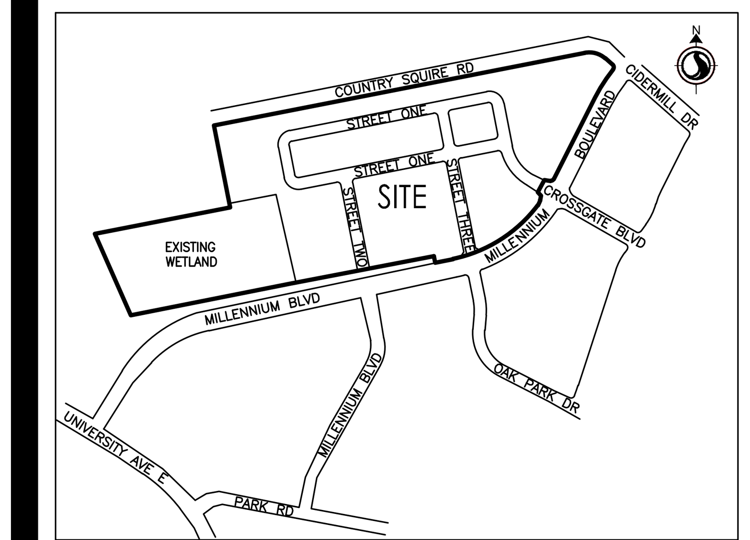
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Key Map NTS.



Legend

- 332.22 EXISTING ELEVATION
- 331.00 EXISTING CONTOUR
- EXISTING SANITARY MANHOLE
- EXISTING SANITARY SEWER
- EXISTING STORM MANHOLE
- EXISTING STORM SEWER
- EXISTING STORM SINGLE/DOUBLE CATCHBASIN MANHOLE
- EXISTING STORM SINGLE/DOUBLE CATCHBASIN
- EXISTING FIRE HYDRANT
- EXISTING VALVE & BOX
- EXISTING WATERMAIN
- IB EXISTING IRON BAR
- REMOVALS
- MONITORING WELL
- BH BORE HOLE
- PROPERTY LINE
- DRIPLINE
- 10m SURVEYED DRIPLINE SETBACK

Revision/Issue	By	Appd	YYYY.MM.DD
1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24

File Name: 160310788_C-050DP	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
	RAS	RAS	TAHF	2023.11.24

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ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title

EXISTING CONDITIONS & REMOVALS PLAN

Project No. 160310788

Scale 1:1000 (0, 10, 30, 50m)

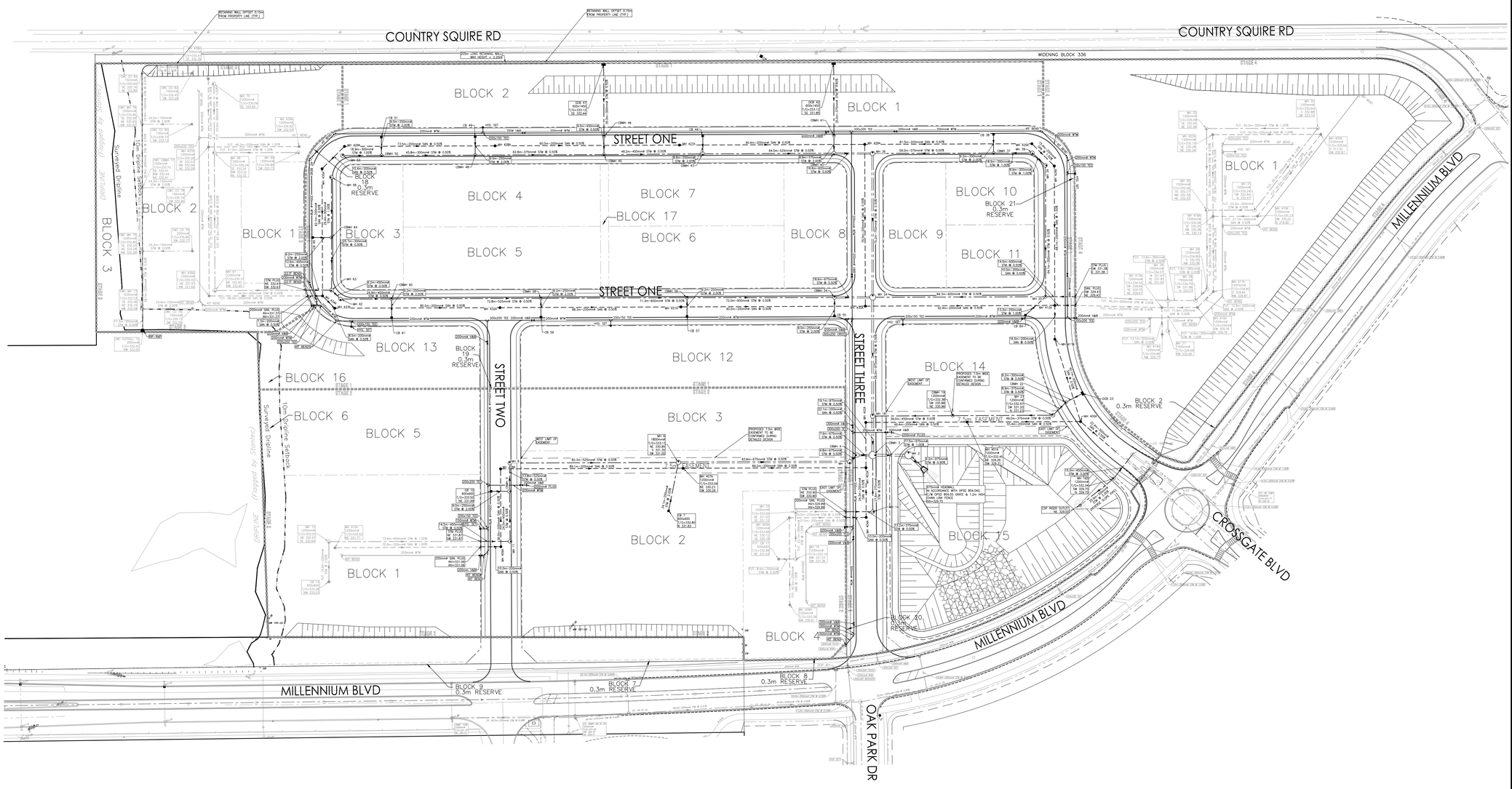
Revision 1

Sheet 1 of 1

Drawing No. **C-050**

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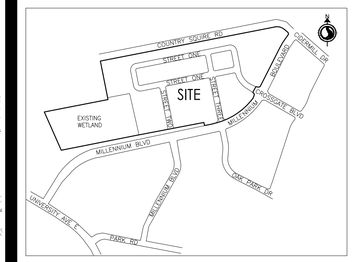
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Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN-OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- STAGE LIMIT
- PROPERTY LINE
- DRIPLINE
- 10m SURVEYED DRIPLINE SETBACK

1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24
Revision/Issue	By	Appd	YYYY.MM.DD
File Name: 160310788_C-100UG	RAS	RAS	TAHF	2024.10.30
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title
GENERAL SERVICING PLAN

Project No. 160310788

Scale 1:1000 (0 10 30 50m)

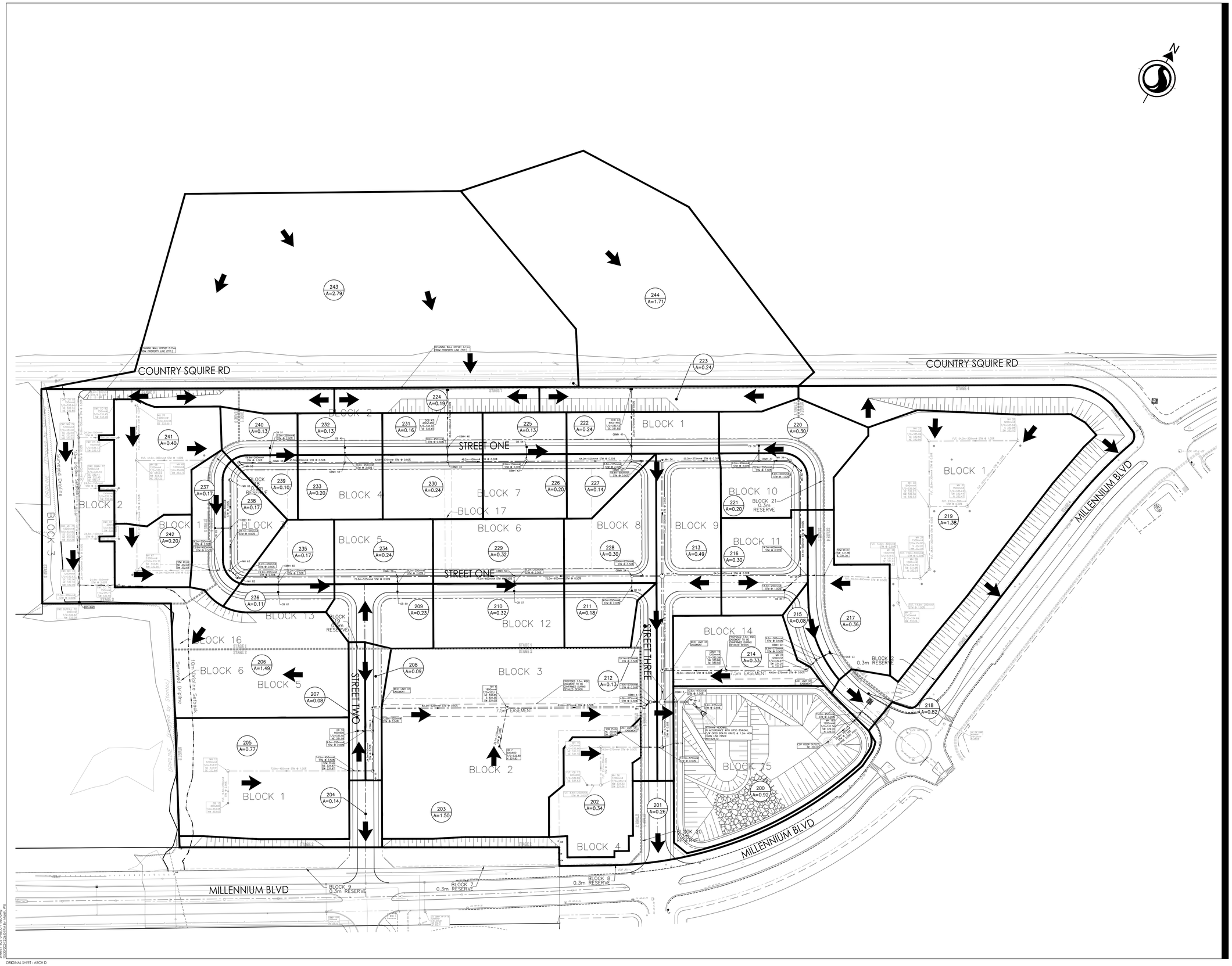
Revision 1

Sheet 1 of 1

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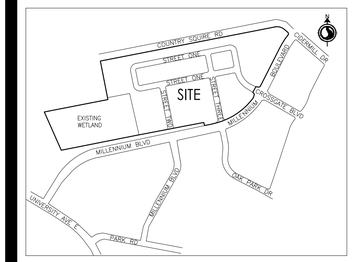
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Key Map NTS.



Legend

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- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN-OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- STAGE LIMIT
- PROPERTY LINE
- DRIPLINE
- 10m SURVEYED DRIPLINE SETBACK
- 200 A=0.90 — AREA ID / CONTRIBUTING AREA (ha)
- MAJOR OVERLAND FLOOD ROUTE
- DRAINAGE BOUNDARY

1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24
Revision/Issue	By	Appd	YYYY.MM.DD
File Name: 160310788_C-110SD	RAS	RAS	TAHF	2024.10.30
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project

ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title

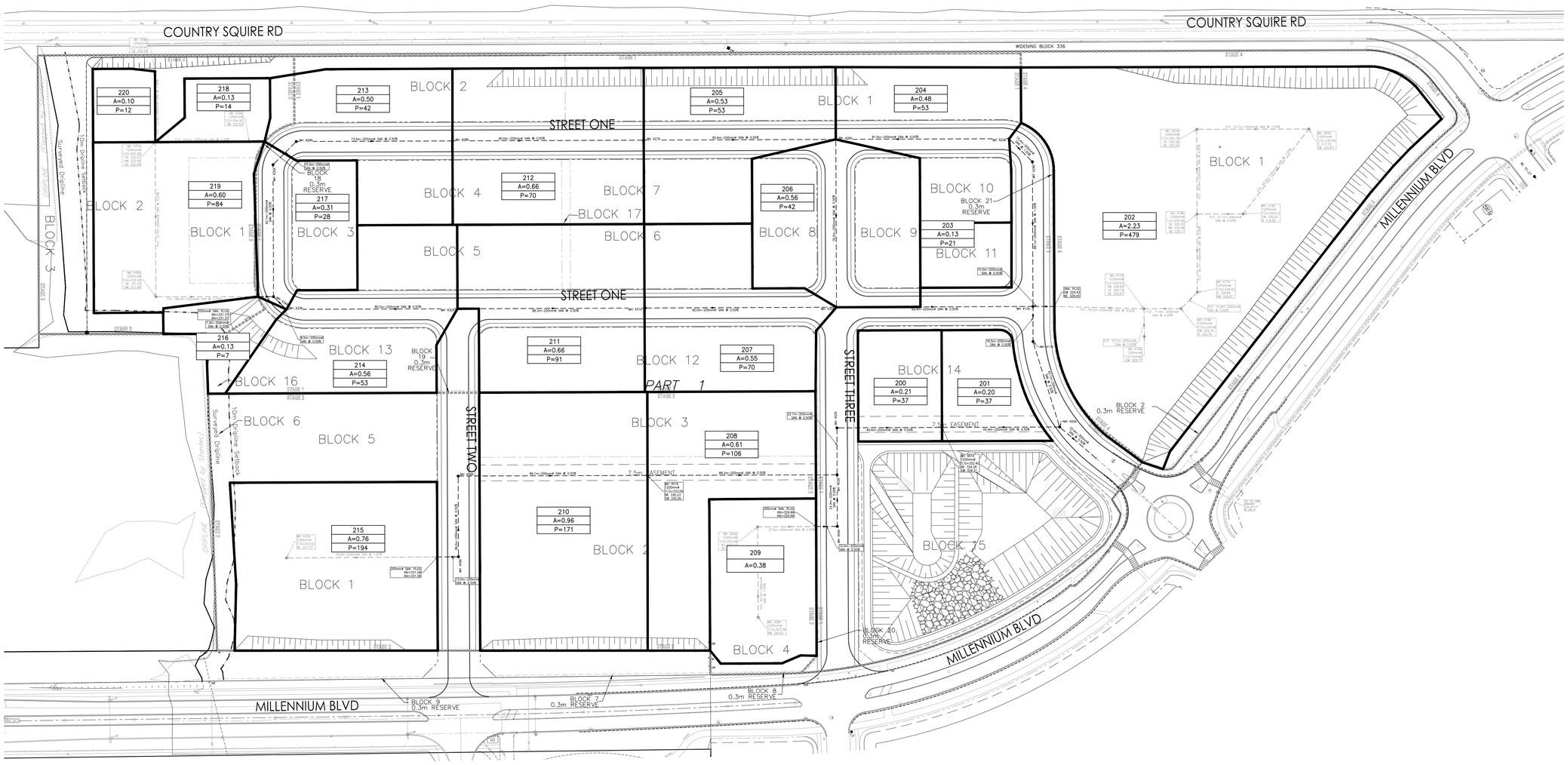
STORM SEWER CATCMENT AREA PLAN

Project No.	Scale
160310788	1:1000 (0 10 30 50m)

Revision	Sheet	Drawing No.
1	1 of 11	C-110

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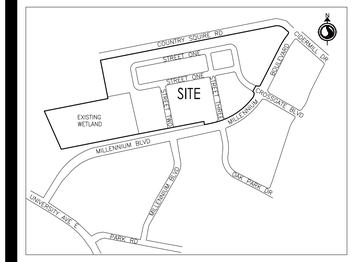
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Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN-OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- STAGE LIMIT
- PROPERTY LINE
- DRIPLINE
- 10m SURVEYED DRIPLINE SETBACK

214	AREA ID
A=0.56	CONTRIBUTING AREA (ha)
P=53	POPULATION

1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24
Revision/Issue	By	Appd	YYYY.MM.DD
File Name: 160310788_C-120SS	RAS	RAS	TAHF 2024.10.30
	Dwn.	Dsgn.	Chkd. YYYY.MM.DD

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MILLENNIUM BOULEVARD

WATERLOO, ON

Title

SANITARY SEWER CATCHMENT AREA PLAN

Project No. 160310788

Scale 1:1000 (0, 10, 30, 50m)

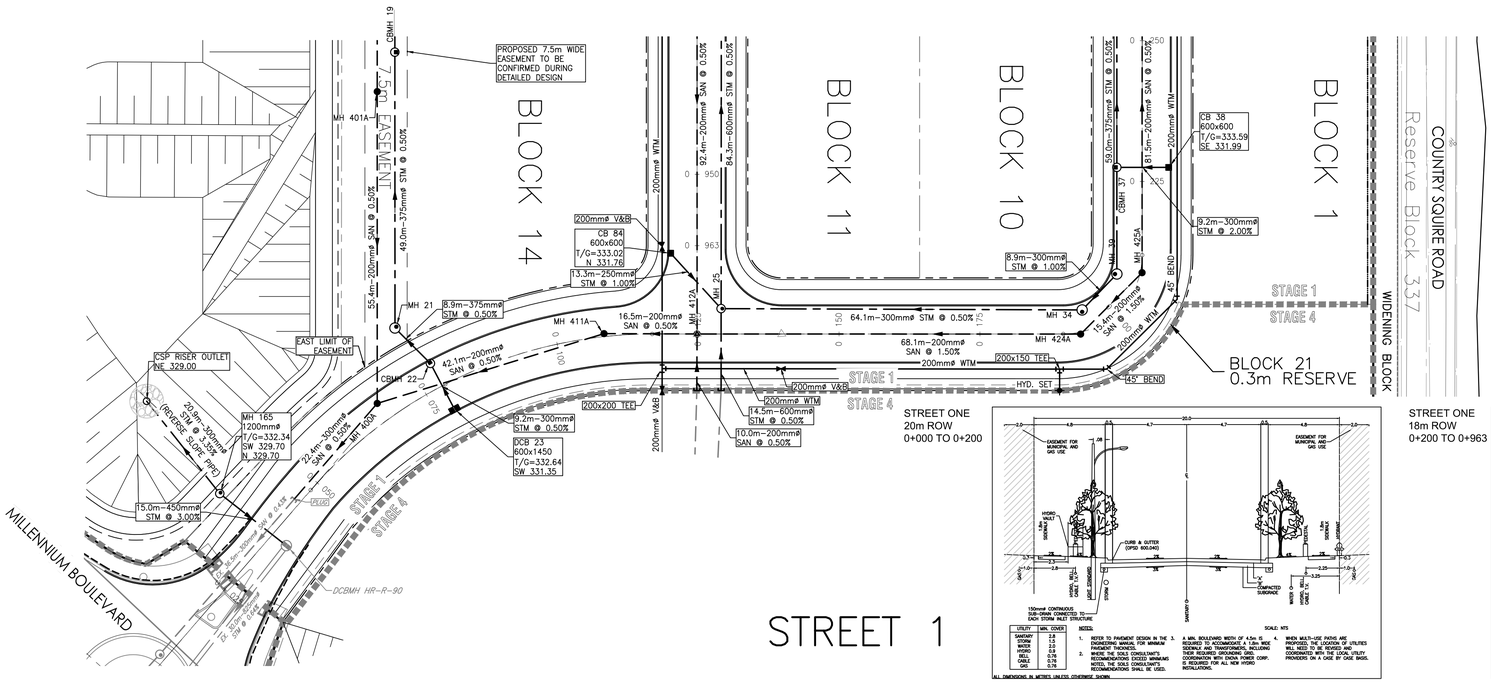
Revision 1

Sheet 1 of 1

Drawing No. **C-120**

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STREET 1

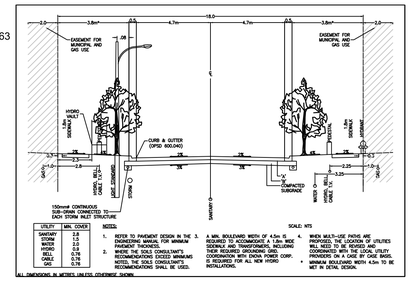
STREET ONE
20m ROW
0+000 TO 0+200

UTILITY	MIN. COVER
SANITARY	2.5
STORM	1.5
WATER	2.5
HYDRO	0.6
BELL	0.76
GAS	0.76
CATV	0.76

NOTES:
1. REFER TO PAVEMENT DESIGN IN THE GEOTECHNICAL ENGINEERING MANUAL FOR MINIMUM PAVEMENT STRUCTURE.
2. WHERE THE SOILS CONSULTANT'S RECOMMENDATIONS EXCEED MINIMUMS NOTED, THE SOILS CONSULTANT'S RECOMMENDATIONS SHALL BE USED.
3. A MIN. BOULEVARD WIDTH OF 4.5m IS REQUIRED TO ACCOMMODATE A 1.8m WIDE SIDEWALK AND ALLOW FOR BOULEVARD TREES WHERE THE SOILS CONSULTANT'S RECOMMENDATIONS ALLOW. BOULEVARD WIDTH MAY BE REDUCED TO 4.0m WHERE THE SOILS CONSULTANT'S RECOMMENDATIONS DO NOT ALLOW FOR BOULEVARD TREES.
4. WHEN MULTI-USE PATHS ARE PROPOSED, THE LOCATION OF UTILITIES SHALL BE TO BE DETERMINED IN COORDINATION WITH THE LOCAL UTILITY PROVIDERS ON A CASE BY CASE BASIS.
5. MINIMUM BOULEVARD WIDTH 4.5m TO BE MET IN DETAIL DESIGN.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.

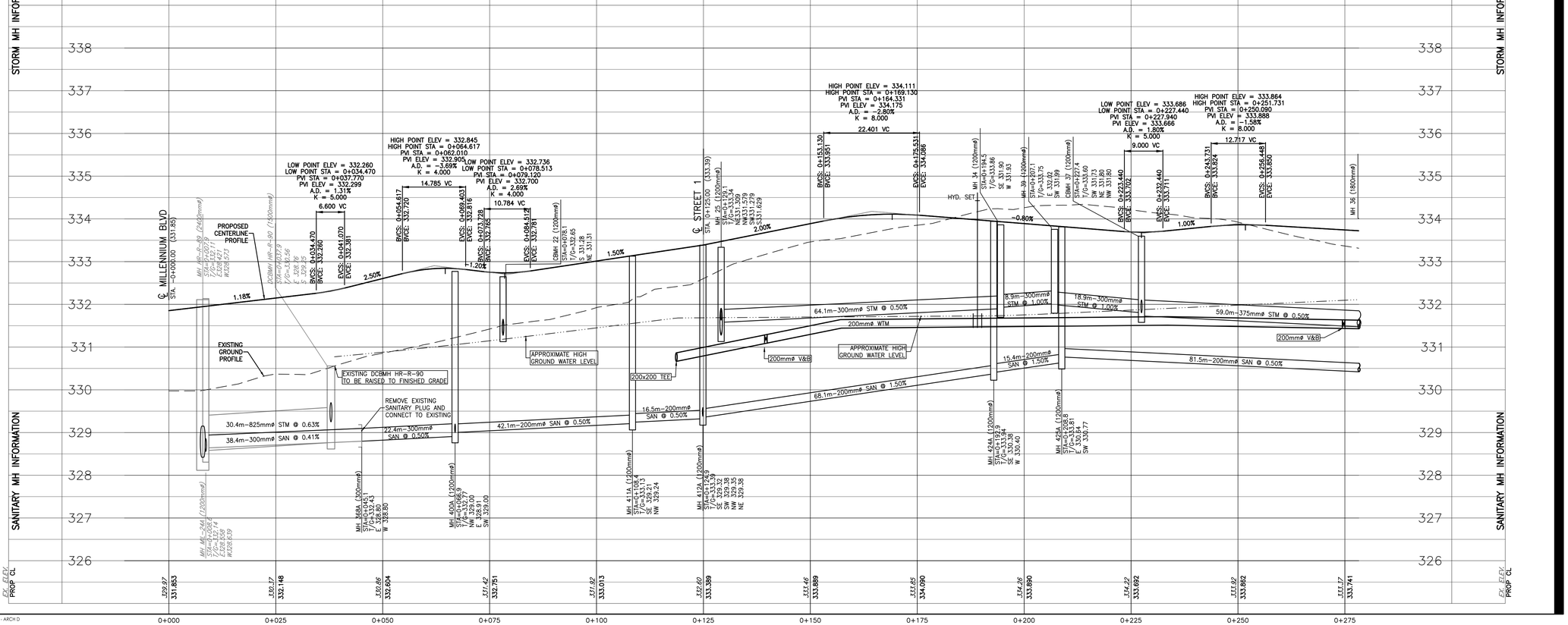
STREET ONE
18m ROW
0+200 TO 0+963

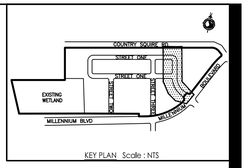


UTILITY	MIN. COVER
SANITARY	2.5
STORM	1.5
WATER	2.5
HYDRO	0.6
BELL	0.76
GAS	0.76
CATV	0.76

NOTES:
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ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.





KEY PLAN Scale : NTS

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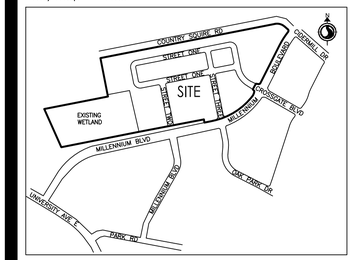
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Notes

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2. DRAFT PLAN PREPARED BY MHBC, DATED OCT 26, 2023.
3. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED MAY 2010. CONTOURS OUTSIDE OF THE PROPERTY LINE, AND WITHIN THE HEAVILY WOODED AREA OF THE SITE, HAVE BEEN OBTAINED FROM S.W.O.O.P TOPOGRAPHIC INFORMATION (2015).

Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN–OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- PROPOSED LIMIT OF GRADING
- STAGE LIMIT

Revision	By	Appd	YYYY.MM.DD
1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24

File Name: 160310788_C-200_203ST-STREET1	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
	RAS	RAS	TAHF	2024.10.30

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title
PLAN & PROFILE
STREET 1
STA. 0+000 TO STA. 0+275

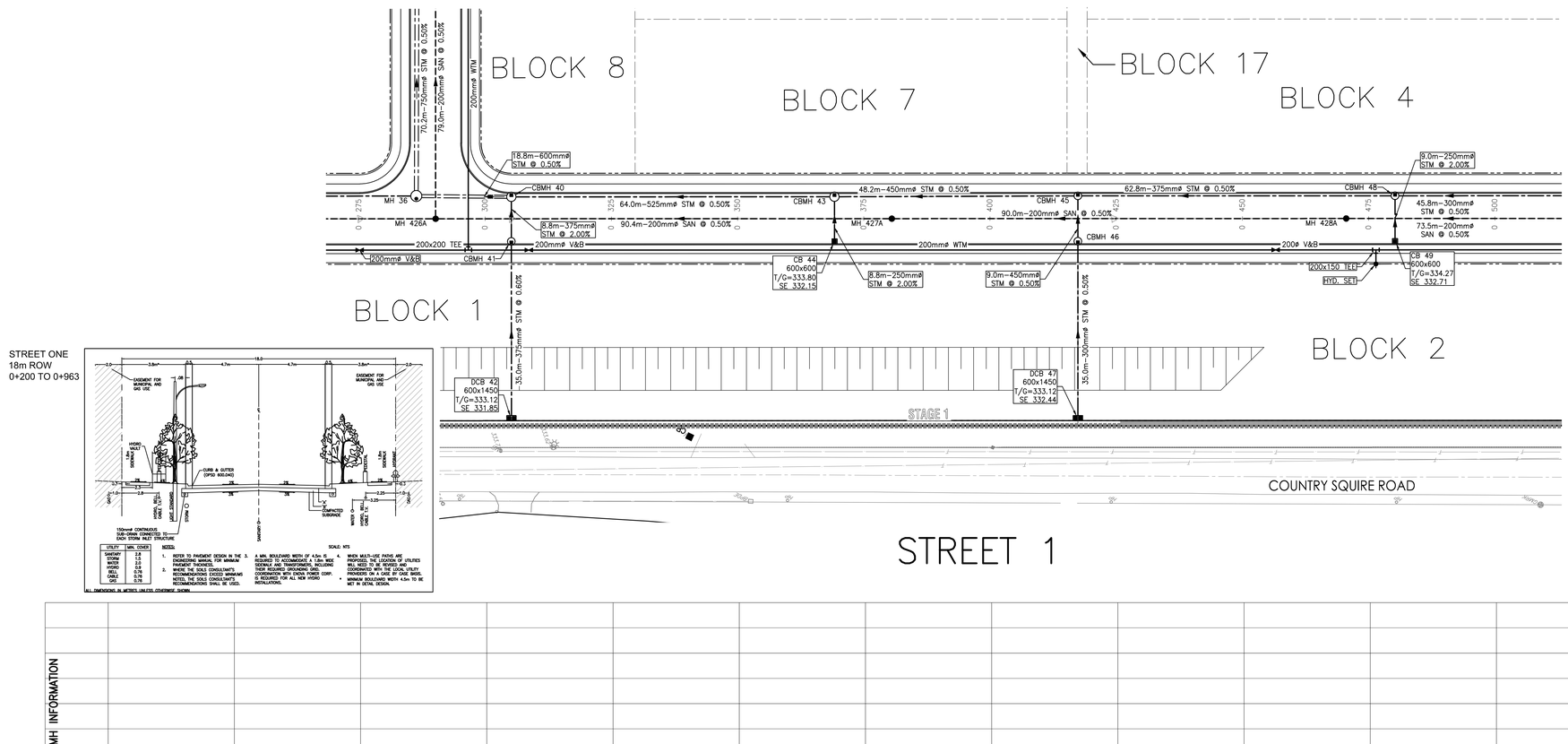
Project No. 160310788

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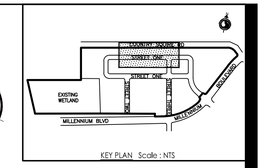
Revision 1 Sheet 1 of 4 Drawing No. **C-200**

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ORIGINAL SHEET - ARCH D



STREET ONE
18m ROW
0+200 TO 0+963



ORIGINAL SHEET - ARCH D

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Plotted: Wednesday, November 06, 2024 8:58:08 AM

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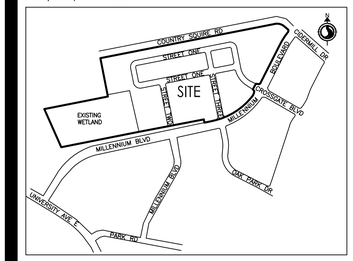
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Notes

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2. DRAFT PLAN PREPARED BY MHBC, DATED OCT 26, 2023.
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Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN–OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- PROPOSED LIMIT OF GRADING
- STAGE LIMIT

1.	REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0.	DRAFT PLAN SUBMISSION			2023.11.24
	Revision	By	Appd	YYYY.MM.DD

File Name:	160310788_C-200_203ST1-STREET1	RAS	RAS	TAHF	2024.10.30
		Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title
PLAN & PROFILE
STREET 1
STA. 0+275 TO STA. 0+500

Project No. 160310788

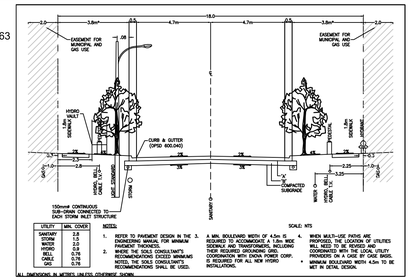
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Revision 1

Sheet 2 of 4

Drawing No. **C-201**

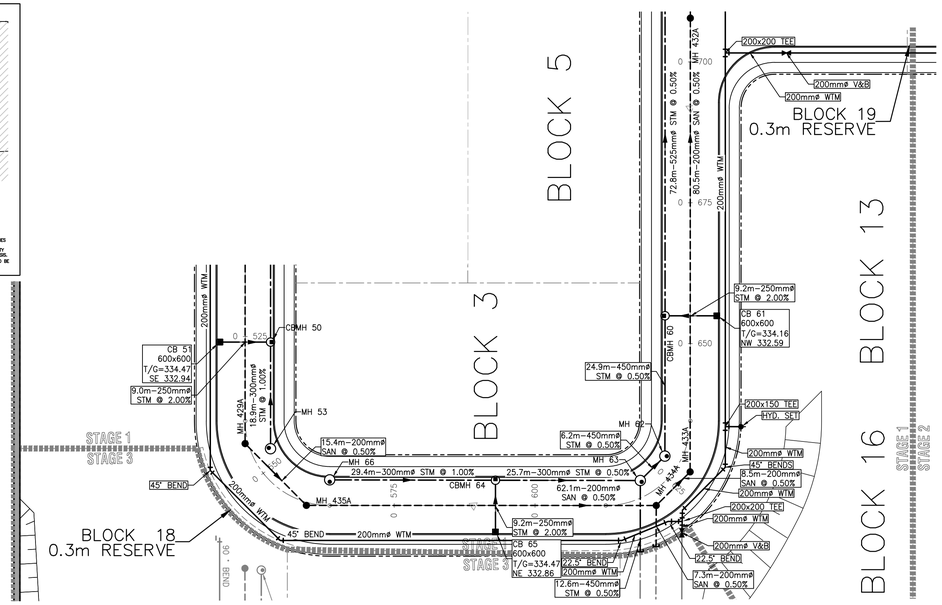
STREET ONE
18m ROW
0+200 TO 0+963

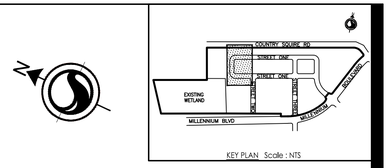


UTILITY	MIN. COVER
SANITARY	2.8
STORM	1.5
WATER	1.7
HYDRO	0.9
BELL	0.75
CABLE	0.75
GAS	0.75

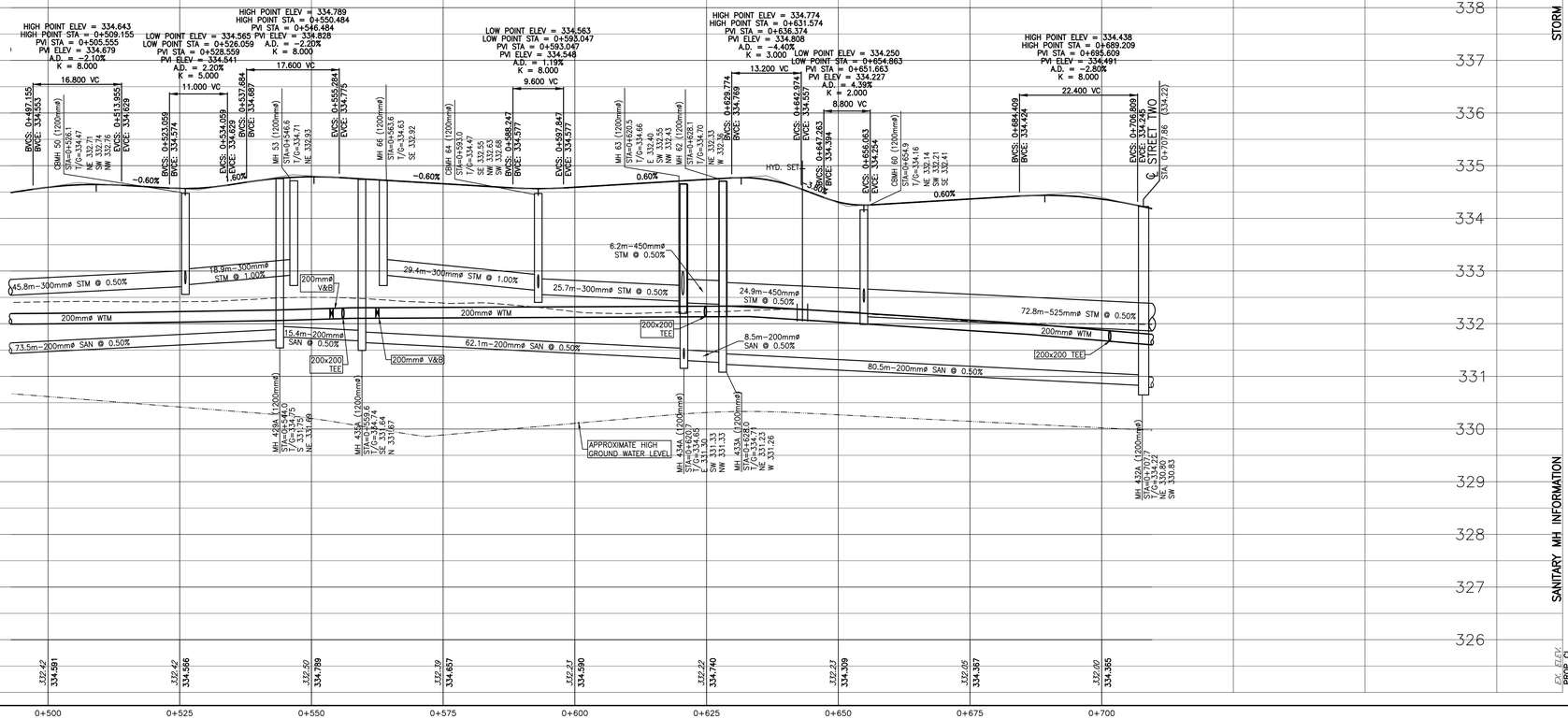
NOTES:
1. REFER TO PAVEMENT DESIGN IN THE ENGINEERING MANUAL FOR MINIMUM PAVEMENT THICKNESS. WHERE GEOTECHNICAL CONSULTANT'S RECOMMENDATIONS EXCEED MINIMUMS NOTED, THE SOILS CONSULTANT'S RECOMMENDATIONS SHALL BE USED.
2. A MIN. BOULEVARD WIDTH OF 4.5m IS REQUIRED TO ACCOMMODATE A 1.8m WIDE SIDEWALK AND TRANSFORMERS, INCLUDING 1.5m CLEARANCE. FINAL LOCATIONS TO BE COORDINATION WITH ENTURA POWER CORP. IS REQUIRED FOR ALL NEW HYDRO INSTALLATIONS.
4. WHEN MULTI-USE PATHS ARE PROPOSED, THE LOCATION OF UTILITIES WILL NEED TO BE REVISED AND COORDINATED WITH ALL THE UTILITY PROVIDERS ON A CASE BY CASE BASIS.
* MINIMUM BOULEVARD WIDTH 4.5m TO BE MET IN DETAIL DESIGN.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN





STREET 1



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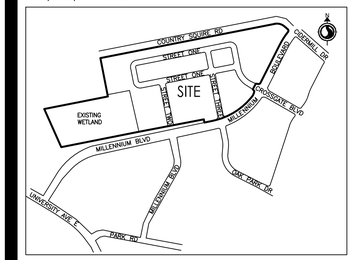
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Notes

1. ELEV'S ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978)
2. DRAFT PLAN PREPARED BY MHBC, DATED OCT 26, 2023.
3. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED MAY 2010. CONTOURS OUTSIDE OF THE PROPERTY LINE, AND WITHIN THE HEAVILY WOODED AREA OF THE SITE, HAVE BEEN OBTAINED FROM S.W.O.O.P TOPOGRAPHIC INFORMATION (2015).

Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN–OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- PROPOSED LIMIT OF GRADING
- STAGE LIMIT

1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24
Revision	By	Appd	YYYY.MM.DD
File Name: 160310788_C-200_203ST-STREET1	RAS	RAS	TAHF	2024.10.30
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title
PLAN & PROFILE
STREET 1
STA. 0+500 TO STA. 0+700

Project No. 160310788

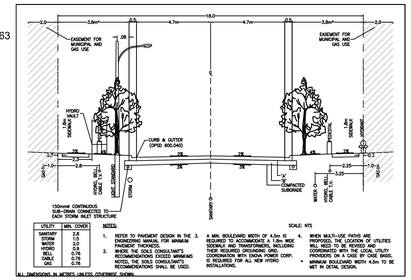
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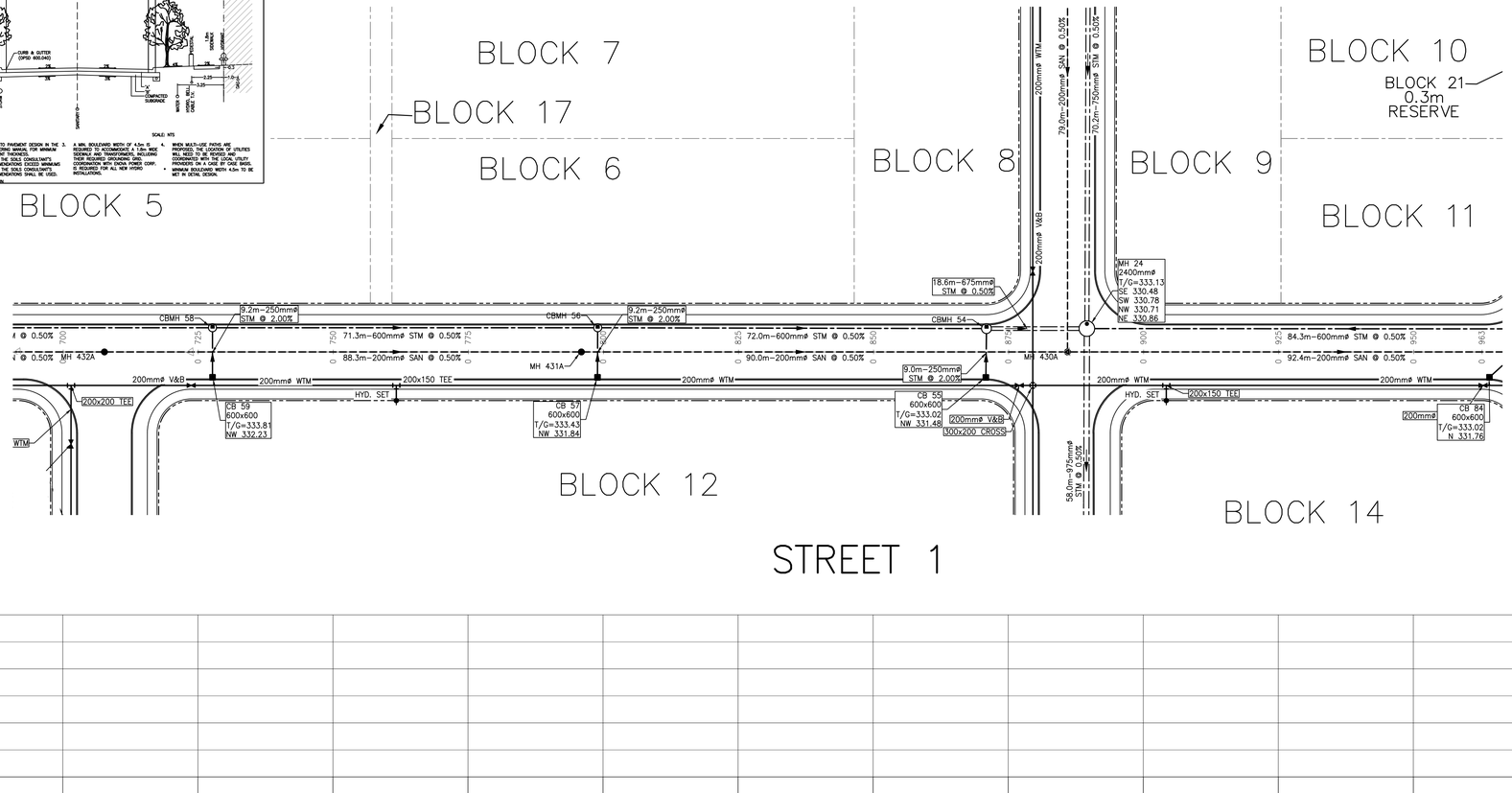
Revision 1 | Sheet 3 of 4 | Drawing No. C-202

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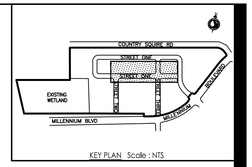
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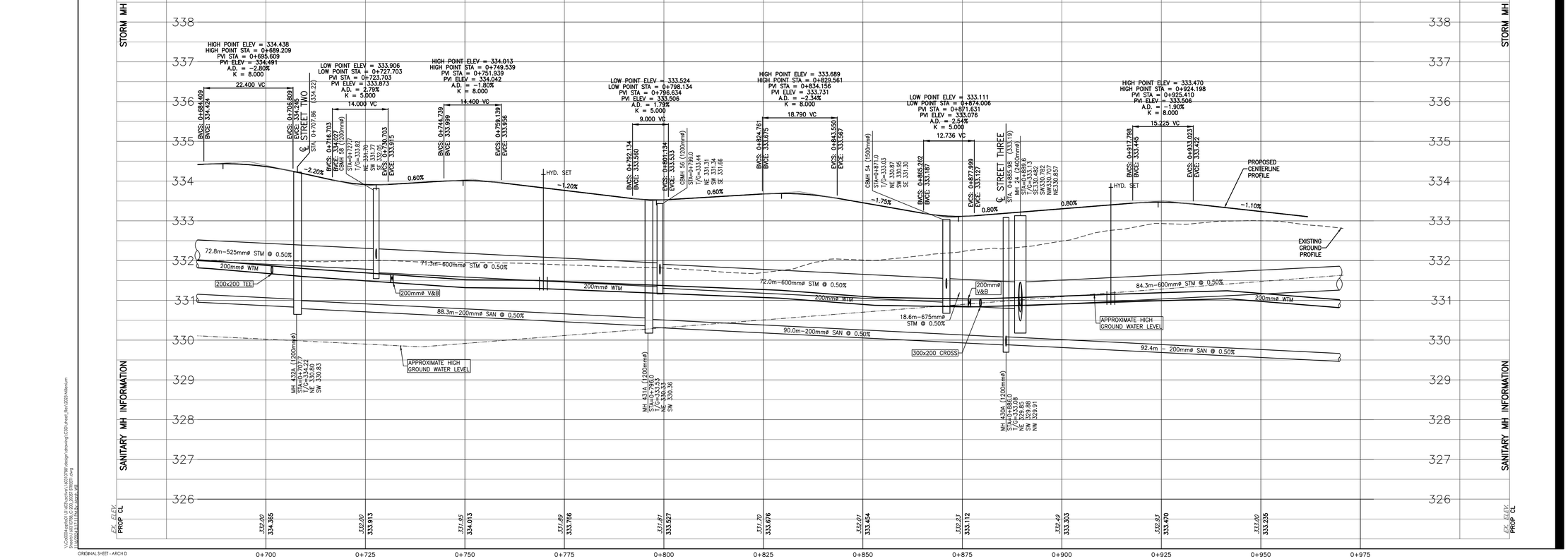
STREET ONE
18m ROW
0+200 TO 0+963





STREET 1





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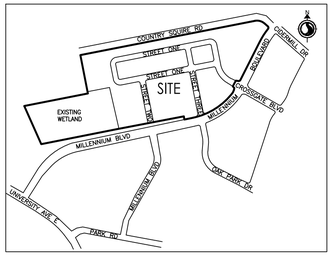
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2. DRAFT PLAN PREPARED BY MHBC, DATED OCT 26, 2023.
3. TOPOGRAPHICAL SURVEY PREPARED BY STANTEC CONSULTING LTD., DATED MAY 2010. CONTOURS OUTSIDE OF THE PROPERTY LINE, AND WITHIN THE HEAVILY WOODED AREA OF THE SITE, HAVE BEEN OBTAINED FROM S.W.O.O.P TOPOGRAPHIC INFORMATION (2015).

Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN-OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- PROPOSED LIMIT OF GRADING
- STAGE LIMIT

1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24
Revision	By	Appd	YYYY.MM.DD
File Name: 160310788_C-200_203ST-STREET1	RAS	RAS	TAHF	2024.10.30
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title
PLAN & PROFILE
STREET 1
STA. 0+700 TO STA. 0+975

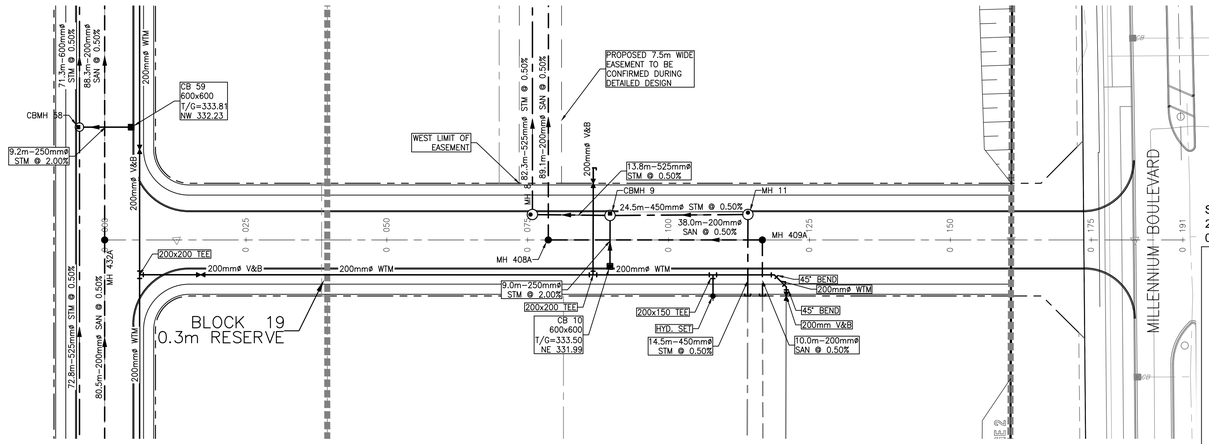
Project No. 160310788

Scale 1:500H 0 5 15 25m; 1:50V 0 0.5 1.5 2.5m

Revision 1 | Sheet 4 of 4 | Drawing No. C-203

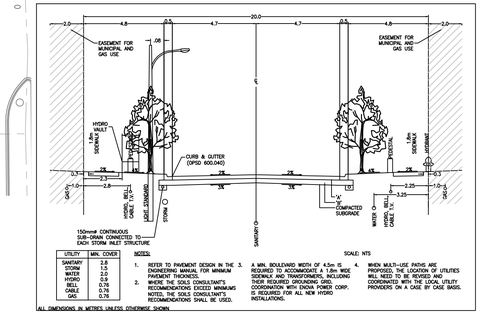
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ORIGINAL SHEET - ARCH D



STREET 2

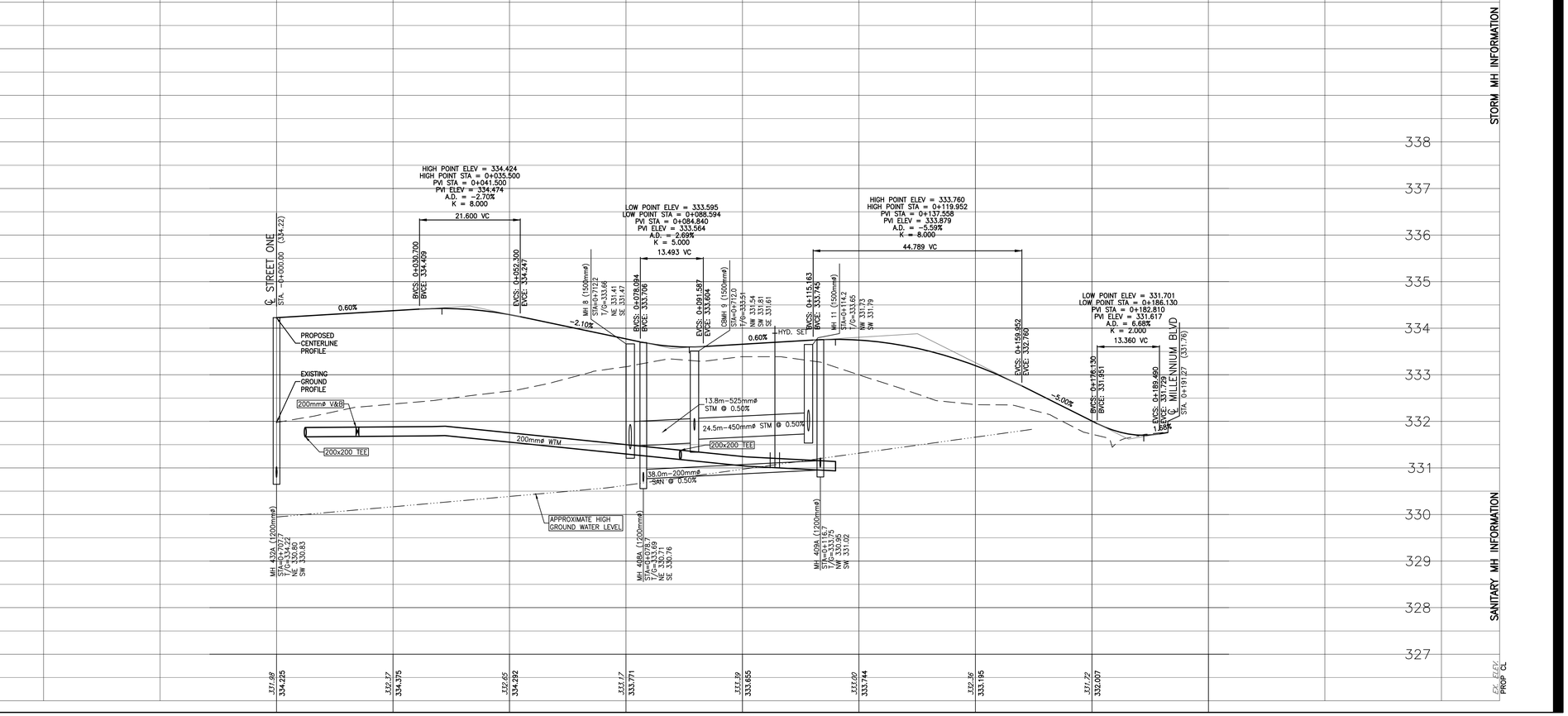
STREET TWO
20m ROW
0+000 TO 0+191



UTILITY	MIN. COVER
SANITARY	2.5
STORM	1.5
WATER	2.0
HYDRO	0.9
BELL	0.76
CABLE TV	0.76
GAS	0.76

NOTES:
1. REFER TO PAVEMENT DESIGN IN THE GEOTECHNICAL REPORT FOR MINIMUM PAVEMENT THICKNESS.
2. WHERE THE SOILS CONSULTANT'S RECOMMENDATIONS EXCEED MINIMUMS NOTED, THE SOILS CONSULTANT'S RECOMMENDATIONS SHALL BE USED.
3. A MNL BOULEVARD WIDTH OF 4.5m IS REQUIRED TO ACCOMMODATE A 1.8m SIDEWALK AND TRANSFORMERS, INCLUDING THEIR REQUIRED GROUNDING GRID. COORDINATION WITH ENOVA POWER CORP. IS REQUIRED FOR ALL NEW HYDRO INSTALLATIONS.
4. WHEN MULTI-USE ZONING ARE PROPOSED, THE LOCATION OF UTILITIES WILL NEED TO BE REVISED AND COORDINATED WITH THE LOCAL UTILITY PROVIDERS ON A CASE BY CASE BASIS.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN



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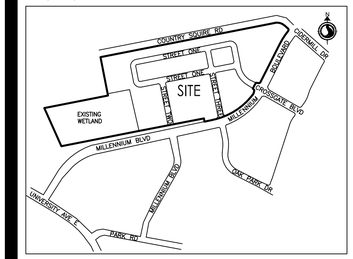
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Notes

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Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN-OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE (3:1 UNLESS NOTED OTHERWISE)
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- PROPOSED LIMIT OF GRADING
- STAGE LIMIT

Revision	By	Appd	YYYY.MM.DD
1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24

File Name: 160310788_C-204ST-STREET2	RAS Dwn.	RAS Dsgn.	TAHF Chkd.	2024.09.13 YYYY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title
PLAN & PROFILE
STREET 2
STA. 0+000 TO STA. 0+200

Project No. 160310788

Scale 1:500H, 1:50V (0 5 15 25m; 0 0.5 1.5 2.5m)

Revision 1

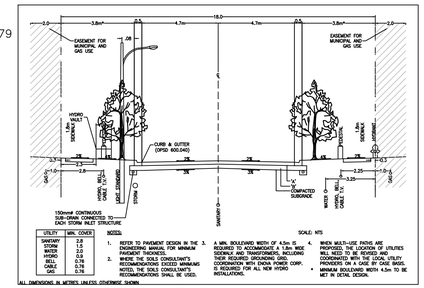
Sheet 1 of 1

Drawing No. **C-204**

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ORIGINAL SHEET - ARCH D

STREET THREE
18m ROW
0+000 TO 0+079

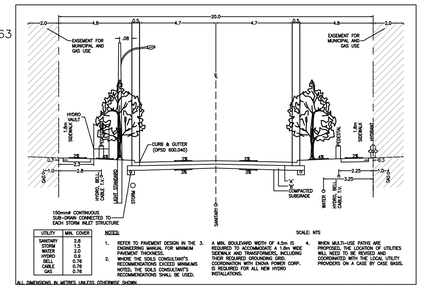


UTILITY	MIN. COVER
SANITARY	2.5
STORM	1.5
WATER	2.0
GAS	0.75
BELL	0.76
CABLE	0.76
GAS	0.76

NOTES:
1. REFER TO PAVEMENT DESIGN IN THE ENGINEERING MANUAL FOR MINIMUM PAVEMENT THICKNESS.
2. WHERE THE SOILS CONSULTANT'S RECOMMENDATIONS DIFFER FROM THOSE NOTED, THE SOILS CONSULTANT'S RECOMMENDATIONS SHALL BE USED.
3. A 1.8m SIDEWALK WIDTH (1.5m IS REQUIRED TO ACCOMMODATE A 1.8m WIDE SIDEWALK AND TRANSFORMERS, INCLUDING THEIR REQUIRED GROUNDING GRID. PROVIDED ON A CASE BY CASE BASIS. MINIMUM BOULEVARD WIDTH 4.5m TO BE MET IN DETAIL DESIGN.
4. WHERE MULTI-USE PATHS ARE PROPOSED, THE LOCATION OF UTILITIES WILL NEED TO BE REVISED AND COORDINATED WITH THE LOCAL UTILITY PROVIDERS ON A CASE BY CASE BASIS. 0.5 IS REQUIRED FOR ALL NEW HYDRO INSTALLATIONS.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED

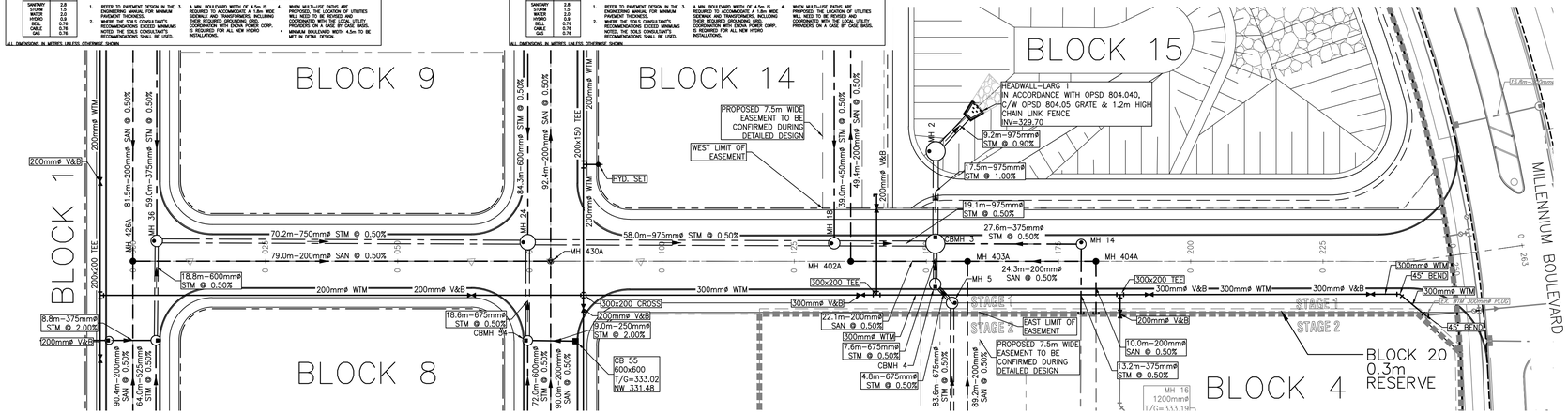
STREET THREE
20m ROW
0+079 TO 0+263

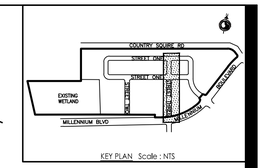


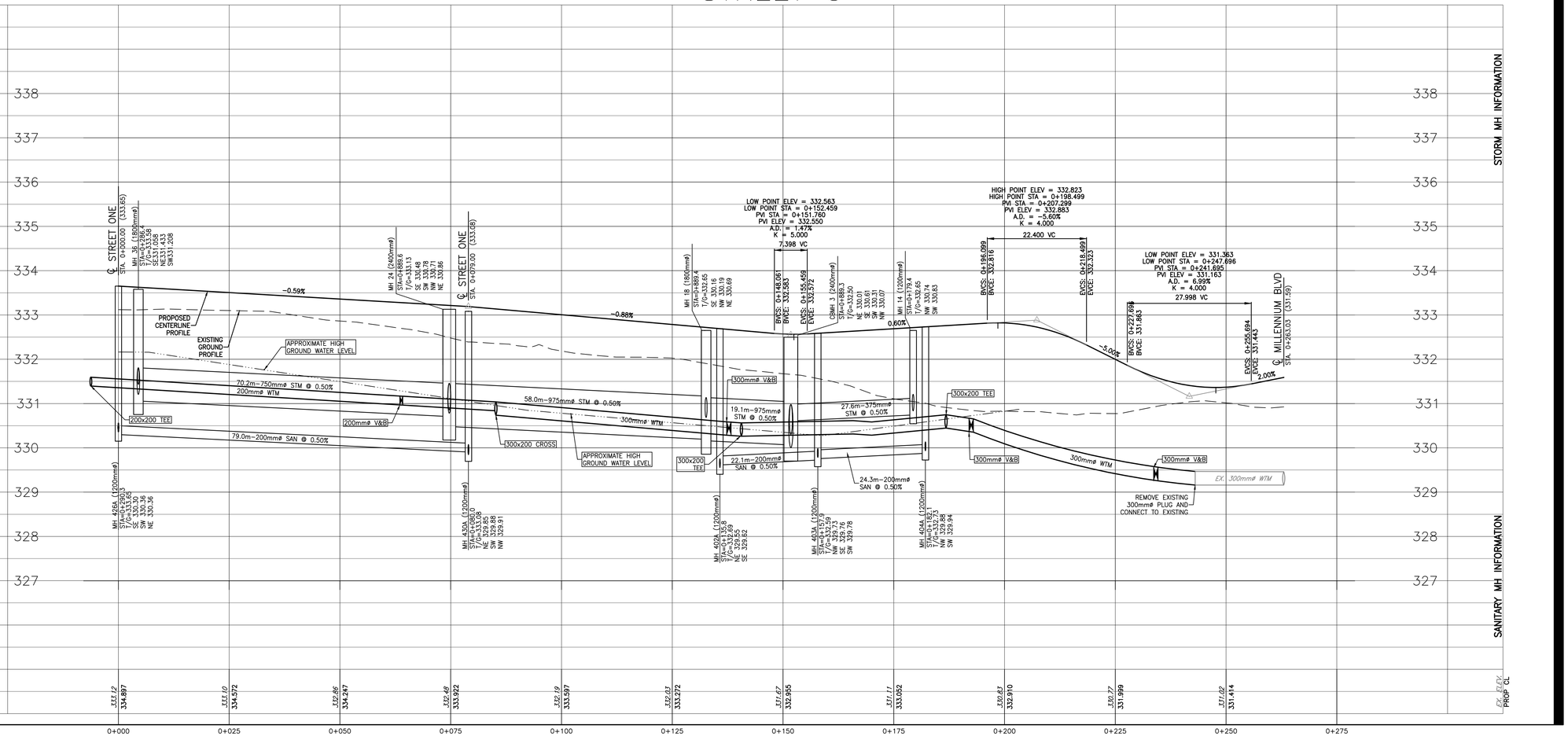
UTILITY	MIN. COVER
SANITARY	2.5
STORM	1.5
WATER	2.0
GAS	0.75
BELL	0.76
CABLE	0.76
GAS	0.76

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4. WHERE MULTI-USE PATHS ARE PROPOSED, THE LOCATION OF UTILITIES WILL NEED TO BE REVISED AND COORDINATED WITH THE LOCAL UTILITY PROVIDERS ON A CASE BY CASE BASIS. 0.5 IS REQUIRED FOR ALL NEW HYDRO INSTALLATIONS.

ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED







ORIGINAL SHEET - ARCH D

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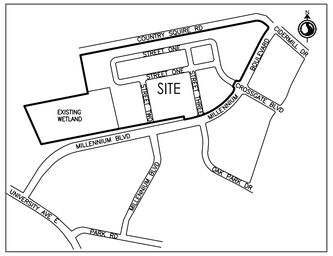
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Key Map NTS.



Legend

- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED STORM SEWER
- PROPOSED SANITARY SEWER
- PROPOSED WATERMAIN
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN–OUT
- PROPOSED CLEAN WATER COLLECTION SYSTEM
- PROPOSED SLOPE (3:1 UNLESS NOTED OTHERWISE)
- PROPOSED RETAINING WALL
- PROPOSED SWALE
- PROPOSED LIMIT OF GRADING
- STAGE LIMIT

1.	REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0.	DRAFT PLAN SUBMISSION			2023.11.24
	Revision	By	Appd	YYYY.MM.DD
	File Name: 160310788_C-205ST-STREET3	RAS Dwn.	RAS Dsgn.	TAHF Chkd.	2024.10.28 YYYY.MM.DD

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Client/Project
ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

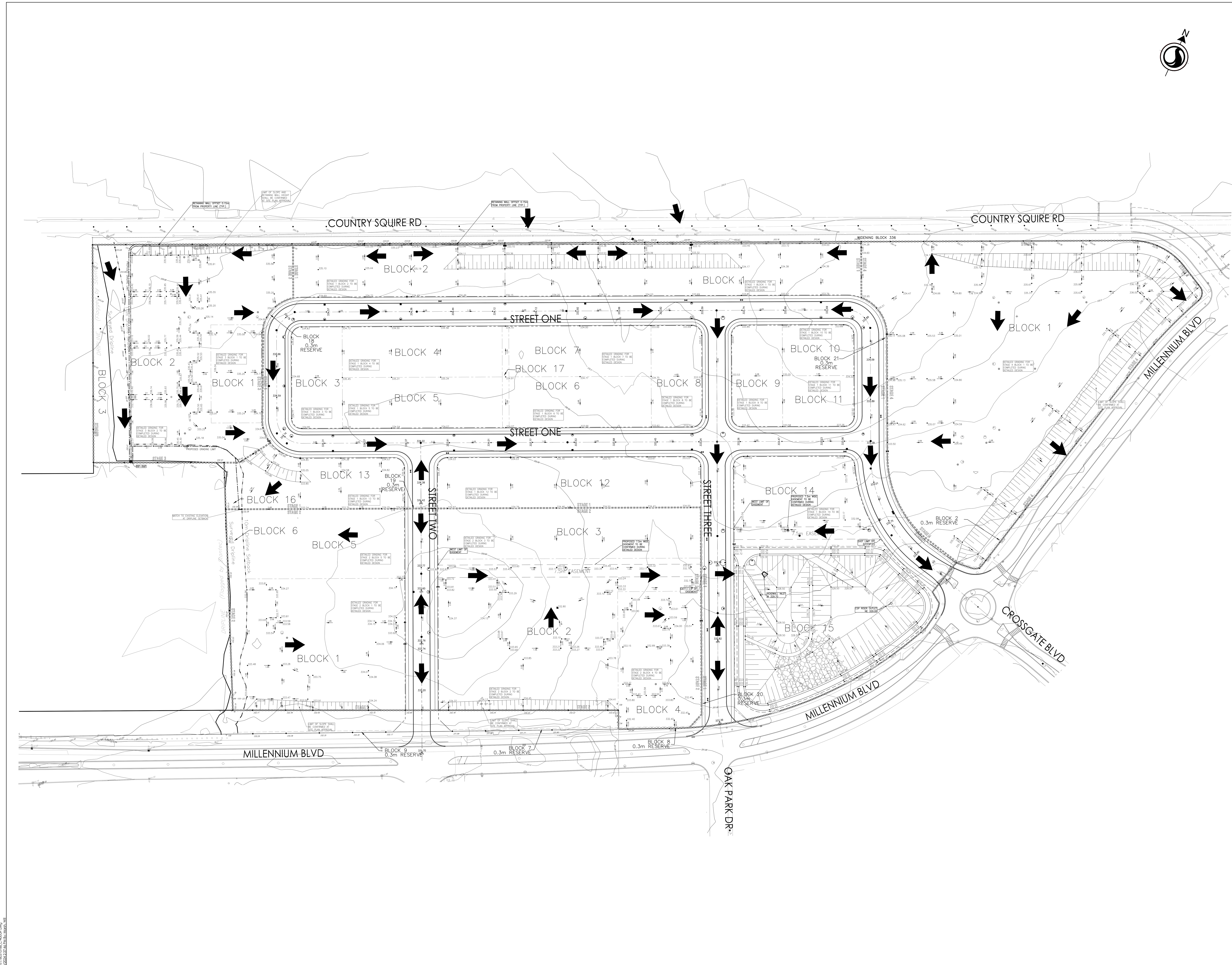
WATERLOO, ON

Title
PLAN & PROFILE
STREET 3
STA. 0+000 TO STA. 0+275

Project No. 160310788

Scale 1:500H, 1:50V
0 5 15 25m
0 0.5 1.5 2.5m

Revision 1 | Sheet 1 of 1 | Drawing No. C-205



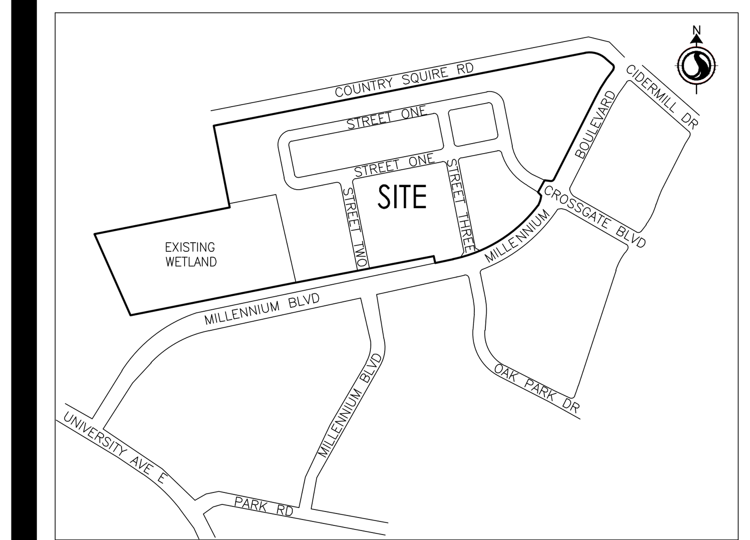
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Key Map NTS.



Legend

- 332.22 EXISTING ELEVATION
- 330.30 PROPOSED ELEVATION
- 5.0% 2.0% FLOW DIRECTION
- PROPOSED DRAINAGE SWALE
- 331.00 EXISTING CONTOUR
- RETAINING WALL
- PROPOSED GRADING LIMIT
- PROPERTY LINE
- DRIPLINE
- 10m SURVEYED DRIPLINE SETBACK
- PROPOSED SLOPE
- OVERLAND FLOW DIRECTION
- PROPOSED STORM MANHOLE
- PROPOSED STORM CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED AREA DRAIN
- PROPOSED SANITARY MANHOLE
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT
- PROPOSED CLEAN WATER MANHOLE
- PROPOSED CLEAN WATER CATCHBASIN MANHOLE
- PROPOSED CLEAN WATER COLLECTOR CLEAN-OUT

Revision/Issue	By	Appd	YYYY.MM.DD
1. REVISED DP SUBMISSION PER CITY COMMENTS	WAM	SZ	2024.10.30
0. DRAFT PLAN SUBMISSION			2023.11.24

File Name: 160310788_C-400GP	RAS	RAS	TAHF	2024.10.30
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project

ACTIVA HOLDINGS INC.

MILLENNIUM BOULEVARD

WATERLOO, ON

Title

GENERAL GRADING PLAN

Project No. 160310788

Scale 1:1000 (0 10 30 50m)

Revision 1

Sheet 1 of 1

Drawing No. **C-400**

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10/30/2024 2:37:46 PM By: Marsh, Will

ORIGINAL SHEET - ARCH D

Appendix B
Sanitary and Water Design Calculations

Stantec

Activa Holdings Inc.
Millennium Blvd

DATE: November 8, 2024
DESIGNED BY: RAS / WM
CHECKED BY: SZ

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T- N/A

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1755.00	MANNING'S n =	0.013	
b=	12.35	MINIMUM COVER:	1.500	m
c=	0.8950	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA								PIPE SELECTION							
Street	U/S	D/S	Area ID	5-Year Area Design (ha)	Runoff Coeff. Design	A x R	Accum. A x R	U/S T_C (min)	Rainfall Intensity (mm/hr)	Total Flow (m^3/s)	Length Design (m)	Design Size (mm)	Slope Design (%)	Full Capacity (m^3/s)	Full Velocity (m/s)	Actual Velocity (m/s)	Time of Flow (min)	5-Year Q_A/Q_C (%)
Block 1 (Stage 3) CWC	82	81	206	0.01	0.90	0.01	0.01	10.00	108.82	0.003	24.21	150	2.00	0.022	1.22	0.80	0.50	12.6%
	81	79	206	0.01	0.90	0.01	0.02	10.50	106.68	0.005	24.83	150	0.50	0.011	0.61	0.60	0.68	49.5%
								11.18										
	80	79	206	0.03	0.90	0.02	0.02	10.00	108.82	0.007	24.24	150	2.00	0.022	1.22	1.06	0.38	31.6%
	79	77	206	0.03	0.90	0.02	0.06	11.18	103.92	0.017	30.90	200	0.50	0.023	0.74	0.82	0.63	74.7%
								11.81										
	78	77	206	0.03	0.90	0.02	0.02	10.00	108.82	0.007	24.28	150	2.00	0.022	1.22	1.06	0.38	31.6%
	77	75	206	0.23	0.30	0.07	0.15	11.81	101.49	0.042	31.02	300	0.50	0.068	0.97	1.02	0.51	61.8%
								12.32										
	76	75	206	0.03	0.90	0.02	0.02	10.00	108.82	0.007	24.32	150	2.00	0.022	1.22	1.06	0.38	31.6%
	75	73	206	0.03	0.90	0.02	0.20	12.32	99.61	0.055	28.09	300	0.50	0.068	0.97	1.08	0.43	80.9%
								12.75										
	74	73	206	0.01	0.90	0.01	0.01	10.00	108.82	0.003	24.36	150	2.00	0.022	1.22	0.84	0.48	15.2%
	73	72	206	0.01	0.90	0.01	0.22	12.80	97.92	0.060	11.34	300	0.50	0.068	0.97	1.10	0.17	87.5%
								12.97										
Street 1	65	64	237	0.17	0.70	0.12	0.12	10.00	108.82	0.036	9.18	250	2.00	0.084	1.71	1.63	0.09	42.8%
	64	63	238	0.17	0.50	0.09	0.20	10.09	108.42	0.061	25.71	300	0.50	0.068	0.97	1.10	0.39	89.8%
								10.48										
Block 2 (Stage 3)	146	63	242	0.60	0.70	0.42	0.42	10.00	108.82	0.127	12.64	450	0.50	0.202	1.27	1.34	0.16	63.0%
	63	62	-	0.00	0.65	0.00	0.62	11.55	102.50	0.178	6.15	450	0.50	0.202	1.27	1.45	0.07	88.1%
	62	60	-	0.00	0.65	0.00	0.62	11.62	102.22	0.177	24.91	450	0.50	0.202	1.27	1.44	0.29	87.9%
								11.91										
Street 1 cont'd	61	60	236	0.11	0.70	0.08	0.08	10.00	108.82	0.023	9.18	250	2.00	0.084	1.71	1.40	0.11	27.7%
	60	58	235	0.17	0.50	0.09	0.79	11.91	101.12	0.221	72.85	525	0.50	0.304	1.40	1.55	0.79	72.6%
								12.70										
	59	58	209	0.23	0.50	0.12	0.12	10.00	108.82	0.035	9.18	250	2.00	0.084	1.71	1.61	0.10	41.3%
	58	56	234	0.24	0.50	0.12	1.02	10.10	108.41	0.307	71.30	600	0.50	0.434	1.54	1.67	0.71	70.8%
								10.80										
	57	56	210	0.32	0.50	0.16	0.16	10.00	108.82	0.048	9.18	250	2.00	0.084	1.71	1.76	0.09	57.5%

Stantec

Activa Holdings Inc.
Millennium Blvd

DATE: November 8, 2024
DESIGNED BY: RAS / WM
CHECKED BY: SZ

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T- N/A

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1755.00	MANNING'S n =	0.013	
b=	12.35	MINIMUM COVER:	1.500	m
c=	0.8950	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA								PIPE SELECTION							
Street	U/S	D/S	Area ID	5-Year Area Design (ha)	Runoff Coeff. Design	A x R	Accum. A x R	U/S T_C (min)	Rainfall Intensity (mm/hr)	Total Flow (m^3/s)	Length Design (m)	Design Size (mm)	Slope Design (%)	Full Capacity (m^3/s)	Full Velocity (m/s)	Actual Velocity (m/s)	Time of Flow (min)	5-Year Q_A/Q_C (%)
	56	54	229	0.32	0.50	0.16	1.34	10.09	108.45	0.404	71.97	600	0.50	0.434	1.54	1.77	0.68	93.0%
								10.77										
	55	54	211	0.18	0.50	0.09	0.09	10.00	108.82	0.027	9.03	250	2.00	0.084	1.71	1.52	0.10	32.3%
	54	24	228	0.30	0.50	0.15	1.58	10.77	108.39	0.476	18.58	675	0.50	0.594	1.66	1.86	0.17	80.1%
								10.94										
	51	50	240	0.13	0.50	0.07	0.07	10.00	108.82	0.020	9.00	250	2.00	0.084	1.71	1.34	0.11	23.4%
	50	48	239	0.10	0.50	0.12	0.18	10.11	108.34	0.054	45.76	300	0.50	0.068	0.97	1.08	0.71	79.2%
								10.82										
	49	48	232	0.13	0.50	0.07	0.07	10.00	108.82	0.020	9.00	250	2.00	0.084	1.71	1.34	0.11	23.4%
	48	45	233	0.20	0.50	0.10	0.35	10.82	105.37	0.101	62.82	375	0.50	0.124	1.12	1.26	0.83	81.5%
								11.65										
Block 2 (Stage 1)	47	46	224	0.19	0.30	0.06	0.06	10.00	108.82	0.017	35.02	375	0.50	0.124	1.12	0.74	0.79	13.9%
Street 1 cont'd	46	45	231	0.16	0.50	0.14	0.19	10.79	105.50	0.057	8.98	450	0.50	0.202	1.27	1.08	0.14	28.2%
	45	43	230	0.24	0.50	0.12	0.31	11.65	102.10	0.089	48.21	450	0.50	0.202	1.27	1.22	0.66	44.2%
								12.31										
	44	43	225	0.13	0.50	0.07	0.07	10.00	108.82	0.020	8.83	250	2.00	0.084	1.71	1.34	0.11	23.4%
	43	40	226	0.20	0.50	0.41	0.48	12.31	99.65	0.133	64.00	525	0.50	0.304	1.40	1.33	0.80	43.6%
								13.11										
Block 1 (Stage 1)	42	41	223	0.24	0.30	0.07	0.07	10.00	108.82	0.022	35.00	375	0.60	0.136	1.23	0.89	0.66	16.0%
Street 1 cont'd	41	40	222	0.24	0.50	0.12	0.19	10.66	106.03	0.057	8.83	375	2.00	0.248	2.25	1.75	0.08	22.8%
	40	36	227	0.14	0.50	0.07	0.74	13.08	96.95	0.200	18.83	600	0.50	0.434	1.54	1.48	0.21	46.0%
								13.29										
	38	37	220	0.30	0.50	0.15	0.15	10.00	108.82	0.045	9.20	300	2.00	0.137	1.93	1.71	0.09	33.2%
	37	36	221	0.20	0.50	0.10	0.25	10.09	108.44	0.075	59.01	375	0.50	0.124	1.12	1.18	0.83	60.7%
								10.92										
	36	24	-	0.00	0.65	0.00	0.99	13.28	96.27	0.265	70.18	750	0.50	0.787	1.78	1.58	0.74	33.7%
								14.02										
Block 1 (Stage 4)	126	25	219	1.38	0.70	0.97	0.97	10.00	108.82	0.292	14.54	600	0.50	0.434	1.54	1.65	0.15	67.3%
Street 1 cont'd	84	25	216	0.30	0.50	0.15	0.15	10.00	108.82	0.045	13.30	250	1.00	0.059	1.21	1.34	0.16	76.2%

Stantec

Activa Holdings Inc.
Millennium Blvd

DATE: November 8, 2024
DESIGNED BY: RAS / WM
CHECKED BY: SZ

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T- N/A

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1755.00	MANNING'S n =	0.013	
b=	12.35	MINIMUM COVER:	1.500	m
c=	0.8950	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA								PIPE SELECTION							
Street	U/S	D/S	Area ID	5-Year Area Design (ha)	Runoff Coeff. Design	A x R	Accum. A x R	U/S T_C (min)	Rainfall Intensity (mm/hr)	Total Flow (m^3/s)	Length Design (m)	Design Size (mm)	Slope Design (%)	Full Capacity (m^3/s)	Full Velocity (m/s)	Actual Velocity (m/s)	Time of Flow (min)	5-Year Q_A/Q_C (%)
	25	24	-	0.00	0.65	0.00	1.12	10.16	108.11	0.335	84.34	600	0.50	0.434	1.54	1.70	0.82	77.2%
								10.99										
	24	18	-	0.00	0.65	0.00	3.69	14.02	93.84	0.961	57.97	975	0.50	1.585	2.12	2.23	0.43	60.7%
								14.46										
Block 1 (Stage 4)	23	22	217	0.36	0.50	0.18	0.18	10.00	108.82	0.054	9.20	300	0.50	0.068	0.97	1.08	0.14	79.6%
Street 1 cont'd	22	21	215	0.08	0.90	0.07	0.25	10.14	108.21	0.076	8.89	375	0.50	0.124	1.12	1.18	0.13	61.1%
	21	19	-	0.00	0.65	0.00	0.25	10.27	107.67	0.075	48.98	375	0.50	0.124	1.12	1.18	0.69	60.8%
								10.96										
Block 14 (Stage 1)	19	18	214	0.33	0.70	0.23	0.48	10.89	105.09	0.141	39.02	450	0.50	0.202	1.27	1.38	0.47	69.9%
								11.36										
	18	3	-	0.00	0.65	0.00	4.17	14.46	92.48	1.072	19.13	975	0.50	1.585	2.12	2.28	0.14	67.6%
Block 1 (Stage 2)	149	11	205	0.77	0.70	0.54	0.54	10.00	108.82	0.163	14.46	450	0.50	0.202	1.27	1.42	0.17	80.8%
	11	9	-	0.00	0.65	0.00	0.54	10.17	108.09	0.162	24.47	450	0.50	0.202	1.27	1.42	0.29	80.3%
								10.46										
Street 2	10	9	207	0.08	0.90	0.07	0.07	10.00	108.82	0.022	9.03	250	2.00	0.084	1.71	1.37	0.11	25.9%
	9	8	208	0.09	0.90	0.08	0.69	10.11	108.35	0.208	13.78	525	0.50	0.304	1.40	1.52	0.15	68.5%
	8	6	-	0.00	0.65	0.00	0.69	10.26	107.70	0.207	82.26	525	0.50	0.304	1.40	1.52	0.90	68.1%
Block 2 (Stage 2)	6	5	203	1.50	0.70	1.05	1.74	11.16	104.01	0.503	83.62	675	0.50	0.594	1.66	1.88	0.74	84.7%
	5	4	-	0.00	0.65	0.00	1.74	11.90	101.15	0.489	4.80	675	0.50	0.594	1.66	1.87	0.04	82.3%
Street 3	4	3	212	0.13	0.90	0.12	1.86	11.95	100.99	0.522	7.64	675	0.50	0.594	1.66	1.89	0.07	87.7%
								12.01										
Block 3 (Stage 2)	139	14	202	0.34	0.70	0.24	0.24	10.00	108.82	0.072	13.20	375	0.50	0.124	1.12	1.17	0.19	58.0%
	14	3	-	0.00	0.65	0.00	0.24	10.19	108.01	0.071	27.59	375	0.50	0.124	1.12	1.16	0.40	57.6%
								10.59										
Street 3 cont'd	3	2	213	0.49	0.50	0.25	6.51	14.59	92.05	1.665	17.47	975	1.00	2.241	3.00	3.32	0.09	74.3%
SWMF	2	1	-	0.00	0.65	0.00	6.51	14.68	91.79	1.661	9.16	975	0.90	2.126	2.85	3.18	0.05	78.1%

Stantec

Activa Holdings Inc.
Millennium Blvd

DATE: November 6, 2024
DESIGNED BY: RAS / WM
CHECKED BY: SZ

FILE NUMBER: N/A
Project Number 160310788

SANITARY SEWER DESIGN SHEET

Design Parameters

Mininum Velocity= 0.600 m/s
n= 0.013
Max Peak Factor= 4.500
Min Peak Factor= 1.500

Residential [1]: 275 L/day/Person
0.0032 L/s/Person
Infiltration: 0.250 L/s/Ha
Commercial 0.500 L/s/Ha

[2]Peak using a factor of 2.5

[1]Based on PPU in new permanently occupied units of 3.49 for singles/semis and 2.30 for townhomes

LOCATION			RESIDENTIAL AREA AND POPULATION							COMMERCIAL				INFILTRATION				PIPE SELECTION						
Street	U/S	D/S	Area ID	Residential Area (ha)	Population (P)	Cummulative Area (ha)	Cumulative Population (min)	Peak Factor	Peak Flow L/s	Area ID	Area (ha)	Accumulated Area (ha)	Total Comm. Flow[2] (L/s)	Total Area (ha)	Accumulated Area (ha)	Flow (L/s)	Total Flow (L/s)	Length Design (m)	Design Size (mm)	Slope Design (%)	Full Capacity (L/s)	Full Velocity (m/s)	Actual Velocity (m/s)	Q_A/Q_C (%)
Block 1 (Stage 3)	438	437	220	0.10	12	0.10	12	4.41	0.17			0.00	0.00	0.10	0.10	0.025	0.19	33.3	200	1.00	35.26	1.16	1.19	0.5%
	439	437	218	0.13	14	0.23	26	4.36	0.36			0.00	0.00	0.13	0.23	0.058	0.42	44.2	200	1.00	35.26	1.16	1.19	1.2%
	437	436	219	0.60	84	0.83	110	4.23	1.48			0.00	0.00	0.60	0.83	0.208	1.69	72.7	200	0.50	24.94	0.82	0.84	6.8%
Block 2 (Stage 3)	436	145	-	0.00	0	0.83	110	4.23	1.48			0.00	0.00	0.00	0.83	0.208	1.69	48.0	200	0.50	24.94	0.82	0.84	6.8%
	145	434	-	0.00	0	0.83	110	4.23	1.48			0.00	0.00	0.00	0.83	0.208	1.69	7.3	200	0.50	24.94	0.82	0.84	6.8%
Street 1	429	435	-	0.00	0	0.00	0	4.50	0.00			0.00	0.00	0.00	0.00	0.000	0.00	15.4	200	0.50	24.94	0.82	0.00	0.0%
	435	434	217	0.31	28	0.31	28	4.36	0.39			0.00	0.00	0.31	0.31	0.078	0.47	62.1	200	0.50	24.94	0.82	0.84	1.9%
	434	433	216	0.13	7	1.27	145	4.20	1.94			0.00	0.00	0.13	1.27	0.318	2.25	8.5	200	0.50	24.94	0.82	0.84	9.0%
	433	432	214	0.56	53	1.83	198	4.15	2.62			0.00	0.00	0.56	1.83	0.458	3.07	80.5	200	0.50	24.94	0.82	0.84	12.3%
	432	431	211	0.66	91	2.49	289	4.09	3.76			0.00	0.00	0.66	2.49	0.623	4.38	88.3	200	0.50	24.94	0.82	0.84	17.6%
	431	430	207	0.55	70	3.04	359	4.04	4.62			0.00	0.00	0.55	3.04	0.760	5.38	90.0	200	0.50	24.94	0.82	0.84	21.6%
Street 1	429	428	213	0.50	42	0.50	42	4.33	0.58			0.00	0.00	0.50	0.50	0.125	0.70	73.5	200	0.50	24.94	0.82	0.84	2.8%
	428	427	212	0.66	70	1.16	112	4.23	1.51			0.00	0.00	0.66	1.16	0.290	1.80	90.0	200	0.50	24.94	0.82	0.84	7.2%
	427	426	205	0.53	53	1.69	165	4.18	2.19			0.00	0.00	0.53	1.69	0.423	2.62	90.4	200	0.50	24.94	0.82	0.84	10.5%
Street 1	425	426	204	0.48	53	0.48	53	4.31	0.73			0.00	0.00	0.48	0.48	0.120	0.85	81.5	200	0.50	24.94	0.82	0.84	3.4%
Street 3	426	430	206	0.56	42	2.73	260	4.10	3.40			0.00	0.00	0.56	2.73	0.683	4.08	79.0	200	0.50	24.94	0.82	0.84	16.4%
Street 1	430	412	203	0.13	21	5.90	640	3.92	7.98			0.00	0.00	0.13	5.90	1.475	9.45	92.4	200	0.50	24.94	0.82	0.84	37.9%
Block 1 (Stage 4)	127	412	202	2.23	479	2.23	479	3.98	6.07			0.00	0.00	2.23	2.23	0.558	6.63	10.0	200	0.50	24.94	0.82	0.84	26.6%
Street 1	412	411	-	0.00	0	8.13	1119	3.77	13.42			0.00	0.00	0.00	8.13	2.033	15.45	16.5	200	0.50	24.94	0.82	0.84	62.0%
	411	400	-	0.00	0	8.13	1119	3.77	13.42			0.00	0.00	0.00	8.13	2.033	15.45	42.1	200	0.50	24.94	0.82	0.84	62.0%
	400		-	0.00	0	8.13	1119					0.00	0.00											
Block 1 (Stage 2)																								
Street 2	148	409	215	0.76	194	0.76	194	4.15	2.56			0.00	0.00	0.76	0.76	0.190	2.75	10.0	200	0.50	24.94	0.82	0.84	11.0%
Block 2 (Stage 2)	409	408	-	0.00	0	0.76	194	4.15	2.56			0.00	0.00	0.00	0.76	0.190	2.75	38.0	200	0.50	24.94	0.82	0.84	11.0%
	408	407	210	0.96	171	1.72	365	4.04	4.69			0.00	0.00	0.96	1.72	0.430	5.12	89.1	200	0.50	24.94	0.82	0.84	20.5%
	407	403	208	0.61	106	2.33	471	3.99	5.98			0.00	0.00	0.61	2.33	0.583	6.56	89.2	200	0.50	24.94	0.82	0.84	26.3%
Block 3 (Stage 2)																								
Plug	406	405		0.00		0.00	0	4.50	0.00	209	0.38	0.38	0.48	0.38	0.38	0.096	0.57	27.5	200	1.00	35.26	1.16	1.19	1.6%
Street 3	405	404	-	0.00	0	0.00	0	4.50	0.00			0.38	0.48	0.00	0.38	0.096	0.57	37.5	200	0.50	24.94	0.82	0.84	2.3%
	404	403	-	0.00	0	0.00	0	4.50	0.00			0.38	0.48	0.00	0.38	0.096	0.57	24.3	200	0.50	24.94	0.82	0.84	2.3%
Street 3																								
Block 14 (Stage 1)	403	402	-	0.00	0	2.33	471	3.99	5.98			0.38	0.48	0.00	2.71	0.678	7.13	22.1	200	0.50	24.94	0.82	0.84	28.6%
	402	401	200	0.21	37	2.54	508	3.97	6.42			0.38	0.48	0.21	2.92	0.731	7.63	49.4	200	0.50	24.94	0.82	0.84	30.6%
	401	400	201	0.20	37	2.74	545	3.95	6.86			0.38	0.48	0.20	3.12	0.781	8.12	55.4	200	0.50	24.94	0.82	0.84	32.6%
Street 1	400	368	-	0.00	0	10.87	1664	3.65	19.31			0.38	0.48	0.00	11.25	2.813	22.60	22.4	300	0.50	73.52	1.07	1.10	30.7%

Appendix C
Stormwater Management

TABLE 2
GROUNDWATER LEVEL DATA - MONITORING WELLS

Well ID	Date	Time	Well Depth			Screen Length	Top of Casing Elevation	Ground Surface Elevation	Pipe Stick-up	Groundwater Level		
			(m BTOC)	(m BGS)	(m AMSL)	(m)	(m AMSL)	(m AMSL)	(m)	(m BGS) [1]	(m BTOC)	(m AMSL)
MW101-22	25-Mar-22	12:15 PM	7.07	5.95	327.27	3.05	334.34	333.22	1.12	3.34	4.46	329.88
	8-Aug-22	10:00 AM								1.97	3.09	331.25
	2-Dec-22	11:32 AM								2.64	3.76	330.58
	20-Mar-23	12:45 PM								0.37	1.49	332.85
	10-Apr-23	5:44 PM								0.27	1.39	332.95
	25-May-23	12:44 PM								0.64	1.76	332.58
MW102-22	25-Mar-22	1:41 PM	5.42	4.30	328.95	3.05	334.37	333.25	1.12	0.85	1.97	332.40
	8-Aug-22	10:37 AM								2.16	3.28	331.09
	2-Dec-22	11:50 AM								2.40	3.52	330.85
	20-Mar-23	1:04 PM								1.30	2.42	331.95
	10-Apr-23	5:33 PM								1.02	2.14	332.23
	25-May-23	12:52 PM								1.65	2.77	331.60
MW103-22	25-Mar-22	2:30 PM	5.39	4.38	328.51	3.05	333.90	332.89	1.01	1.90	2.91	330.99
	8-Aug-22	11:03 AM								2.29	3.30	330.60
	2-Dec-22	12:03 PM								2.57	3.58	330.32
	20-Mar-23	1:22 PM								2.25	3.26	330.64
	10-Apr-23	5:49 PM								1.91	2.92	330.98
	25-May-23	1:00 PM								2.10	3.11	330.79
MW104-22	25-Mar-22	3:20 PM	7.56	6.64	323.88	3.05	331.44	330.52	0.92	0.02	0.94	330.50
	8-Aug-22	11:37 AM								0.52	1.44	330.00
	2-Dec-22	12:29 PM								1.36	2.28	329.16
	20-Mar-23	2:26 PM								0.39	1.31	330.13
	10-Apr-23	6:02 PM								-0.02	0.90	330.54
	25-May-23	12:06 PM								0.23	1.15	330.29
MW105-22	25-Mar-22	4:20 PM	8.15	7.15	325.14	3.05	333.29	332.29	1.00	0.38	1.38	331.91
	8-Aug-22	-								2.09	3.09	330.20
	2-Dec-22	1:02 PM								3.23	4.23	329.06
	20-Mar-23	11:54 AM								0.48	1.48	331.81
	10-Apr-23	5:13 PM								0.61	1.61	331.68
	25-May-23	1:14 PM								0.96	1.96	331.33
MW106-22	25-Mar-22	1:22 PM	8.41	7.51	324.49	3.05	332.90	332.00	0.90	2.18	3.08	329.82
	8-Aug-22	10:45 AM								1.32	2.22	330.68
	2-Dec-22	12:51 PM								2.68	3.58	329.32
	20-Mar-23	3:23 PM								0.70	1.60	331.30
	10-Apr-23	5:28 PM								0.50	1.40	331.50
	25-May-23	12:27 PM								0.85	1.75	331.15
MW107-22	25-Mar-22	3:49 PM	4.65	3.56	328.70	3.05	333.35	332.26	1.09	0.46	1.55	331.80
	8-Aug-22	11:44 AM								1.66	2.75	330.60
	2-Dec-22	12:39 PM								1.78	2.87	330.48
	20-Mar-23	3:53 PM								0.66	1.75	331.60
	10-Apr-23	5:21 PM								0.58	1.67	331.68
	25-May-23	11:29 AM								1.04	2.13	331.22
MW108-22	25-Mar-22	2:50 PM	6.65	5.75	326.52	3.05	333.17	332.27	0.90	0.59	1.49	331.68
	8-Aug-22	11:17 AM	6.65	5.03	327.24	3.05	333.89	332.27	1.62	1.32	2.94	330.95
	2-Dec-22	12:39 PM								1.64	3.26	330.63
	20-Mar-23	2:07 PM								1.06	2.68	331.21
	10-Apr-23	5:56 PM								0.59	2.21	331.68
	25-May-23	12:15 PM								0.90	2.52	331.37

Notes:

m BGS = meters below ground surface
m BTOC = meters below top of casing
m AMSL = meters above mean sea level

160310788 (Millennium Blvd)
NRCS (SCS) Curve Number Determination

TABLE OF CURVE NUMBERS (CN's)									
Land Use		Hydrologic Soil Type							Manning's 'n'
		A	AB	B	BC	C	CD	D	
Meadow	"Good"	30	44	58	64.5	71	74.5	78	0.40
Woodlot	"Fair"	36	48	60	66.5	73	76	79	0.40
Gravel		76	80.5	85	87	89	90	91	0.30
Lawns	"Good"	39	50	61	67.5	74	77	80	0.25
Pasture/Range		58	61.5	65	70.5	76	78.5	81	0.17
Crop		66	70	74	78	82	84	86	0.13
Fallow (Bare)		77	82	86	89	91	93	94	0.05
Impervious		98	98	98	98	98	98	98	0.01

1. MTO Drainage Manual (1997), Design Chart 1.09-Soil/Land Use Curve Numbers
2. Chin (2000), Water-Resources Engineering, Table 6.13-Curve Numbers for Various Urban Land Uses

HYDROLOGIC SOIL TYPE (%) - Existing Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
100			2	3	95			100
101				50	50			100
102				20	80			100
103			10		90			100
104			5		95			100
105				50	50			100

LAND USE (%) - Existing Conditions									
Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Impervious (see note)	Total
100						100			100
101						100			100
102						100			100
103						100			100
104						89.5		10.5	100
105						100			100

CURVE NUMBER (CN) - Existing Conditions										
Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Impervious	Weighted CN	Pervious CN
100	0	0	0	0	0	82	0	0	82	82
101	0	0	0	0	0	80	0	0	80	80
102	0	0	0	0	0	81	0	0	81	81
103	0	0	0	0	0	81	0	0	81	81
104	0	0	0	0	0	73	0	10	83	82
104	0	0	0	0	0	80	0	0	80	80

** AMC II assumed
** Hydrological Soil Group taken from MTO Drainage Manual for each soil type

160310788 (Millennium Blvd)
NRCS (SCS) Curve Number Determination

TABLE OF CURVE NUMBERS (CN's)									
Land Use		Hydrologic Soil Type							Manning's 'n'
		A	AB	B	BC	C	CD	D	
Meadow	"Good"	30	44	58	64.5	71	74.5	78	0.40
Woodlot	"Fair"	36	48	60	66.5	73	76	79	0.40
Gravel		76	80.5	85	87	89	90	91	0.30
Lawns	"Good"	39	50	61	67.5	74	77	80	0.25
Pasture/Range		58	61.5	65	70.5	76	78.5	81	0.17
Crop		66	70	74	78	82	84	86	0.13
Fallow (Bare)		77	82	86	89	91	93	94	0.05
Impervious		98	98	98	98	98	98	98	0.01

1. MTO Drainage Manual (1997), Design Chart 1.09-Soil/Land Use Curve Numbers
2. Chin (2000), Water-Resources Engineering, Table 6.13-Curve Numbers for Various Urban Land Uses

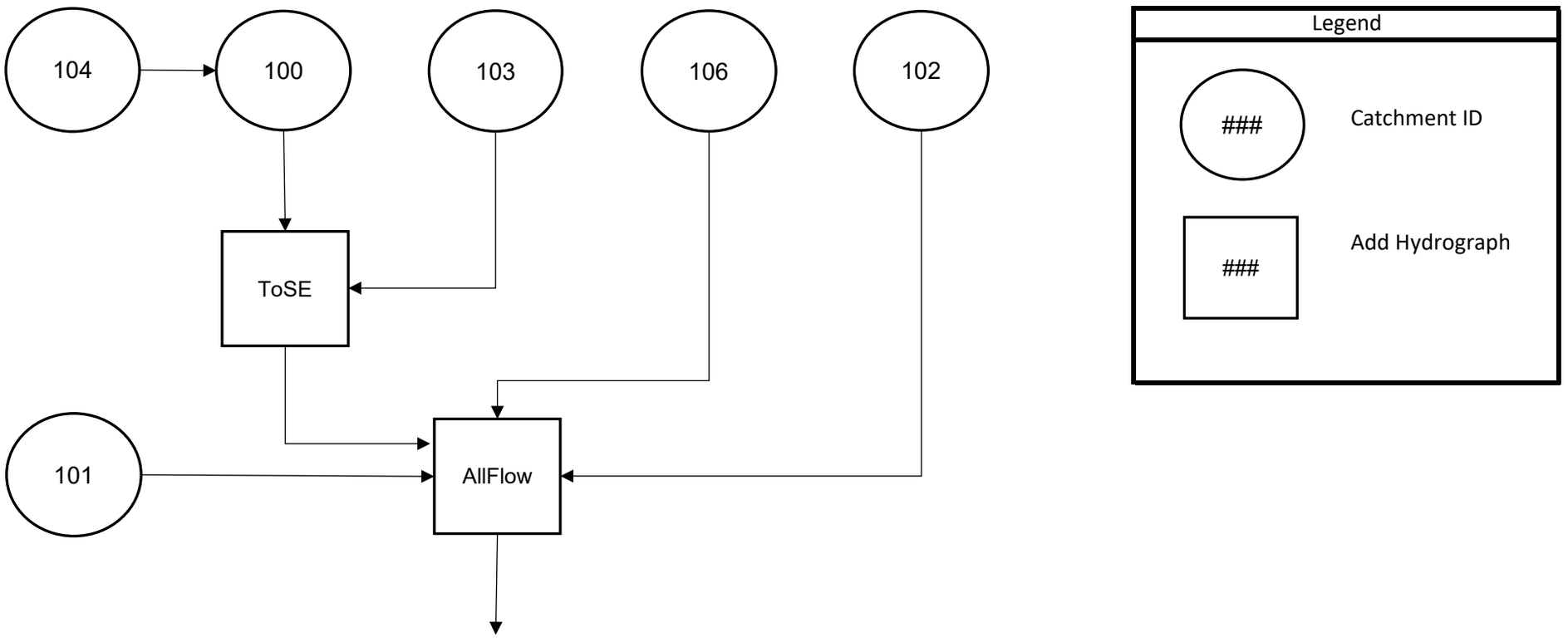
HYDROLOGIC SOIL TYPE (%) - Proposed Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
200				5	95			100
201					100			100
202				50	50			100
203				50	50			100
204			10		90			100
205			10		90			100
206				100				100

LAND USE (%) - Proposed Conditions									
Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Impervious (see note)	Total
200				42				58	100
201				96				4	100
202				70				30	100
203				10				90	100
204				88				12	100
205				90				11	100
206				100				0	100

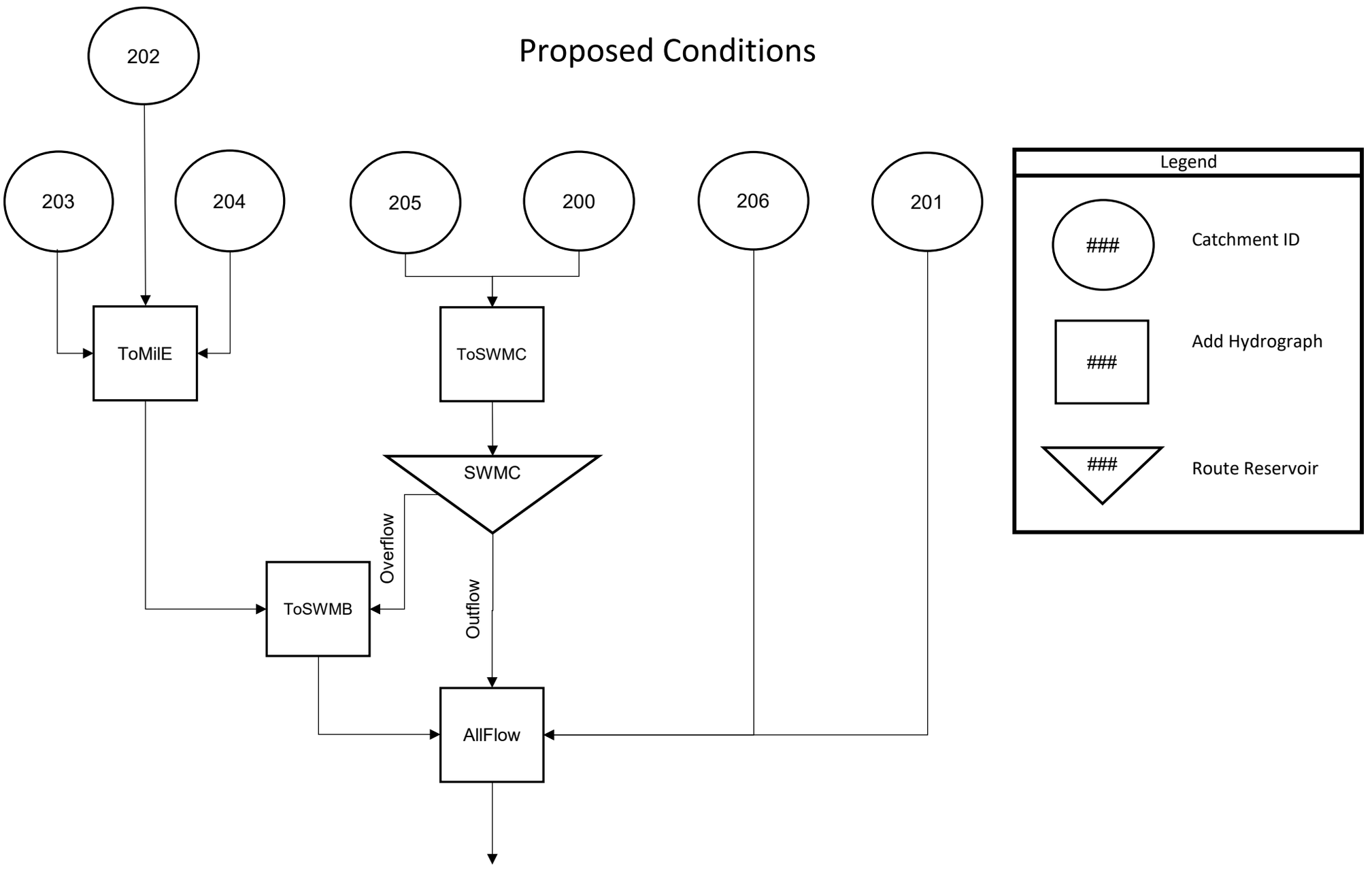
CURVE NUMBER (CN) - Proposed Conditions										
Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Impervious	Weighted CN	Pervious CN
200	0	0	0	31	0	0	0	57	88	74
201	0	0	0	71	0	0	0	4	75	74
202	0	0	0	50	0	0	0	29	79	71
203	0	0	0	7	0	0	0	88	95	71
204	0	0	0	64	0	0	0	12	76	73
205	0	0	0	65	0	0	0	10	75	73
206	0	0	0	68	0	0	0	0	68	68

** AMC II assumed
** Hydrological Soil Group taken from MTO Drainage Manual for each soil type

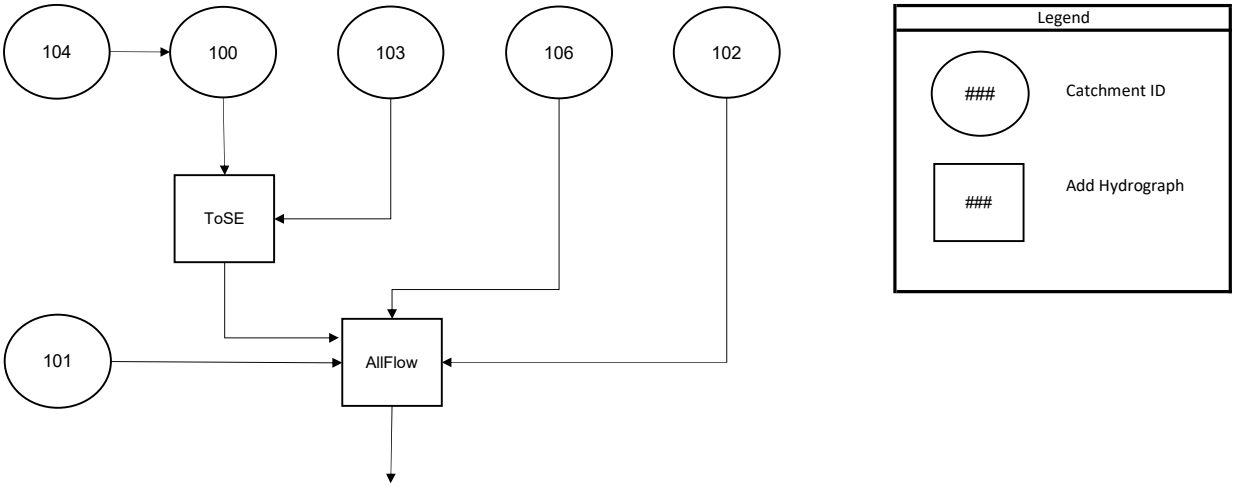
Exisiting Conditions



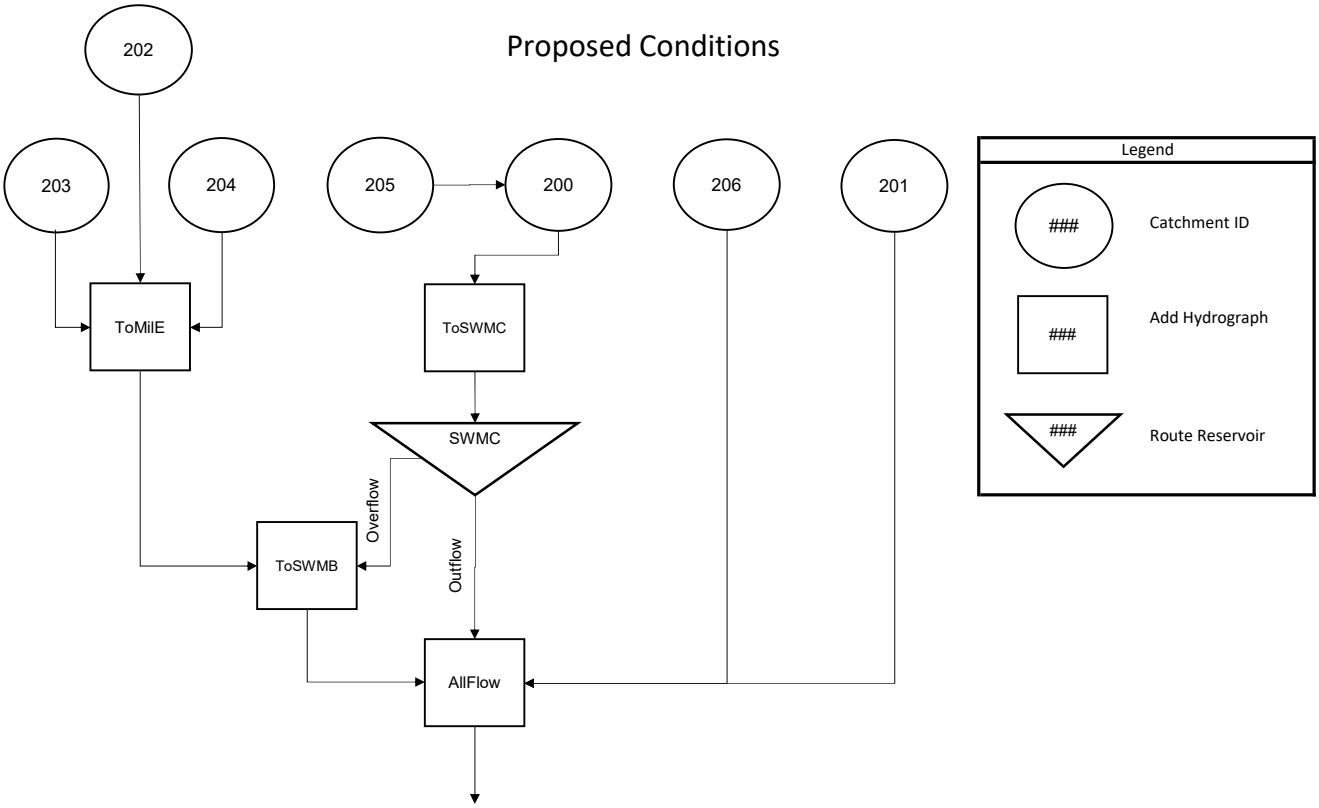
Proposed Conditions



Exisiting Conditions



Proposed Conditions



160310788 (Millennium Blvd)

Stormwater Quality Volumetric Requirements

Drainage Area (ha)	Total % Imp.	Level	Facility Type	Water Quality Unit Volume Requirements [1]			Water Quality Volume Requirements		
				Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Total MOE Volume
16.80	45%	Enhanced	Wetpond	166	126	40	2,112	672	2,784

[1] Water quality unit volume requirements based on Table 3.2, Stormwater Management Planning & Design Manual (MOE 2003)

[2] Drainage Area for Quality control represents total storm sewer drainage area to SWM Facility and includes the area of the SWM block itself and external area draining onto site

160310788 (Millennium Blvd)
Sediment Forebay Sizing Calculations
Using MOE - SWMPD Manual (2003)

Settling

Dist = sqrt(r*Q_p/v_s)

= **25.4** **m**

r : 1 = l to w ratio — r = 4.0

Q_p = peak SWM outflow during quality storm — Q_p = 0.048 — Note 1.

v_s = settling velocity for 0.15 mm particles (m/s) — v_s = 0.0003

Dispersion Length

Dist = 8Q/dv

= 36.3 m

y_s = total depth of sediment in forebay (m) — y_s = 0.35

Q = inlet flow (m^3/s) — Q = 1.929 — Note 2.

d = depth of perm pool in forebay above y_s (m) — d = 0.85

v_f = desired vel in forebay (m/s) — v_f = 0.5

Velocity Checks

v = Q/A

= **0.04** **m/s**

Therefore, **Velocity Target Satisfied**

y = total depth above sediment storage — y = 1.95 — Note 3.

b = bottom width of (avg) of forebay (m) — b = 10

Q = inlet flow (m^3/s) — Q = 1.929 — Note 2.

A = cross-sectional area (m^2) — A = 45.27 — Note 3.

Target velocity (m/s) — V_{targ} = 0.15

Cleanout Frequency

Table 6.3 MOEE SWMPP Guidelines

cleanout = Vol/(load*A_{sew}*effic)

= **8.2** **years**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 16.80

Imp = Percent Impervious (%) — Imp = 45%

load = Sediment Loading (m^3/ha) — load = 1.3

effic = Removal Efficiency (%) - Level 1 — effic = 80%

Targ = Cleanout Frequency Target (years) — Targ = 7

Vol = Sediment volume (m^3) — Vol = 140 — Note 4.

Therefore, **Cleanout Frequency Satisfied**

Notes

1. Taken as the peak outflow of the Water Quality Extended Detention Volume
2. Peak inlet flows to SWM facility based on SWMHYMO modelling (5-year storm)
3. Cross-sectional area based on 5 yr flow depth above maximum sedimentation depth
4. Volume of bottom 0.35 m depth, the maximum sediment accumulation depth

160310788 (Millennium Blvd)
Stormwater Management Facility Design Calculations

	Rating Curve				Estimated Detention	Volume Estimation						Active Storage		Outlet Structure Controls			
			Storage			Forebay		Total Pond	Active Storage	Total				Ext. Detention	Emergency		
	Elevation (m)	Discharge (m^3/s)	Active (m^3)	Total (m^3)	Time (hrs)	Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume ha.m	Volume (excl. sediment) (m^3)	Depth (m)	Elevation (m)	Orifice (m^3/s)	Spillway (m^3/s)	Total Flow	Parameters
	328.5					328.5							328.5				Water Quality Extended Detention Orifice
	328.6		77			328.6	34.67	111.3			77		328.6				Orifice #1 Elev (m) / Orifice Coeff.
	328.7		160			328.7	73.46	233.28			160		328.7				329.70 / 0.600
Max Sed. Storage (328.85)	328.8		249			328.8	116.52	365.67			249		328.8				Orifice #1-Midpoint (m) / Perimeter (m)
	328.9		345			328.9	163.89	508.88			345		328.9				329.80 / 0.597
	329		449			329.0	215.55	664.73			449		329.0				Orifice Diameter (mm) / Area (m^2)
	329.1		622			329.1	272.72	837.59			622		329.1				190 / 0.028
	329.2		807			329.2	333.76	1022.87			807		329.2				Weir Coeff. (Sharp) / Orientation
	329.3		1,006			329.3	398.88	1221.66			1,006		329.3				1.80 / Vertical
	329.4		1,222			329.4	470.6	1437.26			1,222		329.4				
	329.5		1,452			329.5	548.97	1667.22			1,452		329.5				
	329.6		1,722			329.6	641.56	1937.73			1,722		329.6				
Permanent Pool	329.7		1,995			329.7	735.1	2210.33			1,995		329.7				
	329.8	0.0053	286	2,280	14.9	329.8	834.21	2495.87	286	0.029	2,280	0.1	329.8	0.005		0.0053	
	329.9	0.0244	588	2,583	20.5	329.9	940.4	2798.44	588	0.059	2,583	0.2	329.9	0.024		0.0244	
	330	0.0341	905	2,899	23.5	330.0	1051.62	3115.03	905	0.090	2,899	0.3	330.0	0.034		0.0341	
	330.1	0.0416	1,228	3,223	25.9	330.1	1162.74	3438.31	1228	0.123	3,223	0.4	330.1	0.042		0.0416	
	330.2	0.0480	1,573	3,568	28.1	330.2	1285.63	3783.16	1573	0.157	3,568	0.5	330.2	0.048		0.0480	
	330.3	0.0535	1,930	3,925	30.0	330.3	1410.25	4140.82	1930	0.193	3,925	0.6	330.3	0.054		0.0535	Emergency Overflow Weir
	330.4	0.0586	2,302	4,296	31.8	330.4	1542.63	4511.99	2302	0.230	4,296	0.7	330.4	0.059		0.0586	Spillway Invert (m) / Top of Berm (m)
	330.5	0.0633	2,689	4,684	33.6	330.5	1678.32	4899.37	2689	0.269	4,684	0.8	330.5	0.063		0.0633	332.00 / 332.30
	330.6	0.0676	3,084	5,079	35.3	330.6	1817.26	5294.52	3084	0.308	5,079	0.9	330.6	0.068		0.0676	Spillway Length @ Invert (m) / Max. Flow Depth (m)
	330.7	0.0717	3,489	5,484	36.9	330.7	1958.15	5699.46	3489	0.349	5,484	1.0	330.7	0.072		0.0717	2 / 0.30
	330.8	0.0755	4,033	6,028	39.0	330.8	2168.63	6243.1	4033	0.403	6,028	1.1	330.8	0.076		0.0755	Side Slopes (ratio of H:V) / Topwidth
	330.9	0.0792	4,479	6,474	40.6	330.9	2327	6689.18	4479	0.448	6,474	1.2	330.9	0.079		0.0792	5.00 / 5.00
	331	0.0827	4,949	6,944	42.2	331.0	2497.59	7159.6	4949	0.495	6,944	1.3	331.0	0.083		0.0827	Weir Coefficient (Rectangle) / Weir Coeff. (Triangle)
	331.1	0.0861	5,421	7,416	43.7	331.1	2664.94	7631.48	5421	0.542	7,416	1.4	331.1	0.086		0.0861	1.70 / 1.30
	331.2	0.0893	5,904	7,898	45.3	331.2	2835.27	8114.01	5904	0.590	7,898	1.5	331.2	0.089		0.0893	
	331.3	0.0924	6,405	8,400	46.8	331.3	3013.31	8615.26	6405	0.640	8,400	1.6	331.3	0.092		0.0924	
	331.4	0.0955	6,916	8,910	48.3	331.4	3195.5	9125.93	6916	0.692	8,910	1.7	331.4	0.095		0.0955	
	331.5	0.0984	7,436	9,430	49.8	331.5	3379.75	9645.94	7436	0.744	9,430	1.8	331.5	0.098		0.0984	
	331.6	0.1012	7,969	9,964	51.3	331.6	3567.07	10179.71	7969	0.797	9,964	1.9	331.6	0.101		0.1012	
	331.7	0.1040	8,515	10,510	52.7	331.7	3760.99	10725.16	8515	0.851	10,510	2.0	331.7	0.104		0.1040	
	331.8	0.107	9,069	11,064	54.2	331.8	3956.58	11279.13	9069	0.907	11,064	2.1	331.8	0.107		0.1067	
	331.9	0.109	9,638	11,632	55.7	331.9	4158.17	11847.97	9638	0.964	11,632	2.2	331.9	0.109		0.1093	
	332	0.112	10,215	12,210	57.1	332.0	4362.11	12425.21	10215	1.021	12,210	2.3	332.0	0.112		0.1119	
	332.1	0.242	10,804	12,799	58.0	332.1	4571.1	13014.69	10804	1.080	12,799	2.4	332.1	0.114	0.128	0.2425	
	332.2	0.537	11,402	13,397	58.5	332.2	4781.89	13612.56	11402	1.140	13,397	2.5	332.2	0.117	0.420	0.537	
Top of Pond	332.3	0.998	12,973	14,968	59.0	332.3	5111.18	15183.41	12973	1.297	14,968	2.6	332.3	0.119	0.879	0.998	

Drawdown Time Calculations

Greater than 0.1 m above the permanent pool

$T=[v_2-v_1]/[(Q_2+Q_1)/2]/3600$

where

T=drawdown time in hours

v_2=starting pond volume

v_2=ending pond volume

Q_2=starting flow

Q_1=ending flow

From 0.0 to 0.1 m above the permanent pool

$T=[v_2-v_1]/[(Q_2)]/3600$

where

T=drawdown time in hours

v_2=starting pond volume

v_2=ending pond volume

Q_2=starting flow

Weir Equation Used: $Q = C_{wb}*L*H^{1.5} + C_{wt}*S*H^{2.5}$

where

L = bottom width of spillway

H = head above weir invert

S = side slopes (ratio of H:V)

C_{wt} = weir coefficient (triangular)

C_{wb} = weir coefficient (broad-crested)

Sharp crested semi-circular weir equation

Sharp crested semi-circular weir equation

$Q=C*D^{2.5}*(H/D)^{1.88}$

where

C = sharp crested semi-circular weir coefficient

D = diameter of orifice

H = head above orifice invert

Note: used when water elevation is below 3/4 of the orifice diameter

Orifice Flow Calculations: Orifice flow equation

$Q = C{\cdot}A{\cdot}(2{\cdot}g{\cdot}H)^{0.5}$

where

C = orifice coefficient

A = area of orifice

g = acceleration due to gravity

H = head above centre line of orifice

Note: used when water elevation is above 1/2 of the orifice diameter

TABLE 1
WETLAND-CONTRIBUTING CATCHMENT MONTHLY WATER BALANCE
Millennium Blvd

Model Type: Thornthwaite and Mather (1955)
Client: Activa Holdings Inc.
Location Millennium Blvd (Carriage Crossing Subdivision)

Land Description Factors (See end of table for sub-area descriptions)	**Existing**	**Proposed**
Topography	0.15	0.15
Soils	0.20	0.20
Cover	0.15	0.05
Sum (Infiltration Factor)†	0.50	0.40
Soil Moisture Capacity (mm)	200	125
Site area (ha)	**2.03**	**1.50**
Imperviousness Coefficient	0.00	0.04
Impervious Area (ha)	0.00	0.06
Percentage of Total Site Area	0.0%	4.0%
Remaining Pervious Area (ha)	2.03	1.44
Total Pervious Site Area (ha)	2.03	1.44
Percentage of Total Site Area	100.0%	96.0%

	Existing		**Proposed**	
Land Description Factors	**Cultivated land**	**Impervious**	**Urban Lawn**	**Impervious**
Topography	0.15	-	0.15	-
Soils	0.2	-	0.2	-
Cover	0.15	-	0.05	-
Sum (Infiltration Factor)	0.5	-	0.4	-
Soil Moisture Capacity (mm)	200	-	125	-
% of Total Catchment Area	100%	0%	96%	4%
Total Contributing Area (ha)	**2.03**		**1.50**	

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Climate Data‡													
Average Daily Temperature (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	**7.0**
Precipitation (mm)	28.7	29.7	36.8	68	81.8	82.4	98.6	83.9	87.8	66.1	75	38	**777**

Potential Evapotranspiration Analysis for Site	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Heat Index	0.0	0.0	0.0	1.4	4.0	6.7	8.2	7.5	5.0	2.1	0.4	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.0	60.8	87.2	99.8	94.0	71.1	39.0	11.1	0.0	**492**
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	32	75	112	126	110	74	36	9	0	**573**
Precipitation - PET (mm)	29	30	37	36	7	-30	-27	-26	14	30	66	38	**203**

Evapotranspiration Analysis													
Existing	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-69	-38	0	0	
Storage (S)	200	200	200	200	200	172	151	132	146	176	200	200	
Change in Storage	0	0	0	0	0	-28	-22	-18	14	30	24	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	110	120	102	74	36	9	0	**559**
Recharge/Runoff Analysis													
Water Surplus (mm)	29	30	37	36	7	0	0	0	0	0	42	38	**218**
Potential Infiltration (I)	14	15	18	18	4	0	0	0	0	0	21	19	109
Potential Direct Surface Water Runoff (R)	14	15	18	18	4	0	0	0	0	0	21	19	109
Potential Infiltration (mm)	0	0	0	84	4	0	0	0	0	0	21	0	109
Pervious Evapotranspiration (m^3)	0	0	0	659	1517	2234	2444	2071	1504	727	182	0	11,338
Pervious Runoff (m^3)	0	0	0	1713	72	0	0	0	0	0	431	0	**2,216**
Pervious Infiltration (m^3)	0	0	0	1713	72	0	0	0	0	0	431	0	**2,216**
Potential Impervious Evaporation (mm)	3	3	4	7	8	8	10	8	9	7	8	4	78
Potential Impervious Runoff (mm)	26	27	33	61	74	74	89	76	79	59	68	34	699
Impervious Runoff (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Runoff (m^3)													**2,216**

Notes on last page.

Evapotranspiration Analysis													
Proposed	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-69	-38	0	0	
Storage (S)	125	125	125	125	125	99	79	65	78	109	125	125	
Change in Storage	0	0	0	0	0	-26	-19	-15	14	30	16	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	109	118	99	74	36	9	0	**551**
Recharge/Runoff Analysis													
Water Surplus (mm)	29	30	37	36	7	0	0	0	0	0	50	38	**225**
Potential Infiltration (I)	11	12	15	14	3	0	0	0	0	0	20	15	90
Potential Direct Surface Water Runoff (R)	17	18	22	21	4	0	0	0	0	0	30	23	135
Potential Infiltration (mm)	0	0	0	67	3	0	0	0	0	0	20	0	90
Pervious Evapotranspiration (m^3)	0	0	0	468	1076	1568	1696	1420	1067	516	129	0	7,939
Pervious Runoff (m^3)	0	0	0	1458	61	0	0	0	0	0	429	0	**1,948**
Pervious Infiltration (m^3)	0	0	0	972	41	0	0	0	0	0	286	0	**1,299**
Potential Impervious Evaporation (mm)	3	3	4	7	8	8	10	8	9	7	8	4	78
Potential Impervious Runoff (mm)	26	27	33	61	74	74	89	76	79	59	68	34	699
Impervious Runoff (m^3)	0	0	0	109	44	44	53	45	47	36	41	0	**419**
Total Runoff (m^3)													**2,368**
Runoff Surplus (m^3)													**152**
Infiltration Deficit (m^3)													**-917**

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.
* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology,
‡ Climate Data after Environment Canada, 2023. Canadian Climate Normals 1981-2010, Waterloo Wellington A, Climate ID 6149387. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html Accessed May 16, 2023.

Assumptions:
[1] The monthly average precipitation collected at the Waterloo Wellington A climate station is reflective of the precipitation trends that have historically occurred at the Site.
[2] Surplus water is not available for runoff and recharge during months where water losses from actual evapotranspiration exceed precipitation inputs.
[3] Runoff, infiltration and evapotranspiration do not occur in months where the average daily temperature is below 0°C, which is the case for the months of December through March at the Site.
[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

TABLE 2
SITE MONTHLY WATER BALANCE
Millennium Blvd

Model Type: Thornthwaite and Mather (1955)
Client: Activa Holdings Inc.
Location Millennium Blvd (Carriage Crossing Subdivision)

Land Description Factors (See end of table for sub-area descriptions)	**Existing**	**Proposed**
Topography	0.15	0.15
Soils	0.25	0.25
Cover	0.15	0.05
Sum (Infiltration Factor)†	0.55	0.45
Soil Moisture Capacity (mm)	180	110
Site area (ha)	**19.37**	**18.62**
Imperviousness Coefficient	0.02	0.42
Impervious Area (ha)	0.47	7.74
Percentage of Total Site Area	2.4%	41.6%
Remaining Pervious Area (ha)	18.90	10.88
Total Pervious Site Area (ha)	18.90	10.88
Percentage of Total Site Area	97.6%	58.4%

	Existing		**Proposed**		
Land Description Factors	**Cultivated land**	**Impervious**	**Urban Lawn**	**Impervious**	**Pond**
Topography	0.15	-	0.15	-	-
Soils	0.25	-	0.25	-	-
Cover	0.15	-	0.05	-	-
Sum (Infiltration Factor)	0.55	-	0.45	-	-
Soil Moisture Capacity (mm)	180	-	110	-	-
Percentage of Total Site Area	98%	2%	58%	42%	
Total Site Area (ha)	**19.37**		**18.62**		**0.75**

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Climate Data‡													
Average Daily Temperature (°C)	-6.5	-5.5	-1	6.2	12.5	17.6	20	18.9	14.5	8.2	2.5	-3.3	**7.0**
Precipitation (mm)	28.7	29.7	36.8	68	81.8	82.4	98.6	83.9	87.8	66.1	75	38	**777**

Potential Evapotranspiration Analysis for Site	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Heat Index	0.0	0.0	0.0	1.4	4.0	6.7	8.2	7.5	5.0	2.1	0.4	0.0	**35**
Unadjusted Potential Evapotranspiration (mm)	0.0	0.0	0.0	29.0	60.8	87.2	99.8	94.0	71.1	39.0	11.1	0.0	**492**
Potential Evapotranspiration Adjusting Factor for Latitude*	0.77	0.87	0.99	1.12	1.23	1.29	1.26	1.16	1.04	0.92	0.81	0.75	
Adjusted Potential Evapotranspiration (PET)(mm)	0	0	0	32	75	112	126	110	74	36	9	0	**573**
Precipitation - PET (mm)	29	30	37	36	7	-30	-27	-26	14	30	66	38	**203**

Evapotranspiration Analysis													
Existing	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-69	-38	0	0	
Storage (S)	180	180	180	180	180	153	131	114	128	158	180	180	
Change in Storage	0	0	0	0	0	-27	-21	-17	14	30	22	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	110	120	101	74	36	9	0	**557**
Recharge/Runoff Analysis													
Water Surplus (mm)	29	30	37	36	7	0	0	0	0	0	44	38	**220**
Potential Infiltration (I)	16	16	20	19	4	0	0	0	0	0	24	21	120
Potential Direct Surface Water Runoff (R)	13	13	17	16	3	0	0	0	0	0	20	17	100
Potential Infiltration (mm)	0	0	0	92	4	0	0	0	0	0	24	0	120
Pervious Evapotranspiration (m^3)	0	0	0	6138	14120	20753	22655	19150	14007	6767	1698	0	105,289
Pervious Runoff (m^3)	0	0	0	14466	608	0	0	0	0	0	3764	0	**18,838**
Pervious Infiltration (m^3)	0	0	0	17423	732	0	0	0	0	0	4534	0	**22,688**
Potential Impervious Evaporation (mm)	3	3	4	7	8	8	10	8	9	7	8	4	78
Potential Impervious Runoff (mm)	26	27	33	61	74	74	89	76	79	59	68	34	699
Impervious Runoff (m^3)	0	0	0	851	346	349	417	355	371	280	317	0	**3,286**
Total Runoff (m^3)													**22,124**

Notes on last page.

Evapotranspiration Analysis													
Proposed	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Accumulated Potential Water Loss (APWL)	0	0	0	0	0	-30	-57	-82	-69	-38	0	0	
Storage (S)	110	110	110	110	110	84	66	52	66	96	110	110	
Change in Storage	0	0	0	0	0	-26	-18	-14	14	30	14	0	
Actual Evapotranspiration (mm)	0	0	0	32	75	108	117	98	74	36	9	0	**549**
Recharge/Runoff Analysis													
Water Surplus (mm)	29	30	37	36	7	0	0	0	0	0	52	38	**228**
Potential Infiltration (I)	13	13	17	16	3	0	0	0	0	0	23	17	103
Potential Direct Surface Water Runoff (R)	16	16	20	20	4	0	0	0	0	0	29	21	125
Potential Infiltration (mm)	0	0	0	76	3	0	0	0	0	0	23	0	103
Pervious Evapotranspiration (m^3)	0	0	0	3534	8129	11801	12718	10614	8064	3896	978	0	59,735
Pond Evaporation (m^3)	0	0	0	563	791	923	1000	814	495	203	0	0	4,787
Total Evaporation (m^3)	0	0	0	4097	8920	12723	13718	11428	8559	4098	978	0	64,521
Pervious Runoff (m^3)	0	0	0	10098	424	0	0	0	0	0	3113	0	**13,635**
Pond Runoff	0	0	0	662	-177	-305	-260	-185	164	293	563	0	**755**
Pervious Infiltration (m^3)	0	0	0	8262	347	0	0	0	0	0	2547	0	**11,156**
Potential Impervious Evaporation (mm)	3	3	4	7	8	8	10	8	9	7	8	4	78
Potential Impervious Runoff (mm)	26	27	33	61	74	74	89	76	79	59	68	34	699
Impervious Runoff (m^3)	0	0	0	14013	5697	5739	6867	5843	6115	4604	5224	0	**54,103**

Pond													
Pond Evaporation (mm)	0.00	0.00	0.00	75.00	105.40	123.00	133.30	108.50	66.00	27.00	0.00	0.00	**638.2**
Runoff (mm)	0.0	0.0	0.0	88.2	-23.6	-40.6	-34.7	-24.6	21.8	39.1	75.0	0.0	**100.6**

Total Runoff (m^3)	**68,493**
Runoff Surplus (m^3)	**46368**
Infiltration Deficit (m^3)	**-11532**

Notes:
† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.; and Ontario Ministry of Environment and Energy (MOEE). 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.
* PET adjustment factors after Thornthwaite, C.W., and J.R. Mather, 1957. Instructions and Tables for Computing Potential Evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology,
‡ Climate Data after Environment Canada, 2023. Canadian Climate Normals 1981-2010, Waterloo Wellington A, Climate ID 6149387. [Online] http://climate.weather.gc.ca/climate_normals/index_e.html Accessed May 16, 2023.

Assumptions:
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[4] Precipitation during freezing months (i.e., December to March) is assumed to accumulate as snow and result in additional precipitation in the first month thereafter where the average temperature is greater than 0°C (i.e., April).
[5] Soil moisture capacity is at a maximum in April.

```
00001> ================================================================================
00002>
00003>   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>       S  W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
00008>                                                        9   9  9   9   # 4730904
00009>         StormWater Management HYdrologic Model          999    999    =========
00010>
00011> ********************************************************************************
00012> ***************************** SWMHYMO Ver/4.05  ********************************
00013> *********  A single event and continuous hydrologic simulation model  *********
00014> *********     based on the principles of HYMO and its successors      *********
00015> *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
00016> ********************************************************************************
00017> ******** Distributed by:  J.F. Sabourin and Associates Inc.           *********
00018> *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019> *********                  Gatineau, Quebec: (819) 243-6858           *********
00020> *********                  E-Mail: swmhymo@jfsa.com                   *********
00021> ********************************************************************************
00022>
00023> ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024> +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
00025> +++++++++                Kitchener            SERIAL#:4730904        +++++++++
00026> ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028> ********************************************************************************
00029> *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030> *********           Maximum value for ID numbers  :     10            *********
00031> *********           Max. number of rainfall points: 105408            *********
00032> *********           Max. number of flow points    : 105408            *********
00033> ********************************************************************************
00034>
00035>
00036> **********************   D E T A I L E D   O U T P U T   **********************
00037> ********************************************************************************
00038> *         DATE: 2024-11-04     TIME: 14:10:48     RUN COUNTER: 000598          *
00039> ********************************************************************************
00040> * Input   filename: C:\SWMHYMO\MILLEN~1\V4_NOV~1\Mil1024E.dat                  *
00041> * Output  filename: C:\SWMHYMO\MILLEN~1\V4_NOV~1\Mil1024E.out                 *
00042> * Summary filename: C:\SWMHYMO\MILLEN~1\V4_NOV~1\Mil1024E.sum                 *
00043> * User comments:                                                              *
00044> * 1:_____________________________________________________________________     *
00045> * 2:_____________________________________________________________________     *
00046> * 3:_____________________________________________________________________     *
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001-----------------------------------------------------------------------
00051> *#*******************************************************************************
00052> *#  Project Name: [Activa Millennium Blvd. (Carriage Crossing)]
00053> *#  Project Number: [1603-10788]
00054> *#  Date        : 11/04/2024
00055> *#  Modeller    : [Amy Kyle]
00056> *#  Company     : Stantec Consulting Ltd. (Waterloo)
00057> *#  License #   :  4730904
00058> *#
00059> *#  Existing Conditions Model for Millennium Blvd.(Carriage Crossing Catch. 430)
00060> *#  Soils data obtained from Hydrogeological and Geotechnical Study
00061> *#           Activa Waterloo East Lands (Naylor, 2006)
00062> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
00063> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
00064> *#
00065> *#*******************************************************************************
00066> ----------------------
00067> | START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00068> ----------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00069>     TZERO =    .00 hrs on        0
00070>     METOUT=   2 (output = METRIC)
00071>     NRUN  = 001
00072>     NSTORM=   1
00073>               #  1=Wat25mm.STM
00074> --------------------------------------------------------------------------------
00075> 001:0002-----------------------------------------------------------------------
00076> ----------------------
00077> | READ STORM       |    Filename: CHICAGO STORM - 25 mm Event (4hr), City
00078> | Ptotal=  24.99 mm|    Comments: CHICAGO STORM - 25 mm Event (4hr), City
00079> ----------------------
00080>                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00081>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00082>                 .08   1.015 |   1.08   3.577 |   2.08   5.579 |   3.08   1.561
00083>                 .17   1.079 |   1.17   4.470 |   2.17   4.647 |   3.17   1.470
00084>                 .25   1.153 |   1.25   5.891 |   2.25   3.968 |   3.25   1.389
00085>                 .33   1.237 |   1.33   8.432 |   2.33   3.454 |   3.33   1.317
00086>                 .42   1.335 |   1.42  13.932 |   2.42   3.053 |   3.42   1.252
00087>                 .50   1.450 |   1.50  31.444 |   2.50   2.732 |   3.50   1.193
00088>                 .58   1.586 |   1.58  77.925 |   2.58   2.470 |   3.58   1.140
00089>                 .67   1.750 |   1.67  36.326 |   2.67   2.253 |   3.67   1.091
00090>                 .75   1.952 |   1.75  19.268 |   2.75   2.070 |   3.75   1.046
00091>                 .83   2.206 |   1.83  12.471 |   2.83   1.914 |   3.83   1.005
00092>                 .92   2.533 |   1.92   8.985 |   2.92   1.780 |   3.92    .967
00093>                1.00   2.970 |   2.00   6.921 |   3.00   1.663 |   4.00    .932
00094>
00095> --------------------------------------------------------------------------------
00096> 001:0003-----------------------------------------------------------------------
00097> *# ======================================================
00098> *# Existing Drainage Area
00099> *# ======================================================
00100> *#-----------------|-------------------------------------------------------------|
00101> *# External Area Draining onto Property
00102> *#-----------------|-------------------------------------------------------------|
00103> ----------------------
00104> | DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number   (CN)=83.00
00105> | 01:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00106> ----------------------  U.H. Tp(hrs)=    .480
00107>
00108>     Unit Hyd Qpeak  (cms)=     .358
00109>
00110>     PEAK FLOW       (cms)=     .068 (i)
00111>     TIME TO PEAK    (hrs)=    2.183
00112>     RUNOFF VOLUME    (mm)=    7.306
00113>     TOTAL RAINFALL   (mm)=   24.988
00114>     RUNOFF COEFFICIENT   =     .292
00115>
00116>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00117>
00118> --------------------------------------------------------------------------------
00119> 001:0004-----------------------------------------------------------------------
00120> *#-----------------|-------------------------------------------------------------|
00121> *# Largest catchment of existing agricultural lands, draining south
00122> *#-----------------|-------------------------------------------------------------|
00123> ----------------------
00124> | DESIGN NASHYD      |   Area    (ha)=    9.64   Curve Number   (CN)=82.00
00125> | 02:100    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00126> ----------------------  U.H. Tp(hrs)=    .780
00127>
00128>     Unit Hyd Qpeak  (cms)=     .472
00129>
00130>     PEAK FLOW       (cms)=     .097 (i)
00131>     TIME TO PEAK    (hrs)=    2.550
00132>     RUNOFF VOLUME    (mm)=    6.962
00133>     TOTAL RAINFALL   (mm)=   24.988
00134>     RUNOFF COEFFICIENT   =     .279
00135>
00136>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00137>
00138> --------------------------------------------------------------------------------
00139> 001:0005-----------------------------------------------------------------------
00140> *#-----------------|-------------------------------------------------------------|
00141> *# Section of existing agricultural lands east of catchment 100, draining south
00142> *#-----------------|-------------------------------------------------------------|
00143> ----------------------
00144> | DESIGN NASHYD      |   Area    (ha)=    2.25   Curve Number   (CN)=81.00
00145> | 03:103    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00146> ----------------------  U.H. Tp(hrs)=    .340
00147>
00148>     Unit Hyd Qpeak  (cms)=     .253
00149>
00150>     PEAK FLOW       (cms)=     .039 (i)
00151>     TIME TO PEAK    (hrs)=    2.017
00152>     RUNOFF VOLUME    (mm)=    6.641
00153>     TOTAL RAINFALL   (mm)=   24.988
00154>     RUNOFF COEFFICIENT   =     .266
00155>
00156>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00157>
00158> --------------------------------------------------------------------------------
00159> 001:0006-----------------------------------------------------------------------
00160> *#-----------------|-------------------------------------------------------------|
00161> *# Total Flow to Existing DICB, flowing SE
00162> *#-----------------|-------------------------------------------------------------|
00163> ----------------------
00164> | ADD HYD (ToSE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00165> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00166>                      ID1 01:104           4.50     .068    2.18   7.31    .000
00167>                     +ID2 02:100           9.64     .097    2.55   6.96    .000
00168>                     +ID3 03:103           2.25     .039    2.02   6.64    .000
00169>                      ==========================================================
00170>                      SUM 04:ToSE         16.39     .186    2.27   7.01    .000
00171>
00172>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00173>
00174> --------------------------------------------------------------------------------
00175> 001:0007-----------------------------------------------------------------------
00176> *#-----------------|-------------------------------------------------------------|
00177> *# Small section of existing agricultural lands draining to Millennium and
00178> *# flowing east subsequently to SWMF B
00179> *#-----------------|-------------------------------------------------------------|
00180> ----------------------
00181> | DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number   (CN)=80.00
00182> | 08:101    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00183> ----------------------  U.H. Tp(hrs)=    .300
00184>
00185>     Unit Hyd Qpeak  (cms)=     .104
00186>
00187>     PEAK FLOW       (cms)=     .015 (i)
00188>     TIME TO PEAK    (hrs)=    1.967
00189>     RUNOFF VOLUME    (mm)=    6.341
00190>     TOTAL RAINFALL   (mm)=   24.988
00191>     RUNOFF COEFFICIENT   =     .254
00192>
00193>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00194>
00195> --------------------------------------------------------------------------------
00196> 001:0008-----------------------------------------------------------------------
00197> *#-----------------|-------------------------------------------------------------|
00198> *# Small section of existing agricultural lands draining to Millennium Blvd and
00199> *# flowing west
00200> *#-----------------|-------------------------------------------------------------|
00201> ----------------------
00202> | DESIGN NASHYD      |   Area    (ha)=     .13   Curve Number   (CN)=80.00
00203> | 05:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00204> ----------------------  U.H. Tp(hrs)=    .400
00205>
00206>     Unit Hyd Qpeak  (cms)=     .012
00207>
00208>     PEAK FLOW       (cms)=     .002 (i)
00209>     TIME TO PEAK    (hrs)=    2.083
00210>     RUNOFF VOLUME    (mm)=    6.336
00211>     TOTAL RAINFALL   (mm)=   24.988
00212>     RUNOFF COEFFICIENT   =     .254
00213>
00214>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00215>
00216> --------------------------------------------------------------------------------
00217> 001:0009-----------------------------------------------------------------------
00218> *#-----------------|-------------------------------------------------------------|
00219> *# Section of existing agricultural lands, draining west to wetland
00220> *#-----------------|-------------------------------------------------------------|
00221> ----------------------
00222> | DESIGN NASHYD      |   Area    (ha)=    2.03   Curve Number   (CN)=81.00
00223> | 06:102    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00224> ----------------------  U.H. Tp(hrs)=    .360
00225>
00226>     Unit Hyd Qpeak  (cms)=     .215
00227>
00228>     PEAK FLOW       (cms)=     .034 (i)
00229>     TIME TO PEAK    (hrs)=    2.033
00230>     RUNOFF VOLUME    (mm)=    6.641
00231>     TOTAL RAINFALL   (mm)=   24.988
00232>     RUNOFF COEFFICIENT   =     .266
00233>
00234>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00235>
00236> --------------------------------------------------------------------------------
00237> 001:0010-----------------------------------------------------------------------
00238> *#-----------------|-------------------------------------------------------------|
00239> *# Total Flow from Subject Site
00240> *#-----------------|-------------------------------------------------------------|
00241> ----------------------
00242> | ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00243> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00244>                      ID1 04:ToSE         16.39     .186    2.27   7.01    .000
00245>                     +ID2 05:105           .13     .002    2.08   6.34    .000
00246>                     +ID3 06:102          2.03     .034    2.03   6.64    .000
00247>                     +ID4 08:101           .82     .015    1.97   6.34    .000
00248>                      ==========================================================
00249>                      SUM 07:AllFlo       19.37     .229    2.20   6.94    .000
00250>
00251>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00252>
00253> --------------------------------------------------------------------------------
00254> 001:0011-----------------------------------------------------------------------
00255> *#-----------------|-------------------------------------------------------------|
00256>   ** END OF RUN :   1
00257>
00258> ********************************************************************************
00259>
00260>
00261>
00262>
00263>
00264> ----------------------
00265> | START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00266> ----------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00267>     TZERO =    .00 hrs on        0
00268>     METOUT=   2 (output = METRIC)
00269>     NRUN  = 002
00270>     NSTORM=   1
```

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00271>            #  1=Wat2yr.STM
00272> ------------------------------------------------------------------------------
00273> 002:0002-------------------------------------------------------------------------
00274> *#*****************************************************************************
00275> *#  Project Name: [Activa Millennium Blvd. (Carriage Crossing)]
00276> *#  Project Number: [1603-10788]
00277> *#  Date        : 11/04/2024
00278> *#  Modeller    : [Amy Kyle]
00279> *#  Company     : Stantec Consulting Ltd. (Waterloo)
00280> *#  License #   :  4730904
00281> *#
00282> *#  Existing Conditions Model for Millennium Blvd.(Carriage Crossing Catch. 430)
00283> *#  Soils data obtained from Hydrogeological and Geotechnical Study
00284> *#           Activa Waterloo East Lands (Naylor, 2006)
00285> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
00286> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
00287> *#
00288> *#*****************************************************************************
00289> ------------------------------------------------------------------------------
00290> 002:0002-------------------------------------------------------------------------
00291> ---------------------
00292> | READ STORM        |    Filename: CHICAGO STORM
00293> | Ptotal=  32.39 mm|    Comments: CHICAGO STORM
00294> ---------------------
00295>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00296>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00297>                .08   1.966 |    .83   7.988 |   1.58   9.384 |   2.33   2.807
00298>                .17   2.150 |    .92  11.433 |   1.67   7.565 |   2.42   2.596
00299>                .25   2.373 |   1.00  18.891 |   1.75   6.302 |   2.50   2.414
00300>                .33   2.647 |   1.08  42.635 |   1.83   5.381 |   2.58   2.255
00301>                .42   2.991 |   1.17 105.659 |   1.92   4.683 |   2.67   2.116
00302>                .50   3.435 |   1.25  49.254 |   2.00   4.139 |   2.75   1.993
00303>                .58   4.027 |   1.33  26.125 |   2.08   3.704 |   2.83   1.884
00304>                .67   4.850 |   1.42  16.909 |   2.17   3.349 |   2.92   1.786
00305>                .75   6.061 |   1.50  12.183 |   2.25   3.055 |   3.00   1.698
00306>
00307> ------------------------------------------------------------------------------
00308> 002:0003-------------------------------------------------------------------------
00309> *# ============================================================
00310> *# Existing Drainage Area
00311> *# ============================================================
00312> *#-----------------|-----------------------------------------------------------|
00313> *# External Area Draining onto Property
00314> *#-----------------|-----------------------------------------------------------|
00315> ---------------------
00316> | DESIGN NASHYD     |   Area    (ha)=    4.50   Curve Number   (CN)=83.00
00317> | 01:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00318> ---------------------   U.H. Tp(hrs)=    .480
00319>
00320>      Unit Hyd Qpeak  (cms)=     .358
00321>
00322>      PEAK FLOW       (cms)=     .114 (i)
00323>      TIME TO PEAK    (hrs)=    1.767
00324>      RUNOFF VOLUME    (mm)=   11.509
00325>      TOTAL RAINFALL   (mm)=   32.391
00326>      RUNOFF COEFFICIENT   =     .355
00327>
00328>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00329>
00330> ------------------------------------------------------------------------------
00331> 002:0004-------------------------------------------------------------------------
00332> *#-----------------|-----------------------------------------------------------|
00333> *# Largest catchment of existing agricultural lands, draining south
00334> *#-----------------|-----------------------------------------------------------|
00335> ---------------------
00336> | DESIGN NASHYD     |   Area    (ha)=    9.64   Curve Number   (CN)=82.00
00337> | 02:100    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00338> ---------------------   U.H. Tp(hrs)=    .780
00339>
00340>      Unit Hyd Qpeak  (cms)=     .472
00341>
00342>      PEAK FLOW       (cms)=     .162 (i)
00343>      TIME TO PEAK    (hrs)=    2.133
00344>      RUNOFF VOLUME    (mm)=   11.013
00345>      TOTAL RAINFALL   (mm)=   32.391
00346>      RUNOFF COEFFICIENT   =     .340
00347>
00348>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00349>
00350> ------------------------------------------------------------------------------
00351> 002:0005-------------------------------------------------------------------------
00352> *#-----------------|-----------------------------------------------------------|
00353> *# Section of existing agricultural lands east of catchment 100, draining south
00354> *#-----------------|-----------------------------------------------------------|
00355> ---------------------
00356> | DESIGN NASHYD     |   Area    (ha)=    2.25   Curve Number   (CN)=81.00
00357> | 03:103    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00358> ---------------------   U.H. Tp(hrs)=    .340
00359>
00360>      Unit Hyd Qpeak  (cms)=     .253
00361>
00362>      PEAK FLOW       (cms)=     .066 (i)
00363>      TIME TO PEAK    (hrs)=    1.583
00364>      RUNOFF VOLUME    (mm)=   10.547
00365>      TOTAL RAINFALL   (mm)=   32.391
00366>      RUNOFF COEFFICIENT   =     .326
00367>
00368>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00369>
00370> ------------------------------------------------------------------------------
00371> 002:0006-------------------------------------------------------------------------
00372> *#-----------------|-----------------------------------------------------------|
00373> *# Total Flow to Existing DICB, flowing SE
00374> *#-----------------|-----------------------------------------------------------|
00375> ---------------------
00376> | ADD HYD (ToSE     ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00377> ---------------------                     (ha)     (cms)   (hrs)   (mm)    (cms)
00378>                     ID1 01:104            4.50      .114    1.77  11.51    .000
00379>                    +ID2 02:100            9.64      .162    2.13  11.01    .000
00380>                    +ID3 03:103            2.25      .066    1.58  10.55    .000
00381>                     ========================================================
00382>                     SUM 04:ToSE          16.39      .310    1.85  11.09    .000
00383>
00384>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00385>
00386> ------------------------------------------------------------------------------
00387> 002:0007-------------------------------------------------------------------------
00388> *#-----------------|-----------------------------------------------------------|
00389> *# Small section of existing agricultural lands draining to Millennium and
00390> *# flowing east subsequently to SWMF B
00391> *#-----------------|-----------------------------------------------------------|
00392> ---------------------
00393> | DESIGN NASHYD     |   Area    (ha)=     .82   Curve Number   (CN)=80.00
00394> | 08:101    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00395> ---------------------   U.H. Tp(hrs)=    .300
00396>
00397>      Unit Hyd Qpeak  (cms)=     .104
00398>
00399>      PEAK FLOW       (cms)=     .025 (i)
00400>      TIME TO PEAK    (hrs)=    1.533
00401>      RUNOFF VOLUME    (mm)=   10.109
00402>      TOTAL RAINFALL   (mm)=   32.391
00403>      RUNOFF COEFFICIENT   =     .312
00404>
00405>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00406>
00407> ------------------------------------------------------------------------------
00408> 002:0008-------------------------------------------------------------------------
00409> *#-----------------|-----------------------------------------------------------|
00410> *# Small section of existing agricultural lands draining to Millennium Blvd and
00411> *# flowing west
00412> *#-----------------|-----------------------------------------------------------|
00413> ---------------------
00414> | DESIGN NASHYD     |   Area    (ha)=     .13   Curve Number   (CN)=80.00
00415> | 05:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00416> ---------------------   U.H. Tp(hrs)=    .400
00417>
00418>      Unit Hyd Qpeak  (cms)=     .012
00419>
00420>      PEAK FLOW       (cms)=     .003 (i)
00421>      TIME TO PEAK    (hrs)=    1.667
00422>      RUNOFF VOLUME    (mm)=   10.104
00423>      TOTAL RAINFALL   (mm)=   32.391
00424>      RUNOFF COEFFICIENT   =     .312
00425>
00426>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00427>
00428> ------------------------------------------------------------------------------
00429> 002:0009-------------------------------------------------------------------------
00430> *#-----------------|-----------------------------------------------------------|
00431> *# Section of existing agricultural lands, draining west to wetland
00432> *#-----------------|-----------------------------------------------------------|
00433> ---------------------
00434> | DESIGN NASHYD     |   Area    (ha)=    2.03   Curve Number   (CN)=81.00
00435> | 06:102    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00436> ---------------------   U.H. Tp(hrs)=    .360
00437>
00438>      Unit Hyd Qpeak  (cms)=     .215
00439>
00440>      PEAK FLOW       (cms)=     .057 (i)
00441>      TIME TO PEAK    (hrs)=    1.617
00442>      RUNOFF VOLUME    (mm)=   10.547
00443>      TOTAL RAINFALL   (mm)=   32.391
00444>      RUNOFF COEFFICIENT   =     .326
00445>
00446>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00447>
00448> ------------------------------------------------------------------------------
00449> 002:0010-------------------------------------------------------------------------
00450> *#-----------------|-----------------------------------------------------------|
00451> *# Total Flow from Subject Site
00452> *#-----------------|-----------------------------------------------------------|
00453> ---------------------
00454> | ADD HYD (AllFlo    ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00455> ---------------------                     (ha)     (cms)   (hrs)   (mm)    (cms)
00456>                     ID1 04:ToSE          16.39      .310    1.85  11.09    .000
00457>                    +ID2 05:105            .13      .003    1.67  10.10    .000
00458>                    +ID3 06:102           2.03      .057    1.62  10.55    .000
00459>                    +ID4 08:101            .82      .025    1.53  10.11    .000
00460>                     ========================================================
00461>                     SUM 07:AllFlo        19.37      .383    1.77  10.98    .000
00462>
00463>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00464>
00465> ------------------------------------------------------------------------------
00466> 002:0011-------------------------------------------------------------------------
00467> *#-----------------|-----------------------------------------------------------|
00468> ------------------------------------------------------------------------------
00469> 002:0002-------------------------------------------------------------------------
00470>   ** END OF RUN :   4
00471>
00472> *****************************************************************************
00473>
00474>
00475>
00476>
00477>
00478> --------------------
00479> | START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00480> --------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00481>     TZERO =   .00 hrs on        0
00482>     METOUT=   2 (output = METRIC)
00483>     NRUN  = 005
00484>     NSTORM=  1
00485>            #  1=Wat5yr.STM
00486> ------------------------------------------------------------------------------
00487> 005:0002-------------------------------------------------------------------------
00488> *#*****************************************************************************
00489> *#  Project Name: [Activa Millennium Blvd. (Carriage Crossing)]
00490> *#  Project Number: [1603-10788]
00491> *#  Date        : 11/04/2024
00492> *#  Modeller    : [Amy Kyle]
00493> *#  Company     : Stantec Consulting Ltd. (Waterloo)
00494> *#  License #   :  4730904
00495> *#
00496> *#  Existing Conditions Model for Millennium Blvd.(Carriage Crossing Catch. 430)
00497> *#  Soils data obtained from Hydrogeological and Geotechnical Study
00498> *#           Activa Waterloo East Lands (Naylor, 2006)
00499> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
00500> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
00501> *#
00502> *#*****************************************************************************
00503> ------------------------------------------------------------------------------
00504> 005:0002-------------------------------------------------------------------------
00505> ---------------------
00506> | READ STORM        |    Filename: CHICAGO STORM
00507> | Ptotal=  47.53 mm|    Comments: CHICAGO STORM
00508> ---------------------
00509>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00510>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00511>                .08   2.932 |    .83  12.737 |   1.58  14.993 |   2.33   4.285
00512>                .17   3.227 |    .92  18.264 |   1.67  12.052 |   2.42   3.944
00513>                .25   3.585 |   1.00  29.805 |   1.75   9.994 |   2.50   3.650
00514>                .33   4.027 |   1.08  62.985 |   1.83   8.489 |   2.58   3.395
00515>                .42   4.584 |   1.17 136.512 |   1.92   7.347 |   2.67   3.173
00516>                .50   5.307 |   1.25  71.839 |   2.00   6.456 |   2.75   2.976
00517>                .58   6.273 |   1.33  40.530 |   2.08   5.746 |   2.83   2.802
00518>                .67   7.619 |   1.42  26.815 |   2.17   5.167 |   2.92   2.647
00519>                .75   9.600 |   1.50  19.457 |   2.25   4.688 |   3.00   2.508
00520>
00521> ------------------------------------------------------------------------------
00522> 005:0003-------------------------------------------------------------------------
00523> *# ============================================================
00524> *# Existing Drainage Area
00525> *# ============================================================
00526> *#-----------------|-----------------------------------------------------------|
00527> *# External Area Draining onto Property
00528> *#-----------------|-----------------------------------------------------------|
00529> ---------------------
00530> | DESIGN NASHYD     |   Area    (ha)=    4.50   Curve Number   (CN)=83.00
00531> | 01:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00532> ---------------------   U.H. Tp(hrs)=    .480
00533>
00534>      Unit Hyd Qpeak  (cms)=     .358
00535>
00536>      PEAK FLOW       (cms)=     .212 (i)
00537>      TIME TO PEAK    (hrs)=    1.767
00538>      RUNOFF VOLUME    (mm)=   21.611
00539>      TOTAL RAINFALL   (mm)=   47.534
00540>      RUNOFF COEFFICIENT   =     .455
```

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00541>
00542>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00543>
00544> ---------------------------------------------------------------------------
00545> 005:0004-----------------------------------------------------------------
00546> *#-----------------|-------------------------------------------------------|
00547> *# Largest catchment of existing agricultural lands, draining south
00548> *#-----------------|-------------------------------------------------------|
00549> ----------------------
00550> | DESIGN NASHYD      |   Area    (ha)=    9.64   Curve Number    (CN)=82.00
00551> | 02:100    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00552> ----------------------  U.H. Tp(hrs)=    .780
00553>
00554>      Unit Hyd Qpeak  (cms)=     .472
00555>
00556>      PEAK FLOW       (cms)=     .306 (i)
00557>      TIME TO PEAK    (hrs)=    2.133
00558>      RUNOFF VOLUME    (mm)=   20.819
00559>      TOTAL RAINFALL   (mm)=   47.534
00560>      RUNOFF COEFFICIENT   =     .438
00561>
00562>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00563>
00564> ---------------------------------------------------------------------------
00565> 005:0005-----------------------------------------------------------------
00566> *#-----------------|-------------------------------------------------------|
00567> *# Section of existing agricultural lands east of catchment 100, draining south
00568> *#-----------------|-------------------------------------------------------|
00569> ----------------------
00570> | DESIGN NASHYD      |   Area    (ha)=    2.25   Curve Number    (CN)=81.00
00571> | 03:103    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00572> ----------------------  U.H. Tp(hrs)=    .340
00573>
00574>      Unit Hyd Qpeak  (cms)=     .253
00575>
00576>      PEAK FLOW       (cms)=     .124 (i)
00577>      TIME TO PEAK    (hrs)=    1.583
00578>      RUNOFF VOLUME    (mm)=   20.065
00579>      TOTAL RAINFALL   (mm)=   47.534
00580>      RUNOFF COEFFICIENT   =     .422
00581>
00582>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00583>
00584> ---------------------------------------------------------------------------
00585> 005:0006-----------------------------------------------------------------
00586> *#-----------------|-------------------------------------------------------|
00587> *# Total Flow to Existing DICB, flowing SE
00588> *#-----------------|-------------------------------------------------------|
00589> ----------------------
00590> | ADD HYD (ToSE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00591> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00592>                       ID1 01:104          4.50     .212    1.77  21.61    .000
00593>                      +ID2 02:100          9.64     .306    2.13  20.82    .000
00594>                      +ID3 03:103          2.25     .124    1.58  20.06    .000
00595>                       ========================================================
00596>                       SUM 04:ToSE         16.39     .585    1.85  20.93    .000
00597>
00598>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00599>
00600> ---------------------------------------------------------------------------
00601> 005:0007-----------------------------------------------------------------
00602> *#-----------------|-------------------------------------------------------|
00603> *# Small section of existing agricultural lands draining to Millennium and
00604> *# flowing east subsequently to SWMF B
00605> *#-----------------|-------------------------------------------------------|
00606> ----------------------
00607> | DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number    (CN)=80.00
00608> | 08:101    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00609> ----------------------  U.H. Tp(hrs)=    .300
00610>
00611>      Unit Hyd Qpeak  (cms)=     .104
00612>
00613>      PEAK FLOW       (cms)=     .047 (i)
00614>      TIME TO PEAK    (hrs)=    1.533
00615>      RUNOFF VOLUME    (mm)=   19.347
00616>      TOTAL RAINFALL   (mm)=   47.534
00617>      RUNOFF COEFFICIENT   =     .407
00618>
00619>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00620>
00621> ---------------------------------------------------------------------------
00622> 005:0008-----------------------------------------------------------------
00623> *#-----------------|-------------------------------------------------------|
00624> *# Small section of existing agricultural lands draining to Millennium Blvd and
00625> *# flowing west
00626> *#-----------------|-------------------------------------------------------|
00627> ----------------------
00628> | DESIGN NASHYD      |   Area    (ha)=     .13   Curve Number    (CN)=80.00
00629> | 05:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00630> ----------------------  U.H. Tp(hrs)=    .400
00631>
00632>      Unit Hyd Qpeak  (cms)=     .012
00633>
00634>      PEAK FLOW       (cms)=     .006 (i)
00635>      TIME TO PEAK    (hrs)=    1.667
00636>      RUNOFF VOLUME    (mm)=   19.341
00637>      TOTAL RAINFALL   (mm)=   47.534
00638>      RUNOFF COEFFICIENT   =     .407
00639>
00640>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00641>
00642> ---------------------------------------------------------------------------
00643> 005:0009-----------------------------------------------------------------
00644> *#-----------------|-------------------------------------------------------|
00645> *# Section of existing agricultural lands, draining west to wetland
00646> *#-----------------|-------------------------------------------------------|
00647> ----------------------
00648> | DESIGN NASHYD      |   Area    (ha)=    2.03   Curve Number    (CN)=81.00
00649> | 06:102    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00650> ----------------------  U.H. Tp(hrs)=    .360
00651>
00652>      Unit Hyd Qpeak  (cms)=     .215
00653>
00654>      PEAK FLOW       (cms)=     .108 (i)
00655>      TIME TO PEAK    (hrs)=    1.617
00656>      RUNOFF VOLUME    (mm)=   20.065
00657>      TOTAL RAINFALL   (mm)=   47.534
00658>      RUNOFF COEFFICIENT   =     .422
00659>
00660>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00661>
00662> ---------------------------------------------------------------------------
00663> 005:0010-----------------------------------------------------------------
00664> *#-----------------|-------------------------------------------------------|
00665> *# Total Flow from Subject Site
00666> *#-----------------|-------------------------------------------------------|
00667> ----------------------
00668> | ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00669> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00670>                       ID1 04:ToSE         16.39     .585    1.85  20.93    .000
00671>                      +ID2 05:105           .13     .006    1.67  19.34    .000
00672>                      +ID3 06:102          2.03     .108    1.62  20.06    .000
00673>                      +ID4 08:101           .82     .047    1.53  19.35    .000
00674>                       ========================================================
00675>                       SUM 07:AllFlo       19.37     .723    1.77  20.76    .000
00676>
00677>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00678>
00679> ---------------------------------------------------------------------------
00680> 005:0011-----------------------------------------------------------------
00681> *#-----------------|-------------------------------------------------------|
00682> ---------------------------------------------------------------------------
00683> 005:0002-----------------------------------------------------------------
00684> ---------------------------------------------------------------------------
00685> 005:0002-----------------------------------------------------------------
00686>  ** END OF RUN :  24
00687>
00688> ***************************************************************************
00689>
00690>
00691>
00692>
00693>
00694> --------------------
00695> | START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00696> --------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00697>     TZERO =   .00 hrs on      0
00698>     METOUT=   2 (output = METRIC)
00699>     NRUN  = 025
00700>     NSTORM=   1
00701>           #  1=Wat25yr.STM
00702> ---------------------------------------------------------------------------
00703> 025:0002-----------------------------------------------------------------
00704> *#************************************************************************
00705> *#  Project Name: [Activa Millennium Blvd. (Carriage Crossing)]
00706> *#  Project Number: [1603-10788]
00707> *#  Date         : 11/04/2024
00708> *#  Modeller     : [Amy Kyle]
00709> *#  Company      : Stantec Consulting Ltd. (Waterloo)
00710> *#  License #    :  4730904
00711> *#
00712> *#  Existing Conditions Model for Millennium Blvd.(Carriage Crossing Catch. 430)
00713> *#  Soils data obtained from Hydrogeological and Geotechnical Study
00714> *#            Activa Waterloo East Lands (Naylor, 2006)
00715> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
00716> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
00717> *#
00718> *#************************************************************************
00719> ---------------------------------------------------------------------------
00720> 025:0002-----------------------------------------------------------------
00721> --------------------
00722> | READ STORM       |    Filename: CHICAGO STORM
00723> | Ptotal=  69.15 mm|    Comments: CHICAGO STORM
00724> --------------------
00725>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00726>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00727>                .08   3.743 |    .83  19.391 |   1.58  23.038 |   2.33   5.807
00728>                .17   4.185 |    .92  28.285 |   1.67  18.281 |   2.42   5.278
00729>                .25   4.728 |   1.00  46.359 |   1.75  14.946 |   2.50   4.827
00730>                .33   5.406 |   1.08  94.141 |   1.83  12.508 |   2.58   4.439
00731>                .42   6.273 |   1.17 185.944 |   1.92  10.666 |   2.67   4.103
00732>                .50   7.408 |   1.25 106.412 |   2.00   9.237 |   2.75   3.809
00733>                .58   8.944 |   1.33  62.561 |   2.08   8.103 |   2.83   3.550
00734>                .67  11.105 |   1.42  41.776 |   2.17   7.187 |   2.92   3.321
00735>                .75  14.308 |   1.50  30.195 |   2.25   6.434 |   3.00   3.116
00736>
00737> ---------------------------------------------------------------------------
00738> 025:0003-----------------------------------------------------------------
00739> *# ======================================================
00740> *# Existing Drainage Area
00741> *# ======================================================
00742> *#-----------------|-------------------------------------------------------|
00743> *# External Area Draining onto Property
00744> *#-----------------|-------------------------------------------------------|
00745> ----------------------
00746> | DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number    (CN)=83.00
00747> | 01:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00748> ----------------------  U.H. Tp(hrs)=    .480
00749>
00750>      Unit Hyd Qpeak  (cms)=     .358
00751>
00752>      PEAK FLOW       (cms)=     .384 (i)
00753>      TIME TO PEAK    (hrs)=    1.750
00754>      RUNOFF VOLUME    (mm)=   38.242
00755>      TOTAL RAINFALL   (mm)=   69.151
00756>      RUNOFF COEFFICIENT   =     .553
00757>
00758>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00759>
00760> ---------------------------------------------------------------------------
00761> 025:0004-----------------------------------------------------------------
00762> *#-----------------|-------------------------------------------------------|
00763> *# Largest catchment of existing agricultural lands, draining south
00764> *#-----------------|-------------------------------------------------------|
00765> ----------------------
00766> | DESIGN NASHYD      |   Area    (ha)=    9.64   Curve Number    (CN)=82.00
00767> | 02:100    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00768> ----------------------  U.H. Tp(hrs)=    .780
00769>
00770>      Unit Hyd Qpeak  (cms)=     .472
00771>
00772>      PEAK FLOW       (cms)=     .556 (i)
00773>      TIME TO PEAK    (hrs)=    2.117
00774>      RUNOFF VOLUME    (mm)=   37.086
00775>      TOTAL RAINFALL   (mm)=   69.151
00776>      RUNOFF COEFFICIENT   =     .536
00777>
00778>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00779>
00780> ---------------------------------------------------------------------------
00781> 025:0005-----------------------------------------------------------------
00782> *#-----------------|-------------------------------------------------------|
00783> *# Section of existing agricultural lands east of catchment 100, draining south
00784> *#-----------------|-------------------------------------------------------|
00785> ----------------------
00786> | DESIGN NASHYD      |   Area    (ha)=    2.25   Curve Number    (CN)=81.00
00787> | 03:103    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00788> ----------------------  U.H. Tp(hrs)=    .340
00789>
00790>      Unit Hyd Qpeak  (cms)=     .253
00791>
00792>      PEAK FLOW       (cms)=     .227 (i)
00793>      TIME TO PEAK    (hrs)=    1.583
00794>      RUNOFF VOLUME    (mm)=   35.971
00795>      TOTAL RAINFALL   (mm)=   69.151
00796>      RUNOFF COEFFICIENT   =     .520
00797>
00798>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00799>
00800> ---------------------------------------------------------------------------
00801> 025:0006-----------------------------------------------------------------
00802> *#-----------------|-------------------------------------------------------|
00803> *# Total Flow to Existing DICB, flowing SE
00804> *#-----------------|-------------------------------------------------------|
00805> ----------------------
00806> | ADD HYD (ToSE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00807> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00808>                       ID1 01:104          4.50     .384    1.75  38.24    .000
00809>                      +ID2 02:100          9.64     .556    2.12  37.09    .000
00810>                      +ID3 03:103          2.25     .227    1.58  35.97    .000
```

```
                    ============================================================
                    SUM 04:ToSE          16.39    1.064    1.83  37.25    .000
                    ============================================================

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0007--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Small section of existing agricultural lands draining to Millennium and
*# flowing east subsequently to SWMF B
*#------------------|-----------------------------------------------------------|
--------------------
| DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number   (CN)=80.00
| 08:101    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .300

     Unit Hyd Qpeak  (cms)=     .104

     PEAK FLOW       (cms)=     .087 (i)
     TIME TO PEAK    (hrs)=    1.533
     RUNOFF VOLUME    (mm)=   34.896
     TOTAL RAINFALL   (mm)=   69.151
     RUNOFF COEFFICIENT   =     .505

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

--------------------------------------------------------------------------------
025:0008--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Small section of existing agricultural lands draining to Millennium Blvd and
*# flowing west
*#------------------|-----------------------------------------------------------|
--------------------
| DESIGN NASHYD      |   Area    (ha)=     .13   Curve Number   (CN)=80.00
| 05:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .400

     Unit Hyd Qpeak  (cms)=     .012

     PEAK FLOW       (cms)=     .011 (i)
     TIME TO PEAK    (hrs)=    1.667
     RUNOFF VOLUME    (mm)=   34.892
     TOTAL RAINFALL   (mm)=   69.151
     RUNOFF COEFFICIENT   =     .505

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

--------------------------------------------------------------------------------
025:0009--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Section of existing agricultural lands, draining west to wetland
*#------------------|-----------------------------------------------------------|
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.03   Curve Number   (CN)=81.00
| 06:102    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=     .215

     PEAK FLOW       (cms)=     .197 (i)
     TIME TO PEAK    (hrs)=    1.617
     RUNOFF VOLUME    (mm)=   35.971
     TOTAL RAINFALL   (mm)=   69.151
     RUNOFF COEFFICIENT   =     .520

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

--------------------------------------------------------------------------------
025:0010--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Total Flow from Subject Site
*#------------------|-----------------------------------------------------------|
----------------------
| ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                     (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 04:ToSE          16.39    1.064    1.83  37.25    .000
                     +ID2 05:105            .13     .011    1.67  34.89    .000
                     +ID3 06:102           2.03     .197    1.62  35.97    .000
                     +ID4 08:101            .82     .087    1.53  34.90    .000
                      ============================================================
                      SUM 07:AllFlo        19.37    1.318    1.77  37.00    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0011--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
--------------------------------------------------------------------------------
025:0002--------------------------------------------------------------------------
  ** END OF RUN :  99

********************************************************************************




--------------------
| START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
-------------------- Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=Wat100yr.STM
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*#*****************************************************************************
*#  Project Name: [Activa Millennium Blvd. (Carriage Crossing)]
*#  Project Number: [1603-10788]
*#  Date          : 11/04/2024
*#  Modeller      : [Amy Kyle]
*#  Company       : Stantec Consulting Ltd. (Waterloo)
*#  License #     :  4730904
*#
*#  Existing Conditions Model for Millennium Blvd.(Carriage Crossing Catch. 430)
*#  Soils data obtained from Hydrogeological and Geotechnical Study
*#             Activa Waterloo East Lands (Naylor, 2006)
*#  Run using updated 2022/2023 City of Waterloo IDF Parameters
*#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
*#
*#*****************************************************************************
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
--------------------
| READ STORM       |    Filename: CHICAGO STORM
| Ptotal=  89.93 mm|    Comments: CHICAGO STORM
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   4.533 |    .83  25.419 |   1.58  30.321 |   2.33   7.234
               .17   5.108 |    .92  37.364 |   1.67  23.927 |   2.42   6.538
               .25   5.817 |   1.00  61.481 |   1.75  19.443 |   2.50   5.946
               .33   6.707 |   1.08 123.922 |   1.83  16.170 |   2.58   5.439
               .42   7.850 |   1.17 239.793 |   1.92  13.702 |   2.67   5.001
               .50   9.355 |   1.25 139.801 |   2.00  11.791 |   2.75   4.619
               .58  11.400 |   1.33  82.906 |   2.08  10.279 |   2.83   4.284
               .67  14.290 |   1.42  55.398 |   2.17   9.061 |   2.92   3.988
               .75  18.587 |   1.50  39.926 |   2.25   8.063 |   3.00   3.725

--------------------------------------------------------------------------------
100:0003--------------------------------------------------------------------------
*# ========================================================
*# Existing Drainage Area
*# ========================================================
*#------------------|-----------------------------------------------------------|
*# External Area Draining onto Property
*#------------------|-----------------------------------------------------------|
----------------------
| DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number   (CN)=83.00
| 01:104    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .480

     Unit Hyd Qpeak  (cms)=     .358

     PEAK FLOW       (cms)=     .567 (i)
     TIME TO PEAK    (hrs)=    1.750
     RUNOFF VOLUME    (mm)=   55.677
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .619

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

--------------------------------------------------------------------------------
100:0004--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Largest catchment of existing agricultural lands, draining south
*#------------------|-----------------------------------------------------------|
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.64   Curve Number   (CN)=82.00
| 02:100    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .780

     Unit Hyd Qpeak  (cms)=     .472

     PEAK FLOW       (cms)=     .822 (i)
     TIME TO PEAK    (hrs)=    2.100
     RUNOFF VOLUME    (mm)=   54.236
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .603

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

--------------------------------------------------------------------------------
100:0005--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Section of existing agricultural lands east of catchment 100, draining south
*#------------------|-----------------------------------------------------------|
----------------------
| DESIGN NASHYD      |   Area    (ha)=    2.25   Curve Number   (CN)=81.00
| 03:103    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .340

     Unit Hyd Qpeak  (cms)=     .253

     PEAK FLOW       (cms)=     .339 (i)
     TIME TO PEAK    (hrs)=    1.583
     RUNOFF VOLUME    (mm)=   52.835
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .587

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

--------------------------------------------------------------------------------
100:0006--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Total Flow to Existing DICB, flowing SE
*#------------------|-----------------------------------------------------------|
----------------------
| ADD HYD (ToSE      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                     (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:104            4.50     .567    1.75  55.68    .000
                     +ID2 02:100            9.64     .822    2.10  54.24    .000
                     +ID3 03:103            2.25     .339    1.58  52.83    .000
                      ============================================================
                      SUM 04:ToSE          16.39    1.577    1.83  54.44    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0007--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Small section of existing agricultural lands draining to Millennium and
*# flowing east subsequently to SWMF B
*#------------------|-----------------------------------------------------------|
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number   (CN)=80.00
| 08:101    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .300

     Unit Hyd Qpeak  (cms)=     .104

     PEAK FLOW       (cms)=     .130 (i)
     TIME TO PEAK    (hrs)=    1.533
     RUNOFF VOLUME    (mm)=   51.472
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .572

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

--------------------------------------------------------------------------------
100:0008--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Small section of existing agricultural lands draining to Millennium Blvd and
*# flowing west
*#------------------|-----------------------------------------------------------|
----------------------
| DESIGN NASHYD      |   Area    (ha)=     .13   Curve Number   (CN)=80.00
| 05:105    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .400

     Unit Hyd Qpeak  (cms)=     .012

     PEAK FLOW       (cms)=     .017 (i)
     TIME TO PEAK    (hrs)=    1.650
     RUNOFF VOLUME    (mm)=   51.467
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .572

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

--------------------------------------------------------------------------------
100:0009--------------------------------------------------------------------------
*#------------------|-----------------------------------------------------------|
*# Section of existing agricultural lands, draining west to wetland
*#------------------|-----------------------------------------------------------|
```

```
01081> ----------------------
01082> | DESIGN NASHYD      |   Area    (ha)=    2.03   Curve Number   (CN)=81.00
01083> | 06:102    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
01084> ----------------------   U.H. Tp(hrs)=    .360
01085>
01086>      Unit Hyd Qpeak  (cms)=     .215
01087>
01088>      PEAK FLOW       (cms)=     .294 (i)
01089>      TIME TO PEAK    (hrs)=    1.600
01090>      RUNOFF VOLUME    (mm)=   52.835
01091>      TOTAL RAINFALL   (mm)=   89.932
01092>      RUNOFF COEFFICIENT   =     .587
01093>
01094>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01095>
01096> ------------------------------------------------------------------------------
01097> 100:0010--------------------------------------------------------------------
01098> *#-----------------|------------------------------------------------------|
01099> *# Total Flow from Subject Site
01100> *#-----------------|------------------------------------------------------|
01101> ------------------------
01102> | ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01103> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
01104>                        ID1 04:ToSE        16.39    1.577    1.83  54.44    .000
01105>                       +ID2 05:105          .13     .017    1.65  51.47    .000
01106>                       +ID3 06:102         2.03     .294    1.60  52.83    .000
01107>                       +ID4 08:101          .82     .130    1.53  51.47    .000
01108>                        ============================================================
01109>                        SUM 07:AllFlo      19.37    1.956    1.75  54.13    .000
01110>
01111>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01112>
01113> ------------------------------------------------------------------------------
01114> 100:0011--------------------------------------------------------------------
01115> *#-----------------|------------------------------------------------------|
01116> ------------------------------------------------------------------------------
01117> 100:0002--------------------------------------------------------------------
01118> ------------------------------------------------------------------------------
01119> 100:0002--------------------------------------------------------------------
01120> ------------------------------------------------------------------------------
01121> 100:0002--------------------------------------------------------------------
01122> ------------------------------------------------------------------------------
01123> 100:0002--------------------------------------------------------------------
01124>       FINISH
01125> ------------------------------------------------------------------------------
01126> ********************************************************************************
01127>      WARNINGS / ERRORS / NOTES
01128>      -------------------------
01129>    Simulation ended on 2024-11-04     at 14:10:49
01130> ================================================================================
01131>
```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        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  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S  W 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   OOO            9      9   =========
                                                          9   9  9   9   # 4730904
        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.                *********
 ************************************************************************
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 *********                    E-Mail: swmhymo@jfsa.Com                 *********
 ************************************************************************
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
 +++++++++                Kitchener            SERIAL#:4730904        +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ************************************************************************
 *********           ++++++ 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: 2024-11-04     TIME: 14:05:35     RUN COUNTER: 000597         *
 ************************************************************************
 * Input   filename: C:\SWMHYMO\MILLEN~1\V4_NOV~1\Mil1024P.dat                  *
 * Output  filename: C:\SWMHYMO\MILLEN~1\V4_NOV~1\Mil1024P.out                  *
 * Summary filename: C:\SWMHYMO\MILLEN~1\V4_NOV~1\Mil1024P.sum                  *
 * User comments:                                                               *
 * 1:_____________________________________________________________________      *
 * 2:_____________________________________________________________________      *
 * 3:_____________________________________________________________________      *
 ************************************************************************

----------
001:0001----------
*************************************************************************
*#  Project Name: [Activa Millennium Blvd.]    Project Number: [1603-10788]
*#  Date        : 11-04-24
*#  Modeller    : [Amy Kyle]
*#  Company     : Stantec Consulting Ltd. (Waterloo)
*#  License #   :  4730904
*#
*#  Proposed Conditions Model for Millennium Blvd. (Carriage Crossing Catch. 430
*#  Soils data obtained from Hydrogeological and Geotechnical Study
*#           Activa Waterloo East Lands (Naylor, 2006)
*#  Run using updated 2022/2023 City of Waterloo IDF Parameters
*#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
*#
*************************************************************************
--------------------
| START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
--------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
             #  1=Wat25mm.STM
----------
001:0002----------
--------------------
| READ STORM       |    Filename: CHICAGO STORM - 25 mm Event (4hr), City
| Ptotal=  24.99 mm|    Comments: CHICAGO STORM - 25 mm Event (4hr), City
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   1.015 |   1.08   3.577 |   2.08   5.579 |   3.08   1.561
               .17   1.079 |   1.17   4.470 |   2.17   4.647 |   3.17   1.470
               .25   1.153 |   1.25   5.891 |   2.25   3.968 |   3.25   1.389
               .33   1.237 |   1.33   8.432 |   2.33   3.454 |   3.33   1.317
               .42   1.335 |   1.42  13.932 |   2.42   3.053 |   3.42   1.252
               .50   1.450 |   1.50  31.444 |   2.50   2.732 |   3.50   1.193
               .58   1.586 |   1.58  77.925 |   2.58   2.470 |   3.58   1.140
               .67   1.750 |   1.67  36.326 |   2.67   2.253 |   3.67   1.091
               .75   1.952 |   1.75  19.268 |   2.75   2.070 |   3.75   1.046
               .83   2.206 |   1.83  12.471 |   2.83   1.914 |   3.83   1.005
               .92   2.533 |   1.92   8.985 |   2.92   1.780 |   3.92    .967
              1.00   2.970 |   2.00   6.921 |   3.00   1.663 |   4.00    .932
----------
001:0003----------
*# ========================================================
*# PROPOSED
*# ========================================================
*#------------------|---------------------------------------------------------|
*# Small road catchment and grassed area draining to Millennium Blvd and
*# flowing east
*#------------------|---------------------------------------------------------|
----------
| DESIGN STANDHYD    |   Area    (ha)=     .17
| 01:202    DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .12
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      33.67        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      77.92         6.68
                  over (min)       1.00        22.00
     Storage Coeff.  (min)=       1.19 (ii)   22.02 (ii)
     Unit Hyd. Tpeak (min)=       1.00        22.00
     Unit Hyd. peak  (cms)=        .96          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .011 (iii)
     TIME TO PEAK    (hrs)=       1.58         2.00         1.583
     RUNOFF VOLUME    (mm)=      24.19         4.34        10.291
     TOTAL RAINFALL   (mm)=      24.99        24.99        24.988
     RUNOFF COEFFICIENT   =        .97          .17          .412

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------
001:0004----------
*#------------------|---------------------------------------------------------|
*# Small road catchment draining to Millennium Blvd and flowing east
*#------------------|---------------------------------------------------------|
----------
| DESIGN STANDHYD    |   Area    (ha)=     .05
| 02:203    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .04          .01
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      18.26        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      77.92         6.68
                  over (min)       1.00        22.00
     Storage Coeff.  (min)=        .83 (ii)   21.66 (ii)
     Unit Hyd. Tpeak (min)=       1.00        22.00
     Unit Hyd. peak  (cms)=       1.19          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .010 (iii)
     TIME TO PEAK    (hrs)=       1.58         1.98         1.583
     RUNOFF VOLUME    (mm)=      24.19         4.34        22.202
     TOTAL RAINFALL   (mm)=      24.99        24.99        24.988
     RUNOFF COEFFICIENT   =        .97          .17          .889

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------
001:0005----------
*#------------------|---------------------------------------------------------|
*# Rear lots and small road section sheet flowing to Millennium/Crossgate Blvd.
*#------------------|---------------------------------------------------------|
----------
| DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number   (CN)=76.00
| 03:204    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------  U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=     .391

     PEAK FLOW       (cms)=     .025 (i)
     TIME TO PEAK    (hrs)=    1.667
     RUNOFF VOLUME    (mm)=    5.320
     TOTAL RAINFALL   (mm)=   24.988
     RUNOFF COEFFICIENT   =     .213

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

----------
001:0006----------
*#------------------|---------------------------------------------------------|
*# Total Flow direct to Millennium Blvd, flowing east toward SWMF B
*#------------------|---------------------------------------------------------|
----------
| ADD HYD (ToMilE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
---------------------------                (ha)     (cms)   (hrs)    (mm)   (cms)
                     ID1 01:202            .17      .011    1.58   10.29    .000
                   +ID2 02:203             .05      .010    1.58   22.20    .000
                   +ID3 03:204             .82      .025    1.67    5.32    .000
                    ==========================================================
                    SUM 04:ToMilE          1.04     .037    1.58    6.94    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------
001:0007----------
*#------------------|---------------------------------------------------------|
*# External area - assumed remains agricultural
*#------------------|---------------------------------------------------------|
----------
| DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number   (CN)=75.00
| 05:205    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------  U.H. Tp(hrs)=    .480

     Unit Hyd Qpeak  (cms)=     .358

     PEAK FLOW       (cms)=     .047 (i)
     TIME TO PEAK    (hrs)=    2.183
     RUNOFF VOLUME    (mm)=    5.101
     TOTAL RAINFALL   (mm)=   24.988
     RUNOFF COEFFICIENT   =     .204

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

----------
001:0008----------
*#------------------|---------------------------------------------------------|
*# Proposed mixed residential area and SWM facility
*#------------------|---------------------------------------------------------|
----------
| DESIGN STANDHYD    |   Area    (ha)=   12.30
| 06:200    DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   46.00
----------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.13         5.17
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     286.36        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=      77.92        12.84
                  over (min)       4.00        20.00
     Storage Coeff.  (min)=       4.31 (ii)   20.35 (ii)
     Unit Hyd. Tpeak (min)=       4.00        20.00
     Unit Hyd. peak  (cms)=        .27          .06
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .90          .11          .922 (iii)
     TIME TO PEAK    (hrs)=       1.62         1.95         1.617
     RUNOFF VOLUME    (mm)=      24.19         6.09        14.413
     TOTAL RAINFALL   (mm)=      24.99        24.99        24.988
     RUNOFF COEFFICIENT   =        .97          .24          .577

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------
001:0009----------
*#------------------|---------------------------------------------------------|
*# Total Flow to onsite SWMC, outletting to Millennium/Crossgate Blvd outfall
*#------------------|---------------------------------------------------------|
----------
| ADD HYD (ToSWMC    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
---------------------------                (ha)     (cms)   (hrs)    (mm)   (cms)
                     ID1 05:205            4.50     .047    2.18    5.10    .000
                   +ID2 06:200            12.30     .922    1.62   14.41    .000
                    ==========================================================
                    SUM 07:ToSWMC         16.80     .928    1.62   11.92    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
00271> ------------------------------------------------------------------------------
00272> 001:0010------------------------------------------------------------------------
00273> *#-----------------|-----------------------------------------------------------|
00274> ---------------------
00275> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00276> |  IN>07:(ToSWMC)   |
00277> | OUT<08:(SWMC  )   |    =========  OUTLFOW STORAGE TABLE  =========
00278> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00279>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00280>                             .000  .0000E+00    |     .089  .5904E+00
00281>                             .005  .2860E-01    |     .095  .6916E+00
00282>                             .034  .9050E-01    |     .101  .7969E+00
00283>                             .048  .1573E+00    |     .107  .9069E+00
00284>                             .059  .2302E+00    |     .112  .1021E+01
00285>                             .068  .3084E+00    |     .243  .1080E+01
00286>                             .075  .4033E+00    |     .537  .1140E+01
00287>                             .083  .4949E+00    |     .998  .1297E+01
00288>
00289>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00290>     ---------------------       (ha)     (cms)     (hrs)       (mm)
00291>     INFLOW >07: (ToSWMC)      16.80      .928     1.617     11.919
00292>     OUTFLOW<08: (SWMC  )      16.80      .048     3.450     11.918
00293>    OVERFLOW<09: (OVF   )        .00      .000      .000       .000
00294>
00295>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00296>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00297>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00298>
00299>
00300>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.206
00301>                    TIME SHIFT OF PEAK FLOW         (min)=   110.00
00302>                    MAXIMUM  STORAGE   USED       (ha.m.)=.1594E+00
00303>
00304> ------------------------------------------------------------------------------
00305> 001:0011------------------------------------------------------------------------
00306> *#-----------------|-----------------------------------------------------------|
00307> *# Total Flows to the southeast to SWMF B
00308> *#-----------------|-----------------------------------------------------------|
00309> ------------------------
00310> | ADD HYD (ToSWMB    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00311> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00312>                        ID1 04:ToMilE       1.04     .037    1.58   6.94    .000
00313>                       +ID2 09:OVF           .00     .000     .00    .00    .000
00314>                        ========================================================
00315>                        SUM 01:ToSWMB       1.04     .037    1.58   6.94    .000
00316>
00317>   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00318>
00319> ------------------------------------------------------------------------------
00320> 001:0012------------------------------------------------------------------------
00321> *#-----------------|-----------------------------------------------------------|
00322> *# Small grassed area draining to Millennium Blvd and flowing west
00323> *#-----------------|-----------------------------------------------------------|
00324> ----------------------
00325> | DESIGN NASHYD     |   Area    (ha)=     .03   Curve Number   (CN)=68.00
00326> | 02:206    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00327> ----------------------  U.H. Tp(hrs)=    .050
00328>
00329>     Unit Hyd Qpeak  (cms)=     .023
00330>
00331>     PEAK FLOW       (cms)=     .001 (i)
00332>     TIME TO PEAK    (hrs)=    1.617
00333>     RUNOFF VOLUME    (mm)=    3.852
00334>     TOTAL RAINFALL   (mm)=   24.988
00335>     RUNOFF COEFFICIENT   =     .154
00336>
00337>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00338>
00339> ------------------------------------------------------------------------------
00340> 001:0013------------------------------------------------------------------------
00341> *#-----------------|-----------------------------------------------------------|
00342> *# Western catchment, draining to wetland
00343> *#-----------------|-----------------------------------------------------------|
00344> ----------------------
00345> | DESIGN NASHYD     |   Area    (ha)=    1.50   Curve Number   (CN)=75.00
00346> | 03:201    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00347> ----------------------  U.H. Tp(hrs)=    .230
00348>
00349>     Unit Hyd Qpeak  (cms)=     .249
00350>
00351>     PEAK FLOW       (cms)=     .026 (i)
00352>     TIME TO PEAK    (hrs)=    1.867
00353>     RUNOFF VOLUME    (mm)=    5.101
00354>     TOTAL RAINFALL   (mm)=   24.988
00355>     RUNOFF COEFFICIENT   =     .204
00356>
00357>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00358>
00359> ------------------------------------------------------------------------------
00360> 001:0014------------------------------------------------------------------------
00361> *#-----------------|-----------------------------------------------------------|
00362> *# Total Flow from Subject Site
00363> *#-----------------|-----------------------------------------------------------|
00364> ------------------------
00365> | ADD HYD (All Flo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00366> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00367>                        ID1 01:ToSWMB       1.04     .037    1.58   6.94    .000
00368>                       +ID2 02:206           .03     .001    1.62   3.85    .000
00369>                       +ID3 03:201          1.50     .026    1.87   5.10    .000
00370>                       +ID4 08:SWMC        16.80     .048    3.45  11.92    .000
00371>                        ========================================================
00372>                        SUM 04:AllFlo      19.37     .080    1.78  11.11    .000
00373>
00374>   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00375>
00376> ------------------------------------------------------------------------------
00377> 001:0015------------------------------------------------------------------------
00378> *#-----------------|-----------------------------------------------------------|
00379>   ** END OF RUN :   1
00380>
00381> ******************************************************************************
00382>
00383>
00384>
00385>
00386>
00387> --------------------
00388> | START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00389> --------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00390>     TZERO =   .00 hrs on        0
00391>     METOUT=   2 (output = METRIC)
00392>     NRUN  = 002
00393>     NSTORM=   1
00394>              #  1=Wat2yr.STM
00395> ------------------------------------------------------------------------------
00396> 002:0002------------------------------------------------------------------------
00397> *#**************************************************************************
00398> *#  Project Name: [Activa Millennium Blvd.]    Project Number: [1603-10788]
00399> *#  Date        : 11-04-24
00400> *#  Modeller    : [Amy Kyle]
00401> *#  Company     : Stantec Consulting Ltd. (Waterloo)
00402> *#  License #   :  4730904
00403> *#
00404> *#  Proposed Conditions Model for Millennium Blvd. (Carriage Crossing Catch. 430
00405> *#  Soils data obtained from Hydrogeological and Geotechnical Study
00406> *#            Activa Waterloo East Lands (Naylor, 2006)
00407> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
00408> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
00409> *#
00410> *#**************************************************************************
00411> ------------------------------------------------------------------------------
00412> 002:0002------------------------------------------------------------------------
00413> --------------------
00414> | READ STORM        |    Filename: CHICAGO STORM
00415> | Ptotal=  32.39 mm|    Comments: CHICAGO STORM
00416> --------------------
00417>                 TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00418>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00419>                 .08   1.966 |    .83   7.988 |   1.58   9.384 |   2.33   2.807
00420>                 .17   2.150 |    .92  11.433 |   1.67   7.565 |   2.42   2.596
00421>                 .25   2.373 |   1.00  18.891 |   1.75   6.302 |   2.50   2.414
00422>                 .33   2.647 |   1.08  42.635 |   1.83   5.381 |   2.58   2.255
00423>                 .42   2.991 |   1.17 105.659 |   1.92   4.683 |   2.67   2.116
00424>                 .50   3.435 |   1.25  49.254 |   2.00   4.139 |   2.75   1.993
00425>                 .58   4.027 |   1.33  26.125 |   2.08   3.704 |   2.83   1.884
00426>                 .67   4.850 |   1.42  16.909 |   2.17   3.349 |   2.92   1.786
00427>                 .75   6.061 |   1.50  12.183 |   2.25   3.055 |   3.00   1.698
00428>
00429> ------------------------------------------------------------------------------
00430> 002:0003------------------------------------------------------------------------
00431> *# ========================================================
00432> *# PROPOSED
00433> *# ========================================================
00434> *#-----------------|-----------------------------------------------------------|
00435> *# Small road catchment and grassed area draining to Millennium Blvd and
00436> *# flowing east
00437> *#-----------------|-----------------------------------------------------------|
00438> ----------------------
00439> | DESIGN STANDHYD    |   Area    (ha)=     .17
00440> | 01:202     DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
00441> ----------------------
00442>                                    IMPERVIOUS    PERVIOUS (i)
00443>      Surface Area      (ha)=          .05           .12
00444>      Dep. Storage      (mm)=          .80          1.50
00445>      Average Slope      (%)=         2.00          2.00
00446>      Length             (m)=        33.67         40.00
00447>      Mannings n              =         .013          .250
00448>
00449>      Max.eff.Inten.(mm/hr)=       105.66         13.32
00450>                  over (min)          1.00         17.00
00451>      Storage Coeff.  (min)=          1.06 (ii)    16.86 (ii)
00452>      Unit Hyd. Tpeak (min)=          1.00         17.00
00453>      Unit Hyd. peak  (cms)=          1.04           .07
00454>                                                              *TOTALS*
00455>      PEAK FLOW       (cms)=           .01           .00          .015 (iii)
00456>      TIME TO PEAK    (hrs)=          1.17          1.48         1.167
00457>      RUNOFF VOLUME    (mm)=         31.59          7.09        14.438
00458>      TOTAL RAINFALL   (mm)=         32.39         32.39        32.391
00459>      RUNOFF COEFFICIENT   =           .98           .22          .446
00460>
00461>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00462>            CN* =  71.0    Ia = Dep. Storage  (Above)
00463>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00464>            THAN THE STORAGE COEFFICIENT.
00465>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00466>
00467> ------------------------------------------------------------------------------
00468> 002:0004------------------------------------------------------------------------
00469> *#-----------------|-----------------------------------------------------------|
00470> *# Small road catchment draining to Millennium Blvd and flowing east
00471> *#-----------------|-----------------------------------------------------------|
00472> ----------------------
00473> | DESIGN STANDHYD    |   Area    (ha)=     .05
00474> | 02:203     DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
00475> ----------------------
00476>                                    IMPERVIOUS    PERVIOUS (i)
00477>      Surface Area      (ha)=          .04           .01
00478>      Dep. Storage      (mm)=          .80          1.50
00479>      Average Slope      (%)=         2.00          2.00
00480>      Length             (m)=        18.26         40.00
00481>      Mannings n              =         .013          .250
00482>
00483>      Max.eff.Inten.(mm/hr)=       105.66         13.81
00484>                  over (min)          1.00         16.00
00485>      Storage Coeff.  (min)=           .73 (ii)    16.31 (ii)
00486>      Unit Hyd. Tpeak (min)=          1.00         16.00
00487>      Unit Hyd. peak  (cms)=          1.27           .07
00488>                                                              *TOTALS*
00489>      PEAK FLOW       (cms)=           .01           .00          .013 (iii)
00490>      TIME TO PEAK    (hrs)=          1.17          1.47         1.167
00491>      RUNOFF VOLUME    (mm)=         31.59          7.09        29.140
00492>      TOTAL RAINFALL   (mm)=         32.39         32.39        32.391
00493>      RUNOFF COEFFICIENT   =           .98           .22          .900
00494>
00495>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00496>            CN* =  71.0    Ia = Dep. Storage  (Above)
00497>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00498>            THAN THE STORAGE COEFFICIENT.
00499>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00500>
00501> ------------------------------------------------------------------------------
00502> 002:0005------------------------------------------------------------------------
00503> *#-----------------|-----------------------------------------------------------|
00504> *# Rear lots and small road section sheet flowing to Millennium/Crossgate Blvd.
00505> *#-----------------|-----------------------------------------------------------|
00506> ----------------------
00507> | DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number   (CN)=76.00
00508> | 03:204     DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00509> ----------------------  U.H. Tp(hrs)=    .080
00510>
00511>     Unit Hyd Qpeak  (cms)=     .391
00512>
00513>     PEAK FLOW       (cms)=     .042 (i)
00514>     TIME TO PEAK    (hrs)=    1.250
00515>     RUNOFF VOLUME    (mm)=    8.589
00516>     TOTAL RAINFALL   (mm)=   32.391
00517>     RUNOFF COEFFICIENT   =     .265
00518>
00519>     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00520>
00521> ------------------------------------------------------------------------------
00522> 002:0006------------------------------------------------------------------------
00523> *#-----------------|-----------------------------------------------------------|
00524> *# Total Flow direct to Millennium Blvd, flowing east toward SWMF B
00525> *#-----------------|-----------------------------------------------------------|
00526> ------------------------
00527> | ADD HYD (ToMilE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00528> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00529>                        ID1 01:202           .17     .015    1.17  14.44    .000
00530>                       +ID2 02:203           .05     .013    1.17  29.14    .000
00531>                       +ID3 03:204           .82     .042    1.25   8.59    .000
00532>                        ========================================================
00533>                        SUM 04:ToMilE        1.04     .057    1.17  10.53    .000
00534>
00535>   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00536>
00537> ------------------------------------------------------------------------------
00538> 002:0007------------------------------------------------------------------------
00539> *#-----------------|-----------------------------------------------------------|
00540> *# External area - assumed remains agricultural
```

```
00541> *#------------------|-------------------------------------------------------------------|
00542> ----------------------
00543> | DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number   (CN)=75.00
00544> | 05:205    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00545> ----------------------  U.H. Tp(hrs)=    .480
00546>
00547>      Unit Hyd Qpeak  (cms)=     .358
00548>
00549>      PEAK FLOW       (cms)=     .080 (i)
00550>      TIME TO PEAK    (hrs)=    1.767
00551>      RUNOFF VOLUME    (mm)=    8.258
00552>      TOTAL RAINFALL   (mm)=   32.391
00553>      RUNOFF COEFFICIENT   =     .255
00554>
00555>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00556>
00557> -------------------------------------------------------------------------------
00558> 002:0008-----------------------------------------------------------------------
00559> *#------------------|-------------------------------------------------------------------|
00560> *# Proposed mixed residential area and SWM facility
00561> *#------------------|-------------------------------------------------------------------|
00562> ----------------------
00563> | DESIGN STANDHYD    |   Area    (ha)=   12.30
00564> | 06:200    DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   46.00
00565> ----------------------
00566>                              IMPERVIOUS    PERVIOUS (i)
00567>      Surface Area     (ha)=       7.13         5.17
00568>      Dep. Storage     (mm)=        .80         1.50
00569>      Average Slope     (%)=       2.00         2.00
00570>      Length            (m)=     286.36        40.00
00571>      Mannings n             =      .013         .250
00572>
00573>      Max.eff.Inten.(mm/hr)=     105.66        24.59
00574>                 over (min)=       4.00        16.00
00575>      Storage Coeff.  (min)=       3.82 (ii)   16.19 (ii)
00576>      Unit Hyd. Tpeak (min)=       4.00        16.00
00577>      Unit Hyd. peak  (cms)=        .29          .07
00578>                                                          *TOTALS*
00579>      PEAK FLOW       (cms)=       1.26          .21         1.322 (iii)
00580>      TIME TO PEAK    (hrs)=       1.20         1.45         1.200
00581>      RUNOFF VOLUME    (mm)=      31.59         9.69        19.763
00582>      TOTAL RAINFALL   (mm)=      32.39        32.39        32.391
00583>      RUNOFF COEFFICIENT   =        .98          .30          .610
00584>
00585>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00586>            CN* =  74.0    Ia = Dep. Storage  (Above)
00587>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00588>            THAN THE STORAGE COEFFICIENT.
00589>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00590>
00591> -------------------------------------------------------------------------------
00592> 002:0009-----------------------------------------------------------------------
00593> *#------------------|-------------------------------------------------------------------|
00594> *# Total Flow to onsite SWMC, outletting to Millennium/Crossgate Blvd outfall
00595> *#------------------|-------------------------------------------------------------------|
00596> ------------------------
00597> | ADD HYD (ToSWMC    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00598> ------------------------ ----             (ha)     (cms)   (hrs)   (mm)    (cms)
00599>                        ID1 05:205          4.50      .080    1.77   8.26    .000
00600>                       +ID2 06:200         12.30     1.322    1.20  19.76    .000
00601>                        ========================================================
00602>                        SUM 07:ToSWMC       16.80    1.332    1.20  16.68    .000
00603>
00604>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00605>
00606> -------------------------------------------------------------------------------
00607> 002:0010-----------------------------------------------------------------------
00608> *#------------------|-------------------------------------------------------------------|
00609> ----------------------
00610> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00611> |  IN>07:(ToSWMC)    |
00612> | OUT<08:(SWMC  )    |    =========  OUTLFOW STORAGE TABLE  =========
00613> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00614>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
00615>                              .000  .0000E+00    |     .089  .5904E+00
00616>                              .005  .2860E-01    |     .095  .6916E+00
00617>                              .034  .9050E-01    |     .101  .7969E+00
00618>                              .048  .1573E+00    |     .107  .9069E+00
00619>                              .059  .2302E+00    |     .112  .1021E+01
00620>                              .068  .3084E+00    |     .243  .1080E+01
00621>                              .075  .4033E+00    |     .537  .1140E+01
00622>                              .083  .4949E+00    |     .998  .1297E+01
00623>
00624>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00625>     --------------------        (ha)     (cms)     (hrs)       (mm)
00626>     INFLOW >07: (ToSWMC)      16.80     1.332     1.200     16.681
00627>     OUTFLOW<08: (SWMC  )      16.80      .059     3.050     16.681
00628>    OVERFLOW<09: (OVF   )        .00      .000      .000       .000
00629>
00630>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00631>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00632>                    PERCENTAGE OF TIME OVERFLOWING     (%)=     .00
00633>
00634>
00635>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.456
00636>                    TIME SHIFT OF PEAK FLOW         (min)=   111.00
00637>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2367E+00
00638>
00639> -------------------------------------------------------------------------------
00640> 002:0011-----------------------------------------------------------------------
00641> *#------------------|-------------------------------------------------------------------|
00642> *# Total Flows to the southeast to SWMF B
00643> *#------------------|-------------------------------------------------------------------|
00644> ------------------------
00645> | ADD HYD (ToSWMB    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00646> ------------------------ ----             (ha)     (cms)   (hrs)   (mm)    (cms)
00647>                        ID1 04:ToMilE        1.04     .057    1.17  10.53    .000
00648>                       +ID2 09:OVF            .00     .000     .00    .00    .000
00649>                        ========================================================
00650>                        SUM 01:ToSWMB        1.04     .057    1.17  10.53    .000
00651>
00652>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00653>
00654> -------------------------------------------------------------------------------
00655> 002:0012-----------------------------------------------------------------------
00656> *#------------------|-------------------------------------------------------------------|
00657> *# Small grassed area draining to Millennium Blvd and flowing west
00658> *#------------------|-------------------------------------------------------------------|
00659> ----------------------
00660> | DESIGN NASHYD      |   Area    (ha)=     .03   Curve Number   (CN)=68.00
00661> | 02:206    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00662> ----------------------  U.H. Tp(hrs)=    .050
00663>
00664>      Unit Hyd Qpeak  (cms)=     .023
00665>
00666>      PEAK FLOW       (cms)=     .001 (i)
00667>      TIME TO PEAK    (hrs)=    1.200
00668>      RUNOFF VOLUME    (mm)=    6.340
00669>      TOTAL RAINFALL   (mm)=   32.391
00670>      RUNOFF COEFFICIENT   =     .196
00671>
00672>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00673>
00674> -------------------------------------------------------------------------------
00675> 002:0013-----------------------------------------------------------------------
00676> *#------------------|-------------------------------------------------------------------|
00677> *# Western catchment, draining to wetland
00678> *#------------------|-------------------------------------------------------------------|
00679> ----------------------
00680> | DESIGN NASHYD      |   Area    (ha)=    1.50   Curve Number   (CN)=75.00
00681> | 03:201    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
00682> ----------------------  U.H. Tp(hrs)=    .230
00683>
00684>      Unit Hyd Qpeak  (cms)=     .249
00685>
00686>      PEAK FLOW       (cms)=     .044 (i)
00687>      TIME TO PEAK    (hrs)=    1.450
00688>      RUNOFF VOLUME    (mm)=    8.258
00689>      TOTAL RAINFALL   (mm)=   32.391
00690>      RUNOFF COEFFICIENT   =     .255
00691>
00692>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00693>
00694> -------------------------------------------------------------------------------
00695> 002:0014-----------------------------------------------------------------------
00696> *#------------------|-------------------------------------------------------------------|
00697> *# Total Flow from Subject Site
00698> *#------------------|-------------------------------------------------------------------|
00699> ------------------------
00700> | ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00701> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
00702>                        ID1 01:ToSWMB        1.04     .057    1.17  10.53    .000
00703>                       +ID2 02:206           .03     .001    1.20   6.34    .000
00704>                       +ID3 03:201          1.50     .044    1.45   8.26    .000
00705>                       +ID4 08:SWMC        16.80     .059    3.05  16.68    .000
00706>                        ========================================================
00707>                        SUM 04:AllFlo       19.37     .122    1.33  15.68    .000
00708>
00709>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00710>
00711> -------------------------------------------------------------------------------
00712> 002:0015-----------------------------------------------------------------------
00713> *#------------------|-------------------------------------------------------------------|
00714> -------------------------------------------------------------------------------
00715> 002:0002-----------------------------------------------------------------------
00716>   ** END OF RUN :   4
00717>
00718> ***************************************************************************
00719>
00720>
00721>
00722>
00723>
00724> --------------------
00725> | START            |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00726> --------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
00727>     TZERO =   .00 hrs on       0
00728>     METOUT=   2 (output = METRIC)
00729>     NRUN  = 005
00730>     NSTORM=   1
00731>               #  1=Wat5yr.STM
00732> -------------------------------------------------------------------------------
00733> 005:0002-----------------------------------------------------------------------
00734> *****************************************************************************
00735> *#  Project Name: [Activa Millennium Blvd.]    Project Number: [1603-10788]
00736> *#  Date        : 11-04-24
00737> *#  Modeller    : [Amy Kyle]
00738> *#  Company     : Stantec Consulting Ltd. (Waterloo)
00739> *#  License #   :  4730904
00740> *#
00741> *#  Proposed Conditions Model for Millennium Blvd. (Carriage Crossing Catch. 430
00742> *#  Soils data obtained from Hydrogeological and Geotechnical Study
00743> *#            Activa Waterloo East Lands (Naylor, 2006)
00744> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
00745> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
00746> *#
00747> *#****************************************************************************
00748> -------------------------------------------------------------------------------
00749> 005:0002-----------------------------------------------------------------------
00750> --------------------
00751> | READ STORM       |    Filename: CHICAGO STORM
00752> | Ptotal=  47.53 mm|    Comments: CHICAGO STORM
00753> --------------------
00754>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00755>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00756>               .08   2.932 |    .83  12.737 |   1.58  14.993 |   2.33   4.285
00757>               .17   3.227 |    .92  18.264 |   1.67  12.052 |   2.42   3.944
00758>               .25   3.585 |   1.00  29.805 |   1.75   9.994 |   2.50   3.650
00759>               .33   4.027 |   1.08  62.985 |   1.83   8.489 |   2.58   3.395
00760>               .42   4.584 |   1.17 136.512 |   1.92   7.347 |   2.67   3.173
00761>               .50   5.307 |   1.25  71.839 |   2.00   6.456 |   2.75   2.976
00762>               .58   6.273 |   1.33  40.530 |   2.08   5.746 |   2.83   2.802
00763>               .67   7.619 |   1.42  26.815 |   2.17   5.167 |   2.92   2.647
00764>               .75   9.600 |   1.50  19.457 |   2.25   4.688 |   3.00   2.508
00765>
00766> -------------------------------------------------------------------------------
00767> 005:0003-----------------------------------------------------------------------
00768> *# ======================================================
00769> *# PROPOSED
00770> *# ======================================================
00771> *#------------------|-------------------------------------------------------------------|
00772> *# Small road catchment and grassed area draining to Millennium Blvd and
00773> *# flowing east
00774> *#------------------|-------------------------------------------------------------------|
00775> ----------------------
00776> | DESIGN STANDHYD    |   Area    (ha)=     .17
00777> | 01:202    DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
00778> ----------------------
00779>                              IMPERVIOUS    PERVIOUS (i)
00780>      Surface Area     (ha)=        .05          .12
00781>      Dep. Storage     (mm)=        .80         1.50
00782>      Average Slope     (%)=       2.00         2.00
00783>      Length            (m)=      33.67        40.00
00784>      Mannings n             =      .013         .250
00785>
00786>      Max.eff.Inten.(mm/hr)=     136.51        28.64
00787>                 over (min)=       1.00        13.00
00788>      Storage Coeff.  (min)=        .95 (ii)   12.59 (ii)
00789>      Unit Hyd. Tpeak (min)=       1.00        13.00
00790>      Unit Hyd. peak  (cms)=       1.10          .09
00791>                                                          *TOTALS*
00792>      PEAK FLOW       (cms)=        .02          .01          .021 (iii)
00793>      TIME TO PEAK    (hrs)=       1.17         1.42         1.167
00794>      RUNOFF VOLUME    (mm)=      46.73        14.15        23.924
00795>      TOTAL RAINFALL   (mm)=      47.53        47.53        47.534
00796>      RUNOFF COEFFICIENT   =        .98          .30          .503
00797>
00798>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00799>            CN* =  71.0    Ia = Dep. Storage  (Above)
00800>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00801>            THAN THE STORAGE COEFFICIENT.
00802>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00803>
00804> -------------------------------------------------------------------------------
00805> 005:0004-----------------------------------------------------------------------
00806> *#------------------|-------------------------------------------------------------------|
00807> *# Small road catchment draining to Millennium Blvd and flowing east
00808> *#------------------|-------------------------------------------------------------------|
00809> ----------------------
00810> | DESIGN STANDHYD    |   Area    (ha)=     .05
```

```
| 02:203    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .04         .01
     Dep. Storage     (mm)=       .80        1.50
     Average Slope     (%)=      2.00        2.00
     Length            (m)=     18.26       40.00
     Mannings n            =      .013        .250

     Max.eff.Inten.(mm/hr)=    136.51       29.63
               over (min)        1.00       12.00
     Storage Coeff.  (min)=       .66 (ii)  12.14 (ii)
     Unit Hyd. Tpeak (min)=      1.00       12.00
     Unit Hyd. peak  (cms)=      1.33         .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=       .02         .00          .017 (iii)
     TIME TO PEAK    (hrs)=      1.17        1.40         1.167
     RUNOFF VOLUME    (mm)=     46.73       14.15        43.475
     TOTAL RAINFALL   (mm)=     47.53       47.53        47.534
     RUNOFF COEFFICIENT   =       .98         .30          .915

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0005
*#
*# Rear lots and small road section sheet flowing to Millennium/Crossgate Blvd.
*#
| DESIGN NASHYD     |   Area    (ha)=     .82   Curve Number   (CN)=76.00
| 03:204    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=     .391

     PEAK FLOW       (cms)=     .078 (i)
     TIME TO PEAK    (hrs)=    1.250
     RUNOFF VOLUME    (mm)=   16.786
     TOTAL RAINFALL   (mm)=   47.534
     RUNOFF COEFFICIENT   =     .353

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

005:0006
*#
*# Total Flow direct to Millennium Blvd, flowing east toward SWMF B
*#
| ADD HYD (ToMilE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
                        (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:202             .17     .021    1.17  23.92    .000
                     +ID2 02:203             .05     .017    1.17  43.48    .000
                     +ID3 03:204             .82     .078    1.25  16.79    .000
                      ==========================================================
                      SUM 04:ToMilE         1.04     .101    1.25  19.24    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0007
*#
*# External area - assumed remains agricultural
*#
| DESIGN NASHYD     |   Area    (ha)=    4.50   Curve Number   (CN)=75.00
| 05:205    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=    .480

     Unit Hyd Qpeak  (cms)=     .358

     PEAK FLOW       (cms)=     .157 (i)
     TIME TO PEAK    (hrs)=    1.767
     RUNOFF VOLUME    (mm)=   16.214
     TOTAL RAINFALL   (mm)=   47.534
     RUNOFF COEFFICIENT   =     .341

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

005:0008
*#
*# Proposed mixed residential area and SWM facility
*#
| DESIGN STANDHYD   |   Area    (ha)=   12.30
| 06:200    DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   46.00

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      7.13        5.17
     Dep. Storage     (mm)=       .80        1.50
     Average Slope     (%)=      2.00        2.00
     Length            (m)=    286.36       40.00
     Mannings n            =      .013        .250

     Max.eff.Inten.(mm/hr)=    136.51       49.10
               over (min)        3.00       13.00
     Storage Coeff.  (min)=      3.44 (ii)  12.83 (ii)
     Unit Hyd. Tpeak (min)=      3.00       13.00
     Unit Hyd. peak  (cms)=       .34         .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=      1.76         .45         1.911 (iii)
     TIME TO PEAK    (hrs)=      1.18        1.40         1.183
     RUNOFF VOLUME    (mm)=     46.73       18.57        31.525
     TOTAL RAINFALL   (mm)=     47.53       47.53        47.534
     RUNOFF COEFFICIENT   =       .98         .39          .663

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

005:0009
*#
*# Total Flow to onsite SWMC, outletting to Millennium/Crossgate Blvd outfall
*#
| ADD HYD (ToSWMC    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
                        (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 05:205             4.50     .157    1.77  16.21    .000
                     +ID2 06:200            12.30    1.911    1.18  31.53    .000
                      ==========================================================
                      SUM 07:ToSWMC        16.80    1.929    1.18  27.42    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0010
*#
*# Small grassed area draining to Millennium Blvd and flowing west
*#
| DESIGN NASHYD     |   Area    (ha)=     .03   Curve Number   (CN)=68.00
| 02:206    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=    .050

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.200
     RUNOFF VOLUME    (mm)=   12.796
     TOTAL RAINFALL   (mm)=   47.534
     RUNOFF COEFFICIENT   =     .269

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

005:0013
*#
*# Western catchment, draining to wetland
*#
| DESIGN NASHYD     |   Area    (ha)=    1.50   Curve Number   (CN)=75.00
| 03:201    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .249

     PEAK FLOW       (cms)=     .084 (i)
     TIME TO PEAK    (hrs)=    1.450
     RUNOFF VOLUME    (mm)=   16.214
     TOTAL RAINFALL   (mm)=   47.534
     RUNOFF COEFFICIENT   =     .341

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

005:0014
*#
*# Total Flow from Subject Site
*#
| ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
                        (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:ToSWMB          1.04     .101    1.25  19.24    .000
                     +ID2 02:206             .03     .002    1.20  12.80    .000
                     +ID3 03:201            1.50     .084    1.45  16.21    .000
                     +ID4 08:SWMC          16.80     .075    3.12  27.42    .000
                      ==========================================================
                      SUM 04:AllFlo         19.37     .207    1.33  26.09    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0015
*#
005:0002
005:0002
005:0002
  ** END OF RUN :  24
**********

| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>07:(ToSWMC)   |
| OUT<08:(SWMC  )   |    =========  OUTFLOW STORAGE TABLE  =========
                       OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                         (cms)     (ha.m.)  |    (cms)    (ha.m.)
                          .000  .0000E+00   |     .089  .5904E+00
                          .005  .2860E-01   |     .095  .6916E+00
                          .034  .9050E-01   |     .101  .7969E+00
                          .048  .1573E+00   |     .107  .9069E+00
                          .059  .2302E+00   |     .112  .1021E+01
                          .068  .3084E+00   |     .243  .1080E+01
                          .075  .4033E+00   |     .537  .1140E+01
                          .083  .4949E+00   |     .998  .1297E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ---------------            (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (ToSWMC)      16.80     1.929     1.183     27.424
     OUTFLOW<08: (SWMC  )      16.80      .075     3.117     27.423
    OVERFLOW<09: (OVF   )        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.908
                  TIME SHIFT OF PEAK FLOW          (min)=   116.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.4021E+00

005:0011
*#
*# Total Flows to the southeast to SWMF B
*#
| ADD HYD (ToSWMB    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
                        (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 04:ToMilE          1.04     .101    1.25  19.24    .000
                      +ID2 09:OVF             .00      .000     .00    .00    .000
                       ==========================================================
                       SUM 01:ToSWMB         1.04     .101    1.25  19.24    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0012
*#
*# Small grassed area draining to Millennium Blvd and flowing west
*#
| DESIGN NASHYD     |   Area    (ha)=     .03   Curve Number   (CN)=68.00
| 02:206    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=    .050

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.200
     RUNOFF VOLUME    (mm)=   12.796
     TOTAL RAINFALL   (mm)=   47.534
     RUNOFF COEFFICIENT   =     .269

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

005:0013
*#
*# Western catchment, draining to wetland
*#
| DESIGN NASHYD     |   Area    (ha)=    1.50   Curve Number   (CN)=75.00
| 03:201    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
                       U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .249

     PEAK FLOW       (cms)=     .084 (i)
     TIME TO PEAK    (hrs)=    1.450
     RUNOFF VOLUME    (mm)=   16.214
     TOTAL RAINFALL   (mm)=   47.534
     RUNOFF COEFFICIENT   =     .341

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

005:0014
*#
*# Total Flow from Subject Site
*#
| ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
                        (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:ToSWMB          1.04     .101    1.25  19.24    .000
                      +ID2 02:206             .03      .002    1.20  12.80    .000
                      +ID3 03:201            1.50      .084    1.45  16.21    .000
                      +ID4 08:SWMC          16.80      .075    3.12  27.42    .000
                       ==========================================================
                       SUM 04:AllFlo         19.37     .207    1.33  26.09    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

005:0015
*#
005:0002
005:0002
005:0002
  ** END OF RUN :  25
**********

| START             |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
                     |  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
             #  1=Wat25yr.STM

025:0002
**********
*#  Project Name: [Activa Millennium Blvd.]    Project Number: [1603-10788]
*#  Date         : 11-04-24
*#  Modeller     : [Amy Kyle]
*#  Company      : Stantec Consulting Ltd. (Waterloo)
*#  License #    :  4730904
*#
*#  Proposed Conditions Model for Millennium Blvd. (Carriage Crossing Catch. 430
```

```
*#  Soils data obtained from Hydrogeological and Geotechnical Study
*#           Activa Waterloo East Lands (Naylor, 2006)
*#  Run using updated 2022/2023 City of Waterloo IDF Parameters
*#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
*#
*#*************************************************************************
----------------------------------------------------------------------------
025:0002------------------------------------------------------------------
--------------------
| READ STORM      |    Filename: CHICAGO STORM
| Ptotal=  69.15 mm|    Comments: CHICAGO STORM
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08   3.743 |    .83  19.391 |   1.58  23.038 |   2.33   5.807
                .17   4.185 |    .92  28.285 |   1.67  18.281 |   2.42   5.278
                .25   4.728 |   1.00  46.359 |   1.75  14.946 |   2.50   4.827
                .33   5.406 |   1.08  94.141 |   1.83  12.508 |   2.58   4.439
                .42   6.273 |   1.17 185.944 |   1.92  10.666 |   2.67   4.103
                .50   7.408 |   1.25 106.412 |   2.00   9.237 |   2.75   3.809
                .58   8.944 |   1.33  62.561 |   2.08   8.103 |   2.83   3.550
                .67  11.105 |   1.42  41.776 |   2.17   7.187 |   2.92   3.321
                .75  14.308 |   1.50  30.195 |   2.25   6.434 |   3.00   3.116
----------------------------------------------------------------------------
025:0003------------------------------------------------------------------
*# ========================================================
*# PROPOSED
*# ========================================================
*#-----------------|-------------------------------------------------------|
*# Small road catchment and grassed area draining to Millennium Blvd and
*# flowing east
*#-----------------|-------------------------------------------------------|
--------------------
| DESIGN STANDHYD    |   Area    (ha)=     .17
| 01:202    DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .12
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      33.67        40.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     185.94        60.67
                    over (min)      1.00         9.00
     Storage Coeff.  (min)=        .84 (ii)    9.46 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=       1.18          .12

                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .01          .032 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.33         1.167
     RUNOFF VOLUME    (mm)=      68.35        26.70        39.197
     TOTAL RAINFALL   (mm)=      69.15        69.15        69.151
     RUNOFF COEFFICIENT   =        .99          .39          .567

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------
025:0004------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Small road catchment draining to Millennium Blvd and flowing east
*#-----------------|-------------------------------------------------------|
--------------------
| DESIGN STANDHYD    |   Area    (ha)=     .05
| 02:203    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .04          .01
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      18.26        40.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     185.94        60.67
                    over (min)      1.00         9.00
     Storage Coeff.  (min)=        .58 (ii)    9.20 (ii)
     Unit Hyd. Tpeak (min)=       1.00         9.00
     Unit Hyd. peak  (cms)=       1.39          .12

                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .023 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.33         1.167
     RUNOFF VOLUME    (mm)=      68.35        26.70        64.186
     TOTAL RAINFALL   (mm)=      69.15        69.15        69.151
     RUNOFF COEFFICIENT   =        .99          .39          .928

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------
025:0005------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Rear lots and small road section sheet flowing to Millennium/Crossgate Blvd.
*#-----------------|-------------------------------------------------------|
--------------------
| DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number    (CN)=76.00
| 03:204    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .080

     Unit Hyd Qpeak  (cms)=     .391

     PEAK FLOW       (cms)=     .142 (i)
     TIME TO PEAK    (hrs)=    1.250
     RUNOFF VOLUME    (mm)=   30.952
     TOTAL RAINFALL   (mm)=   69.151
     RUNOFF COEFFICIENT   =     .448

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

----------------------------------------------------------------------------
025:0006------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Total Flow direct to Millennium Blvd, flowing east toward SWMF B
*#-----------------|-------------------------------------------------------|
------------------------
| ADD HYD (ToMilE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:202           .17      .032    1.17  39.20     .000
                     +ID2 02:203           .05      .023    1.17  64.19     .000
                     +ID3 03:204           .82      .142    1.25  30.95     .000
                      ==========================================================
                      SUM 04:ToMilE        1.04     .182    1.25  33.90     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------
025:0007------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# External area - assumed remains agricultural
*#-----------------|-------------------------------------------------------|
--------------------
| DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number    (CN)=75.00
| 05:205    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .480

     Unit Hyd Qpeak  (cms)=     .358

     PEAK FLOW       (cms)=     .297 (i)
     TIME TO PEAK    (hrs)=    1.767
     RUNOFF VOLUME    (mm)=   30.047
     TOTAL RAINFALL   (mm)=   69.151
     RUNOFF COEFFICIENT   =     .435

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

----------------------------------------------------------------------------
025:0008------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Proposed mixed residential area and SWM facility
*#-----------------|-------------------------------------------------------|
--------------------
| DESIGN STANDHYD    |   Area    (ha)=   12.30
| 06:200    DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   46.00
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.13         5.17
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     286.36        40.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=     185.94        98.97
                    over (min)      3.00        10.00
     Storage Coeff.  (min)=       3.04 (ii)   10.13 (ii)
     Unit Hyd. Tpeak (min)=       3.00        10.00
     Unit Hyd. peak  (cms)=        .37          .11

                                                      *TOTALS*
     PEAK FLOW       (cms)=       2.50          .92         2.948 (iii)
     TIME TO PEAK    (hrs)=       1.18         1.35         1.183
     RUNOFF VOLUME    (mm)=      68.35        33.64        49.607
     TOTAL RAINFALL   (mm)=      69.15        69.15        69.151
     RUNOFF COEFFICIENT   =        .99          .49          .717

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------
025:0009------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Total Flow to onsite SWMC, outletting to Millennium/Crossgate Blvd outfall
*#-----------------|-------------------------------------------------------|
--------------------
| ADD HYD (ToSWMC    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 05:205           4.50     .297    1.77  30.05     .000
                     +ID2 06:200          12.30    2.948    1.18  49.61     .000
                      ==========================================================
                      SUM 07:ToSWMC       16.80    2.986    1.18  44.37     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------
025:0010------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*#-----------------|-------------------------------------------------------|
--------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>07:(ToSWMC)    |
| OUT<08:(SWMC  )    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW     STORAGE    |  OUTFLOW     STORAGE
                           (cms)     (ha.m.)    |    (cms)     (ha.m.)
                            .000  .0000E+00     |     .089  .5904E+00
                            .005  .2860E-01     |     .095  .6916E+00
                            .034  .9050E-01     |     .101  .7969E+00
                            .048  .1573E+00     |     .107  .9069E+00
                            .059  .2302E+00     |     .112  .1021E+01
                            .068  .3084E+00     |     .243  .1080E+01
                            .075  .4033E+00     |     .537  .1140E+01
                            .083  .4949E+00     |     .998  .1297E+01

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (ToSWMC)       16.80     2.986     1.183     44.367
     OUTFLOW<08: (SWMC  )       16.80      .094     3.150     44.366
    OVERFLOW<09: (OVF   )         .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.154
                    TIME SHIFT OF PEAK FLOW          (min)=   118.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.6699E+00

----------------------------------------------------------------------------
025:0011------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Total Flows to the southeast to SWMF B
*#-----------------|-------------------------------------------------------|
--------------------
| ADD HYD (ToSWMB    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 04:ToMilE        1.04     .182    1.25  33.90     .000
                     +ID2 09:OVF            .00     .000     .00    .00     .000
                      ==========================================================
                      SUM 01:ToSWMB        1.04     .182    1.25  33.90     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----------------------------------------------------------------------------
025:0012------------------------------------------------------------------
*#-----------------|-------------------------------------------------------|
*# Small grassed area draining to Millennium Blvd and flowing west
*#-----------------|-------------------------------------------------------|
--------------------
| DESIGN NASHYD      |   Area    (ha)=     .03   Curve Number    (CN)=68.00
| 02:206    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .050

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    1.200
     RUNOFF VOLUME    (mm)=   24.447
     TOTAL RAINFALL   (mm)=   69.151
     RUNOFF COEFFICIENT   =     .354

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

----------------------------------------------------------------------------
```

```
01351> 025:0013-------------------------------------------------------------------------------
01352> *#-----------------|-------------------------------------------------------------------|
01353> *# Western catchment, draining to wetland
01354> *#-----------------|-------------------------------------------------------------------|
01355> ---------------------
01356> | DESIGN NASHYD      |   Area    (ha)=    1.50   Curve Number   (CN)=75.00
01357> | 03:201    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
01358> ----------------------  U.H. Tp(hrs)=    .230
01359>
01360>      Unit Hyd Qpeak  (cms)=     .249
01361>
01362>      PEAK FLOW       (cms)=     .158 (i)
01363>      TIME TO PEAK    (hrs)=    1.450
01364>      RUNOFF VOLUME    (mm)=   30.047
01365>      TOTAL RAINFALL   (mm)=   69.151
01366>      RUNOFF COEFFICIENT   =     .435
01367>
01368>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01369>
01370> -------------------------------------------------------------------------------
01371> 025:0014-------------------------------------------------------------------------------
01372> *#-----------------|-------------------------------------------------------------------|
01373> *# Total Flow from Subject Site
01374> *#-----------------|-------------------------------------------------------------------|
01375> ----------------------
01376> | ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01377> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
01378>                       ID1 01:ToSWMB        1.04     .182    1.25  33.90    .000
01379>                      +ID2 02:206           .03      .005    1.20  24.45    .000
01380>                      +ID3 03:201           1.50     .158    1.45  30.05    .000
01381>                      +ID4 08:SWMC          16.80    .094    3.15  44.37    .000
01382>                       ============================================================
01383>                       SUM 04:AllFlo        19.37    .356    1.33  42.66    .000
01384>
01385>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01386>
01387> -------------------------------------------------------------------------------
01388> 025:0015-------------------------------------------------------------------------------
01389> *#-----------------|-------------------------------------------------------------------|
01390> -------------------------------------------------------------------------------
01391> 025:0002-------------------------------------------------------------------------------
01392> -------------------------------------------------------------------------------
01393> 025:0002-------------------------------------------------------------------------------
01394> -------------------------------------------------------------------------------
01395> 025:0002-------------------------------------------------------------------------------
01396>   ** END OF RUN :  99
01397>
01398> ********************************************************************************
01399>
01400>
01401>
01402>
01403>
01404> ---------------------
01405> | START              |  Project  dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
01406> ----------------------  Rainfall dir.: C:\SWMHYMO\MILLEN~1\V4_NOV~1\
01407>     TZERO =   .00 hrs on      0
01408>     METOUT=   2 (output = METRIC)
01409>     NRUN  = 100
01410>     NSTORM=   1
01411>            #  1=Wat100yr.STM
01412> -------------------------------------------------------------------------------
01413> 100:0002-------------------------------------------------------------------------------
01414> *#*******************************************************************************
01415> *#  Project Name: [Activa Millennium Blvd.]    Project Number: [1603-10788]
01416> *#  Date        : 11-04-24
01417> *#  Modeller    : [Amy Kyle]
01418> *#  Company     : Stantec Consulting Ltd. (Waterloo)
01419> *#  License #   :  4730904
01420> *#
01421> *#  Proposed Conditions Model for Millennium Blvd. (Carriage Crossing Catch. 430
01422> *#  Soils data obtained from Hydrogeological and Geotechnical Study
01423> *#            Activa Waterloo East Lands (Naylor, 2006)
01424> *#  Run using updated 2022/2023 City of Waterloo IDF Parameters
01425> *#  Storm events modelled are 25mm, 2, 5, 25, and 100-year Chicago storms
01426> *#
01427> *#*******************************************************************************
01428> -------------------------------------------------------------------------------
01429> 100:0002-------------------------------------------------------------------------------
01430> ---------------------
01431> | READ STORM         |    Filename: CHICAGO STORM
01432> | Ptotal=  89.93 mm|    Comments: CHICAGO STORM
01433> ---------------------
01434>                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01435>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01436>                 .08   4.533 |    .83  25.419 |   1.58  30.321 |   2.33   7.234
01437>                 .17   5.108 |    .92  37.364 |   1.67  23.927 |   2.42   6.538
01438>                 .25   5.817 |   1.00  61.481 |   1.75  19.443 |   2.50   5.946
01439>                 .33   6.707 |   1.08 123.922 |   1.83  16.170 |   2.58   5.439
01440>                 .42   7.850 |   1.17 239.793 |   1.92  13.702 |   2.67   5.001
01441>                 .50   9.355 |   1.25 139.801 |   2.00  11.791 |   2.75   4.619
01442>                 .58  11.400 |   1.33  82.906 |   2.08  10.279 |   2.83   4.284
01443>                 .67  14.290 |   1.42  55.398 |   2.17   9.061 |   2.92   3.988
01444>                 .75  18.587 |   1.50  39.926 |   2.25   8.063 |   3.00   3.725
01445>
01446> -------------------------------------------------------------------------------
01447> 100:0003-------------------------------------------------------------------------------
01448> *# ======================================================
01449> *# PROPOSED
01450> *# ======================================================
01451> *#-----------------|-------------------------------------------------------------------|
01452> *# Small road catchment and grassed area draining to Millennium Blvd and
01453> *# flowing east
01454> *#-----------------|-------------------------------------------------------------------|
01455> ---------------------
01456> | DESIGN STANDHYD    |   Area    (ha)=     .17
01457> | 01:202    DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
01458> ----------------------
01459>                              IMPERVIOUS    PERVIOUS (i)
01460>      Surface Area     (ha)=        .05          .12
01461>      Dep. Storage     (mm)=        .80         1.50
01462>      Average Slope     (%)=       2.00         2.00
01463>      Length            (m)=      33.67        40.00
01464>      Mannings n             =      .013         .250
01465>
01466>      Max.eff.Inten.(mm/hr)=     239.79        95.44
01467>                 over (min)        1.00         8.00
01468>      Storage Coeff.  (min)=        .76 (ii)    7.95 (ii)
01469>      Unit Hyd. Tpeak (min)=       1.00         8.00
01470>      Unit Hyd. peak  (cms)=       1.24          .14
01471>                                                          *TOTALS*
01472>      PEAK FLOW       (cms)=        .03          .02          .045 (iii)
01473>      TIME TO PEAK    (hrs)=       1.17         1.32         1.167
01474>      RUNOFF VOLUME    (mm)=      89.13        40.69        55.224
01475>      TOTAL RAINFALL   (mm)=      89.93        89.93        89.932
01476>      RUNOFF COEFFICIENT   =        .99          .45          .614
01477>
01478>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01479>            CN* =  71.0    Ia = Dep. Storage  (Above)
01480>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01481>              THAN THE STORAGE COEFFICIENT.
01482>        (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01483>
01484> -------------------------------------------------------------------------------
01485> 100:0004-------------------------------------------------------------------------------
01486> *#-----------------|-------------------------------------------------------------------|
01487> *# Small road catchment draining to Millennium Blvd and flowing east
01488> *#-----------------|-------------------------------------------------------------------|
01489> ---------------------
01490> | DESIGN STANDHYD    |   Area    (ha)=     .05
01491> | 02:203    DT= 1.00 |   Total Imp(%)=   90.00   Dir. Conn.(%)=   90.00
01492> ----------------------
01493>                              IMPERVIOUS    PERVIOUS (i)
01494>      Surface Area     (ha)=        .04          .01
01495>      Dep. Storage     (mm)=        .80         1.50
01496>      Average Slope     (%)=       2.00         2.00
01497>      Length            (m)=      18.26        40.00
01498>      Mannings n             =      .013         .250
01499>
01500>      Max.eff.Inten.(mm/hr)=     239.79        95.44
01501>                 over (min)        1.00         8.00
01502>      Storage Coeff.  (min)=        .53 (ii)    7.72 (ii)
01503>      Unit Hyd. Tpeak (min)=       1.00         8.00
01504>      Unit Hyd. peak  (cms)=       1.44          .15
01505>                                                          *TOTALS*
01506>      PEAK FLOW       (cms)=        .03          .00          .030 (iii)
01507>      TIME TO PEAK    (hrs)=       1.17         1.30         1.167
01508>      RUNOFF VOLUME    (mm)=      89.13        40.69        84.288
01509>      TOTAL RAINFALL   (mm)=      89.93        89.93        89.932
01510>      RUNOFF COEFFICIENT   =        .99          .45          .937
01511>
01512>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01513>            CN* =  71.0    Ia = Dep. Storage  (Above)
01514>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01515>              THAN THE STORAGE COEFFICIENT.
01516>        (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01517>
01518> -------------------------------------------------------------------------------
01519> 100:0005-------------------------------------------------------------------------------
01520> *#-----------------|-------------------------------------------------------------------|
01521> *# Rear lots and small road section sheet flowing to Millennium/Crossgate Blvd.
01522> *#-----------------|-------------------------------------------------------------------|
01523> ---------------------
01524> | DESIGN NASHYD      |   Area    (ha)=     .82   Curve Number   (CN)=76.00
01525> | 03:204    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
01526> ----------------------  U.H. Tp(hrs)=    .080
01527>
01528>      Unit Hyd Qpeak  (cms)=     .391
01529>
01530>      PEAK FLOW       (cms)=     .216 (i)
01531>      TIME TO PEAK    (hrs)=    1.250
01532>      RUNOFF VOLUME    (mm)=   46.372
01533>      TOTAL RAINFALL   (mm)=   89.932
01534>      RUNOFF COEFFICIENT   =     .516
01535>
01536>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01537>
01538> -------------------------------------------------------------------------------
01539> 100:0006-------------------------------------------------------------------------------
01540> *#-----------------|-------------------------------------------------------------------|
01541> *# Total Flow direct to Millennium Blvd, flowing east toward SWMF B
01542> *#-----------------|-------------------------------------------------------------------|
01543> ----------------------
01544> | ADD HYD (ToMilE    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01545> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
01546>                       ID1 01:202           .17      .045    1.17  55.22    .000
01547>                      +ID2 02:203           .05      .030    1.17  84.29    .000
01548>                      +ID3 03:204           .82      .216    1.25  46.37    .000
01549>                       ============================================================
01550>                       SUM 04:ToMilE        1.04     .275    1.25  49.64    .000
01551>
01552>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01553>
01554> -------------------------------------------------------------------------------
01555> 100:0007-------------------------------------------------------------------------------
01556> *#-----------------|-------------------------------------------------------------------|
01557> *# External area - assumed remains agricultural
01558> *#-----------------|-------------------------------------------------------------------|
01559> ----------------------
01560> | DESIGN NASHYD      |   Area    (ha)=    4.50   Curve Number   (CN)=75.00
01561> | 05:205    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
01562> ----------------------  U.H. Tp(hrs)=    .480
01563>
01564>      Unit Hyd Qpeak  (cms)=     .358
01565>
01566>      PEAK FLOW       (cms)=     .454 (i)
01567>      TIME TO PEAK    (hrs)=    1.767
01568>      RUNOFF VOLUME    (mm)=   45.178
01569>      TOTAL RAINFALL   (mm)=   89.932
01570>      RUNOFF COEFFICIENT   =     .502
01571>
01572>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01573>
01574> -------------------------------------------------------------------------------
01575> 100:0008-------------------------------------------------------------------------------
01576> *#-----------------|-------------------------------------------------------------------|
01577> *# Proposed mixed residential area and SWM facility
01578> *#-----------------|-------------------------------------------------------------------|
01579> ----------------------
01580> | DESIGN STANDHYD    |   Area    (ha)=   12.30
01581> | 06:200    DT= 1.00 |   Total Imp(%)=   58.00   Dir. Conn.(%)=   46.00
01582> ----------------------
01583>                              IMPERVIOUS    PERVIOUS (i)
01584>      Surface Area     (ha)=       7.13         5.17
01585>      Dep. Storage     (mm)=        .80         1.50
01586>      Average Slope     (%)=       2.00         2.00
01587>      Length            (m)=     286.36        40.00
01588>      Mannings n             =      .013         .250
01589>
01590>      Max.eff.Inten.(mm/hr)=     239.79       150.38
01591>                 over (min)        3.00         9.00
01592>      Storage Coeff.  (min)=       2.75 (ii)    8.74 (ii)
01593>      Unit Hyd. Tpeak (min)=       3.00         9.00
01594>      Unit Hyd. peak  (cms)=        .40          .13
01595>                                                          *TOTALS*
01596>      PEAK FLOW       (cms)=       3.29         1.47         4.124 (iii)
01597>      TIME TO PEAK    (hrs)=       1.18         1.32         1.183
01598>      RUNOFF VOLUME    (mm)=      89.13        49.81        67.900
01599>      TOTAL RAINFALL   (mm)=      89.93        89.93        89.932
01600>      RUNOFF COEFFICIENT   =        .99          .55          .755
01601>
01602>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01603>            CN* =  74.0    Ia = Dep. Storage  (Above)
01604>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01605>              THAN THE STORAGE COEFFICIENT.
01606>        (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01607>
01608> -------------------------------------------------------------------------------
01609> 100:0009-------------------------------------------------------------------------------
01610> *#-----------------|-------------------------------------------------------------------|
01611> *# Total Flow to onsite SWMC, outletting to Millennium/Crossgate Blvd outfall
01612> *#-----------------|-------------------------------------------------------------------|
01613> ----------------------
01614> | ADD HYD (ToSWMC    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01615> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
01616>                       ID1 05:205           4.50     .454    1.77  45.18    .000
01617>                      +ID2 06:200           12.30    4.124   1.18  67.90    .000
01618>                       ============================================================
01619>                       SUM 07:ToSWMC        16.80    4.187   1.18  61.81    .000
01620>
```

```
   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

100:0010--------------------------------------------------------------------------------
*#-----------------|------------------------------------------------------------------|
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>07:(ToSWMC)   |
| OUT<08:(SWMC  )   |    =========  OUTLFOW STORAGE TABLE  =========
 ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |    (cms)    (ha.m.)
                             .000  .0000E+00   |     .089  .5904E+00
                             .005  .2860E-01   |     .095  .6916E+00
                             .034  .9050E-01   |     .101  .7969E+00
                             .048  .1573E+00   |     .107  .9069E+00
                             .059  .2302E+00   |     .112  .1021E+01
                             .068  .3084E+00   |     .243  .1080E+01
                             .075  .4033E+00   |     .537  .1140E+01
                             .083  .4949E+00   |     .998  .1297E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >07: (ToSWMC)      16.80     4.187     1.183     61.814
     OUTFLOW<08: (SWMC  )      16.80      .109     3.183     61.812
    OVERFLOW<09: (OVF   )        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    2.594
                   TIME SHIFT OF PEAK FLOW         (min)=   120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9488E+00

--------------------------------------------------------------------------------
100:0011--------------------------------------------------------------------------------
*#-----------------|------------------------------------------------------------------|
*# Total Flows to the southeast to SWMF B
*#-----------------|------------------------------------------------------------------|
 -------------------------
| ADD HYD (ToSWMB    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
 -------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                       ID1 04:ToMilE         1.04     .275    1.25  49.64    .000
                      +ID2 09:OVF             .00     .000     .00    .00    .000
                       ==========================================================
                       SUM 01:ToSWMB         1.04     .275    1.25  49.64    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0012--------------------------------------------------------------------------------
*#-----------------|------------------------------------------------------------------|
*# Small grassed area draining to Millennium Blvd and flowing west
*#-----------------|------------------------------------------------------------------|
 ----------------------
| DESIGN NASHYD      |   Area    (ha)=     .03   Curve Number   (CN)=68.00
| 02:206    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .050

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .007 (i)
     TIME TO PEAK    (hrs)=    1.200
     RUNOFF VOLUME    (mm)=   37.601
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .418

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

--------------------------------------------------------------------------------
100:0013--------------------------------------------------------------------------------
*#-----------------|------------------------------------------------------------------|
*# Western catchment, draining to wetland
*#-----------------|------------------------------------------------------------------|
 ----------------------
| DESIGN NASHYD      |   Area    (ha)=    1.50   Curve Number   (CN)=75.00
| 03:201    DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
 ----------------------   U.H. Tp(hrs)=    .230

     Unit Hyd Qpeak  (cms)=     .249

     PEAK FLOW       (cms)=     .242 (i)
     TIME TO PEAK    (hrs)=    1.450
     RUNOFF VOLUME    (mm)=   45.178
     TOTAL RAINFALL   (mm)=   89.932
     RUNOFF COEFFICIENT   =     .502

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

--------------------------------------------------------------------------------
100:0014--------------------------------------------------------------------------------
*#-----------------|------------------------------------------------------------------|
*# Total Flow from Subject Site
*#-----------------|------------------------------------------------------------------|
 -------------------------
| ADD HYD (AllFlo    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
 -------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                       ID1 01:ToSWMB         1.04     .275    1.25  49.64    .000
                      +ID2 02:206             .03     .007    1.20  37.60    .000
                      +ID3 03:201            1.50     .242    1.45  45.18    .000
                      +ID4 08:SWMC          16.80     .109    3.18  61.81    .000
                       ==========================================================
                       SUM 04:AllFlo        19.37     .517    1.33  59.83    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0015--------------------------------------------------------------------------------
*#-----------------|------------------------------------------------------------------|
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2024-11-04     at 14:05:36
================================================================================

```

Carriage Crossing Subdivision
Final Stormwater Management Report
City of Waterloo

Prepared for:

City of Waterloo

Prepared by:

Stantec Consulting Ltd.
49 Frederick Street
Kitchener ON N2H 6M7
Tel: (519) 579-4410
Fax: (519) 579-6733

Date: May 2010
Project No. 1603-10788

Carriage Crossing Subdivision
Final Stormwater Management Report
City of Waterloo

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1.0 Introduction and Background

1.1 OVERVIEW

This Final Stormwater Management (FSWM) Report has been completed to satisfy the Draft Plan Approval conditions for the Carriage Crossing Subdivision (previously referred to as Rural East District Subdivision) located in the City of Waterloo (City), Region of Waterloo. The subject 70.6 ha property is located at the northeast limit of the City of Waterloo as shown in Figure 1.0. It is bordered to the north by Country Squire Road, to the south and west by Rim Park, to the east by an access laneway/agricultural/forested lands and to the west by other residential landowners. Woolwich Street bisects the site. An aerial plan of the subject lands is illustrated in Figure 2.0. An intermittent stream traverses the site, originating from the termination of a farm tile drain just northwest of Woolwich Street and flows northwest to southeast. This stream joins the Horst Tributary upstream of Grey Silo Golf Course and ultimately flows into the Grand River.

It is proposed to develop the subject property as a mixed-use residential community, consisting of single-family and multi-residential units, two parks, municipal roadways, and two stormwater management facilities (SWMFs). A 14.9 ha parcel of land at the northwest of the site is proposed to be developed as employment lands. A stormwater management facility (SWMF) for minor storms will be provided with the development of the employment lands.

This report documents the storm drainage strategy for the development and includes the detailed design of the two wetland facilities proposed to provide the required water quality, water quantity and erosion controls. Details as to the erosion and sediment control strategy to be implemented during the construction phase(s) of the project have also been included. Monitoring requirements are also discussed.

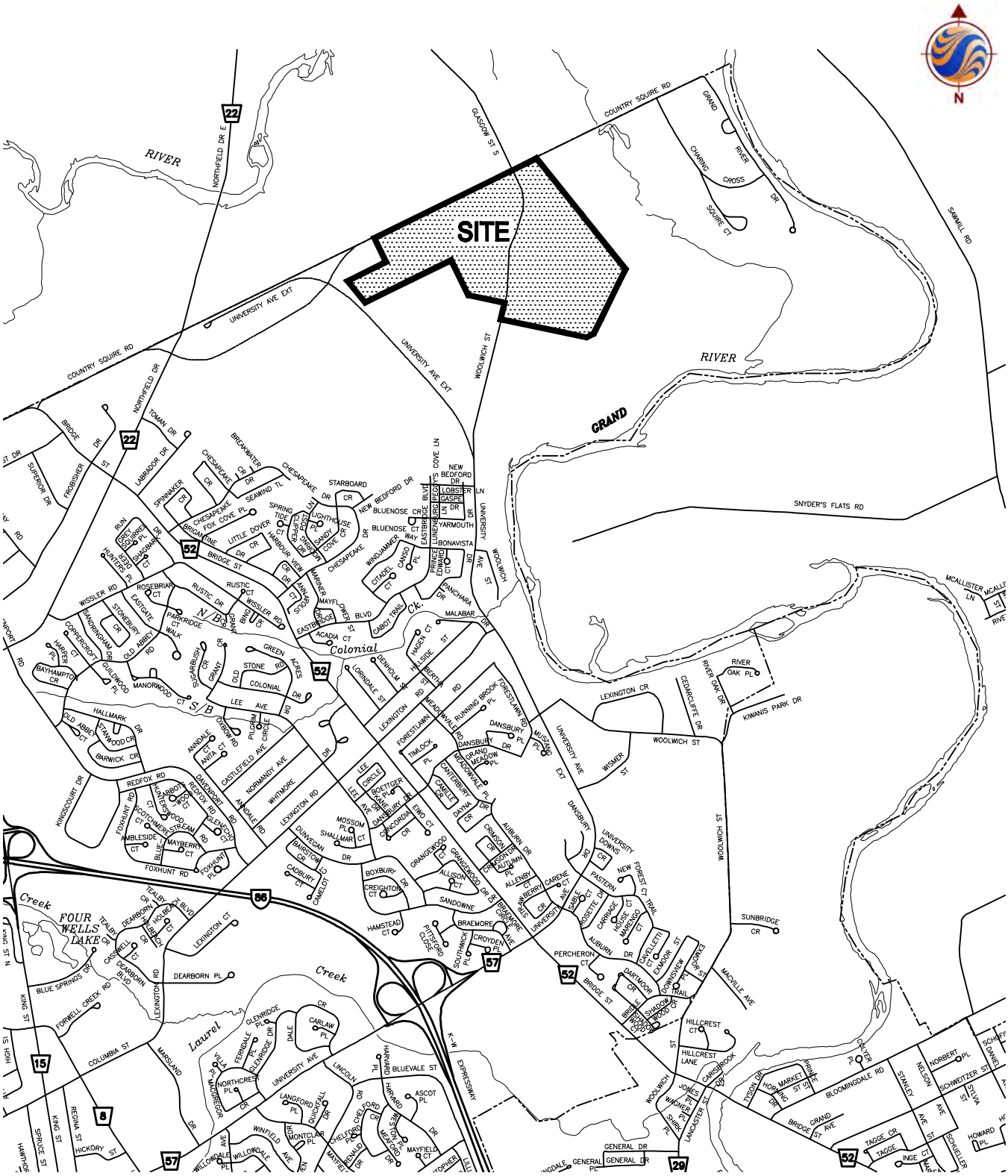
This report should be read in conjunction with the Final Design Drawings dated May 2010, which have also been prepared by Stantec Consulting Ltd. (Stantec) for this development.

1.2 STUDY APPROACH

The objective of this SWM Plan is to ensure that the proposed development includes the necessary controls to protect the hydrology and water quality of the receiving water systems which ultimately drain into the Grand River and is consistent with the preliminary design approach. Further, this plan also confirms that the Draft Plan Approved blocks and corridors for SWM measures will be sufficient. This approach involved the following study components:

- Revising hydrologic models for the existing and proposed development conditions to determine runoff volumes and peak flow rates to downstream areas

- Detailed design of appropriate SWMFs that will control the site runoff in a manner consistent with current requirements (water quality and water quantity)



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2010-05-11 02:35PM By: afigliomeni

APRIL 2010
1603-10788

ORIGINAL SHEET - ANSI A

Stantec Consulting Ltd.
49 Frederick Street
Kitchener ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.6733
www.stantec.com

Client/Project
ACTIVA HOLDINGS INC.
CARRIAGE CROSSING SUBDIVISION
CITY OF WATERLOO

Figure No.
1.0

Title
SITE LOCATION PLAN



N

V:\01603\active\160310788\design\drawing\swm\160310788_mon-loc_AP-E-11-10.dwg
2010-05-11 01:39PM By: afigliomeni

MAY 2010
1603-10788

ORIGINAL SHEET - ANSI B

Stantec Consulting Ltd.
49 Frederick Street
Kitchener ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.6733
www.stantec.com

Legend

PROPERTY LIMITS

Notes

1. BASE DRAWING FROM REGION OF WATERLOO GIS LOCATOR, 2003 AERIAL PHOTOGRAPHY.

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ACTIVA HOLDINGS INC.
CARRIAGE CROSSING SUBDIVISION
CITY OF WATERLOO

Figure No.
2.0

Title
AERIAL PHOTOGRAPH OF SITE

- Revise assessment of the infiltration potential for the site based on additional groundwater level monitoring
- Provision of an Erosion and Sediment Control Plan to be implemented during construction
- Discussion regarding monitoring requirements during construction as well as post-construction
- Summary of the study by identifying conclusions and recommendations

1.3 BACKGROUND INFORMATION

A variety of sources have been referenced during the preparation of this report, including:

- *Activa Waterloo East – Monitoring Report 2009,* Stantec Consulting Ltd. (Kitchener), April 2010
- *Buffer Assessment for the SWM Ponds, Waterloo Rural East, Activa Properties Ltd.,* Stantec Consulting Ltd., July 2009
- *Region of Waterloo and Area Municipal – Design Guidelines and Supplemental Specifications for Municipal Services*, Region of Waterloo, January 2007
- *Hydrogeological and Geotechnical Study, Activa Waterloo East Lands,* Naylor Engineering Associates Ltd., February 2006
- *Erosion & Sediment Control Guideline for Urban Construction*, Greater Golden Horseshoe Area Conservation Authorities, 2006
- *City of Waterloo – Development Manual*, City of Waterloo, November 2003
- *Stormwater Management Planning and Design Manual (SWMPD Manual),* Ontario Ministry of the Environment, March 2003
- *City of Waterloo Development Monitoring Protocol,* City of Waterloo, 1999
- *The State of the Resources: Improving the Land Resource Data Base – The Regional Municipality of Waterloo Soil Information Upgrade*, Ecologistics Ltd. for the Ministry of Agriculture and Agri-Food Canada, 1996
- *Laurel Creek Watershed Study* (*LCWS*), Grand River Conservation Authority, 1993

2.0 Stormwater Management Design Criteria

SWM criteria were established based on the characteristics of the receiving systems. Monitoring of the site to provide baseline environmental information has been undertaken since 2005. This monitoring includes surface water and groundwater as well as terrestrial and biological monitoring components. The Monitoring Program addressed the City's development monitoring requirements implemented for Laurel Creek and other watercourses within the City. A summary of the monitoring results is provided in the following section.

2.1 PRE-CONSTRUCTION MONITORING RESULTS

As part of the Monitoring Program, monthly water quality samples were obtained at two locations along the stream that traverses the site with one of the sites being at the downstream of the proposed development land. This included collecting at least three samples to reflect "dry weather" conditions provided the stream sustains perennial flow. The samples were analyzed for total suspended sediment (TSS), temperature, dissolved oxygen (DO), total phosphorous (TP) and bacteria (E.*coli*). Flow rates were also measured at the two sampling locations at least once a month after rainfall and three occurrences during dry weather conditions. Groundwater has also been monitored with groundwater levels recorded during three seasons: spring; summer; and fall, at selected borehole locations. The terrestrial monitoring consisted of a photographic inventory of the vegetation along the edges to observe any disturbances, encroachments, invasive species, etc. The biological monitoring consisted of undertaking benthic monitoring; however, this could not be conducted until 2007 when a new method was introduced to account for low flow rates and shallow water.

As there is no Subwatershed Study for the Horst Tributary, the targets in the *Laurel Creek Watershed Study* (LCWS) (GRCA, 1993) were used as a comparison. The warm water fisheries temperatures were used as a baseline target. The findings of the monitoring on the subject lands indicate the following:

- Results for TSS from 2005 to 2009 indicated that concentration of suspended solids were typically below the target of 25 mg/L
- TP concentrations downstream of the proposed development area from 2005 to 2008 were consistently above the target of 0.08 mg/L but showed some improvements in 2009
- DO concentrations met the target of greater than 5.0 mg/L on all occasions but 4 from 2005 to 2009
- *E.coli* concentrations were frequently higher than the target of 200 CFU/100 mL; however, average concentrations have been improving at the two monitoring stations since 2005
- The stream temperatures met the targets on all occasions from 2005 to 2009

- Terrestrial monitoring stations were established in 2006 based on preliminary monitoring observations made in 2005. No major changes in conditions were recorded in 2006 while only minor changes were noted in 2007 through 2009. In 2009, the eco-sites were noted to be in good condition with only a few minor signs of stress

- Benthic monitoring was unsuccessful in 2005 and 2006. From 2007 to 2009, benthic monitoring appeared to show a somewhat stressed community in the upper reaches of the tributary, likely a result of a variable community with intermittent flows. Further downstream the benthic communities appeared to be more stable

2.2 STORMWATER MANAGEMENT CRITERIA

Based on the monitoring data collected thus far, the following SWM criteria have been applied to the site:

- Water Quality – Provide sufficient permanent pool and extended detention volume to meet MOE *Enhanced* (Level 1) criteria despite the warm water fisheries given the Provincially Significant wetland feature

- Water Quantity – Control the 2-year through to 100-year post-development peak flow rates to existing conditions flow rates

- Maintain flows to the intermittent stream under partial built-out and ultimate built-out conditions

- Evaluate the infiltration potential onsite as it relates to the existing water budget, and recommend measures to meet the goal of maintaining or enhancing groundwater recharge These may include:

    - Providing at-source infiltration equivalent to the first 25 mm of runoff from roof surfaces in areas where soils are conducive to infiltration

    - Promoting infiltration of the runoff generated from some non-roof areas

- Erosion and sediment control - provide appropriate erosion and sediment control during construction to protect neighboring properties and the downstream receivers from potential siltation

A copy of the GRCA Final SWM Checklist and Pre-consultation Checklist is provided in Appendix D.

2.3 SETBACKS

Based on the *Environmental Impact Study – Rural East District Lands (*Stantec Consulting Ltd., June 2008) and the follow-up letter *Buffer Assessment for the SWM Ponds, Waterloo Rural East, Activa Properties Ltd.,* (Stantec Consulting Ltd, July 10, 2009) a 10 m buffer from the edge of the wetland has been proposed for both SWMFs. Based on the July 10, 2009 letter, it was recommended that a spreader swale at the outlet of SWMF A be utilized to mimic sheet flow conditions along the wetland boundary.

3.0 Existing Conditions

3.1 TOPOGRAPHY AND SURFACE DRAINAGE

The ground surface of the site is moderately rolling with elevations ranging between approximately 314 m and 332 m AMSL (above mean sea level). The terrain generally slopes towards the south and east with most of the flows directed to the intermittent stream as shown in Figure 3.0. There are two culverts located across Woolwich Street. Overland flows ultimately drain southeasterly towards the Grand River.

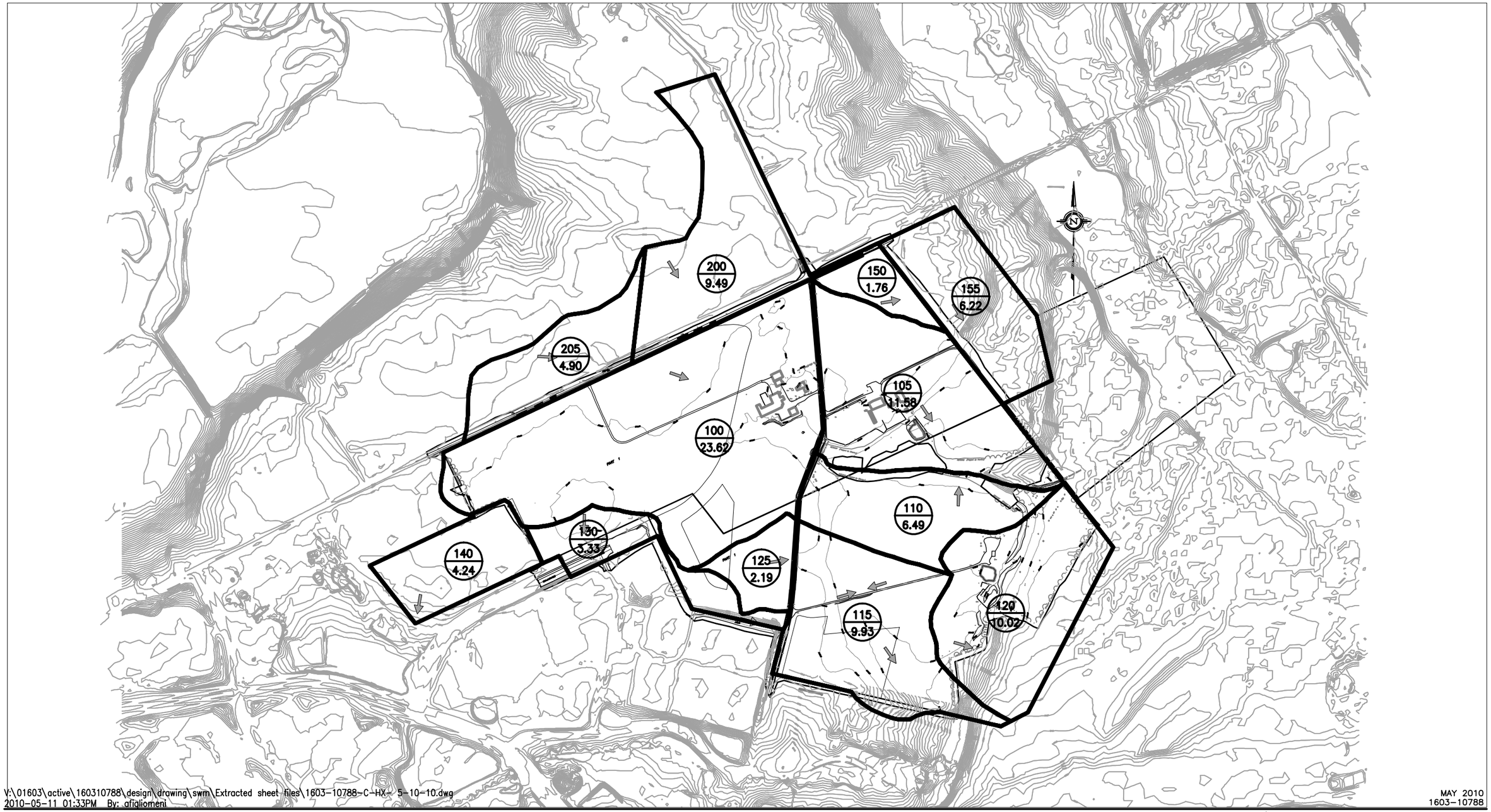
The existing land use in the proposed subdivision area is primarily agricultural; however, there are woodlots present to the west, east and south of the subject lands.

3.2 GEOTECHNICAL AND HYDROGEOLOGICAL INFORMATION

The *Hydrogeological and Geotechnical Study* (Naylor, February 2006) describes the site as being within the Waterloo Sand Hills which is also referred to as the Waterloo Moraine. The soil stratigraphy comprises silt and sand rich topsoil overlying major native deposits of sand, sand and gravel, silt and glacial till. The sand and gravel, as well as sand only deposits, overlay deposits of silt and silt/clay till. In general, the silty till soils are at the northwest and northeast of the site. The *State of the Resources: Improving the Land Resource Data Base – The Regional Municipality of Waterloo Soil Information Upgrade* prepared for the Ministry of Agriculture and Agri-Food Canada (Ecologistics Ltd., 1996) indicates that the soils are generally loams and sandy loams. Hydrologic soil groups were determined by using the soil information from the geotechnical investigation. Conservative assumptions were made for external catchments which were not part of the geotechnical investigation.

Based on the geotechnical investigation, the groundwater occurs in the shallow overburden soil deposits where flow is mainly lateral towards the intermittent stream. The intermittent nature of the stream can be explained by the fact that it infiltrates into the surrounding soils downstream of the silts and reappears at the downstream limit of the site where the groundwater table is closer to the surface. Within the deep overburden soils and bedrock, which are part of the regional aquifer system, flows are generally south and east towards the Grand River. In the locations where surficial sands and gravels are found, some of the shallow groundwater flows vertically to the regional aquifer system.

As part of the Monitoring Program, groundwater levels were taken seasonally for some of the boreholes. Groundwater levels were found to vary between 0.5 m and 4.0 m below the ground surface and to be located between 320 and 332 m AMSL. High groundwater elevations were found west of Woolwich Street (to be renamed Grey Silo Street) which result in reducing potential infiltration measures. This is discussed further in Section 4.3.



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MAY 2010
1603-10788

ORIGINAL SHEET - ANSI B

Stantec Consulting Ltd.
49 Frederick Street
Kitchener ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.6733
www.stantec.com

LEGEND:

200 / 4.50 — CATCHMENT ID / CONTRIBUTING AREA (ha)

MAJOR OVERLAND FLOOD ROUTE

DRAINAGE BOUNDARY

1:7500 0 75 225 375m

Client/Project
ACTIVA HOLDINGS INC.
CARRIAGE CROSSING SUBDIVISION

Figure No.
3.0

Title
EXISTING DRAINAGE CATCHMEI PLAN AREA

4.0 Stormwater Management Design

4.1 HYDROLOGIC MODELING

A hydrologic model was prepared to simulate drainage conditions for the subject development. SWMHYMO (Stormwater Management Hydrologic Model) was employed to predict flows for the existing and proposed development conditions and design SWM systems to ensure the criteria are achieved. To address the criteria, existing and post-development conditions were modeled for:

- The 25 mm (first-flush) 4-hour Chicago Storm derived using the Region of Waterloo IDF parameters as provided in Table 1
- 3-hour Chicago Storms were derived using a combination of the Region of Waterloo IDF and the City of Waterloo IDF parameters as per discussions with City staff. As such, the 2- and 5-year storms were derived using the City of Waterloo IDF parameters and the 10-, 25-, 50-, and 100-year storms were derived using the Region of Waterloo IDF parameters as provided in Table 1

Table 1: Rainfall Events – IDF Parameters

Return Period	Source of Data	IDF Parameters			
		A	B	C	Depth (mm)
25 mm, 4-hr	Region	508.5	6	0.799	25.0
2-year, 3-hr	City	1101	9.3	0.882	32.4
5-year, 3-hr	City	1755	12.4	0.895	47.5
10-year, 3-hr	Region	2146	16.9	0.878	62.3
25-year, 3-hr	Region	3509	22.6	0.925	77.4
50-year, 3-hr	Region	4620	25.8	0.948	88.8
100-year, 3-hr	Region	5886	28.6	0.969	99.9

4.1.1 Existing Conditions Hydrologic Model

An existing conditions hydrologic model was prepared to simulate drainage using SWMHYMO. Schematics of the SWMHYMO models are provided in Appendix A while the input and output files are provided in Appendix B. Soil Conservation Service (SCS) Curve Numbers and catchment parameters were calculated for each catchment based on land use and soil type and are provided in Appendix C. Delineation of existing drainage catchments, including external areas which drain onto the subject property, is provided on Figure 3.0 and is summarized as follows:

- Catchment 100: 23.62 ha of agricultural land located south of Country Squire Road and west of Woolwich Street draining to a culvert across Woolwich Street which is tributary to an intermittent stream

- Catchment 105: 11.58 ha of agricultural land and wooded area located south of Country Squire Road and east of Woolwich Street draining south to the intermittent stream
- Catchment 110: 6.49 ha of agricultural land which also contains a portion of wooded area draining north to the intermittent stream
- Catchment 115: 9.93 ha of agricultural land located south east and draining south
- Catchment 120: 10.02 ha of woodlot and agricultural land located at the southeast corner of the subdivision and draining southeast
- Catchment 125: 2.19 ha of agricultural land located west of Woolwich Street draining easterly across Woolwich Street into Catchment 115
- Catchment 130: 3.33 ha of mainly agricultural land and a portion of Millenium Boulevard draining south
- Catchment 140: 4.24 ha of woodlot located west and draining west
- Catchment 150: 1.76 ha of agricultural land at the northeast corner of the subject property and drains east
- Catchment 155: 6.22 ha of external area comprising agricultural land which drains south
- Catchment 200: 9.49 ha of agricultural land located northeast of Country Squire Road which drain south onto the site and eventually to the intermittent stream
- Catchment 205: 4.90 ha of agricultural land located northwest of Country Squire Road that drains south onto the site and eventually to the intermittent stream

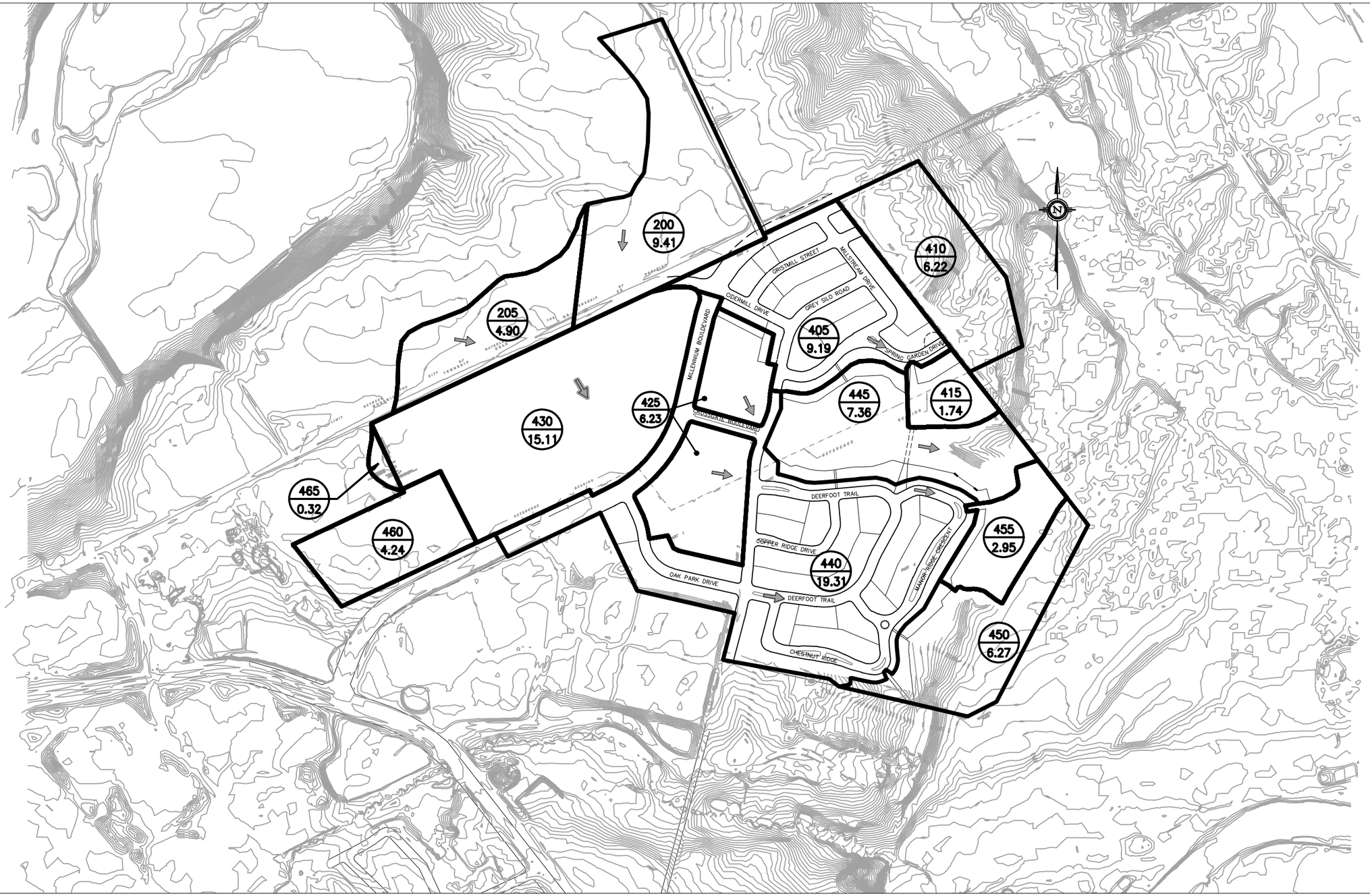
Table 2 provides a summary of the existing flows at key locations on the site. The first is at the crossing at Woolwich Street where flows to the intermittent stream begin. The other location is flows in the intermittent stream at the downstream limit of the site. The other flows provided account for all flows off the property including catchments which drain westerly and southerly.

Table 2: Existing Conditions Peak Flow Rates at Various Locations

Rainfall Event	Flow Rates at Various Point of Interest (m^3/s)		
	Woolwich Street at Start of Intermittent Stream	Intermittent Stream Leaving Property	Total Flow Offsite
25 mm	0.35	0.50	0.86
2-year	0.60	0.87	1.48
5-year	1.17	1.70	2.92
10-year	1.74	2.54	4.34
25-year	2.48	3.64	6.23
50-year	3.08	4.53	7.75
100-year	3.68	5.43	9.30

4.1.2 Proposed Conditions Hydrologic Model

Proposed conditions catchments were delineated as shown on Figure 4.0. Some of the catchment areas, previously separated in the Preliminary Stormwater Management (PSWM) Report catchment figure, have been amalgamated to simplify the modeling. Two stormwater management facilities (SWMFs) are proposed; one is located northeast of the intermittent stream in Catchment 415, and is referred to as SWMF A. The other is located southeast of the intermittent stream in Catchment 455, and is referred to as SWMF B. Minor flows from the employment lands will be directed to a SWMF (referred to in the modeling as SWMFC), to be designed at a later date and will be located in Catchment 430. Major flows from the employment lands (Catchment 430) will be conveyed overland along the road network to SWMF B. SCS Curve Numbers were calculated for each catchment based on land use and soil type and are provided in Appendix C. Schematics of the SWMHYMO model are provided in Appendix A; input and output files are provided in Appendix B. The proposed catchments are summarized as follows:



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MAY 2010
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ORIGINAL SHEET - ANSI B

Stantec Consulting Ltd.
49 Frederick Street
Kitchener ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.6733
www.stantec.com

LEGEND:

200 / 4.50 — CATCHMENT ID / CONTRIBUTING AREA (ha)

MAJOR OVERLAND FLOOD ROUTE

DRAINAGE BOUNDARY

1:7500 0 75 225 375m

Client/Project
ACTIVA HOLDINGS INC.
CARRIAGE CROSSING SUBDIVISION
CITY OF WATERLOO

Figure No.
4.0

Title
POST DEVELOPMENT DRAINAGE CATCHMENT AREA PLAN

Draining to SWMF A (north of stream)

- Catchment 405: 9.19 ha of single-family residential area as well as a park area draining to the facility
- Catchment 410: 6.22 ha external catchment east of the subject site which was assumed to be future residential draining to the facility
- Catchment 200: 9.41 ha of agricultural land located northeast of Country Squire Road draining to the site
- Catchment 415: 1.74 ha of SWM block including a few rear yards

Draining to SWMF B (south of stream)

- Catchment 205: 4.90 ha of agricultural land located northwest of Country Squire Road draining to the employment lands
- Catchment 430: 15.11 ha of employment lands with minor flows directed to a proposed facility and major flows are directed to SWMF B. This area includes a portion of the road right-of-way as per existing conditions and is therefore larger than the Draft Plan area of 14.88 ha
- Catchment 425: 6.23 ha of multi residential lands
- Catchment 440: 19.31 ha of single-family residential, park as well as a commercial/convenience area
- Catchment 465: 0.32 ha of external catchment consisting of a wooded area and a residence
- Catchment 455: 2.95 ha of SWM block

Draining Uncontrolled to Intermittent Stream

- Catchment 445: 7.36 ha of open space as well as rear yard drainage on either side of the intermittent stream
- Catchment 450: 6.27 ha of open space at the southeast corner of the subject site consisting of woodlot
- Catchment 460: 4.24 ha of woodlot at the west of the site draining west

The total area considered under existing conditions is 93.77 ha while the total area under post-development conditions is 93.25 ha. These differ slightly as a result of a small external area at the south of the site that was omitted under post-development conditions as this area will flow parallel to the rear yards of the proposed single-family dwellings in Catchment 440.

4.2 SWM FACILITY DESIGN

4.2.1 SWM Facility A (North Basin)

The design of this stormwater management facility, illustrated on Drawing SWM-A, utilizes a constructed wetland configuration to provide an *enhanced* level of water quality control, with a maximum ponding elevation of approximately 325.90 m during the 100-year return period event. The limits of grading does not extend beyond the 10 m buffer from the wetland limit and a minimum 30 m buffer, from the top of the permanent pool to the wetland limit has been provided. A forebay has been included in the design to provide for the centralized collection of sediment for ease of removal. In addition to the permanent pool characteristics, the pond will provide sufficient extended detention storage to achieve a 25-hour drawdown of the Ministry of the Environment (MOE) water quality control volumes. The MOE requirement for permanent pool volume is 1138 m^3 and 1908 m^3 and is provided within the top 0.3 m of the permanent pool and forebay areas (top 0.2 m of the forebay only). Pond design characteristics are summarized in Table 3, with detailed design calculations provided in Appendix C.

The forebay length required to sufficiently attenuate the 5-year storm sewer inlet flows is 40 m and the length provided is 44 m. Detailed design calculations are provided in Appendix C. The depth of the forebay is 1.5 m and the design has accounted for the bottom 0.5 m to accumulate sediment, resulting in a clean out frequency of 8 years. The GRCA had previously requested that confirmation be provided regarding whether the forebay design would prevent settled sediment from being entrained into the main cell as a result of some overland flows being directed into the forebay rather than entirely into the main cell. Details were provided in an email from Stantec staff dated April 7, 2009 (Matt Ninomiya to John Brum) and computations were completed to determine whether the 10-year design storm would entrain sediment into the main cell. The depth of water in the forebay during a 10-year storm would be increased to 1.94 m (above the sediment storage). Similarly, the volume in the forebay would be increased, so the computed dispersion length required to sufficiently attenuate the flows would be 26 m. Since the actual length is 47 m, sediment should remain in the forebay during the 10-year storm.

The outlet structure for the constructed wetland facility consists of a riser near the southwest limits of the facility. Orifice plate controls, detailed in Table 3 and illustrated on Drawing SWM-A, will provide the required extended detention control. Flows from the 10-year storm event and greater will discharge via a double ditch inlet catchbasin which are controlled by an

orifice plate. Flows from the 25-year event and greater will discharge via an overflow weir, with a length of 8.5 m and an invert of 324.70 m, towards the intermittent stream. The weir is proposed to be lined with turfstone and the back slope, where weir flow will be directed, is proposed to be surface treated with erosion control matting, MacMat N10. Downstream of the outlet, a spreader swale is proposed. A length of 60 m is proposed with a depth of 0.3 m. Peak flow rates from the site draining to the SWMF are summarized in Table 4 with detailed modeling files included in Appendix B.

Table 3: SWM Facility A Design Characteristics

Parameter	Basin Characteristics
Total Contributing Area	26.6 ha
Total Contributing Area req. Quality Control	17.2 ha
Total Percent Impervious	55%
Bottom Elevation of Forebay	323.20 m
Bottom Elevation of Wetland	324.40 m
Permanent Pool Elevation	324.70 m
Pond Top Elevation	326.20 m
High Water Level (100-year Storm Event)	325.90 m
Freeboard Provided Above High Water Level	0.30 m
Quality Control (Enhanced/Level 1)	
Unit Area Storage Requirement	105 m^3/ha
Permanent Pool Volume Required (65 m^3/ha)	1115 m^3
Permanent Pool Volume Provided in Wetland	1908 m^3
Permanent Pool Depth in Wetland	0.30 m
Extended Detention Volume Required (40 m^3/ha)	686 m^3
Extended Detention Water Level	324.80m
Extended Detention Time	25 hrs
Forebay	
Length Required (based on 5-year flows)	40 m
Length Provided	47 m
Maximum Sediment Accumulation Depth	0.5 m
Cleanout Frequency	8 yrs
Water Quality Outlet from Wetland	
Orifice 1 Diameter	160 mm
Orifice 1 Invert Elevation	324.70 m
Orifice 2 Diameter	300 mm
Orifice 2 Invert Elevation	324.80 m
Double Ditch-inlet Catchbasin (1200 x 600 mm) T/G Invert (4:1 Grate) elevation	325.50 m
Orifice 3 Diameter	475 mm
Orifice 3 Invert Elevation	324.70 m
Overflow Spillway from Wetland	
Spillway Elevation	325.70 m
Spillway Bottom Width	8.5 m

The boreholes in proximity to the SWMF are BH16 and BH17. Borehole 17 was monitored on a yearly basis with groundwater levels having been recorded as frequently as five times a year since 2005. The highest level recorded at this borehole was 323.22 m AMSL (April 2008). The bottom of the permanent pool is at an elevation of 324.40 m and the outlet structure will be located above the highest groundwater level. The Geotechnical Engineer will inspect the soils at the time of construction and recommend the thickness of clay liner if it is required.

A 4 m-wide maintenance access road has been provided for ease of inspection and maintenance of the forebay, inlet and outlet structures. The access road will be surfaced with asphalt and have a maximum longitudinal slope of 10:1. The elevation of the access road will be somewhat variable but has been generally maintained at or above the active storage zone.

Table 4: SWM Facility A Operating Characteristics

	Storm Event						
	25 mm	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
Proposed peak flow to facility (m^3/s)	1.31	1.93	2.72	3.11	3.88	4.50	5.12
Proposed peak flow from facility (m^3/s)	0.07	0.11	0.17	0.41	0.92	1.44	1.97
Maximum Storage Volume (m^3)	2340	3355	5550	7445	8701	9430	10020
Maximum ponding depth (m)	0.32	0.45	0.72	0.93	1.06	1.14	1.20
Maximum ponding elevation (m)	325.02	325.15	325.42	325.63	325.76	325.84	325.90
Drawdown time (hours)	41	44	48	50	51	51	51

The proposed design of the SWMF adheres to the guidelines as presented in the *SWM Manual* (MOE, 2003) and provides the necessary water quality and quantity controls. The landscaping plans associated with the SWMF are show on Drawing L-1 with details shown on Drawing L-3 and are appended for reference.

4.2.2 SWM Facility B (South Basin)

The design of this stormwater management facility, illustrated on Drawing SWM-B, utilizes a constructed wetland configuration to provide an *enhanced* level of water quality control with a maximum ponding elevation of approximately 319.20 m during the 100-year return-period event. A forebay has been included in the design to provide for the centralized collection of sediment for ease of removal. In addition to the permanent pool characteristics, the pond will provide sufficient extended detention storage to achieve a 26-hour drawdown of the MOE water quality control volumes. The MOE requirement for permanent pool volume is 1994 m^3 and 2268 m^3 is provided in the permanent pool and forebay volume (top 0.2 m of the forebay only). Pond design characteristics are summarized in Table 5, with detailed design calculations provided in Appendix C.

Table 5: SWM Facility B Design Characteristics

Parameter	Basin Characteristics
Total Contributing Area	53.1 ha
Total Contributing Area req. Quality Control (not incl. SWM Block)	28.5 ha
Total Percent Impervious	60%
Bottom Elevation of Forebay	315.90 m
Bottom Elevation of Wetland	317.10 m
Permanent Pool Elevation	317.40 m
Pond Top Elevation	319.50 m
High Water Level (100-year Storm Event)	319.20 m
Freeboard Provided Above High Water Level	0.30 m
Quality Control (Enhanced/Level 1)	
Unit Area Storage Requirement	110 m^3/ha
Permanent Pool Volume Required (70 m^3/ha)	1994 m^3
Permanent Pool Volume Provided in Wetland	2268 m^3
Permanent Pool Depth in Wetland	0.30 m
Extended Detention Volume Required (40 m^3/ha)	1140 m^3
Extended Detention Water Level	317.62m
Extended Detention Time	26 hrs
Forebay	
Length Required (for 5-year storm)	65 m
Length Provided	115 m
Maximum Sediment Accumulation Depth	0.5 m
Cleanout Frequency	25 yrs
Water Quality Outlet from Wetland	
Orifice 1 Diameter	275 mm
Orifice 1 Invert Elevation	317.50 m
Double Ditch-inlet Catchbasin (1200 x 600 mm) T/G Invert (4:1 Grate)	317.90 m
Orifice 2 Diameter	350 mm
Orifice 2 Invert Elevation	317.50 m
Overflow Spillway from Wetland	
Spillway Elevation	319.00 m
Spillway Bottom Width	6.5 m

The forebay length required to sufficiently attenuate the 5-year storm sewer inlet flows is 65 m and the length provided is 115 m. Detailed design calculations are provided in Appendix C. The depth of the forebay is 1.5 m and the design has accounted for the bottom 0.5 m to accumulate sediment, resulting in a clean out frequency of 25 years. The GRCA had previously requested that confirmation be provided regarding whether the forebay design would prevent settled sediment from being entrained into the main cell as a result of some overland flows being directed into the forebay rather than entirely into the main cell. Details were provided in an email from Stantec staff dated April 7, 2009 (Matt Ninomiya to John Brum) and computations were completed to determine whether the 10-year design storm would entrain sediment into the main cell. The depth of water in the forebay during a 10-year storm would be increased to 2.06 m (above the sediment storage). Similarly, the volume in the forebay would be increased,

so the computed dispersion length required to sufficiently attenuate the flows would be 46 m. Since the actual length is 115 m, sediment should remain in the forebay during the 10-year storm.

The permanent pool elevation of the pond is at 317.40 m; however, the first 0.10 m of the storage in the pond will be directed to an infiltration gallery via two ditch inlet catchbasins rather than outletting directly to the intermittent stream. Details are provided in Section 4.3.2. The outlet structure for the constructed wetland facility consists of a riser near the northeast limits of the facility. An orifice plate control, detailed in Table 5 and illustrated on Drawing SWM-B, will provide the required extended detention control. Flows from the 2-year storm event and greater will discharge via a double ditch inlet catchbasin and be controlled using an orifice plate. Flows from the 50-year event and greater will discharge via an overflow weir towards the intermittent stream. The weir is proposed to be 6.5 m in length at an invert of 319.00 m. The side slopes are at 12.5H:1V as the weir will serve as a trail connection. The weir is proposed to be lined with turfstone and the back slope, where weir flow will be directed, is proposed to be surface treated with erosion control matting, MacMat N10. The proposed outlet is in close proximity to the intermittent stream and therefore a spreader swale is not recommended at this location. Peak flow rates from the site draining to the SWMF are summarized in Table 6 with detailed modeling files included in Appendix B.

The boreholes in proximity to the SWMF are BH23 and BH34. Neither of these was monitored; however, groundwater levels were recorded at the time of the geotechnical investigation. The water level recorded in BH23 was at 312.25 m AMSL (November 2005) while the water level in the upper standpipe was as high as 313.02 m AMSL (November 2005). The bottom of the permanent pool is at an elevation of 317.10 m while the bottom of the forebay is at 315.90 m. The bottom of the infiltration gallery will be at 316.0 m and therefore should be well above the groundwater table. The Geotechnical Engineer will inspect the soils at the time of construction and recommend the thickness of clay liner if it is required.

A 4 m-wide maintenance access road has been provided for ease of inspection and maintenance of the forebay, inlet and outlet structures. The access road will be surfaced with asphalt, have a maximum longitudinal slope of 10:1 and will comprise a hammerhead-type turnaround in proximity to the outlet with a radius of at least 10 m. The elevation of the access road will vary from 325.28 m at the entrance from Manor Ridge Crescent to 319.5 m which is coincident with the top of the pond.

Table 6: SWM Facility B Operating Characteristics

	Storm Event						
	25 mm	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
Proposed peak flow to facility (m^3/s)	2.21	3.25	4.47	5.96	9.61	11.81	13.41
Proposed peak flow from facility (m^3/s)	0.07	0.15	0.27	0.35	0.44	0.88	1.51
Maximum Storage Volume (m^3)	3452	4655	7022	10820	15650	18780	21500
Maximum ponding depth (m)	0.44	0.55	0.75	1.06	1.41	1.62	1.80
Maximum ponding elevation (m)	317.84	317.95	318.15	318.46	318.81	319.02	319.20
Drawdown time (hours)	43	46	49	52	56	57	58

The proposed design of the SWMF adheres to the guidelines as presented in the *SWM Manual* (MOE, 2003) and provides the necessary water quality and quantity controls. The landscaping plans associated with the SWMF are show on Drawing L-2 with details on Drawing L-3 and are appended for reference.

4.2.8 Right-of-Way Capacity

The capacity of the right-of-ways to contain the 100-year flows was assessed at three locations using FlowMaster. An 18 m wide section was utilized and the largest 100-year flow along Manor Ridge Crescent, Spring Garden Drive and Deerfoot Trail was investigated. The 5-year flows were subtracted from the 100-year flows to account for conveyance through the storm sewer system. All analyzed locations would convey the 100-year flow without over topping the road and have depths less than 0.3 m. Details are provided in Appendix C.

4.2.9 Intermittent Stream Conditions

Tributary A to Horst Tributary intermittently flows in an easterly to southeasterly direction through the site and originates at the subterranean tile drain outlet just upstream of Woolwich Street. The tributary flows through some wetlands. This watercourse was identified as being a warmwater fishery in the Environmental Impact Study (Stantec, June 2008) and its value and quality as direct fish habitat were deemed to likely be marginal as a result of its intermittent nature. The proposed development will not encroach into the intermittent tributary. The following sections address the impacts on flows, volumes and temperatures subsequent to development on the site.

4.2.9.1 Quantity Control

The SWM criteria established for the site included controlling the 2-year through to 100-year post-development peak flow rates to existing conditions flow rates. As shown in Table 7, the proposed flow rates will be less than the existing conditions flow rates and flows will be maintained to the intermittent stream.

Table 7: Comparison of Existing Conditions and Post-Development Peak Flow Rates

Flow Rates for Each Rainfall Event	Point of Interest					
	Woolwich Street at Start of Intermittent Stream		Intermittent Stream Leaving Property		Total Flow Offsite	
	Existing	Post[1]	Existing	Post[1]	Existing	Post[1]
25 mm	0.35	0.34	0.51	0.49	0.86	0.55
2-year	0.60	0.59	0.87	0.83	1.48	0.94
5-year	1.17	1.14	1.70	1.69	2.92	1.92
10-year	1.74	1.17	2.54	1.92	4.34	2.26
25-year	2.48	1.17	3.64	2.66	6.23	3.04
50-year	3.08	1.17	4.53	3.78	7.75	4.27
100-year	3.68	1.17	5.43	5.09	9.30	5.75

[1]Assumes employment lands are developed

Flows from the three SWMFs (2 of which are part of the detailed design submission) will be directed to the intermittent stream. A spreader swale at the outlet of SWMF A is proposed to mimic the conveyance of flows under existing conditions and to disperse flows due to the distance from the watercourse being approximately 20 m. The outlet to SWMF B is adjacent to the watercourse and has been oriented to be as parallel to flows as possible. The outlet of the required SWMF on the employment lands will be directed through a storm sewer which will outlet to the intermittent stream.

4.2.4.2 Volume Control

While not a SWM control criteria, during the preliminary design stage, the GRCA requested additional information regarding the control of volumetric runoff to the intermittent stream. The design of the stormwater management facilities provide flow controls but will result in an increase volume to the intermittent stream however some volumetric control will be provided, particularly for the more frequent storm events, through the use of groundwater infiltration in soakaway pits and the infiltration gallery.

4.2.9.3 Temperature Mitigation

Temperature control was not established as a SWM control criteria; however, some mitigation will be provided as a result of infiltration on the site (passive as well as through soakaway pits and infiltration galleries) and the use of vegetation in the SWMFs. The spreader swale at SWMF A will likely contribute some additional infiltration and thermal mitigation benefits.

4.3 INFILTRATION ASSESSMENT

As stated previously, geotechnical work on the site has identified the subsurface stratigraphy of the site as generally comprising sand, sand and gravel, silt and glacial till. The *Hydrogeological and Geotechnical Study* (Naylor, February 2006) had indicated that the sand and sand and gravel soils were suitable for infiltration. A hydraulic conductivity ranging between 10^{-4} and 10^{-5} m/s was provided for these soils. The hydraulic conductivity for silt and glacial till deposits were estimated as ranging between 10^{-5} and 10^{-7} m/s with higher values located in the upper few meters of the till deposits in the unsaturated zones.

Subsequent to the preliminary SWM Design, additional groundwater levels obtained at various boreholes showed high groundwater table elevations west of the proposed Grey Silo Road. This has now resulted in making it more difficult to infiltrate at the multi-residential lots, employment lands and the street fronting townhouses without significantly raising the grades of the site. The infiltration approach was therefore revised and infiltration at the employment lands has not been included under proposed conditions due to the groundwater conditions. It is recommended that during the design of the employment lands, infiltration be considered and incorporated if suitable conditions exist.

An existing conditions water balance calculation was undertaken and the estimated yearly infiltration is approximately 204 mm/year. Under proposed conditions, passive infiltration would fall to approximately 70 mm/year and would require augmentation. To provide augmentation under proposed conditions, the following is proposed:

- Infiltrate roof runoff from 118 larger single-family residential lots, 9 of which are located in the northern portion of the site

- Infiltration of road and driveway runoff as well as roof runoff from multi residential development via an infiltration gallery located in SWMF B using 0.1 m of dead storage in the basin (providing 975 m^3) and a 200 m long infiltration gallery

Based on the calculations, the post-development water balance would result in a 9% deficit as shown in Appendix C. This deficit would likely be less than this for the following reasons:

- Post-development calculations do not include potential infiltration from the 28 smaller single-family lots and three larger single-family residential lots at the north end where silt soils are present. These were not accounted for since the lower range of the hydraulic conductivity for these soils is below the minimum MOE SWM Manual (2003) range of acceptable values. These would provide some infiltration

- Post-development calculations did not include any infiltration on the employment lands since the higher groundwater elevations recently recorded would suggest that infiltration would be difficult in this location. It is recommended that the potential for infiltration at this location be investigated once a preliminary design for these lands is undertaken

- Infiltration which may occur in the sand and gravel soils at the outlet of Basin A in the spreader swale were not accounted for

- Existing conditions calculations did not take into account the fact that a significant/major portion of the site infiltration is intercepted and conveyed in a tile drain system

Sizing of the soakaway pits was based on providing a sufficient volume to store the runoff from the larger single-family residential dwellings (assumed rooftop area of 230 m^2) as well as the smaller single-family dwellings (assumed rooftop area of 130 m^2). The resulting foot print for the soakaway pits for a single-family residential dwelling is 5.0 m in length by 3.0 m in width with a height of 1 m. The footprint for the soakaway pits for the smaller residential lots is a 3.4 m length and 2.5 m width with a height of 1 m. Details are provided in Appendix C.



MAY 2010
1603–10788

V:\01603\active\160310788\design\drawing\C3D\model_files\SWM Ponds\160310788_c-Infiltration Galleries.dwg
2010-05-11 02:03PM By: afigliomeni

ORIGINAL SHEET - A3

STANTEC CONSULTING LTD.

49 FREDERICK ST.
KITCHENER, ON CANADA
N2H 6M7

TEL. 519 579.4410
FAX. 519 579.6733

Legend

- SAND SOILS
- SAND & GRAVEL SOILS
- SILT & SILT TILL SOILS
- LOTS WITH SOAKAWAY PITS IN BOULEVARD

Notes

SHALLOW SOIL DISTRIBUTION
AS PER HYDROGEOLOGICAL AND GEOTECHNICAL STUDY
(NAYLOR ENGINEERING ASSOCIATED LTD., FEB 2006)

Client/Project
ACTIVA HOLDINGS INC.
CARRIAGE CROSSING SUBDIVISION
CITY OF WATERLOO

Figure No.
5.0

Title
SOAKAWAY PIT LOCATION

5.0 Erosion and Sediment Control Plan

In order to control erosion and transportation of sediment offsite, an Erosion and Sediment Control Plan will be required during the construction process. This plan will focus on the protection of the tributary to the Horst Tributary. Further details are provided in Pregrading, Sediment and Erosion Control Brief (Stantec Consulting Ltd., May 2010).

5.1 EROSION POTENTIAL IMPACT

The "Greater Golden Horseshoe Area Conservation Authorities' Erosion and Sediment Control Guideline for Urban Construction" (2006) was used to determine the erosion potential of the site. The erosion potential is based on slope gradient, slope length and soil texture and is then used to determine the appropriate erosion control methods.

Site slope gradients for the Rural East District development can be summarized as generally gentle (0 – 10%) with an average slope in the order of 1%. The slope lengths are considered long (greater than 30 m). Site soils are comprised primarily of sands and silts, which are considered to represent a low to medium erodibility potential. Thus, the overall erosion potential for the site is considered to be low to moderate.

5.2 EROSION AND SEDIMENT CONTROL PLAN

The following erosion and sediment control measures are proposed:

- Steep slopes (> 3:1) shall have erosion blankets
- Light and/or heavy duty silt fencing will be erected on all site boundaries where there is potential for runoff to be discharged offsite, to protect adjacent and downstream lands from migration of sediment in overland flow. The location of this fencing will be adjacent to the limit of grading
- Provide a construction entrance feature ("mud mat") at all site entrances to minimize the offsite transport of sediment via construction vehicles
- Construct a temporary sediment basin(s) with a minimum active storage volume of 125 m^3/ha contributing drainage area and a minimum length-to-width ratio of 4:1 and additional design considerations as per the *Erosion & Sediment Control Guideline for Urban Construction* (Greater Golden Horseshoe Area Conservation Authorities, 2006)
- Swales constructed on site will have temporary rock check dams to help attenuate flows and encourage deposition of suspended sediment where appropriate
- All disturbed areas where construction is not expected for 30 days shall be re-vegetated with 50 mm of topsoil and hydro-seeded according to OPSS 572

- Following site stabilization, all erosion and sediment control measures and accumulated sediment are to be removed

The erosion control measures shall be maintained in good repair during the entire construction period, and shall only be removed when directed by the engineer. In addition, the condition of erosion control works, their overall performance, and any repairs, replacement or modifications to the installed item shall be noted in monitoring reports submitted to the GRCA and to the City. Monitoring reports should be submitted monthly (quarterly, during periods of inactivity or house construction) and should be based on inspections completed bi-weekly or after any significant rainfall events (>13 mm), whichever is greater.

6.0 Monitoring, Maintenance, and Mitigation Program

Monitoring and maintenance activities are an important part of a SWM Plan to ensure that the designed features continue to operate as intended. The City of Waterloo Development Monitoring Protocol (City of Waterloo, 1999) identifies three stages of monitoring: pre-construction (Stage I), during-construction (Stage II) and post-construction (Stage III) analysis. The objectives of these stages are to establish baseline environmental conditions, monitor the effectiveness of the erosion and sedimentation control measures during construction and to evaluate the operation of the facilities, respectively.

6.1 STAGE I (PRE-CONSTRUCTION) MONITORING PROGRAM

As detailed in the *Activa Waterloo East Monitoring Report 2009* (Stantec, 2009) extensive sampling and monitoring has been completed for the subject lands. The study components included water quality, groundwater levels, terrestrial and benthic macroinvertebrate monitoring. The required 2-year pre-construction period is now considered complete. Detailed results and discussion of this study can be located in the above noted report.

6.2 STAGE II (DURING-CONSTRUCTION) MONITORING PROGRAM

Stage II or during-construction monitoring will ensure that the environmental controls being implemented are performing as anticipated and will continue until 90% of the subdivision is built-out and stabilized.

Water Quality and Quantity

The Stage II Monitoring Program will continue with the same scope and frequency of sampling and analysis as required during the Stage I monitoring.

After the construction of the SWMFs, monitoring of water quality and quantity will be completed at the following locations (at the same time that the Stage I monitoring stations are being monitored):

i) at the storm sewer inlet to the SWMFs or its pre-sedimentation facility

ii) at the outlet(s) from the SWMFs

General Inspection

The following inspections will be carried out during the construction period:

- The general condition of the discharge point from the SWMFs
- The stability of the SWMF embankment and the condition of plantings
- The performance and sedimentation of the temporary and permanent SWMFs

Groundwater

During the Stage II Groundwater Monitoring Program, it is expected that some of the monitoring wells will be removed during the grading and servicing operations on the site; however, monitoring will continue at the remaining wells with the same scope and frequency of sampling and analysis as undertaken during the Stage I monitoring.

Terrestrial and Biological

The Stage II terrestrial and biological monitoring will continue at the same locations and frequency as established during the Stage I monitoring.

6.3 STAGE III (POST-CONSTRUCTION) MONITORING

The Stage III monitoring period begins when 90% of the subdivision is built out and stabilized and concludes with the end of the two year maintenance period of the SWMFs. Stage III monitoring will focus largely on the maintenance and operation of the SWMFs. The monitoring program will include the following items:

- Monitor (photograph) vegetation health within and around the facilities annually to ensure that the landscaping is developing appropriately and weeds are controlled
- Inspection of inlet and outlet conditions, berm stability and erosion problems
- Observation of water level fluctuations and drawdown times
- Periodic sediment removal from the facility forebays as required (i.e., when sediment depth reaches 0.5 m)
- Removal of any trash accumulation from facility slopes and around structures
- Water quality grab samples obtained from all inlets and outlets to be analyzed for TSS, TP, DO and *E.coli*. In addition, flow and temperature measurements will be obtained coincidentally with each sampling session. These samples are in addition to those already

being obtained along the intermittent stream corridor as continued from the Stage II monitoring. Sampling is to occur monthly within 24 hours following a rain event

- An annual report will be submitted to the City of Waterloo and GRCA summarizing the monitoring results and will make appropriate recommendations for future monitoring if necessary

6.4 POST-CONSTRUCTION MAINTENANCE

Once the Post-Construction Monitoring Program is complete, the ownership and responsibility of monitoring and maintenance of the SWMF will be transferred to the City. Sediment accumulation should be monitored by City staff to confirm clean-out frequency and to ensure that sediment depths do not exceed design criteria.

6.5 REPORTING AND MITIGATION PROCEDURES

The Stage II and Stage III Monitoring Programs will incorporate reporting and mitigation measures in the event that unexpected circumstances occur. Bi-weekly erosion and sediment control reports based on the above monitoring programs will be submitted for review to the GRCA and the City.

It is anticipated that the monitoring program outlined above will be refined over time as information and knowledge of the operation of the facilities is increased. Any changes to the proposed monitoring would be made in consultation with the appropriate review agencies.

If the monitoring program outlined above indicates a persistent problem then the following process will be undertaken to determine appropriate mitigation measures:

1. Analyze the monitoring information and undertake field visits as required to determine the cause of the problem.

2. Develop a preliminary mitigation plan to address the issue.

3. Convene a meeting with the appropriate review agencies to discuss the problem.

4. Develop a consensus on a proposed plan of action to resolve the problem in consultation with agency staff.

5. Implement mitigation measures and monitor the results.

7.0 Conclusions and Recommendations

Based on the preceding report, the following conclusions can be drawn:

- *Enhanced* (Level 1) water quality control will be provided by two constructed wetland facilities. Adequate permanent pool and extended detention volumes will be provided to meet the MOE water quality requirements associated with constructed wetlands
- A future SWMF for minor storms is required in the employment lands to provide water quality control. Major storms for the employment lands will be directed to SWMF B via the roadway corridor. Details for the facility will be provided at the time of site plan submission.
- The proposed SWMFs will control post-development flows to existing conditions flow rates
- Infiltration measures are proposed on the site consisting of
    - Infiltration of roof runoff from 121 larger single-family residential lots and 28 smaller single-family residential lots through lot level soakaway pits located in the boulevard
    - Infiltration of road and driveway runoff as well as roof runoff from the multi residential development will be directed to into an infiltration gallery located in SWMF B
- High groundwater elevations particularly west of proposed Grey Silo Road have resulted in not including infiltration on the multi-residential lands, employment lands and street fronting townhouses
- The water balance post development conditions will result in a water balance deficit of 9%. This deficit would be lower since infiltration from the silt soils was not accounted for, nor was potential infiltration at the outlet of SWMF A

Based on the findings of the report, the following recommendations are provided:

- Active infiltration measures be implemented
- The proposed SWM monitoring and erosion and sediment control measures provided in this report be implemented for the proposed development

All of which is respectfully submitted;

STANTEC CONSULTING LTD.

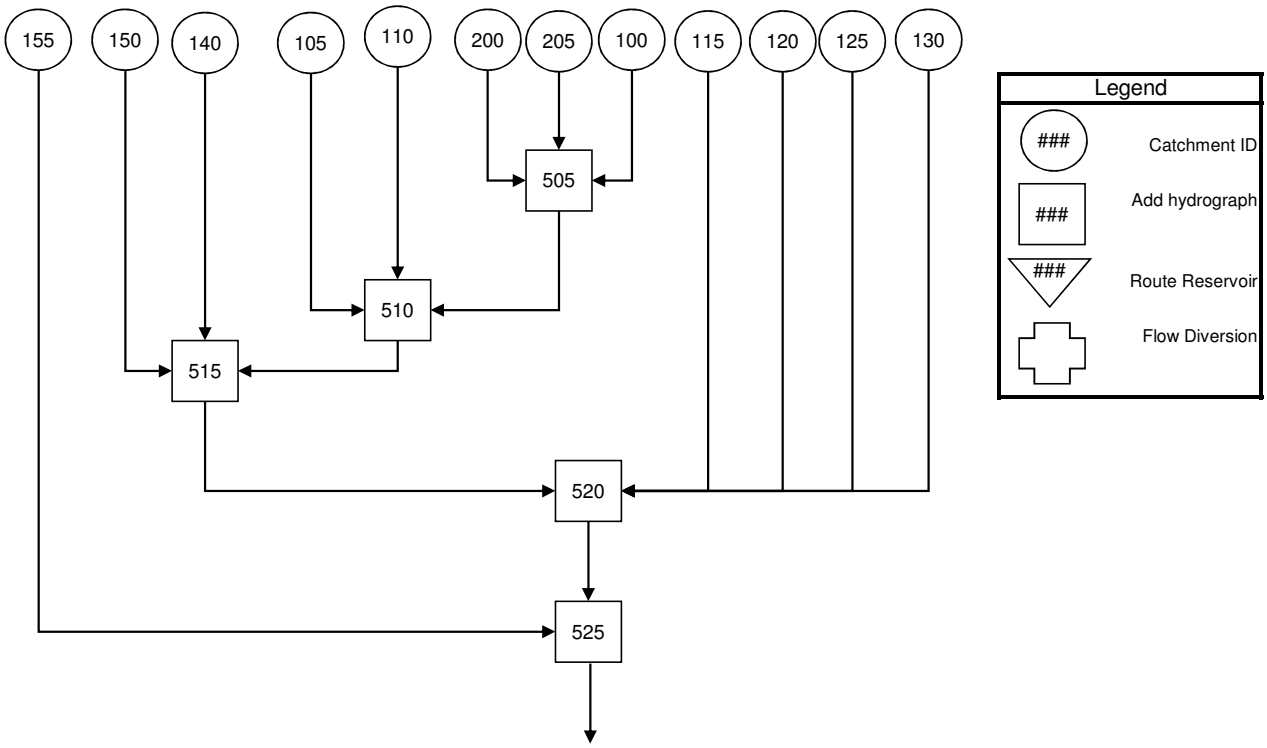


Melissa Ryan, M.Sc., P. Eng.
Water Resources Engineer

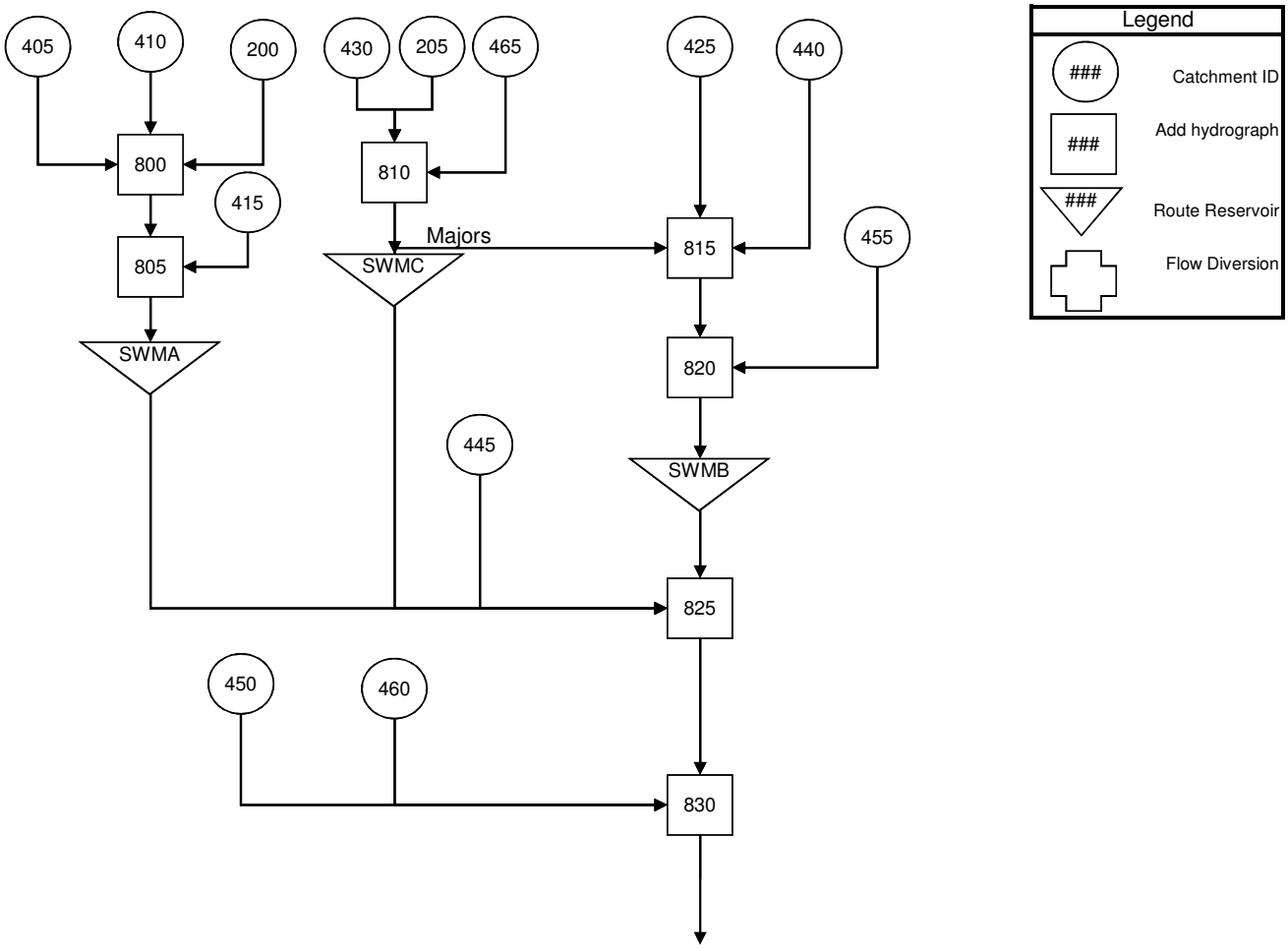
APPENDIX A

SWMHMO Modeling Schematics

1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo
Existing Conditions SWMHYMO Schematic



1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo
Proposed Conditions SWMHYMO Schematic



APPENDIX B

SWMHMO Files

```
00001> 2     Metric units
00002> *#**************************************************************************
00003> *#  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
00004> *#  Date        : 05-14 -2010
00005> *#  Modeller    : [original M.Ninomiya- revisions M.Ryan]
00006> *#  Company     : Stantec Consulting Ltd. (Kitchener)
00007> *#  License #   :  4730904
00008> *#
00009> *#  Existing Conditions Model for Waterloo East Lands
00010> *#  Soils data obtained from Hydrogeological and Geothechnical Study
00011> *#            Activa Waterloo East Lands (Naylor, 2006)
00012> *#  Re-run using City of Waterloo IDF Parameters
00013> *#            Final Design Submission
00014> *#**************************************************************************
00015> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
00016> *%                   ["Wat25mm.stm"] <--storm filename, one per line for NSTORM
00017> *%-----------------|-------------------------------------------------------|
00018> READ STORM          STORM_FILENAME=["Storm.001"]
00019> *%-----------------|-------------------------------------------------------|
00020> *# ========================================================
00021> *# Existing Drainage Area (EAST & FAR WEST)
00022> *# ========================================================
00023> *# Northeast area draining east
00024> DESIGN NASHYD       ID=[1], NHYD=["150"], DT=[1]min, AREA=[1.76](ha),
00025>                     DWF=[0](cms), CN/C=[78], TP=[0.415]hrs,
00026>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00027> *%-----------------|-------------------------------------------------------|
00028> *# Northeast area draining east (External to site)
00029> DESIGN NASHYD       ID=[2], NHYD=["155"], DT=[1]min, AREA=[6.22](ha),
00030>                     DWF=[0](cms), CN/C=[76], TP=[0.426]hrs,
00031>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00032> *%-----------------|-------------------------------------------------------|
00033> *# East Area draining south to creek
00034> DESIGN NASHYD       ID=[3], NHYD=["105"], DT=[1]min, AREA=[11.58](ha),
00035>                     DWF=[0](cms), CN/C=[71], TP=[0.387]hrs,
00036>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00037> *%-----------------|-------------------------------------------------------|
00038> *# Target flow for SWM Facility A
00039> ADD HYD             IDsum=[9], NHYD=["900"], IDs to add=[1+2+3]
00040> *%-----------------|-------------------------------------------------------|
00041> *# west woodlot area draining southwest
00042> DESIGN NASHYD       ID=[4], NHYD=["140"], DT=[1]min, AREA=[4.24](ha),
00043>                     DWF=[0](cms), CN/C=[67], TP=[0.733]hrs,
00044>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00045> *%-----------------|-------------------------------------------------------|
00046> *# ========================================================
00047> *# Existing Drainage Area (CENTRAL)
00048> *# ========================================================
00049> *# External Area Draining onto Property
00050> DESIGN NASHYD       ID=[5], NHYD=["200"], DT=[1]min, AREA=[9.49](ha),
00051>                     DWF=[0](cms), CN/C=[74], TP=[0.481]hrs,
00052>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00053> *%-----------------|-------------------------------------------------------|
00054> *# External Area Draining onto Property
00055> DESIGN NASHYD       ID=[6], NHYD=["205"], DT=[1]min, AREA=[4.90](ha),
00056>                     DWF=[0](cms), CN/C=[78], TP=[0.330]hrs,
00057>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00058> *%-----------------|-------------------------------------------------------|
00059> *# West area draining to tile drain location
00060> DESIGN NASHYD       ID=[7], NHYD=["100"], DT=[1]min, AREA=[23.62](ha),
00061>                     DWF=[0](cms), CN/C=[74], TP=[0.618]hrs,
00062>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00063> *%-----------------|-------------------------------------------------------|
00064> *# Total Flow to Point A
00065> ADD HYD             IDsum=[8], NHYD=["505"], IDs to add=[5+6+7]
00066> *%-----------------|-------------------------------------------------------|
00067> *# East Area draining north to creek
00068> DESIGN NASHYD       ID=[5], NHYD=["110"], DT=[1]min, AREA=[6.49](ha),
00069>                     DWF=[0](cms), CN/C=[66], TP=[0.537]hrs,
00070>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00071> *%-----------------|-------------------------------------------------------|
00072> *# Total Flow at Point B
00073> ADD HYD             IDsum=[7], NHYD=["510"], IDs to add=[3+8+5]
00074> *%-----------------|-------------------------------------------------------|
00075> *# Subtotal of total flow from site
00076> ADD HYD             IDsum=[3], NHYD=["515"], IDs to add=[1+4+7]
00077> *%-----------------|-------------------------------------------------------|
00078> *# Southeast area draining south
00079> DESIGN NASHYD       ID=[1], NHYD=["115"], DT=[1]min, AREA=[9.93](ha),
00080>                     DWF=[0](cms), CN/C=[70], TP=[0.378]hrs,
00081>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00082> *%-----------------|-------------------------------------------------------|
00083> *# Southeast area draining east
00084> DESIGN NASHYD       ID=[8], NHYD=["120"], DT=[1]min, AREA=[10.02](ha),
00085>                     DWF=[0](cms), CN/C=[64], TP=[0.261]hrs,
00086>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00087> *%-----------------|-------------------------------------------------------|
00088> *# west area draining east to area 115
00089> DESIGN NASHYD       ID=[4], NHYD=["125"], DT=[1]min, AREA=[2.19](ha),
00090>                     DWF=[0](cms), CN/C=[72], TP=[0.453]hrs,
00091>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00092> *%-----------------|-------------------------------------------------------|
00093> *# Southwest area draining south
00094> DESIGN NASHYD       ID=[7], NHYD=["130"], DT=[1]min, AREA=[3.33](ha),
00095>                     DWF=[0](cms), CN/C=[78], TP=[0.230]hrs,
00096>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00097> *%-----------------|-------------------------------------------------------|
00098> *#  Target flow for SWM Facility B
00099> ADD HYD             IDsum=[9], NHYD=["905"], IDs to add=[1+4+5+7]
00100> *%-----------------|-------------------------------------------------------|
00101> *#  Total flow from subject site w/o external area for future development
00102> ADD HYD             IDsum=[6], NHYD=["520"], IDs to add=[1+8+3+4+7]
00103> *%-----------------|-------------------------------------------------------|
00104> *#  Total flow from subject site and external area for future development
00105> ADD HYD             IDsum=[3], NHYD=["525"], IDs to add=[2+6]
00106> *%-----------------|-------------------------------------------------------|
00107>
00108> *# ========================================================
00109> *# PROPOSED
00110> *# ========================================================
00111> *# Single Family Residential Area (On-site) including park draining to SWM A
00112> DESIGN STANDHYD     ID=[2], NHYD=["405"], DT=[1]min, AREA=[9.19](ha),
00113>                     XIMP=[0.45], TIMP=[0.55], DWF=[0](cms),  LOSS=[2], CN=[74],
00114>                     SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00115> *%-----------------|-------------------------------------------------------|
00116> *# Single Family Residential Area (External)to SWM A
00117> DESIGN STANDHYD     ID=[3], NHYD=["410"], DT=[1]min, AREA=[6.22](ha),
00118>                     XIMP=[0.45], TIMP=[0.55], DWF=[0](cms),  LOSS=[2], CN=[73],
00119>                     SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00120> *%-----------------|-------------------------------------------------------|
00121> *# North East External Area- assumed remains agricultural
00122> DESIGN NASHYD       ID=[4], NHYD=["200"], DT=[1]min, AREA=[9.41](ha),
00123>                     DWF=[0](cms), CN/C=[74], TP=[0.481]hrs,
00124>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00125> *%-----------------|-------------------------------------------------------|
00126> *# Total Flow to inlet of SWM Facility A
00127> ADD HYD             IDsum=[5], NHYD=["800"], IDs to add=[2+3+4]
00128> *%-----------------|-------------------------------------------------------|
00129> *# SWM Blk A including a few rear yards
00130> DESIGN STANDHYD     ID=[1], NHYD=["415"], DT=[1]min, AREA=[1.74](ha),
00131>                     XIMP=[0.5], TIMP=[0.5], DWF=[0](cms),  LOSS=[2], CN=[66],
00132>                     SLOPE=[10](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00133> *%-----------------|-------------------------------------------------------|
00134> *# Total Flow contributing to SWMF A
00135> ADD HYD             IDsum=[2], NHYD=["805"], IDs to add=[5+1]
00136> *%-----------------|-------------------------------------------------------|
00137> ROUTE RESERVOIR     IDout=[1],   NHYD=["SWMA"],  IDin=[2],
00138>                     RDT=[1 ](min),
00139>                           TABLE of ( OUTFLOW-STORAGE ) values
00140>                                      (cms) - (ha-m)
00141>                                    [   0.0 ,  0.0 ]
00142>                                    [ 0.008, 0.0689]
00143>                                    [ 0.030, 0.1406]
00144>                                    [ 0.150, 0.4543]
00145>                                    [ 0.168, 0.5395]
00146>                                    [ 0.185, 0.6275]
00147>                                    [ 0.334, 0.7181]
00148>                                    [ 0.611, 0.8115]
00149>                                    [ 1.124, 0.9075]
00150>                                    [ 2.009, 1.0063]
00151>                                    [ 3.151, 1.1078]
00152>                                    [   -1  ,  -1  ]  (max twenty pts)
00153>                           IDovf=[ ], NHYDovf=[ ]
00154> *%-----------------|-------------------------------------------------------|
00155> *%-----------------|-------------------------------------------------------|
00156> *# Commercial/Employment area
00157> DESIGN STANDHYD     ID=[2], NHYD=["430"], DT=[1]min, AREA=[15.11](ha),
00158>                     XIMP=[0.80], TIMP=[0.90], DWF=[0](cms),  LOSS=[2], CN=[74],
00159>                     SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00160> *%-----------------|-------------------------------------------------------|
00161> *# north west External area - assumed remains agricultural
00162> DESIGN NASHYD       ID=[3], NHYD=["205"], DT=[1]min, AREA=[4.90](ha),
00163>                     DWF=[0](cms), CN/C=[78], TP=[0.330]hrs,
00164>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00165> *%-----------------|-------------------------------------------------------|
00166> *# External Area West of Commercial Lands
00167> DESIGN NASHYD       ID=[5], NHYD=["465"], DT=[1]min, AREA=[0.32](ha),
00168>                     DWF=[0](cms), CN/C=[69], TP=[0.258]hrs,
00169>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00170> *%-----------------|-------------------------------------------------------|
00171> *# Total Flow to Commercial SWM Facility
00172> ADD HYD             IDsum=[4], NHYD=["810"], IDs to add=[2+3+5]
00173> *%-----------------|-------------------------------------------------------|
00174> ROUTE RESERVOIR     IDout=[5],   NHYD=["SWMC"],  IDin=[4],
00175>                     RDT=[1 ](min),
00176>                           TABLE of ( OUTFLOW-STORAGE ) values
00177>                                      (cms) - (ha-m)
00178>                                    [   0.0 ,  0.0 ]
00179>                                    [ 0.348, 0.2100]
00180>                                    [ 0.573, 0.2650]
00181>                                    [ 1.165, 0.3800]
00182>                                    [   -1  ,  -1  ]  (max twenty pts)
00183>                           IDovf=[9], NHYDovf=["ComOVF"]
00184> *%-----------------|-------------------------------------------------------|
00185> *# Total Multi-residential area draining to SWMF B
00186> DESIGN STANDHYD     ID=[3], NHYD=["425"], DT=[1]min, AREA=[6.23](ha),
00187>                     XIMP=[0.65], TIMP=[0.75], DWF=[0](cms),  LOSS=[2], CN=[67],
00188>                     SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00189> *%-----------------|-------------------------------------------------------|
00190> *# Single Family Residential, park and commercial area draining to SWMF B
00191> DESIGN STANDHYD     ID=[6], NHYD=["440"], DT=[1]min, AREA=[19.31](ha),
00192>                     XIMP=[0.45], TIMP=[0.55], DWF=[0](cms),  LOSS=[2], CN=[66],
00193>                     SLOPE=[2](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00194> *%-----------------|-------------------------------------------------------|
00195> *# Total Flow to SWM Facility B (Inlet Flow)
00196> ADD HYD             IDsum=[7], NHYD=["815"], IDs to add=[3+6+9]
00197> *%-----------------|-------------------------------------------------------|
00198> *# SWMF B Block
00199> DESIGN STANDHYD     ID=[2], NHYD=["455"], DT=[1]min, AREA=[2.95](ha),
00200>                     XIMP=[0.50], TIMP=[0.50], DWF=[0](cms),  LOSS=[2], CN=[63],
00201>                     SLOPE=[10](%), RAINFALL=[ , , , , ](mm/hr), END=-1
00202> *%-----------------|-------------------------------------------------------|
00203> *# Total Flow to SWM Facility (includes SWM Block)
00204> ADD HYD             IDsum=[6], NHYD=["820"], IDs to add=[7+2]
00205> *%-----------------|-------------------------------------------------------|
00206> ROUTE RESERVOIR     IDout=[8],   NHYD=["SWMB"],  IDin=[6],
00207>                     RDT=[1 ](min),
00208>                           TABLE of ( OUTFLOW-STORAGE ) values
00209>                                      (cms) - (ha-m)
00210>                                    [   0.0 ,  0.0 ]
00211>                                    [ 0.011, 0.0975]
00212>                                    [ 0.039, 0.1986]
00213>                                    [ 0.064, 0.3034]
00214>                                    [ 0.081, 0.4117]
00215>                                    [ 0.229, 0.5237]
00216>                                    [ 0.422, 1.4084]
00217>                                    [ 0.460, 1.6937]
00218>                                    [ 1.507, 2.1486]
00219>                                    [ 2.361, 2.3075]
00220>                                    [   -1  ,  -1  ]  (max twenty pts)
00221>                           IDovf=[   ], NHYDovf=[   ]
00222> *%-----------------|-------------------------------------------------------|
00223> *# Open Space (Main Channel Area)
00224> DESIGN NASHYD       ID=[2], NHYD=["445"], DT=[1]min, AREA=[7.36](ha),
00225>                     DWF=[0](cms), CN/C=[56], TP=[0.298]hrs,
00226>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00227> *%-----------------|-------------------------------------------------------|
00228> *# Total Flow at Property Line in Channel
00229> ADD HYD             IDsum=[6], NHYD=["825"], IDs to add=[1+2+5+8]
00230> *%-----------------|-------------------------------------------------------|
00231> *# Open Space (South Woodlot)
00232> DESIGN NASHYD       ID=[1], NHYD=["450"], DT=[1]min, AREA=[6.27](ha),
00233>                     DWF=[0](cms), CN/C=[58], TP=[0.243]hrs,
00234>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00235> *%-----------------|-------------------------------------------------------|
00236> *# West Woodlot
00237> DESIGN NASHYD       ID=[3], NHYD=["460"], DT=[1]min, AREA=[4.24](ha),
00238>                     DWF=[0](cms), CN/C=[67], TP=[0.733]hrs,
00239>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00240> *%-----------------|-------------------------------------------------------|
00241> *# Total Flow from Subject Site
00242> ADD HYD             IDsum=[2], NHYD=["830"], IDs to add=[1+6+3]
00243> *%-----------------|-------------------------------------------------------|
00244>
00245>
00246> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
00247> *%                   ["wat2yr.stm"] <--storm filename, one per line for NSTORM t
00248> *%-----------------|-------------------------------------------------------|
00249> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
00250> *%                   ["wat5yr.stm"] <--storm filename, one per line for NSTORM t
00251> *%-----------------|-------------------------------------------------------|
00252> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
00253> *%                   ["rwat10.3hr"] <--storm filename, one per line for NSTORM t
00254> *%-----------------|-------------------------------------------------------|
00255> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
00256> *%                   ["rwat25.3hr"] <--storm filename, one per line for NSTORM t
00257> *%-----------------|-------------------------------------------------------|
00258> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
00259> *%                   ["rwat50.3hr"] <--storm filename, one per line for NSTORM t
00260> *%-----------------|-------------------------------------------------------|
00261> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
00262> *%                   ["rwat100.3hr"] <--storm filename, one per line for NSTORM
00263> *%-----------------|-------------------------------------------------------|
00264> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
00265> *%                   ["10mmCH.4hr"] <--storm filename, one per line for NSTORM
00266>
00267>
00268> FINISH
00269>
00270>
```

```
00001> ================================================================================
00002>
00003>  SSSSS  W    W  M    M  H    H  Y    Y  M    M   OOO        999    999  =========
00004>  S      W W W  MM MM  H    H   Y Y     MM MM  O   O      9   9  9   9
00005>  SSSSS  W W W  M M M  HHHHH    Y      M M M  O   O  ##  9   9  9   9 Ver. 4.02
00006>      S   W W   M    M  H    H    Y     M    M  O   O       9999   9999 July 1999
00007>  SSSSS   W W   M    M  H    H    Y     M    M   OOO           9      9 =========
00008>                                                            9   9  9   9 # 4730904
00009>       StormWater Management HYdrologic Model                999    999  =========
00010>
00011>  ********************************************************************************
00012>  ************************** SWMHYMO-99 Ver/4.02 ********************************
00013>  *******  A single event and continuous hydrologic simulation model  *******
00014>  *******     based on the principles of HYMO and its successors       *******
00015>  *******                  OTTHYMO-83 and OTTHYMO-89.                  *******
00016>  ********************************************************************************
00017>  ******* Distributed by:  J.F. Sabourin and Associates Inc.           *******
00018>  *******                  Ottawa,  Ontario: (613) 727-5199           *******
00019>  *******                  Gatineau, Quebec: (819) 243-6858           *******
00020>  *******                  E-Mail: swmhymo@jfsa.Com                   *******
00021>  ********************************************************************************
00022>
00023>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++
00025>  +++++++                Kitchener             SERIAL#:4730904       +++++++
00026>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ********************************************************************************
00029>  *******           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *******
00030>  *******           Maximum value for ID numbers  :     10            *******
00031>  *******           Max. number of rainfall points:  15000            *******
00032>  *******           Max. number of flow points    :  15000            *******
00033>  ********************************************************************************
00034>
00035>  *** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
00036>  ***-------------------------------------------------------------------------***
00037>  ***    ID:  Hydrograph IDentification numbers, (1-10).                  ***
00038>  ***  NHYD:  Hydrograph reference numbers, (6 digits or characters).     ***
00039>  ***  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).   ***
00040>  *** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).     ***
00041>  *** TpeakDate_hh:mm is the date and time of the peak flow.              ***
00042>  ***  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       ***
00043>  ***  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       ***
00044>  ***    *:  see WARNING or NOTE message printed at end of run.          ***
00045>  ***   **:  see  ERROR  message printed at end of run.                  ***
00046>  ********************************************************************************
00047>  ********************************************************************************
00048>
00049> ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
00050>
00051>  ********************************************************************************
00052>
00053>  *********************   S U M M A R Y   O U T P U T   *********************
00054>  ********************************************************************************
00055>  *       DATE: 2010-05-15     TIME: 16:02:08     RUN COUNTER: 000147       *
00056>  ********************************************************************************
00057>  * Input   filename: C:\MELISSA\FILES\SWMHYMO\WatEast\10788_05.dat          *
00058>  * Output  filename: C:\MELISSA\FILES\SWMHYMO\WatEast\10788_05.out          *
00059>  * Summary filename: C:\MELISSA\FILES\SWMHYMO\WatEast\10788_05.sum          *
00060>  * User comments:                                                          *
00061>  * 1:_____________________________________________________________________*
00062>  * 2:_____________________________________________________________________*
00063>  * 3:_____________________________________________________________________*
00064>  ********************************************************************************
00065>
00066>
00067> #*******************************************************************************
00068> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
00069> #  Date       : 05-14 -2010
00070> #  Modeller   : [original M.Ninomiya- revisions M.Ryan]
00071> #  Company    : Stantec Consulting Ltd. (Kitchener)
00072> #  License #  :  4730904
00073> #
00074> #  Existing Conditions Model for Waterloo East Lands
00075> #  Soils data obtained from Hydrogeological and Geothechnical Study
00076> #            Activa Waterloo East Lands (Naylor, 2006)
00077> #  Re-run using City of Waterloo IDF Parameters
00078> #            Final Design Submission
00079> #
00080> #*******************************************************************************
00081>  RUN:COMMAND#
00082>  001:0001-------------------------------------------------------------------
00083>      START
00084>       [TZERO =    .00 hrs on        0]
00085>       [METOUT=   2    (1=imperial, 2=metric output)]
00086>       [NSTORM=   1 ]
00087>       [NRUN  =   1 ]
00088>  001:0002-------------------------------------------------------------------
00089>      READ STORM
00090>       Filename = Storm.001
00091>       Comment  = CHICAGO STORM - 25 mm Event (4hr), City of Waterloo IDF Data
00092>       [SDT= 5.00:SDUR=   4.00:PTOT=  24.99]
00093> # ========================================================
00094> # Existing Drainage Area (EAST & FAR WEST)
00095> # ========================================================
00096> # Northeast area draining east
00097>  001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00098>      DESIGN NASHYD      01:150        1.76     .023 No_date    2:06    5.80 .232
00099>       [CN= 78.0: N= 3.00]
00100>       [Tp=  .41:DT= 1.00]
00101> # Northeast area draining east (External to site)
00102>  001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00103>      DESIGN NASHYD      02:155        6.22     .074 No_date    2:07    5.32 .213
00104>       [CN= 76.0: N= 3.00]
00105>       [Tp=  .43:DT= 1.00]
00106> # East Area draining south to creek
00107>  001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00108>      DESIGN NASHYD      03:105       11.58     .119 No_date    2:05    4.34 .174
00109>       [CN= 71.0: N= 3.00]
00110>       [Tp=  .39:DT= 1.00]
00111> # Target flow for SWM Facility A
00112>  001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00113>      ADD HYD            01:150        1.76     .023 No_date    2:06    5.80  n/a
00114>                       + 02:155        6.22     .074 No_date    2:07    5.32  n/a
00115>                       + 03:105       11.58     .119 No_date    2:05    4.34  n/a
00116>       [DT= 1.00]  SUM=  09:900       19.56     .216 No_date    2:06    4.78  n/a
00117> # west woodlot area draining southwest
00118>  001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00119>      DESIGN NASHYD      04:140        4.24     .023 No_date    2:31    3.71 .149
00120>       [CN= 67.0: N= 3.00]
00121>       [Tp=  .73:DT= 1.00]
00122> # ========================================================
00123> # Existing Drainage Area (CENTRAL)
00124> # ========================================================
00125> # External Area Draining onto Property
00126>  001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00127>      DESIGN NASHYD      05:200        9.49     .095 No_date    2:12    4.89 .196
00128>       [CN= 74.0: N= 3.00]
00129>       [Tp=  .48:DT= 1.00]
00130> # External Area Draining onto Property
00131>  001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00132>      DESIGN NASHYD      06:205        4.90     .076 No_date    2:00    5.80 .232
00133>       [CN= 78.0: N= 3.00]
00134>       [Tp=  .33:DT= 1.00]
00135> # West area draining to tile drain location
00136>  001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00137>      DESIGN NASHYD      07:100       23.62     .197 No_date    2:22    4.89 .196
00138>       [CN= 74.0: N= 3.00]
00139>       [Tp=  .62:DT= 1.00]
00140> # Total Flow to Point A
00141>  001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00142>      ADD HYD            05:200        9.49     .095 No_date    2:12    4.89  n/a
00143>                       + 06:205        4.90     .076 No_date    2:00    5.80  n/a
00144>                       + 07:100       23.62     .197 No_date    2:22    4.89  n/a
00145>       [DT= 1.00]  SUM=  08:505       38.01     .348 No_date    2:14    5.01  n/a
00146> # East Area draining north to creek
00147>  001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00148>      DESIGN NASHYD      05:110        6.49     .043 No_date    2:16    3.57 .143
00149>       [CN= 66.0: N= 3.00]
00150>       [Tp=  .54:DT= 1.00]
00151> # Total Flow at Point B
00152>  001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00153>      ADD HYD            03:105       11.58     .119 No_date    2:05    4.34  n/a
00154>                       + 08:505       38.01     .348 No_date    2:14    5.01  n/a
00155>                       + 05:110        6.49     .043 No_date    2:16    3.57  n/a
00156>       [DT= 1.00]  SUM=  07:510       56.08     .505 No_date    2:11    4.71  n/a
00157> # Subtotal of total flow from site
00158>  001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00159>      ADD HYD            01:150        1.76     .023 No_date    2:06    5.80  n/a
00160>                       + 04:140        4.24     .023 No_date    2:31    3.71  n/a
00161>                       + 07:510       56.08     .505 No_date    2:11    4.71  n/a
00162>       [DT= 1.00]  SUM=  03:515       62.08     .547 No_date    2:11    4.67  n/a
00163> # Southeast area draining south
00164>  001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00165>      DESIGN NASHYD      01:115        9.93     .099 No_date    2:04    4.17 .167
00166>       [CN= 70.0: N= 3.00]
00167>       [Tp=  .38:DT= 1.00]
00168> # Southeast area draining east
00169>  001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00170>      DESIGN NASHYD      08:120       10.02     .101 No_date    1:55    3.32 .133
00171>       [CN= 64.0: N= 3.00]
00172>       [Tp=  .26:DT= 1.00]
00173> # west area draining east to area 115
00174>  001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00175>      DESIGN NASHYD      04:125        2.19     .021 No_date    2:10    4.51 .181
00176>       [CN= 72.0: N= 3.00]
00177>       [Tp=  .45:DT= 1.00]
00178> # Southwest area draining south
00179>  001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00180>      DESIGN NASHYD      07:130        3.33     .065 No_date    1:52    5.80 .232
00181>       [CN= 78.0: N= 3.00]
00182>       [Tp=  .23:DT= 1.00]
00183> #  Target flow for SWM Facility B
00184>  001:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00185>      ADD HYD            01:115        9.93     .099 No_date    2:04    4.17  n/a
00186>                       + 04:125        2.19     .021 No_date    2:10    4.51  n/a
00187>                       + 05:110        6.49     .043 No_date    2:16    3.57  n/a
00188>                       + 07:130        3.33     .065 No_date    1:52    5.80  n/a
00189>       [DT= 1.00]  SUM=  09:905       21.94     .211 No_date    2:02    4.27  n/a
00190> #  Total flow from subject site w/o external area for future development
00191>  001:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00192>      ADD HYD            01:115        9.93     .099 No_date    2:04    4.17  n/a
00193>                       + 08:120       10.02     .101 No_date    1:55    3.32  n/a
00194>                       + 03:515       62.08     .547 No_date    2:11    4.67  n/a
00195>                       + 04:125        2.19     .021 No_date    2:10    4.51  n/a
00196>                       + 07:130        3.33     .065 No_date    1:52    5.80  n/a
00197>       [DT= 1.00]  SUM=  06:520       87.55     .789 No_date    2:06    4.50  n/a
00198> #  Total flow from subject site and external area for future development
00199>  001:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00200>      ADD HYD            02:155        6.22     .074 No_date    2:07    5.32  n/a
00201>                       + 06:520       87.55     .789 No_date    2:06    4.50  n/a
00202>       [DT= 1.00]  SUM=  03:525       93.77     .863 No_date    2:06    4.55  n/a
00203> # ========================================================
00204> # PROPOSED
00205> # ========================================================
00206> # Single Family Residential Area (On-site) including park draining to SWM A
00207>  001:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00208>      DESIGN STANDHYD    02:405        9.19     .689 No_date    1:37   14.09 .564
00209>       [XIMP=.45:TIMP=.55]
00210>       [SLP=2.00:DT= 1.00]
00211>       [LOSS= 2 :CN= 74.0]
00212> # Single Family Residential Area (External)to SWM A
00213>  001:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00214>      DESIGN STANDHYD    03:410        6.22     .480 No_date    1:37   13.97 .559
00215>       [XIMP=.45:TIMP=.55]
00216>       [SLP=2.00:DT= 1.00]
00217>       [LOSS= 2 :CN= 73.0]
00218> # North East External Area- assumed remains agricultural
00219>  001:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00220>      DESIGN NASHYD      04:200        9.41     .094 No_date    2:12    4.89 .196
00221>       [CN= 74.0: N= 3.00]
00222>       [Tp=  .48:DT= 1.00]
00223> # Total Flow to inlet of SWM Facility A
00224>  001:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00225>      ADD HYD            02:405        9.19     .689 No_date    1:37   14.09  n/a
00226>                       + 03:410        6.22     .480 No_date    1:37   13.97  n/a
00227>                       + 04:200        9.41     .094 No_date    2:12    4.89  n/a
00228>       [DT= 1.00]  SUM=  05:800       24.82    1.180 No_date    1:37   10.57  n/a
00229> # SWM Blk A including a few rear yards
00230>  001:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00231>      DESIGN STANDHYD    01:415        1.74     .187 No_date    1:35   13.88 .556
00232>       [XIMP=.50:TIMP=.50]
00233>       [SLP=****:DT= 1.00]
00234>       [LOSS= 2 :CN= 66.0]
00235> # Total Flow contributing to SWMF A
00236>  001:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00237>      ADD HYD            05:800       24.82    1.180 No_date    1:37   10.57  n/a
00238>                       + 01:415        1.74     .187 No_date    1:35   13.88  n/a
00239>       [DT= 1.00]  SUM=  02:805       26.56    1.305 No_date    1:36   10.79  n/a
00240>  001:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00241>      ROUTE RESERVOIR -> 02:805       26.56    1.305 No_date    1:36   10.79  n/a
00242>       [RDT= 1.00] out<- 01:SWMA      26.56     .066 No_date    3:34   10.79  n/a
00243>      {MxStoUsed=.2340E+00}
00244> # Commercial/Employment area
00245>  001:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00246>      DESIGN STANDHYD    02:430       15.11    1.876 No_date    1:38   21.06 .843
00247>       [XIMP=.80:TIMP=.90]
00248>       [SLP=2.00:DT= 1.00]
00249>       [LOSS= 2 :CN= 74.0]
00250> # north west External area - assumed remains agricultural
00251>  001:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00252>      DESIGN NASHYD      03:205        4.90     .076 No_date    2:00    5.80 .232
00253>       [CN= 78.0: N= 3.00]
00254>       [Tp=  .33:DT= 1.00]
00255> # External Area West of Commercial Lands
00256>  001:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00257>      DESIGN NASHYD      05:465         .32     .004 No_date    1:55    4.01 .160
00258>       [CN= 69.0: N= 3.00]
00259>       [Tp=  .26:DT= 1.00]
00260> # Total Flow to Commercial SWM Facility
00261>  001:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00262>      ADD HYD            02:430       15.11    1.876 No_date    1:38   21.06  n/a
00263>                       + 03:205        4.90     .076 No_date    2:00    5.80  n/a
00264>                       + 05:465         .32     .004 No_date    1:55    4.01  n/a
00265>       [DT= 1.00]  SUM=  04:810       20.33    1.897 No_date    1:38   17.11  n/a
00266>  001:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00267>      ROUTE RESERVOIR -> 04:810       20.33    1.897 No_date    1:38   17.11  n/a
00268>       [RDT= 1.00] out<- 05:SWMC      20.33     .338 No_date    2:08   17.11  n/a
00269>             overflow <= 09:ComOVF      .00     .000 No_date    0:00     .00  n/a
00270>      {MxStoUsed=.2039E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
```

```
00271> # Total Multi-residential area draining to SWMF B
00272>  001:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00273>      DESIGN STANDHYD    03:425        6.23     .686 No_date    1:37   17.49 .700
00274>       [XIMP=.65:TIMP=.75]
00275>       [SLP=2.00:DT= 1.00]
00276>       [LOSS= 2 :CN= 67.0]
00277> # Single Family Residential, park and commercial area draining to SWMF B
00278>  001:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00279>      DESIGN STANDHYD     06:440       19.31    1.318 No_date    1:38   13.26 .531
00280>       [XIMP=.45:TIMP=.55]
00281>       [SLP=2.00:DT= 1.00]
00282>       [LOSS= 2 :CN= 66.0]
00283> # Total Flow to SWM Facility B (Inlet Flow)
00284>  001:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00285>      ADD HYD            03:425        6.23     .686 No_date    1:37   17.49  n/a
00286>                       +  06:440       19.31    1.318 No_date    1:38   13.26  n/a
00287>                       +  09:ComOVF      .00     .000 No_date    0:00     .00  n/a
00288>       [DT= 1.00]  SUM=  07:815       25.54    1.987 No_date    1:37   14.29  n/a
00289> # SWMF B Block
00290>  001:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00291>      DESIGN STANDHYD    02:455        2.95     .306 No_date    1:35   13.69 .548
00292>       [XIMP=.50:TIMP=.50]
00293>       [SLP=****:DT= 1.00]
00294>       [LOSS= 2 :CN= 63.0]
00295> # Total Flow to SWM Facility (includes SWM Block)
00296>  001:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00297>      ADD HYD            07:815       25.54    1.987 No_date    1:37   14.29  n/a
00298>                       +  02:455        2.95     .306 No_date    1:35   13.69  n/a
00299>       [DT= 1.00]  SUM=  06:820       28.49    2.213 No_date    1:37   14.23  n/a
00300>  001:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00301>      ROUTE RESERVOIR -> 06:820       28.49    2.213 No_date    1:37   14.23  n/a
00302>       [RDT= 1.00] out<- 08:SWMB      28.49     .071 No_date    3:36   14.23  n/a
00303>       {MxStoUsed=.3452E+00}
00304> # Open Space (Main Channel Area)
00305>  001:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00306>      DESIGN NASHYD      02:445        7.36     .050 No_date    1:58    2.47 .099
00307>       [CN= 56.0: N= 3.00]
00308>       [Tp=  .30:DT= 1.00]
00309> # Total Flow at Property Line in Channel
00310>  001:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00311>      ADD HYD            01:SWMA       26.56     .066 No_date    3:34   10.79  n/a
00312>                       +  02:445        7.36     .050 No_date    1:58    2.47  n/a
00313>                       +  05:SWMC      20.33     .338 No_date    2:08   17.11  n/a
00314>                       +  08:SWMB      28.49     .071 No_date    3:36   14.23  n/a
00315>       [DT= 1.00]  SUM=  06:825       82.74     .492 No_date    2:09   12.79  n/a
00316> # Open Space (South Woodlot)
00317>  001:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00318>      DESIGN NASHYD      01:450        6.27     .053 No_date    1:54    2.66 .106
00319>       [CN= 58.0: N= 3.00]
00320>       [Tp=  .24:DT= 1.00]
00321> # West Woodlot
00322>  001:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00323>      DESIGN NASHYD      03:460        4.24     .023 No_date    2:31    3.71 .149
00324>       [CN= 67.0: N= 3.00]
00325>       [Tp=  .73:DT= 1.00]
00326> # Total Flow from Subject Site
00327>  001:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00328>      ADD HYD            01:450        6.27     .053 No_date    1:54    2.66  n/a
00329>                       +  06:825       82.74     .492 No_date    2:09   12.79  n/a
00330>                       +  03:460        4.24     .023 No_date    2:31    3.71  n/a
00331>       [DT= 1.00]  SUM=  02:830       93.25     .550 No_date    2:06   11.69  n/a
00332>   ** END OF RUN :   1
00333>
00334> ****************************************************************************
00335>
00336>
00337>
00338>
00339>
00340>  RUN:COMMAND#
00341>  002:0001---------------------------------------------------------------------
00342>      START
00343>       [TZERO =    .00 hrs on        0]
00344>       [METOUT=   2    (1=imperial, 2=metric output)]
00345>       [NSTORM=   1 ]
00346>       [NRUN  =   2 ]
00347> #****************************************************************************
00348> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
00349> #  Date        : 05-14 -2010
00350> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
00351> #  Company     : Stantec Consulting Ltd. (Kitchener)
00352> #  License #   :  4730904
00353> #
00354> #  Existing Conditions Model for Waterloo East Lands
00355> #  Soils data obtained from Hydrogeological and Geothechnical Study
00356> #            Activa Waterloo East Lands (Naylor, 2006)
00357> #  Re-run using City of Waterloo IDF Parameters
00358> #            Final Design Submission
00359> #
00360> #****************************************************************************
00361>  002:0002---------------------------------------------------------------------
00362>      READ STORM
00363>       Filename = Storm.001
00364>       Comment  = CHICAGO STORM - 2 Year Event, City of Waterloo IDF Data
00365>       [SDT= 5.00:SDUR=   3.00:PTOT=  32.39]
00366> # ========================================================
00367> # Existing Drainage Area (EAST & FAR WEST)
00368> # ========================================================
00369> # Northeast area draining east
00370>  002:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00371>      DESIGN NASHYD      01:150        1.76     .039 No_date    1:41    9.31 .287
00372>       [CN= 78.0: N= 3.00]
00373>       [Tp=  .41:DT= 1.00]
00374> # Northeast area draining east (External to site)
00375>  002:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00376>      DESIGN NASHYD      02:155        6.22     .126 No_date    1:42    8.59 .265
00377>       [CN= 76.0: N= 3.00]
00378>       [Tp=  .43:DT= 1.00]
00379> # East Area draining south to creek
00380>  002:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00381>      DESIGN NASHYD      03:105       11.58     .205 No_date    1:39    7.09 .219
00382>       [CN= 71.0: N= 3.00]
00383>       [Tp=  .39:DT= 1.00]
00384> # Target flow for SWM Facility A
00385>  002:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00386>      ADD HYD            01:150        1.76     .039 No_date    1:41    9.31  n/a
00387>                       +  02:155        6.22     .126 No_date    1:42    8.59  n/a
00388>                       +  03:105       11.58     .205 No_date    1:39    7.09  n/a
00389>       [DT= 1.00]  SUM=  09:900       19.56     .370 No_date    1:40    7.76  n/a
00390> # west woodlot area draining southwest
00391>  002:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00392>      DESIGN NASHYD      04:140        4.24     .041 No_date    2:06    6.12 .189
00393>       [CN= 67.0: N= 3.00]
00394>       [Tp=  .73:DT= 1.00]
00395> # ========================================================
00396> # Existing Drainage Area (CENTRAL)
00397> # ========================================================
00398> # External Area Draining onto Property
00399>  002:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00400>      DESIGN NASHYD      05:200        9.49     .163 No_date    1:46    7.94 .245
00401>       [CN= 74.0: N= 3.00]
00402>       [Tp=  .48:DT= 1.00]
00403> # External Area Draining onto Property
00404>  002:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00405>      DESIGN NASHYD      06:205        4.90     .129 No_date    1:35    9.31 .287
00406>       [CN= 78.0: N= 3.00]
00407>       [Tp=  .33:DT= 1.00]
00408> # West area draining to tile drain location
00409>  002:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00410>      DESIGN NASHYD      07:100       23.62     .337 No_date    1:57    7.94 .245
00411>       [CN= 74.0: N= 3.00]
00412>       [Tp=  .62:DT= 1.00]
00413> # Total Flow to Point A
00414>  002:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00415>      ADD HYD            05:200        9.49     .163 No_date    1:46    7.94  n/a
00416>                       +  06:205        4.90     .129 No_date    1:35    9.31  n/a
00417>                       +  07:100       23.62     .337 No_date    1:57    7.94  n/a
00418>       [DT= 1.00]  SUM=  08:505       38.01     .595 No_date    1:48    8.12  n/a
00419> # East Area draining north to creek
00420>  002:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00421>      DESIGN NASHYD      05:110        6.49     .076 No_date    1:51    5.90 .182
00422>       [CN= 66.0: N= 3.00]
00423>       [Tp=  .54:DT= 1.00]
00424> # Total Flow at Point B
00425>  002:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00426>      ADD HYD            03:105       11.58     .205 No_date    1:39    7.09  n/a
00427>                       +  08:505       38.01     .595 No_date    1:48    8.12  n/a
00428>                       +  05:110        6.49     .076 No_date    1:51    5.90  n/a
00429>       [DT= 1.00]  SUM=  07:510       56.08     .866 No_date    1:46    7.65  n/a
00430> # Subtotal of total flow from site
00431>  002:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00432>      ADD HYD            01:150        1.76     .039 No_date    1:41    9.31  n/a
00433>                       +  04:140        4.24     .041 No_date    2:06    6.12  n/a
00434>                       +  07:510       56.08     .866 No_date    1:46    7.65  n/a
00435>       [DT= 1.00]  SUM=  03:515       62.08     .939 No_date    1:46    7.59  n/a
00436> # Southeast area draining south
00437>  002:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00438>      DESIGN NASHYD      01:115        9.93     .172 No_date    1:39    6.83 .211
00439>       [CN= 70.0: N= 3.00]
00440>       [Tp=  .38:DT= 1.00]
00441> # Southeast area draining east
00442>  002:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00443>      DESIGN NASHYD      08:120       10.02     .177 No_date    1:30    5.49 .170
00444>       [CN= 64.0: N= 3.00]
00445>       [Tp=  .26:DT= 1.00]
00446> # west area draining east to area 115
00447>  002:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00448>      DESIGN NASHYD      04:125        2.19     .036 No_date    1:44    7.36 .227
00449>       [CN= 72.0: N= 3.00]
00450>       [Tp=  .45:DT= 1.00]
00451> # Southwest area draining south
00452>  002:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00453>      DESIGN NASHYD      07:130        3.33     .110 No_date    1:27    9.31 .287
00454>       [CN= 78.0: N= 3.00]
00455>       [Tp=  .23:DT= 1.00]
00456> #  Target flow for SWM Facility B
00457>  002:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00458>      ADD HYD            01:115        9.93     .172 No_date    1:39    6.83  n/a
00459>                       +  04:125        2.19     .036 No_date    1:44    7.36  n/a
00460>                       +  05:110        6.49     .076 No_date    1:51    5.90  n/a
00461>                       +  07:130        3.33     .110 No_date    1:27    9.31  n/a
00462>       [DT= 1.00]  SUM=  09:905       21.94     .364 No_date    1:37    6.98  n/a
00463> #  Total flow from subject site w/o external area for future development
00464>  002:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00465>      ADD HYD            01:115        9.93     .172 No_date    1:39    6.83  n/a
00466>                       +  08:120       10.02     .177 No_date    1:30    5.49  n/a
00467>                       +  03:515       62.08     .939 No_date    1:46    7.59  n/a
00468>                       +  04:125        2.19     .036 No_date    1:44    7.36  n/a
00469>                       +  07:130        3.33     .110 No_date    1:27    9.31  n/a
00470>       [DT= 1.00]  SUM=  06:520       87.55    1.358 No_date    1:41    7.32  n/a
00471> #  Total flow from subject site and external area for future development
00472>  002:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00473>      ADD HYD            02:155        6.22     .126 No_date    1:42    8.59  n/a
00474>                       +  06:520       87.55    1.358 No_date    1:41    7.32  n/a
00475>       [DT= 1.00]  SUM=  03:525       93.77    1.483 No_date    1:41    7.41  n/a
00476> # ========================================================
00477> # PROPOSED
00478> # ========================================================
00479> # Single Family Residential Area (On-site) including park draining to SWM A
00480>  002:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00481>      DESIGN STANDHYD    02:405        9.19    1.005 No_date    1:11   19.34 .597
00482>       [XIMP=.45:TIMP=.55]
00483>       [SLP=2.00:DT= 1.00]
00484>       [LOSS= 2 :CN= 74.0]
00485> # Single Family Residential Area (External)to SWM A
00486>  002:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00487>      DESIGN STANDHYD    03:410        6.22     .700 No_date    1:11   19.16 .592
00488>       [XIMP=.45:TIMP=.55]
00489>       [SLP=2.00:DT= 1.00]
00490>       [LOSS= 2 :CN= 73.0]
00491> # North East External Area- assumed remains agricultural
00492>  002:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00493>      DESIGN NASHYD      04:200        9.41     .161 No_date    1:46    7.94 .245
00494>       [CN= 74.0: N= 3.00]
00495>       [Tp=  .48:DT= 1.00]
00496> # Total Flow to inlet of SWM Facility A
00497>  002:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00498>      ADD HYD            02:405        9.19    1.005 No_date    1:11   19.34  n/a
00499>                       +  03:410        6.22     .700 No_date    1:11   19.16  n/a
00500>                       +  04:200        9.41     .161 No_date    1:46    7.94  n/a
00501>       [DT= 1.00]  SUM=  05:800       24.82    1.720 No_date    1:11   14.98  n/a
00502> # SWM Blk A including a few rear yards
00503>  002:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00504>      DESIGN STANDHYD    01:415        1.74     .258 No_date    1:10   18.75 .579
00505>       [XIMP=.50:TIMP=.50]
00506>       [SLP=****:DT= 1.00]
00507>       [LOSS= 2 :CN= 66.0]
00508> # Total Flow contributing to SWMF A
00509>  002:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00510>      ADD HYD            05:800       24.82    1.720 No_date    1:11   14.98  n/a
00511>                       +  01:415        1.74     .258 No_date    1:10   18.75  n/a
00512>       [DT= 1.00]  SUM=  02:805       26.56    1.927 No_date    1:10   15.22  n/a
00513>  002:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00514>      ROUTE RESERVOIR -> 02:805       26.56    1.927 No_date    1:10   15.22  n/a
00515>       [RDT= 1.00] out<- 01:SWMA      26.56     .105 No_date    3:01   15.22  n/a
00516>       {MxStoUsed=.3355E+00}
00517> # Commercial/Employment area
00518>  002:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00519>      DESIGN STANDHYD    02:430       15.11    2.709 No_date    1:12   27.90 .861
00520>       [XIMP=.80:TIMP=.90]
00521>       [SLP=2.00:DT= 1.00]
00522>       [LOSS= 2 :CN= 74.0]
00523> # north west External area - assumed remains agricultural
00524>  002:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00525>      DESIGN NASHYD      03:205        4.90     .129 No_date    1:35    9.31 .287
00526>       [CN= 78.0: N= 3.00]
00527>       [Tp=  .33:DT= 1.00]
00528> # External Area West of Commercial Lands
00529>  002:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00530>      DESIGN NASHYD      05:465         .32     .007 No_date    1:30    6.58 .203
00531>       [CN= 69.0: N= 3.00]
00532>       [Tp=  .26:DT= 1.00]
00533> # Total Flow to Commercial SWM Facility
00534>  002:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00535>      ADD HYD            02:430       15.11    2.709 No_date    1:12   27.90  n/a
00536>                       +  03:205        4.90     .129 No_date    1:35    9.31  n/a
00537>                       +  05:465         .32     .007 No_date    1:30    6.58  n/a
00538>       [DT= 1.00]  SUM=  04:810       20.33    2.738 No_date    1:12   23.08  n/a
00539>  002:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00540>      ROUTE RESERVOIR -> 04:810       20.33    2.738 No_date    1:12   23.08  n/a
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00541>       [RDT= 1.00] out<- 05:SWMC      20.33     .594 No_date    1:37   23.08  n/a
00542>            overflow <= 09:ComOVF      .00     .000 No_date    0:00     .00  n/a
00543>     {MxStoUsed=.2691E+00, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=    0.hrs
00544> # Total Multi-residential area draining to SWMF B
00545>  002:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00546>       DESIGN STANDHYD    03:425        6.23     .991 No_date    1:11   23.38 .722
00547>        [XIMP=.65:TIMP=.75]
00548>        [SLP=2.00:DT= 1.00]
00549>        [LOSS= 2 :CN= 67.0]
00550> # Single Family Residential, park and commercial area draining to SWMF B
00551>  002:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00552>       DESIGN STANDHYD    06:440       19.31    1.912 No_date    1:12   18.08 .558
00553>        [XIMP=.45:TIMP=.55]
00554>        [SLP=2.00:DT= 1.00]
00555>        [LOSS= 2 :CN= 66.0]
00556> # Total Flow to SWM Facility B (Inlet Flow)
00557>  002:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00558>       ADD HYD            03:425        6.23     .991 No_date    1:11   23.38  n/a
00559>                        +  06:440       19.31    1.912 No_date    1:12   18.08  n/a
00560>                        +  09:ComOVF      .00     .000 No_date    0:00     .00  n/a
00561>       [DT= 1.00]  SUM=  07:815       25.54    2.865 No_date    1:11   19.37  n/a
00562> # SWMF B Block
00563>  002:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00564>       DESIGN STANDHYD    02:455        2.95     .425 No_date    1:10   18.45 .569
00565>        [XIMP=.50:TIMP=.50]
00566>        [SLP=****:DT= 1.00]
00567>        [LOSS= 2 :CN= 63.0]
00568> # Total Flow to SWM Facility (includes SWM Block)
00569>  002:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00570>       ADD HYD            07:815       25.54    2.865 No_date    1:11   19.37  n/a
00571>                        +  02:455        2.95     .425 No_date    1:10   18.45  n/a
00572>       [DT= 1.00]  SUM=  06:820       28.49    3.254 No_date    1:11   19.28  n/a
00573>  002:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00574>       ROUTE RESERVOIR -> 06:820       28.49    3.254 No_date    1:11   19.28  n/a
00575>        [RDT= 1.00] out<- 08:SWMB      28.49     .152 No_date    2:36   19.28  n/a
00576>       {MxStoUsed=.4655E+00}
00577> # Open Space (Main Channel Area)
00578>  002:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00579>       DESIGN NASHYD      02:445        7.36     .089 No_date    1:33    4.14 .128
00580>        [CN= 56.0: N= 3.00]
00581>        [Tp=  .30:DT= 1.00]
00582> # Total Flow at Property Line in Channel
00583>  002:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00584>       ADD HYD            01:SWMA       26.56     .105 No_date    3:01   15.22  n/a
00585>                        +  02:445        7.36     .089 No_date    1:33    4.14  n/a
00586>                        +  05:SWMC      20.33     .594 No_date    1:37   23.08  n/a
00587>                        +  08:SWMB      28.49     .152 No_date    2:36   19.28  n/a
00588>       [DT= 1.00]  SUM=  06:825       82.74     .831 No_date    1:38   17.56  n/a
00589> # Open Space (South Woodlot)
00590>  002:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00591>       DESIGN NASHYD      01:450        6.27     .093 No_date    1:29    4.44 .137
00592>        [CN= 58.0: N= 3.00]
00593>        [Tp=  .24:DT= 1.00]
00594> # West Woodlot
00595>  002:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00596>       DESIGN NASHYD      03:460        4.24     .041 No_date    2:06    6.12 .189
00597>        [CN= 67.0: N= 3.00]
00598>        [Tp=  .73:DT= 1.00]
00599> # Total Flow from Subject Site
00600>  002:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00601>       ADD HYD            01:450        6.27     .093 No_date    1:29    4.44  n/a
00602>                        +  06:825       82.74     .831 No_date    1:38   17.56  n/a
00603>                        +  03:460        4.24     .041 No_date    2:06    6.12  n/a
00604>       [DT= 1.00]  SUM=  02:830       93.25     .941 No_date    1:37   16.16  n/a
00605>   ** END OF RUN :   2
00606>
00607> ********************************************************************************
00608>
00609>
00610>
00611>
00612>
00613>  RUN:COMMAND#
00614>  003:0001---------------------------------------------------------------------
00615>       START
00616>        [TZERO =    .00 hrs on        0]
00617>        [METOUT=   2    (1=imperial, 2=metric output)]
00618>        [NSTORM=   1 ]
00619>        [NRUN  =   3 ]
00620> #*******************************************************************************
00621> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
00622> #  Date        : 05-14 -2010
00623> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
00624> #  Company     : Stantec Consulting Ltd. (Kitchener)
00625> #  License #   :  4730904
00626> #
00627> #  Existing Conditions Model for Waterloo East Lands
00628> #  Soils data obtained from Hydrogeological and Geothechnical Study
00629> #            Activa Waterloo East Lands (Naylor, 2006)
00630> #  Re-run using City of Waterloo IDF Parameters
00631> #            Final Design Submission
00632> #
00633> #*******************************************************************************
00634>  003:0002---------------------------------------------------------------------
00635>       READ STORM
00636>        Filename = Storm.001
00637>        Comment  = CHICAGO STORM - 5 Year Event, City of Waterloo IDF Data
00638>        [SDT= 5.00:SDUR=   3.00:PTOT=  47.53]
00639> # ================================================
00640> # Existing Drainage Area (EAST & FAR WEST)
00641> # ================================================
00642> # Northeast area draining east
00643>  003:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00644>       DESIGN NASHYD      01:150        1.76     .076 No_date    1:41   18.01 .379
00645>        [CN= 78.0: N= 3.00]
00646>        [Tp=  .41:DT= 1.00]
00647> # Northeast area draining east (External to site)
00648>  003:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00649>       DESIGN NASHYD      02:155        6.22     .244 No_date    1:42   16.79 .353
00650>        [CN= 76.0: N= 3.00]
00651>        [Tp=  .43:DT= 1.00]
00652> # East Area draining south to creek
00653>  003:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00654>       DESIGN NASHYD      03:105       11.58     .405 No_date    1:40   14.15 .298
00655>        [CN= 71.0: N= 3.00]
00656>        [Tp=  .39:DT= 1.00]
00657> # Target flow for SWM Facility A
00658>  003:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00659>       ADD HYD            01:150        1.76     .076 No_date    1:41   18.01  n/a
00660>                        +  02:155        6.22     .244 No_date    1:42   16.79  n/a
00661>                        +  03:105       11.58     .405 No_date    1:40   14.15  n/a
00662>       [DT= 1.00]  SUM=  09:900       19.56     .724 No_date    1:41   15.33  n/a
00663> # west woodlot area draining southwest
00664>  003:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00665>       DESIGN NASHYD      04:140        4.24     .082 No_date    2:06   12.38 .260
00666>        [CN= 67.0: N= 3.00]
00667>        [Tp=  .73:DT= 1.00]
00668> # ================================================
00669> # Existing Drainage Area (CENTRAL)
00670> # ================================================
00671> # External Area Draining onto Property
00672>  003:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00673>       DESIGN NASHYD      05:200        9.49     .319 No_date    1:47   15.67 .330
00674>        [CN= 74.0: N= 3.00]
00675>        [Tp=  .48:DT= 1.00]
00676> # External Area Draining onto Property
00677>  003:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00678>       DESIGN NASHYD      06:205        4.90     .246 No_date    1:35   18.01 .379
00679>        [CN= 78.0: N= 3.00]
00680>        [Tp=  .33:DT= 1.00]
00681> # West area draining to tile drain location
00682>  003:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00683>       DESIGN NASHYD      07:100       23.62     .663 No_date    1:57   15.67 .330
00684>        [CN= 74.0: N= 3.00]
00685>        [Tp=  .62:DT= 1.00]
00686> # Total Flow to Point A
00687>  003:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00688>       ADD HYD            05:200        9.49     .319 No_date    1:47   15.67  n/a
00689>                        +  06:205        4.90     .246 No_date    1:35   18.01  n/a
00690>                        +  07:100       23.62     .663 No_date    1:57   15.67  n/a
00691>       [DT= 1.00]  SUM=  08:505       38.01    1.165 No_date    1:49   15.97  n/a
00692> # East Area draining north to creek
00693>  003:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00694>       DESIGN NASHYD      05:110        6.49     .153 No_date    1:51   11.98 .252
00695>        [CN= 66.0: N= 3.00]
00696>        [Tp=  .54:DT= 1.00]
00697> # Total Flow at Point B
00698>  003:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00699>       ADD HYD            03:105       11.58     .405 No_date    1:40   14.15  n/a
00700>                        +  08:505       38.01    1.165 No_date    1:49   15.97  n/a
00701>                        +  05:110        6.49     .153 No_date    1:51   11.98  n/a
00702>       [DT= 1.00]  SUM=  07:510       56.08    1.703 No_date    1:46   15.13  n/a
00703> # Subtotal of total flow from site
00704>  003:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00705>       ADD HYD            01:150        1.76     .076 No_date    1:41   18.01  n/a
00706>                        +  04:140        4.24     .082 No_date    2:06   12.38  n/a
00707>                        +  07:510       56.08    1.703 No_date    1:46   15.13  n/a
00708>       [DT= 1.00]  SUM=  03:515       62.08    1.848 No_date    1:47   15.02  n/a
00709> # Southeast area draining south
00710>  003:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00711>       DESIGN NASHYD      01:115        9.93     .341 No_date    1:39   13.68 .288
00712>        [CN= 70.0: N= 3.00]
00713>        [Tp=  .38:DT= 1.00]
00714> # Southeast area draining east
00715>  003:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00716>       DESIGN NASHYD      08:120       10.02     .353 No_date    1:30   11.22 .236
00717>        [CN= 64.0: N= 3.00]
00718>        [Tp=  .26:DT= 1.00]
00719> # west area draining east to area 115
00720>  003:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00721>       DESIGN NASHYD      04:125        2.19     .071 No_date    1:45   14.63 .308
00722>        [CN= 72.0: N= 3.00]
00723>        [Tp=  .45:DT= 1.00]
00724> # Southwest area draining south
00725>  003:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00726>       DESIGN NASHYD      07:130        3.33     .208 No_date    1:27   18.01 .379
00727>        [CN= 78.0: N= 3.00]
00728>        [Tp=  .23:DT= 1.00]
00729> #  Target flow for SWM Facility B
00730>  003:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00731>       ADD HYD            01:115        9.93     .341 No_date    1:39   13.68  n/a
00732>                        +  04:125        2.19     .071 No_date    1:45   14.63  n/a
00733>                        +  05:110        6.49     .153 No_date    1:51   11.98  n/a
00734>                        +  07:130        3.33     .208 No_date    1:27   18.01  n/a
00735>       [DT= 1.00]  SUM=  09:905       21.94     .716 No_date    1:37   13.93  n/a
00736> #  Total flow from subject site w/o external area for future development
00737>  003:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00738>       ADD HYD            01:115        9.93     .341 No_date    1:39   13.68  n/a
00739>                        +  08:120       10.02     .353 No_date    1:30   11.22  n/a
00740>                        +  03:515       62.08    1.848 No_date    1:47   15.02  n/a
00741>                        +  04:125        2.19     .071 No_date    1:45   14.63  n/a
00742>                        +  07:130        3.33     .208 No_date    1:27   18.01  n/a
00743>       [DT= 1.00]  SUM=  06:520       87.55    2.676 No_date    1:41   14.54  n/a
00744> #  Total flow from subject site and external area for future development
00745>  003:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00746>       ADD HYD            02:155        6.22     .244 No_date    1:42   16.79  n/a
00747>                        +  06:520       87.55    2.676 No_date    1:41   14.54  n/a
00748>       [DT= 1.00]  SUM=  03:525       93.77    2.920 No_date    1:41   14.69  n/a
00749> # ================================================
00750> # PROPOSED
00751> # ================================================
00752> # Single Family Residential Area (On-site) including park draining to SWM A
00753>  003:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00754>       DESIGN STANDHYD    02:405        9.19    1.423 No_date    1:11   30.91 .650
00755>        [XIMP=.45:TIMP=.55]
00756>        [SLP=2.00:DT= 1.00]
00757>        [LOSS= 2 :CN= 74.0]
00758> # Single Family Residential Area (External)to SWM A
00759>  003:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00760>       DESIGN STANDHYD    03:410        6.22     .983 No_date    1:11   30.61 .644
00761>        [XIMP=.45:TIMP=.55]
00762>        [SLP=2.00:DT= 1.00]
00763>        [LOSS= 2 :CN= 73.0]
00764> # North East External Area- assumed remains agricultural
00765>  003:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00766>       DESIGN NASHYD      04:200        9.41     .316 No_date    1:47   15.67 .330
00767>        [CN= 74.0: N= 3.00]
00768>        [Tp=  .48:DT= 1.00]
00769> # Total Flow to inlet of SWM Facility A
00770>  003:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00771>       ADD HYD            02:405        9.19    1.423 No_date    1:11   30.91  n/a
00772>                        +  03:410        6.22     .983 No_date    1:11   30.61  n/a
00773>                        +  04:200        9.41     .316 No_date    1:47   15.67  n/a
00774>       [DT= 1.00]  SUM=  05:800       24.82    2.442 No_date    1:11   25.06  n/a
00775> # SWM Blk A including a few rear yards
00776>  003:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00777>       DESIGN STANDHYD    01:415        1.74     .347 No_date    1:10   29.36 .618
00778>        [XIMP=.50:TIMP=.50]
00779>        [SLP=****:DT= 1.00]
00780>        [LOSS= 2 :CN= 66.0]
00781> # Total Flow contributing to SWMF A
00782>  003:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00783>       ADD HYD            05:800       24.82    2.442 No_date    1:11   25.06  n/a
00784>                        +  01:415        1.74     .347 No_date    1:10   29.36  n/a
00785>       [DT= 1.00]  SUM=  02:805       26.56    2.717 No_date    1:10   25.34  n/a
00786>  003:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00787>       ROUTE RESERVOIR -> 02:805       26.56    2.717 No_date    1:10   25.34  n/a
00788>        [RDT= 1.00] out<- 01:SWMA      26.56     .171 No_date    3:02   25.34  n/a
00789>       {MxStoUsed=.5550E+00}
00790> # Commercial/Employment area
00791>  003:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00792>       DESIGN STANDHYD    02:430       15.11    3.781 No_date    1:12   42.18 .887
00793>        [XIMP=.80:TIMP=.90]
00794>        [SLP=2.00:DT= 1.00]
00795>        [LOSS= 2 :CN= 74.0]
00796> # north west External area - assumed remains agricultural
00797>  003:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00798>       DESIGN NASHYD      03:205        4.90     .246 No_date    1:35   18.01 .379
00799>        [CN= 78.0: N= 3.00]
00800>        [Tp=  .33:DT= 1.00]
00801> # External Area West of Commercial Lands
00802>  003:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00803>       DESIGN NASHYD      05:465         .32     .013 No_date    1:30   13.23 .278
00804>        [CN= 69.0: N= 3.00]
00805>        [Tp=  .26:DT= 1.00]
00806> # Total Flow to Commercial SWM Facility
00807>  003:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00808>       ADD HYD            02:430       15.11    3.781 No_date    1:12   42.18  n/a
00809>                        +  03:205        4.90     .246 No_date    1:35   18.01  n/a
00810>                        +  05:465         .32     .013 No_date    1:30   13.23  n/a
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00811>       [DT= 1.00]  SUM=  04:810       20.33     3.844 No_date    1:12   35.90  n/a
00812>  003:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00813>      ROUTE RESERVOIR -> 04:810       20.33     3.844 No_date    1:12   35.90  n/a
00814>        [RDT= 1.00] out<- 05:SWMC      20.33     1.141 No_date    1:33   35.90  n/a
00815>              overflow <= 09:ComOVF      .00      .000 No_date    0:00     .00  n/a
00816>      {MxStoUsed=.3755E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
00817> # Total Multi-residential area draining to SWMF B
00818>  003:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00819>      DESIGN STANDHYD    03:425        6.23     1.361 No_date    1:11   35.94 .756
00820>        [XIMP=.65:TIMP=.75]
00821>        [SLP=2.00:DT= 1.00]
00822>        [LOSS= 2 :CN= 67.0]
00823> # Single Family Residential, park and commercial area draining to SWMF B
00824>  003:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00825>      DESIGN STANDHYD    06:440       19.31     2.711 No_date    1:12   28.72 .604
00826>        [XIMP=.45:TIMP=.55]
00827>        [SLP=2.00:DT= 1.00]
00828>        [LOSS= 2 :CN= 66.0]
00829> # Total Flow to SWM Facility B (Inlet Flow)
00830>  003:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00831>      ADD HYD            03:425        6.23     1.361 No_date    1:11   35.94  n/a
00832>                       + 06:440       19.31     2.711 No_date    1:12   28.72  n/a
00833>                       + 09:ComOVF      .00      .000 No_date    0:00     .00  n/a
00834>        [DT= 1.00]  SUM=  07:815       25.54     4.019 No_date    1:11   30.48  n/a
00835> # SWMF B Block
00836>  003:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00837>      DESIGN STANDHYD    02:455        2.95      .577 No_date    1:10   28.80 .606
00838>        [XIMP=.50:TIMP=.50]
00839>        [SLP=****:DT= 1.00]
00840>        [LOSS= 2 :CN= 63.0]
00841> # Total Flow to SWM Facility (includes SWM Block)
00842>  003:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00843>      ADD HYD            07:815       25.54     4.019 No_date    1:11   30.48  n/a
00844>                       + 02:455        2.95      .577 No_date    1:10   28.80  n/a
00845>        [DT= 1.00]  SUM=  06:820       28.49     4.470 No_date    1:11   30.31  n/a
00846>  003:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00847>      ROUTE RESERVOIR -> 06:820       28.49     4.470 No_date    1:11   30.31  n/a
00848>        [RDT= 1.00] out<- 08:SWMB      28.49      .268 No_date    2:29   30.31  n/a
00849>      {MxStoUsed=.7022E+00}
00850> # Open Space (Main Channel Area)
00851>  003:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00852>      DESIGN NASHYD      02:445        7.36      .182 No_date    1:33    8.63 .182
00853>        [CN= 56.0: N= 3.00]
00854>        [Tp=  .30:DT= 1.00]
00855> # Total Flow at Property Line in Channel
00856>  003:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00857>      ADD HYD            01:SWMA       26.56      .171 No_date    3:02   25.34  n/a
00858>                       + 02:445        7.36      .182 No_date    1:33    8.63  n/a
00859>                       + 05:SWMC      20.33     1.141 No_date    1:33   35.90  n/a
00860>                       + 08:SWMB      28.49      .268 No_date    2:29   30.31  n/a
00861>        [DT= 1.00]  SUM=  06:825       82.74     1.690 No_date    1:35   28.16  n/a
00862> # Open Space (South Woodlot)
00863>  003:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00864>      DESIGN NASHYD      01:450        6.27      .187 No_date    1:29    9.22 .194
00865>        [CN= 58.0: N= 3.00]
00866>        [Tp=  .24:DT= 1.00]
00867> # West Woodlot
00868>  003:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00869>      DESIGN NASHYD      03:460        4.24      .082 No_date    2:06   12.38 .260
00870>        [CN= 67.0: N= 3.00]
00871>        [Tp=  .73:DT= 1.00]
00872> # Total Flow from Subject Site
00873>  003:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00874>      ADD HYD            01:450        6.27      .187 No_date    1:29    9.22  n/a
00875>                       + 06:825       82.74     1.690 No_date    1:35   28.16  n/a
00876>                       + 03:460        4.24      .082 No_date    2:06   12.38  n/a
00877>        [DT= 1.00]  SUM=  02:830       93.25     1.918 No_date    1:35   26.16  n/a
00878>   ** END OF RUN :   3
00879>
00880> ****************************************************************************
00881>
00882>
00883>
00884>
00885>
00886>  RUN:COMMAND#
00887>  004:0001---------------------------------------------------------------------
00888>      START
00889>        [TZERO =    .00 hrs on        0]
00890>        [METOUT=   2    (1=imperial, 2=metric output)]
00891>        [NSTORM=   1 ]
00892>        [NRUN  =   4 ]
00893> #****************************************************************************
00894> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
00895> #  Date        : 05-14 -2010
00896> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
00897> #  Company     : Stantec Consulting Ltd. (Kitchener)
00898> #  License #   :  4730904
00899> #
00900> #  Existing Conditions Model for Waterloo East Lands
00901> #  Soils data obtained from Hydrogeological and Geothechnical Study
00902> #           Activa Waterloo East Lands (Naylor, 2006)
00903> #  Re-run using City of Waterloo IDF Parameters
00904> #            Final Design Submission
00905> #
00906> #****************************************************************************
00907>  004:0002---------------------------------------------------------------------
00908>      READ STORM
00909>       Filename = Storm.001
00910>       Comment  = 10 yr, 3-hr, CHICAGO STORM, Region of Waterloo (a=2146, b=16
00911>       [SDT= 5.00:SDUR=   3.00:PTOT=  62.26]
00912> # ------------------------------------------------------
00913> # Existing Drainage Area (EAST & FAR WEST)
00914> # ------------------------------------------------------
00915> # Northeast area draining east
00916>  004:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00917>      DESIGN NASHYD      01:150        1.76      .110 No_date    1:42   27.89 .448
00918>        [CN= 78.0: N= 3.00]
00919>        [Tp=  .41:DT= 1.00]
00920> # Northeast area draining east (External to site)
00921>  004:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00922>      DESIGN NASHYD      02:155        6.22      .358 No_date    1:43   26.19 .421
00923>        [CN= 76.0: N= 3.00]
00924>        [Tp=  .43:DT= 1.00]
00925> # East Area draining south to creek
00926>  004:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00927>      DESIGN NASHYD      03:105       11.58      .601 No_date    1:41   22.44 .360
00928>        [CN= 71.0: N= 3.00]
00929>        [Tp=  .39:DT= 1.00]
00930> # Target flow for SWM Facility A
00931>  004:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00932>      ADD HYD            01:150        1.76      .110 No_date    1:42   27.89  n/a
00933>                       + 02:155        6.22      .358 No_date    1:43   26.19  n/a
00934>                       + 03:105       11.58      .601 No_date    1:41   22.44  n/a
00935>        [DT= 1.00]  SUM=  09:900       19.56     1.069 No_date    1:42   24.13  n/a
00936> # west woodlot area draining southwest
00937>  004:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00938>      DESIGN NASHYD      04:140        4.24      .127 No_date    2:08   19.87 .319
00939>        [CN= 67.0: N= 3.00]
00940>        [Tp=  .73:DT= 1.00]
00941> # ------------------------------------------------------
00942> # Existing Drainage Area (CENTRAL)
00943> # ------------------------------------------------------
00944> # External Area Draining onto Property
00945>  004:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00946>      DESIGN NASHYD      05:200        9.49      .474 No_date    1:48   24.61 .395
00947>        [CN= 74.0: N= 3.00]
00948>        [Tp=  .48:DT= 1.00]
00949> # External Area Draining onto Property
00950>  004:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00951>      DESIGN NASHYD      06:205        4.90      .353 No_date    1:36   27.89 .448
00952>        [CN= 78.0: N= 3.00]
00953>        [Tp=  .33:DT= 1.00]
00954> # West area draining to tile drain location
00955>  004:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00956>      DESIGN NASHYD      07:100       23.62      .997 No_date    1:58   24.61 .395
00957>        [CN= 74.0: N= 3.00]
00958>        [Tp=  .62:DT= 1.00]
00959> # Total Flow to Point A
00960>  004:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00961>      ADD HYD            05:200        9.49      .474 No_date    1:48   24.61  n/a
00962>                       + 06:205        4.90      .353 No_date    1:36   27.89  n/a
00963>                       + 07:100       23.62      .997 No_date    1:58   24.61  n/a
00964>        [DT= 1.00]  SUM=  08:505       38.01     1.736 No_date    1:50   25.04  n/a
00965> # East Area draining north to creek
00966>  004:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00967>      DESIGN NASHYD      05:110        6.49      .233 No_date    1:53   19.27 .309
00968>        [CN= 66.0: N= 3.00]
00969>        [Tp=  .54:DT= 1.00]
00970> # Total Flow at Point B
00971>  004:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00972>      ADD HYD            03:105       11.58      .601 No_date    1:41   22.44  n/a
00973>                       + 08:505       38.01     1.736 No_date    1:50   25.04  n/a
00974>                       + 05:110        6.49      .233 No_date    1:53   19.27  n/a
00975>        [DT= 1.00]  SUM=  07:510       56.08     2.541 No_date    1:48   23.83  n/a
00976> # Subtotal of total flow from site
00977>  004:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00978>      ADD HYD            01:150        1.76      .110 No_date    1:42   27.89  n/a
00979>                       + 04:140        4.24      .127 No_date    2:08   19.87  n/a
00980>                       + 07:510       56.08     2.541 No_date    1:48   23.83  n/a
00981>        [DT= 1.00]  SUM=  03:515       62.08     2.758 No_date    1:48   23.68  n/a
00982> # Southeast area draining south
00983>  004:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00984>      DESIGN NASHYD      01:115        9.93      .506 No_date    1:40   21.77 .350
00985>        [CN= 70.0: N= 3.00]
00986>        [Tp=  .38:DT= 1.00]
00987> # Southeast area draining east
00988>  004:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00989>      DESIGN NASHYD      08:120       10.02      .520 No_date    1:31   18.13 .291
00990>        [CN= 64.0: N= 3.00]
00991>        [Tp=  .26:DT= 1.00]
00992> # west area draining east to area 115
00993>  004:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00994>      DESIGN NASHYD      04:125        2.19      .106 No_date    1:46   23.14 .372
00995>        [CN= 72.0: N= 3.00]
00996>        [Tp=  .45:DT= 1.00]
00997> # Southwest area draining south
00998>  004:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
00999>      DESIGN NASHYD      07:130        3.33      .293 No_date    1:28   27.89 .448
01000>        [CN= 78.0: N= 3.00]
01001>        [Tp=  .23:DT= 1.00]
01002> #  Target flow for SWM Facility B
01003>  004:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01004>      ADD HYD            01:115        9.93      .506 No_date    1:40   21.77  n/a
01005>                       + 04:125        2.19      .106 No_date    1:46   23.14  n/a
01006>                       + 05:110        6.49      .233 No_date    1:53   19.27  n/a
01007>                       + 07:130        3.33      .293 No_date    1:28   27.89  n/a
01008>        [DT= 1.00]  SUM=  09:905       21.94     1.059 No_date    1:39   22.09  n/a
01009> #  Total flow from subject site w/o external area for future development
01010>  004:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01011>      ADD HYD            01:115        9.93      .506 No_date    1:40   21.77  n/a
01012>                       + 08:120       10.02      .520 No_date    1:31   18.13  n/a
01013>                       + 03:515       62.08     2.758 No_date    1:48   23.68  n/a
01014>                       + 04:125        2.19      .106 No_date    1:46   23.14  n/a
01015>                       + 07:130        3.33      .293 No_date    1:28   27.89  n/a
01016>        [DT= 1.00]  SUM=  06:520       87.55     3.982 No_date    1:43   22.97  n/a
01017> #  Total flow from subject site and external area for future development
01018>  004:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01019>      ADD HYD            02:155        6.22      .358 No_date    1:43   26.19  n/a
01020>                       + 06:520       87.55     3.982 No_date    1:43   22.97  n/a
01021>        [DT= 1.00]  SUM=  03:525       93.77     4.341 No_date    1:43   23.19  n/a
01022> # ------------------------------------------------------
01023> # PROPOSED
01024> # ------------------------------------------------------
01025> # Single Family Residential Area (On-site) including park draining to SWM A
01026>  004:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01027>      DESIGN STANDHYD    02:405        9.19     1.617 No_date    1:11   42.94 .690
01028>        [XIMP=.45:TIMP=.55]
01029>        [SLP=2.00:DT= 1.00]
01030>        [LOSS= 2 :CN= 74.0]
01031> # Single Family Residential Area (External)to SWM A
01032>  004:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01033>      DESIGN STANDHYD    03:410        6.22     1.122 No_date    1:11   42.52 .683
01034>        [XIMP=.45:TIMP=.55]
01035>        [SLP=2.00:DT= 1.00]
01036>        [LOSS= 2 :CN= 73.0]
01037> # North East External Area- assumed remains agricultural
01038>  004:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01039>      DESIGN NASHYD      04:200        9.41      .470 No_date    1:48   24.61 .395
01040>        [CN= 74.0: N= 3.00]
01041>        [Tp=  .48:DT= 1.00]
01042> # Total Flow to inlet of SWM Facility A
01043>  004:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01044>      ADD HYD            02:405        9.19     1.617 No_date    1:11   42.94  n/a
01045>                       + 03:410        6.22     1.122 No_date    1:11   42.52  n/a
01046>                       + 04:200        9.41      .470 No_date    1:48   24.61  n/a
01047>        [DT= 1.00]  SUM=  05:800       24.82     2.805 No_date    1:11   35.89  n/a
01048> # SWM Blk A including a few rear yards
01049>  004:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01050>      DESIGN STANDHYD    01:415        1.74      .376 No_date    1:10   40.37 .648
01051>        [XIMP=.50:TIMP=.50]
01052>        [SLP=****:DT= 1.00]
01053>        [LOSS= 2 :CN= 66.0]
01054> # Total Flow contributing to SWMF A
01055>  004:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01056>      ADD HYD            05:800       24.82     2.805 No_date    1:11   35.89  n/a
01057>                       + 01:415        1.74      .376 No_date    1:10   40.37  n/a
01058>        [DT= 1.00]  SUM=  02:805       26.56     3.109 No_date    1:11   36.18  n/a
01059>  004:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01060>      ROUTE RESERVOIR -> 02:805       26.56     3.109 No_date    1:11   36.18  n/a
01061>        [RDT= 1.00] out<- 01:SWMA      26.56      .412 No_date    2:43   36.18  n/a
01062>      {MxStoUsed=.7445E+00}
01063> # Commercial/Employment area
01064>  004:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01065>      DESIGN STANDHYD    02:430       15.11     4.183 No_date    1:12   56.30 .904
01066>        [XIMP=.80:TIMP=.90]
01067>        [SLP=2.00:DT= 1.00]
01068>        [LOSS= 2 :CN= 74.0]
01069> # north west External area - assumed remains agricultural
01070>  004:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01071>      DESIGN NASHYD      03:205        4.90      .353 No_date    1:36   27.89 .448
01072>        [CN= 78.0: N= 3.00]
01073>        [Tp=  .33:DT= 1.00]
01074> # External Area West of Commercial Lands
01075>  004:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01076>      DESIGN NASHYD      05:465         .32      .020 No_date    1:31   21.11 .339
01077>        [CN= 69.0: N= 3.00]
01078>        [Tp=  .26:DT= 1.00]
01079> # Total Flow to Commercial SWM Facility
01080>  004:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
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01081>      ADD HYD            02:430       15.11    4.183 No_date    1:12   56.30  n/a
01082>                    +  03:205        4.90     .353 No_date    1:36   27.89  n/a
01083>                    +  05:465         .32     .020 No_date    1:31   21.11  n/a
01084>       [DT= 1.00]  SUM=  04:810       20.33    4.288 No_date    1:12   48.90  n/a
01085>  004:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01086>      ROUTE RESERVOIR -> 04:810       20.33    4.288 No_date    1:12   48.90  n/a
01087>        [RDT= 1.00] out<- 05:SWMC     17.90    1.165 No_date    1:19   48.90  n/a
01088>             overflow <= 09:ComOVF     2.43    2.169 No_date    1:19   48.90  n/a
01089>      {MxStoUsed=.3798E+00, TotOvfVol=.1188E+00, N-Ovf=    2, TotDurOvf=    0.hrs
01090> # Total Multi-residential area draining to SWMF B
01091>  004:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01092>      DESIGN STANDHYD    03:425        6.23    1.497 No_date    1:11   48.66 .781
01093>        [XIMP=.65:TIMP=.75]
01094>        [SLP=2.00:DT= 1.00]
01095>        [LOSS= 2 :CN= 67.0]
01096> # Single Family Residential, park and commercial area draining to SWMF B
01097>  004:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01098>      DESIGN STANDHYD    06:440       19.31    3.099 No_date    1:12   39.85 .640
01099>        [XIMP=.45:TIMP=.55]
01100>        [SLP=2.00:DT= 1.00]
01101>        [LOSS= 2 :CN= 66.0]
01102> # Total Flow to SWM Facility B (Inlet Flow)
01103>  004:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01104>      ADD HYD            03:425        6.23    1.497 No_date    1:11   48.66  n/a
01105>                    +  06:440       19.31    3.099 No_date    1:12   39.85  n/a
01106>                    +  09:ComOVF     2.43    2.169 No_date    1:19   48.90  n/a
01107>       [DT= 1.00]  SUM=  07:815       27.97    5.636 No_date    1:19   42.60  n/a
01108> # SWMF B Block
01109>  004:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01110>      DESIGN STANDHYD    02:455        2.95     .627 No_date    1:10   39.53 .635
01111>        [XIMP=.50:TIMP=.50]
01112>        [SLP=****:DT= 1.00]
01113>        [LOSS= 2 :CN= 63.0]
01114> # Total Flow to SWM Facility (includes SWM Block)
01115>  004:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01116>      ADD HYD            07:815       27.97    5.636 No_date    1:19   42.60  n/a
01117>                    +  02:455        2.95     .627 No_date    1:10   39.53  n/a
01118>       [DT= 1.00]  SUM=  06:820       30.92    5.962 No_date    1:19   42.30  n/a
01119>  004:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01120>      ROUTE RESERVOIR -> 06:820       30.92    5.962 No_date    1:19   42.30  n/a
01121>        [RDT= 1.00] out<- 08:SWMB     30.92     .351 No_date    2:42   42.30  n/a
01122>      {MxStoUsed=.1082E+01}
01123> # Open Space (Main Channel Area)
01124>  004:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01125>      DESIGN NASHYD      02:445        7.36     .275 No_date    1:35   14.18 .228
01126>        [CN= 56.0: N= 3.00]
01127>        [Tp=  .30:DT= 1.00]
01128> # Total Flow at Property Line in Channel
01129>  004:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01130>      ADD HYD            01:SWMA      26.56     .412 No_date    2:43   36.18  n/a
01131>                    +  02:445        7.36     .275 No_date    1:35   14.18  n/a
01132>                    +  05:SWMC      17.90    1.165 No_date    1:19   48.90  n/a
01133>                    +  08:SWMB      30.92     .351 No_date    2:42   42.30  n/a
01134>       [DT= 1.00]  SUM=  06:825       82.74    1.922 No_date    1:40   39.26  n/a
01135> # Open Space (South Woodlot)
01136>  004:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01137>      DESIGN NASHYD      01:450        6.27     .278 No_date    1:30   15.09 .242
01138>        [CN= 58.0: N= 3.00]
01139>        [Tp=  .24:DT= 1.00]
01140> # West Woodlot
01141>  004:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01142>      DESIGN NASHYD      03:460        4.24     .127 No_date    2:08   19.87 .319
01143>        [CN= 67.0: N= 3.00]
01144>        [Tp=  .73:DT= 1.00]
01145> # Total Flow from Subject Site
01146>  004:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01147>      ADD HYD            01:450        6.27     .278 No_date    1:30   15.09  n/a
01148>                    +  06:825       82.74    1.922 No_date    1:40   39.26  n/a
01149>                    +  03:460        4.24     .127 No_date    2:08   19.87  n/a
01150>       [DT= 1.00]  SUM=  02:830       93.25    2.261 No_date    1:37   36.75  n/a
01151>   ** END OF RUN :   4
01152>
01153> ********************************************************************************
01154>
01155>
01156>
01157>
01158>
01159>  RUN:COMMAND#
01160>  005:0001--------------------------------------------------------------------
01161>      START
01162>       [TZERO =    .00 hrs on       0]
01163>       [METOUT=   2    (1=imperial, 2=metric output)]
01164>       [NSTORM=   1 ]
01165>       [NRUN  =   5 ]
01166> #*******************************************************************************
01167> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
01168> #  Date        : 05-14 -2010
01169> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
01170> #  Company     : Stantec Consulting Ltd. (Kitchener)
01171> #  License #   :  4730904
01172> #
01173> #  Existing Conditions Model for Waterloo East Lands
01174> #  Soils data obtained from Hydrogeological and Geothechnical Study
01175> #            Activa Waterloo East Lands (Naylor, 2006)
01176> #  Re-run using City of Waterloo IDF Parameters
01177> #            Final Design Submission
01178> #
01179> #*******************************************************************************
01180>  005:0002--------------------------------------------------------------------
01181>      READ STORM
01182>       Filename = Storm.001
01183>       Comment  = 25 yr, 3-hr, CHICAGO STORM, Region of Waterloo (a=3509, b=22
01184>       [SDT= 5.00:SDUR=   3.00:PTOT=  77.36]
01185> # ------------------------------------------------------
01186> # Existing Drainage Area (EAST & FAR WEST)
01187> # ------------------------------------------------------
01188> # Northeast area draining east
01189>  005:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01190>      DESIGN NASHYD      01:150        1.76     .155 No_date    1:43   39.01 .504
01191>        [CN= 78.0: N= 3.00]
01192>        [Tp=  .41:DT= 1.00]
01193> # Northeast area draining east (External to site)
01194>  005:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01195>      DESIGN NASHYD      02:155        6.22     .508 No_date    1:44   36.87 .477
01196>        [CN= 76.0: N= 3.00]
01197>        [Tp=  .43:DT= 1.00]
01198> # East Area draining south to creek
01199>  005:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01200>      DESIGN NASHYD      03:105       11.58     .864 No_date    1:41   32.04 .414
01201>        [CN= 71.0: N= 3.00]
01202>        [Tp=  .39:DT= 1.00]
01203> # Target flow for SWM Facility A
01204>  005:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01205>      ADD HYD            01:150        1.76     .155 No_date    1:43   39.01  n/a
01206>                    +  02:155        6.22     .508 No_date    1:44   36.87  n/a
01207>                    +  03:105       11.58     .864 No_date    1:41   32.04  n/a
01208>       [DT= 1.00]  SUM=  09:900       19.56    1.526 No_date    1:42   34.20  n/a
01209> # west woodlot area draining southwest
01210>  005:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01211>      DESIGN NASHYD      04:140        4.24     .186 No_date    2:08   28.63 .370
01212>        [CN= 67.0: N= 3.00]
01213>        [Tp=  .73:DT= 1.00]
01214> # ------------------------------------------------------
01215> # Existing Drainage Area (CENTRAL)
01216> # ------------------------------------------------------
01217> # External Area Draining onto Property
01218>  005:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01219>      DESIGN NASHYD      05:200        9.49     .677 No_date    1:48   34.85 .451
01220>        [CN= 74.0: N= 3.00]
01221>        [Tp=  .48:DT= 1.00]
01222> # External Area Draining onto Property
01223>  005:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01224>      DESIGN NASHYD      06:205        4.90     .496 No_date    1:36   39.01 .504
01225>        [CN= 78.0: N= 3.00]
01226>        [Tp=  .33:DT= 1.00]
01227> # West area draining to tile drain location
01228>  005:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01229>      DESIGN NASHYD      07:100       23.62    1.428 No_date    1:58   34.85 .451
01230>        [CN= 74.0: N= 3.00]
01231>        [Tp=  .62:DT= 1.00]
01232> # Total Flow to Point A
01233>  005:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01234>      ADD HYD            05:200        9.49     .677 No_date    1:48   34.85  n/a
01235>                    +  06:205        4.90     .496 No_date    1:36   39.01  n/a
01236>                    +  07:100       23.62    1.428 No_date    1:58   34.85  n/a
01237>       [DT= 1.00]  SUM=  08:505       38.01    2.479 No_date    1:50   35.39  n/a
01238> # East Area draining north to creek
01239>  005:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01240>      DESIGN NASHYD      05:110        6.49     .341 No_date    1:53   27.84 .360
01241>        [CN= 66.0: N= 3.00]
01242>        [Tp=  .54:DT= 1.00]
01243> # Total Flow at Point B
01244>  005:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01245>      ADD HYD            03:105       11.58     .864 No_date    1:41   32.04  n/a
01246>                    +  08:505       38.01    2.479 No_date    1:50   35.39  n/a
01247>                    +  05:110        6.49     .341 No_date    1:53   27.84  n/a
01248>       [DT= 1.00]  SUM=  07:510       56.08    3.642 No_date    1:48   33.82  n/a
01249> # Subtotal of total flow from site
01250>  005:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01251>      ADD HYD            01:150        1.76     .155 No_date    1:43   39.01  n/a
01252>                    +  04:140        4.24     .186 No_date    2:08   28.63  n/a
01253>                    +  07:510       56.08    3.642 No_date    1:48   33.82  n/a
01254>       [DT= 1.00]  SUM=  03:515       62.08    3.954 No_date    1:48   33.62  n/a
01255> # Southeast area draining south
01256>  005:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01257>      DESIGN NASHYD      01:115        9.93     .729 No_date    1:40   31.15 .403
01258>        [CN= 70.0: N= 3.00]
01259>        [Tp=  .38:DT= 1.00]
01260> # Southeast area draining east
01261>  005:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01262>      DESIGN NASHYD      08:120       10.02     .754 No_date    1:32   26.31 .340
01263>        [CN= 64.0: N= 3.00]
01264>        [Tp=  .26:DT= 1.00]
01265> # west area draining east to area 115
01266>  005:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01267>      DESIGN NASHYD      04:125        2.19     .153 No_date    1:46   32.95 .426
01268>        [CN= 72.0: N= 3.00]
01269>        [Tp=  .45:DT= 1.00]
01270> # Southwest area draining south
01271>  005:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01272>      DESIGN NASHYD      07:130        3.33     .409 No_date    1:28   39.01 .504
01273>        [CN= 78.0: N= 3.00]
01274>        [Tp=  .23:DT= 1.00]
01275> #  Target flow for SWM Facility B
01276>  005:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01277>      ADD HYD            01:115        9.93     .729 No_date    1:40   31.15  n/a
01278>                    +  04:125        2.19     .153 No_date    1:46   32.95  n/a
01279>                    +  05:110        6.49     .341 No_date    1:53   27.84  n/a
01280>                    +  07:130        3.33     .409 No_date    1:28   39.01  n/a
01281>       [DT= 1.00]  SUM=  09:905       21.94    1.519 No_date    1:39   31.54  n/a
01282> #  Total flow from subject site w/o external area for future development
01283>  005:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01284>      ADD HYD            01:115        9.93     .729 No_date    1:40   31.15  n/a
01285>                    +  08:120       10.02     .754 No_date    1:32   26.31  n/a
01286>                    +  03:515       62.08    3.954 No_date    1:48   33.62  n/a
01287>                    +  04:125        2.19     .153 No_date    1:46   32.95  n/a
01288>                    +  07:130        3.33     .409 No_date    1:28   39.01  n/a
01289>       [DT= 1.00]  SUM=  06:520       87.55    5.720 No_date    1:43   32.69  n/a
01290> #  Total flow from subject site and external area for future development
01291>  005:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01292>      ADD HYD            02:155        6.22     .508 No_date    1:44   36.87  n/a
01293>                    +  06:520       87.55    5.720 No_date    1:43   32.69  n/a
01294>       [DT= 1.00]  SUM=  03:525       93.77    6.228 No_date    1:43   32.97  n/a
01295> # ------------------------------------------------------
01296> # PROPOSED
01297> # ------------------------------------------------------
01298> # Single Family Residential Area (On-site) including park draining to SWM A
01299>  005:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01300>      DESIGN STANDHYD    02:405        9.19    2.021 No_date    1:11   55.82 .722
01301>        [XIMP=.45:TIMP=.55]
01302>        [SLP=2.00:DT= 1.00]
01303>        [LOSS= 2 :CN= 74.0]
01304> # Single Family Residential Area (External)to SWM A
01305>  005:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01306>      DESIGN STANDHYD    03:410        6.22    1.382 No_date    1:11   55.28 .715
01307>        [XIMP=.45:TIMP=.55]
01308>        [SLP=2.00:DT= 1.00]
01309>        [LOSS= 2 :CN= 73.0]
01310> # North East External Area- assumed remains agricultural
01311>  005:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01312>      DESIGN NASHYD      04:200        9.41     .671 No_date    1:48   34.85 .451
01313>        [CN= 74.0: N= 3.00]
01314>        [Tp=  .48:DT= 1.00]
01315> # Total Flow to inlet of SWM Facility A
01316>  005:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01317>      ADD HYD            02:405        9.19    2.021 No_date    1:11   55.82  n/a
01318>                    +  03:410        6.22    1.382 No_date    1:11   55.28  n/a
01319>                    +  04:200        9.41     .671 No_date    1:48   34.85  n/a
01320>       [DT= 1.00]  SUM=  05:800       24.82    3.512 No_date    1:12   47.74  n/a
01321> # SWM Blk A including a few rear yards
01322>  005:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01323>      DESIGN STANDHYD    01:415        1.74     .448 No_date    1:10   52.20 .675
01324>        [XIMP=.50:TIMP=.50]
01325>        [SLP=****:DT= 1.00]
01326>        [LOSS= 2 :CN= 66.0]
01327> # Total Flow contributing to SWMF A
01328>  005:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01329>      ADD HYD            05:800       24.82    3.512 No_date    1:12   47.74  n/a
01330>                    +  01:415        1.74     .448 No_date    1:10   52.20  n/a
01331>       [DT= 1.00]  SUM=  02:805       26.56    3.882 No_date    1:11   48.03  n/a
01332>  005:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01333>      ROUTE RESERVOIR -> 02:805       26.56    3.882 No_date    1:11   48.03  n/a
01334>        [RDT= 1.00] out<- 01:SWMA      26.56     .924 No_date    2:16   48.03  n/a
01335>      {MxStoUsed=.8701E+00}
01336> # Commercial/Employment area
01337>  005:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01338>      DESIGN STANDHYD    02:430       15.11    5.052 No_date    1:11   70.93 .917
01339>        [XIMP=.80:TIMP=.90]
01340>        [SLP=2.00:DT= 1.00]
01341>        [LOSS= 2 :CN= 74.0]
01342> # north west External area - assumed remains agricultural
01343>  005:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01344>      DESIGN NASHYD      03:205        4.90     .496 No_date    1:36   39.01 .504
01345>        [CN= 78.0: N= 3.00]
01346>        [Tp=  .33:DT= 1.00]
01347> # External Area West of Commercial Lands
01348>  005:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01349>      DESIGN NASHYD      05:465         .32     .028 No_date    1:31   30.29 .392
01350>        [CN= 69.0: N= 3.00]
```

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01351>       [Tp=  .26:DT= 1.00]
01352> # Total Flow to Commercial SWM Facility
01353>  005:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01354>       ADD HYD            02:430       15.11    5.052 No_date    1:11   70.93  n/a
01355>                        + 03:205        4.90     .496 No_date    1:36   39.01  n/a
01356>                        + 05:465         .32     .028 No_date    1:31   30.29  n/a
01357>       [DT= 1.00]  SUM=  04:810       20.33    5.189 No_date    1:11   62.59  n/a
01358>  005:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01359>       ROUTE RESERVOIR -> 04:810       20.33    5.189 No_date    1:11   62.59  n/a
01360>        [RDT= 1.00] out<- 05:SWMC      15.37    1.165 No_date    1:14   62.59  n/a
01361>                  overflow <- 09:ComOVF     4.96    3.724 No_date    1:14   62.59  n/a
01362>       {MxStoUsed=.3799E+00, TotOvfVol=.3108E+00, N-Ovf=    2, TotDurOvf=    1.hrs
01363> # Total Multi-residential area draining to SWMF B
01364>  005:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01365>       DESIGN STANDHYD    03:425        6.23    1.789 No_date    1:11   62.06 .802
01366>        [XIMP=.65:TIMP=.75]
01367>        [SLP=2.00:DT= 1.00]
01368>        [LOSS= 2 :CN= 67.0]
01369> # Single Family Residential, park and commercial area draining to SWMF B
01370>  005:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01371>       DESIGN STANDHYD    06:440       19.31    3.819 No_date    1:13   51.85 .670
01372>        [XIMP=.45:TIMP=.55]
01373>        [SLP=2.00:DT= 1.00]
01374>        [LOSS= 2 :CN= 66.0]
01375> # Total Flow to SWM Facility B (Inlet Flow)
01376>  005:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01377>       ADD HYD            03:425        6.23    1.789 No_date    1:11   62.06  n/a
01378>                        + 06:440       19.31    3.819 No_date    1:13   51.85  n/a
01379>                        + 09:ComOVF     4.96    3.724 No_date    1:14   62.59  n/a
01380>       [DT= 1.00]  SUM=  07:815       30.50    9.037 No_date    1:14   55.68  n/a
01381> # SWMF B Block
01382>  005:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01383>       DESIGN STANDHYD    02:455        2.95     .745 No_date    1:10   51.06 .660
01384>        [XIMP=.50:TIMP=.50]
01385>        [SLP=****:DT= 1.00]
01386>        [LOSS= 2 :CN= 63.0]
01387> # Total Flow to SWM Facility (includes SWM Block)
01388>  005:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01389>       ADD HYD            07:815       30.50    9.037 No_date    1:14   55.68  n/a
01390>                        + 02:455        2.95     .745 No_date    1:10   51.06  n/a
01391>       [DT= 1.00]  SUM=  06:820       33.45    9.613 No_date    1:14   55.28  n/a
01392>  005:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01393>       ROUTE RESERVOIR -> 06:820       33.45    9.613 No_date    1:14   55.28  n/a
01394>        [RDT= 1.00] out<- 08:SWMB      33.45     .443 No_date    2:39   55.27  n/a
01395>       {MxStoUsed=.1565E+01}
01396> # Open Space (Main Channel Area)
01397>  005:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01398>       DESIGN NASHYD      02:445        7.36     .405 No_date    1:35   20.89 .270
01399>        [CN= 56.0: N= 3.00]
01400>        [Tp=  .30:DT= 1.00]
01401> # Total Flow at Property Line in Channel
01402>  005:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01403>       ADD HYD            01:SWMA       26.56     .924 No_date    2:16   48.03  n/a
01404>                        + 02:445        7.36     .405 No_date    1:35   20.89  n/a
01405>                        + 05:SWMC      15.37    1.165 No_date    1:14   62.59  n/a
01406>                        + 08:SWMB      33.45     .443 No_date    2:39   55.27  n/a
01407>       [DT= 1.00]  SUM=  06:825       82.74    2.656 No_date    2:01   51.25  n/a
01408> # Open Space (South Woodlot)
01409>  005:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01410>       DESIGN NASHYD      01:450        6.27     .407 No_date    1:30   22.15 .286
01411>        [CN= 58.0: N= 3.00]
01412>        [Tp=  .24:DT= 1.00]
01413> # West Woodlot
01414>  005:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01415>       DESIGN NASHYD      03:460        4.24     .186 No_date    2:08   28.63 .370
01416>        [CN= 67.0: N= 3.00]
01417>        [Tp=  .73:DT= 1.00]
01418> # Total Flow from Subject Site
01419>  005:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01420>       ADD HYD            01:450        6.27     .407 No_date    1:30   22.15  n/a
01421>                        + 06:825       82.74    2.656 No_date    2:01   51.25  n/a
01422>                        + 03:460        4.24     .186 No_date    2:08   28.63  n/a
01423>       [DT= 1.00]  SUM=  02:830       93.25    3.043 No_date    1:58   48.26  n/a
01424>  ** END OF RUN :   5
01425>
01426> ****************************************************************************
01427>
01428>
01429>
01430>
01431>
01432>  RUN:COMMAND#
01433>  006:0001---------------------------------------------------------------------
01434>       START
01435>        [TZERO =    .00 hrs on        0]
01436>        [METOUT=   2    (1=imperial, 2=metric output)]
01437>        [NSTORM=   1 ]
01438>        [NRUN  =   6 ]
01439> #****************************************************************************
01440> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
01441> #  Date        : 05-14 -2010
01442> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
01443> #  Company     : Stantec Consulting Ltd. (Kitchener)
01444> #  License #   :  4730904
01445> #
01446> #  Existing Conditions Model for Waterloo East Lands
01447> #  Soils data obtained from Hydrogeological and Geothechnical Study
01448> #            Activa Waterloo East Lands (Naylor, 2006)
01449> #  Re-run using City of Waterloo IDF Parameters
01450> #            Final Design Submission
01451> #
01452> #****************************************************************************
01453>  006:0002---------------------------------------------------------------------
01454>       READ STORM
01455>        Filename = Storm.001
01456>        Comment  = 50 yr, 3-hr, CHICAGO STORM, Region of Waterloo (a=4620, b=25
01457>        [SDT= 5.00:SDUR=   3.00:PTOT=  88.81]
01458> # ========================================================
01459> # Existing Drainage Area (EAST & FAR WEST)
01460> # ========================================================
01461> # Northeast area draining east
01462>  006:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01463>       DESIGN NASHYD      01:150        1.76     .191 No_date    1:43   47.96 .540
01464>        [CN= 78.0: N= 3.00]
01465>        [Tp=  .41:DT= 1.00]
01466> # Northeast area draining east (External to site)
01467>  006:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01468>       DESIGN NASHYD      02:155        6.22     .628 No_date    1:44   45.50 .512
01469>        [CN= 76.0: N= 3.00]
01470>        [Tp=  .43:DT= 1.00]
01471> # East Area draining south to creek
01472>  006:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01473>       DESIGN NASHYD      03:105       11.58    1.077 No_date    1:41   39.90 .449
01474>        [CN= 71.0: N= 3.00]
01475>        [Tp=  .39:DT= 1.00]
01476> # Target flow for SWM Facility A
01477>  006:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01478>       ADD HYD            01:150        1.76     .191 No_date    1:43   47.96  n/a
01479>                        + 02:155        6.22     .628 No_date    1:44   45.50  n/a
01480>                        + 03:105       11.58    1.077 No_date    1:41   39.90  n/a
01481>       [DT= 1.00]  SUM=  09:900       19.56    1.894 No_date    1:42   42.40  n/a
01482> # west woodlot area draining southwest
01483>  006:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01484>       DESIGN NASHYD      04:140        4.24     .234 No_date    2:08   35.88 .404
01485>        [CN= 67.0: N= 3.00]
01486>        [Tp=  .73:DT= 1.00]
01487> # ========================================================
01488> # Existing Drainage Area (CENTRAL)
01489> # ========================================================
01490> # External Area Draining onto Property
01491>  006:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01492>       DESIGN NASHYD      05:200        9.49     .840 No_date    1:48   43.17 .486
01493>        [CN= 74.0: N= 3.00]
01494>        [Tp=  .48:DT= 1.00]
01495> # External Area Draining onto Property
01496>  006:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01497>       DESIGN NASHYD      06:205        4.90     .608 No_date    1:36   47.96 .540
01498>        [CN= 78.0: N= 3.00]
01499>        [Tp=  .33:DT= 1.00]
01500> # West area draining to tile drain location
01501>  006:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01502>       DESIGN NASHYD      07:100       23.62    1.775 No_date    1:58   43.17 .486
01503>        [CN= 74.0: N= 3.00]
01504>        [Tp=  .62:DT= 1.00]
01505> # Total Flow to Point A
01506>  006:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01507>       ADD HYD            05:200        9.49     .840 No_date    1:48   43.17  n/a
01508>                        + 06:205        4.90     .608 No_date    1:36   47.96  n/a
01509>                        + 07:100       23.62    1.775 No_date    1:58   43.17  n/a
01510>       [DT= 1.00]  SUM=  08:505       38.01    3.075 No_date    1:50   43.79  n/a
01511> # East Area draining north to creek
01512>  006:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01513>       DESIGN NASHYD      05:110        6.49     .429 No_date    1:53   34.94 .393
01514>        [CN= 66.0: N= 3.00]
01515>        [Tp=  .54:DT= 1.00]
01516> # Total Flow at Point B
01517>  006:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01518>       ADD HYD            03:105       11.58    1.077 No_date    1:41   39.90  n/a
01519>                        + 08:505       38.01    3.075 No_date    1:50   43.79  n/a
01520>                        + 05:110        6.49     .429 No_date    1:53   34.94  n/a
01521>       [DT= 1.00]  SUM=  07:510       56.08    4.529 No_date    1:48   41.96  n/a
01522> # Subtotal of total flow from site
01523>  006:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01524>       ADD HYD            01:150        1.76     .191 No_date    1:43   47.96  n/a
01525>                        + 04:140        4.24     .234 No_date    2:08   35.88  n/a
01526>                        + 07:510       56.08    4.529 No_date    1:48   41.96  n/a
01527>       [DT= 1.00]  SUM=  03:515       62.08    4.917 No_date    1:48   41.72  n/a
01528> # Southeast area draining south
01529>  006:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01530>       DESIGN NASHYD      01:115        9.93     .910 No_date    1:41   38.86 .438
01531>        [CN= 70.0: N= 3.00]
01532>        [Tp=  .38:DT= 1.00]
01533> # Southeast area draining east
01534>  006:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01535>       DESIGN NASHYD      08:120       10.02     .946 No_date    1:32   33.11 .373
01536>        [CN= 64.0: N= 3.00]
01537>        [Tp=  .26:DT= 1.00]
01538> # west area draining east to area 115
01539>  006:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01540>       DESIGN NASHYD      04:125        2.19     .190 No_date    1:46   40.96 .461
01541>        [CN= 72.0: N= 3.00]
01542>        [Tp=  .45:DT= 1.00]
01543> # Southwest area draining south
01544>  006:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01545>       DESIGN NASHYD      07:130        3.33     .500 No_date    1:28   47.96 .540
01546>        [CN= 78.0: N= 3.00]
01547>        [Tp=  .23:DT= 1.00]
01548> #  Target flow for SWM Facility B
01549>  006:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01550>       ADD HYD            01:115        9.93     .910 No_date    1:41   38.86  n/a
01551>                        + 04:125        2.19     .190 No_date    1:46   40.96  n/a
01552>                        + 05:110        6.49     .429 No_date    1:53   34.94  n/a
01553>                        + 07:130        3.33     .500 No_date    1:28   47.96  n/a
01554>       [DT= 1.00]  SUM=  09:905       21.94    1.891 No_date    1:39   39.29  n/a
01555> #  Total flow from subject site w/o external area for future development
01556>  006:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01557>       ADD HYD            01:115        9.93     .910 No_date    1:41   38.86  n/a
01558>                        + 08:120       10.02     .946 No_date    1:32   33.11  n/a
01559>                        + 03:515       62.08    4.917 No_date    1:48   41.72  n/a
01560>                        + 04:125        2.19     .190 No_date    1:46   40.96  n/a
01561>                        + 07:130        3.33     .500 No_date    1:28   47.96  n/a
01562>       [DT= 1.00]  SUM=  06:520       87.55    7.124 No_date    1:43   40.63  n/a
01563> #  Total flow from subject site and external area for future development
01564>  006:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01565>       ADD HYD            02:155        6.22     .628 No_date    1:44   45.50  n/a
01566>                        + 06:520       87.55    7.124 No_date    1:43   40.63  n/a
01567>       [DT= 1.00]  SUM=  03:525       93.77    7.752 No_date    1:43   40.95  n/a
01568> # ========================================================
01569> # PROPOSED
01570> # ========================================================
01571> # Single Family Residential Area (On-site) including park draining to SWM A
01572>  006:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01573>       DESIGN STANDHYD    02:405        9.19    2.322 No_date    1:12   65.87 .742
01574>        [XIMP=.45:TIMP=.55]
01575>        [SLP=2.00:DT= 1.00]
01576>        [LOSS= 2 :CN= 74.0]
01577> # Single Family Residential Area (External)to SWM A
01578>  006:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01579>       DESIGN STANDHYD    03:410        6.22    1.605 No_date    1:11   65.26 .735
01580>        [XIMP=.45:TIMP=.55]
01581>        [SLP=2.00:DT= 1.00]
01582>        [LOSS= 2 :CN= 73.0]
01583> # North East External Area- assumed remains agricultural
01584>  006:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01585>       DESIGN NASHYD      04:200        9.41     .833 No_date    1:48   43.17 .486
01586>        [CN= 74.0: N= 3.00]
01587>        [Tp=  .48:DT= 1.00]
01588> # Total Flow to inlet of SWM Facility A
01589>  006:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01590>       ADD HYD            02:405        9.19    2.322 No_date    1:12   65.87  n/a
01591>                        + 03:410        6.22    1.605 No_date    1:11   65.26  n/a
01592>                        + 04:200        9.41     .833 No_date    1:48   43.17  n/a
01593>       [DT= 1.00]  SUM=  05:800       24.82    4.077 No_date    1:12   57.11  n/a
01594> # SWM Blk A including a few rear yards
01595>  006:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01596>       DESIGN STANDHYD    01:415        1.74     .512 No_date    1:10   61.47 .692
01597>        [XIMP=.50:TIMP=.50]
01598>        [SLP=****:DT= 1.00]
01599>        [LOSS= 2 :CN= 66.0]
01600> # Total Flow contributing to SWMF A
01601>  006:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01602>       ADD HYD            05:800       24.82    4.077 No_date    1:12   57.11  n/a
01603>                        + 01:415        1.74     .512 No_date    1:10   61.47  n/a
01604>       [DT= 1.00]  SUM=  02:805       26.56    4.495 No_date    1:11   57.40  n/a
01605>  006:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01606>       ROUTE RESERVOIR -> 02:805       26.56    4.495 No_date    1:11   57.40  n/a
01607>        [RDT= 1.00] out<- 01:SWMA      26.56    1.441 No_date    2:03   57.39  n/a
01608>       {MxStoUsed=.9430E+00}
01609> # Commercial/Employment area
01610>  006:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01611>       DESIGN STANDHYD    02:430       15.11    5.716 No_date    1:11   82.09 .924
01612>        [XIMP=.80:TIMP=.90]
01613>        [SLP=2.00:DT= 1.00]
01614>        [LOSS= 2 :CN= 74.0]
01615> # north west External area - assumed remains agricultural
01616>  006:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01617>       DESIGN NASHYD      03:205        4.90     .608 No_date    1:36   47.96 .540
01618>        [CN= 78.0: N= 3.00]
01619>        [Tp=  .33:DT= 1.00]
01620> # External Area West of Commercial Lands
```

```
01621>  006:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01622>      DESIGN NASHYD      05:465         .32     .035 No_date    1:31   37.84 .426
01623>        [CN= 69.0: N= 3.00]
01624>        [Tp=  .26:DT= 1.00]
01625> # Total Flow to Commercial SWM Facility
01626>  006:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01627>      ADD HYD            02:430       15.11    5.716 No_date    1:11   82.09  n/a
01628>                       + 03:205        4.90     .608 No_date    1:36   47.96  n/a
01629>                       + 05:465         .32     .035 No_date    1:31   37.84  n/a
01630>        [DT= 1.00]  SUM=  04:810       20.33    5.893 No_date    1:11   73.17  n/a
01631>  006:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01632>      ROUTE RESERVOIR -> 04:810       20.33    5.893 No_date    1:11   73.17  n/a
01633>        [RDT= 1.00] out<- 05:SWMC      13.87    1.165 No_date    1:12   73.17  n/a
01634>              overflow <= 09:ComOVF     6.46    4.713 No_date    1:12   73.17  n/a
01635>      {MxStoUsed=.3800E+00, TotOvfVol=.4727E+00, N-Ovf=    2, TotDurOvf=    1.hrs
01636> # Total Multi-residential area draining to SWMF B
01637>  006:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01638>      DESIGN STANDHYD    03:425         6.23    2.029 No_date    1:11   72.42 .815
01639>        [XIMP=.65:TIMP=.75]
01640>        [SLP=2.00:DT= 1.00]
01641>        [LOSS= 2 :CN= 67.0]
01642> # Single Family Residential, park and commercial area draining to SWMF B
01643>  006:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01644>      DESIGN STANDHYD    06:440        19.31    4.441 No_date    1:13   61.28 .690
01645>        [XIMP=.45:TIMP=.55]
01646>        [SLP=2.00:DT= 1.00]
01647>        [LOSS= 2 :CN= 66.0]
01648> # Total Flow to SWM Facility B (Inlet Flow)
01649>  006:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01650>      ADD HYD            03:425         6.23    2.029 No_date    1:11   72.42  n/a
01651>                       + 06:440        19.31    4.441 No_date    1:13   61.28  n/a
01652>                       + 09:ComOVF      6.46    4.713 No_date    1:12   73.17  n/a
01653>        [DT= 1.00]  SUM=  07:815       32.00   11.128 No_date    1:12   65.85  n/a
01654> # SWMF B Block
01655>  006:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01656>      DESIGN STANDHYD    02:455         2.95     .839 No_date    1:10   60.12 .677
01657>        [XIMP=.50:TIMP=.50]
01658>        [SLP=****:DT= 1.00]
01659>        [LOSS= 2 :CN= 63.0]
01660> # Total Flow to SWM Facility (includes SWM Block)
01661>  006:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01662>      ADD HYD            07:815       32.00   11.128 No_date    1:12   65.85  n/a
01663>                       + 02:455         2.95     .839 No_date    1:10   60.12  n/a
01664>        [DT= 1.00]  SUM=  06:820       34.95   11.811 No_date    1:12   65.36  n/a
01665>  006:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01666>      ROUTE RESERVOIR -> 06:820       34.95   11.811 No_date    1:12   65.36  n/a
01667>        [RDT= 1.00] out<- 08:SWMB      34.95     .884 No_date    2:13   65.36  n/a
01668>      {MxStoUsed=.1878E+01}
01669> # Open Space (Main Channel Area)
01670>  006:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01671>      DESIGN NASHYD      02:445         7.36     .514 No_date    1:35   26.57 .299
01672>        [CN= 56.0: N= 3.00]
01673>        [Tp=  .30:DT= 1.00]
01674> # Total Flow at Property Line in Channel
01675>  006:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01676>      ADD HYD            01:SWMA       26.56    1.441 No_date    2:03   57.39  n/a
01677>                       + 02:445         7.36     .514 No_date    1:35   26.57  n/a
01678>                       + 05:SWMC       13.87    1.165 No_date    1:12   73.17  n/a
01679>                       + 08:SWMB       34.95     .884 No_date    2:13   65.36  n/a
01680>        [DT= 1.00]  SUM=  06:825       82.74    3.779 No_date    2:00   60.66  n/a
01681> # Open Space (South Woodlot)
01682>  006:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01683>      DESIGN NASHYD      01:450         6.27     .515 No_date    1:31   28.10 .316
01684>        [CN= 58.0: N= 3.00]
01685>        [Tp=  .24:DT= 1.00]
01686> # West Woodlot
01687>  006:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01688>      DESIGN NASHYD      03:460         4.24     .234 No_date    2:08   35.88 .404
01689>        [CN= 67.0: N= 3.00]
01690>        [Tp=  .73:DT= 1.00]
01691> # Total Flow from Subject Site
01692>  006:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01693>      ADD HYD            01:450         6.27     .515 No_date    1:31   28.10  n/a
01694>                       + 06:825        82.74    3.779 No_date    2:00   60.66  n/a
01695>                       + 03:460         4.24     .234 No_date    2:08   35.88  n/a
01696>        [DT= 1.00]  SUM=  02:830       93.25    4.271 No_date    1:58   57.35  n/a
01697>    ** END OF RUN :   6
01698>
01699> ****************************************************************************
01700>
01701>
01702>
01703>
01704>
01705>  RUN:COMMAND#
01706>  007:0001---------------------------------------------------------------------
01707>      START
01708>        [TZERO =    .00 hrs on        0]
01709>        [METOUT=   2    (1=imperial, 2=metric output)]
01710>        [NSTORM=   1 ]
01711>        [NRUN  =   7 ]
01712> ****************************************************************************
01713> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
01714> #  Date        : 05-14 -2010
01715> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
01716> #  Company     : Stantec Consulting Ltd. (Kitchener)
01717> #  License #   :  4730904
01718> #
01719> #  Existing Conditions Model for Waterloo East Lands
01720> #  Soils data obtained from Hydrogeological and Geothechnical Study
01721> #            Activa Waterloo East Lands (Naylor, 2006)
01722> #  Re-run using City of Waterloo IDF Parameters
01723> #            Final Design Submission
01724> #
01725> ****************************************************************************
01726>  007:0002---------------------------------------------------------------------
01727>      READ STORM
01728>        Filename = Storm.001
01729>        Comment  = 100 yr, 3-hr, CHICAGO STORM, Region of Waterloo (a=5886, b=2
01730>        [SDT= 5.00:SDUR=   3.00:PTOT=  99.85]
01731> # ========================================================
01732> # Existing Drainage Area (EAST & FAR WEST)
01733> # ========================================================
01734> # Northeast area draining east
01735>  007:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01736>      DESIGN NASHYD      01:150         1.76     .227 No_date    1:43   56.90 .570
01737>        [CN= 78.0: N= 3.00]
01738>        [Tp=  .41:DT= 1.00]
01739> # Northeast area draining east (External to site)
01740>  007:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01741>      DESIGN NASHYD      02:155         6.22     .749 No_date    1:44   54.17 .543
01742>        [CN= 76.0: N= 3.00]
01743>        [Tp=  .43:DT= 1.00]
01744> # East Area draining south to creek
01745>  007:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01746>      DESIGN NASHYD      03:105        11.58    1.294 No_date    1:41   47.86 .479
01747>        [CN= 71.0: N= 3.00]
01748>        [Tp=  .39:DT= 1.00]
01749> # Target flow for SWM Facility A
01750>  007:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01751>      ADD HYD            01:150         1.76     .227 No_date    1:43   56.90  n/a
01752>                       + 02:155         6.22     .749 No_date    1:44   54.17  n/a
01753>                       + 03:105        11.58    1.294 No_date    1:41   47.86  n/a
01754>        [DT= 1.00]  SUM=  09:900       19.56    2.268 No_date    1:42   50.68  n/a
01755> # west woodlot area draining southwest
01756>  007:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01757>      DESIGN NASHYD      04:140         4.24     .283 No_date    2:08   43.29 .434
01758>        [CN= 67.0: N= 3.00]
01759>        [Tp=  .73:DT= 1.00]
01760> # ========================================================
01761> # Existing Drainage Area (CENTRAL)
01762> # ========================================================
01763> # External Area Draining onto Property
01764>  007:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01765>      DESIGN NASHYD      05:200         9.49    1.006 No_date    1:48   51.56 .516
01766>        [CN= 74.0: N= 3.00]
01767>        [Tp=  .48:DT= 1.00]
01768> # External Area Draining onto Property
01769>  007:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01770>      DESIGN NASHYD      06:205         4.90     .722 No_date    1:36   56.90 .570
01771>        [CN= 78.0: N= 3.00]
01772>        [Tp=  .33:DT= 1.00]
01773> # West area draining to tile drain location
01774>  007:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01775>      DESIGN NASHYD      07:100        23.62    2.127 No_date    1:58   51.56 .516
01776>        [CN= 74.0: N= 3.00]
01777>        [Tp=  .62:DT= 1.00]
01778> # Total Flow to Point A
01779>  007:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01780>      ADD HYD            05:200         9.49    1.006 No_date    1:48   51.56  n/a
01781>                       + 06:205         4.90     .722 No_date    1:36   56.90  n/a
01782>                       + 07:100        23.62    2.127 No_date    1:58   51.56  n/a
01783>        [DT= 1.00]  SUM=  08:505       38.01    3.680 No_date    1:50   52.25  n/a
01784> # East Area draining north to creek
01785>  007:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01786>      DESIGN NASHYD      05:110         6.49     .520 No_date    1:53   42.20 .423
01787>        [CN= 66.0: N= 3.00]
01788>        [Tp=  .54:DT= 1.00]
01789> # Total Flow at Point B
01790>  007:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01791>      ADD HYD            03:105        11.58    1.294 No_date    1:41   47.86  n/a
01792>                       + 08:505        38.01    3.680 No_date    1:50   52.25  n/a
01793>                       + 05:110         6.49     .520 No_date    1:53   42.20  n/a
01794>        [DT= 1.00]  SUM=  07:510       56.08    5.431 No_date    1:48   50.18  n/a
01795> # Subtotal of total flow from site
01796>  007:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01797>      ADD HYD            01:150         1.76     .227 No_date    1:43   56.90  n/a
01798>                       + 04:140         4.24     .283 No_date    2:08   43.29  n/a
01799>                       + 07:510        56.08    5.431 No_date    1:48   50.18  n/a
01800>        [DT= 1.00]  SUM=  03:515       62.08    5.898 No_date    1:48   49.90  n/a
01801> # Southeast area draining south
01802>  007:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01803>      DESIGN NASHYD      01:115         9.93    1.095 No_date    1:41   46.68 .468
01804>        [CN= 70.0: N= 3.00]
01805>        [Tp=  .38:DT= 1.00]
01806> # Southeast area draining east
01807>  007:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01808>      DESIGN NASHYD      08:120        10.02    1.144 No_date    1:32   40.10 .402
01809>        [CN= 64.0: N= 3.00]
01810>        [Tp=  .26:DT= 1.00]
01811> # west area draining east to area 115
01812>  007:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01813>      DESIGN NASHYD      04:125         2.19     .229 No_date    1:46   49.07 .491
01814>        [CN= 72.0: N= 3.00]
01815>        [Tp=  .45:DT= 1.00]
01816> # Southwest area draining south
01817>  007:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01818>      DESIGN NASHYD      07:130         3.33     .591 No_date    1:28   56.90 .570
01819>        [CN= 78.0: N= 3.00]
01820>        [Tp=  .23:DT= 1.00]
01821> #  Target flow for SWM Facility B
01822>  007:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01823>      ADD HYD            01:115         9.93    1.095 No_date    1:41   46.68  n/a
01824>                       + 04:125         2.19     .229 No_date    1:46   49.07  n/a
01825>                       + 05:110         6.49     .520 No_date    1:53   42.20  n/a
01826>                       + 07:130         3.33     .591 No_date    1:28   56.90  n/a
01827>        [DT= 1.00]  SUM=  09:905       21.94    2.271 No_date    1:39   47.15  n/a
01828> #  Total flow from subject site w/o external area for future development
01829>  007:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01830>      ADD HYD            01:115         9.93    1.095 No_date    1:41   46.68  n/a
01831>                       + 08:120        10.02    1.144 No_date    1:32   40.10  n/a
01832>                       + 03:515        62.08    5.898 No_date    1:48   49.90  n/a
01833>                       + 04:125         2.19     .229 No_date    1:46   49.07  n/a
01834>                       + 07:130         3.33     .591 No_date    1:28   56.90  n/a
01835>        [DT= 1.00]  SUM=  06:520       87.55    8.555 No_date    1:43   48.66  n/a
01836> #  Total flow from subject site and external area for future development
01837>  007:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01838>      ADD HYD            02:155         6.22     .749 No_date    1:44   54.17  n/a
01839>                       + 06:520        87.55    8.555 No_date    1:43   48.66  n/a
01840>        [DT= 1.00]  SUM=  03:525       93.77    9.304 No_date    1:43   49.02  n/a
01841> # ========================================================
01842> # PROPOSED
01843> # ========================================================
01844> # Single Family Residential Area (On-site) including park draining to SWM A
01845>  007:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01846>      DESIGN STANDHYD    02:405         9.19    2.670 No_date    1:12   75.74 .759
01847>        [XIMP=.45:TIMP=.55]
01848>        [SLP=2.00:DT= 1.00]
01849>        [LOSS= 2 :CN= 74.0]
01850> # Single Family Residential Area (External)to SWM A
01851>  007:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01852>      DESIGN STANDHYD    03:410         6.22    1.804 No_date    1:11   75.06 .752
01853>        [XIMP=.45:TIMP=.55]
01854>        [SLP=2.00:DT= 1.00]
01855>        [LOSS= 2 :CN= 73.0]
01856> # North East External Area- assumed remains agricultural
01857>  007:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01858>      DESIGN NASHYD      04:200         9.41     .998 No_date    1:48   51.56 .516
01859>        [CN= 74.0: N= 3.00]
01860>        [Tp=  .48:DT= 1.00]
01861> # Total Flow to inlet of SWM Facility A
01862>  007:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01863>      ADD HYD            02:405         9.19    2.670 No_date    1:12   75.74  n/a
01864>                       + 03:410         6.22    1.804 No_date    1:11   75.06  n/a
01865>                       + 04:200         9.41     .998 No_date    1:48   51.56  n/a
01866>        [DT= 1.00]  SUM=  05:800       24.82    4.630 No_date    1:11   66.40  n/a
01867> # SWM Blk A including a few rear yards
01868>  007:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01869>      DESIGN STANDHYD    01:415         1.74     .571 No_date    1:10   70.63 .707
01870>        [XIMP=.50:TIMP=.50]
01871>        [SLP=****:DT= 1.00]
01872>        [LOSS= 2 :CN= 66.0]
01873> # Total Flow contributing to SWMF A
01874>  007:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01875>      ADD HYD            05:800        24.82    4.630 No_date    1:11   66.40  n/a
01876>                       + 01:415         1.74     .571 No_date    1:10   70.63  n/a
01877>        [DT= 1.00]  SUM=  02:805       26.56    5.124 No_date    1:11   66.68  n/a
01878>  007:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01879>      ROUTE RESERVOIR -> 02:805       26.56    5.124 No_date    1:11   66.68  n/a
01880>        [RDT= 1.00] out<- 01:SWMA      26.56    1.972 No_date    1:56   66.68  n/a
01881>      {MxStoUsed=.1002E+01}
01882> # Commercial/Employment area
01883>  007:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01884>      DESIGN STANDHYD    02:430        15.11    6.349 No_date    1:11   92.91 .930
01885>        [XIMP=.80:TIMP=.90]
01886>        [SLP=2.00:DT= 1.00]
01887>        [LOSS= 2 :CN= 74.0]
01888> # north west External area - assumed remains agricultural
01889>  007:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01890>      DESIGN NASHYD      03:205         4.90     .722 No_date    1:36   56.90 .570
```

```
01891>       [CN= 78.0: N= 3.00]
01892>       [Tp=  .33:DT= 1.00]
01893> # External Area West of Commercial Lands
01894>  007:0031---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01895>      DESIGN NASHYD      05:465        .32     .042 No_date    1:31    45.52 .456
01896>       [CN= 69.0: N= 3.00]
01897>       [Tp=  .26:DT= 1.00]
01898> # Total Flow to Commercial SWM Facility
01899>  007:0032---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01900>      ADD HYD            02:430       15.11    6.349 No_date    1:11    92.91  n/a
01901>                       + 03:205        4.90     .722 No_date    1:36    56.90  n/a
01902>                       + 05:465         .32     .042 No_date    1:31    45.52  n/a
01903>       [DT= 1.00]  SUM=  04:810       20.33    6.567 No_date    1:11    83.48  n/a
01904>  007:0033---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01905>      ROUTE RESERVOIR -> 04:810       20.33    6.567 No_date    1:11    83.48  n/a
01906>       [RDT= 1.00] out<- 05:SWMC      12.67    1.165 No_date    1:10    83.48  n/a
01907>             overflow <= 09:ComOVF     7.66    5.386 No_date    1:12    83.48  n/a
01908>      {MxStoUsed=.3799E+00, TotOvfVol=.6393E+00, N-Ovf=    3, TotDurOvf=    1.hrs
01909> # Total Multi-residential area draining to SWMF B
01910>  007:0034---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01911>      DESIGN STANDHYD    03:425        6.23    2.269 No_date    1:10    82.53 .827
01912>       [XIMP=.65:TIMP=.75]
01913>       [SLP=2.00:DT= 1.00]
01914>       [LOSS= 2 :CN= 67.0]
01915> # Single Family Residential, park and commercial area draining to SWMF B
01916>  007:0035---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01917>      DESIGN STANDHYD    06:440       19.31    5.057 No_date    1:12    70.58 .707
01918>       [XIMP=.45:TIMP=.55]
01919>       [SLP=2.00:DT= 1.00]
01920>       [LOSS= 2 :CN= 66.0]
01921> # Total Flow to SWM Facility B (Inlet Flow)
01922>  007:0036---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01923>      ADD HYD            03:425        6.23    2.269 No_date    1:10    82.53  n/a
01924>                       + 06:440       19.31    5.057 No_date    1:12    70.58  n/a
01925>                       + 09:ComOVF     7.66    5.386 No_date    1:12    83.48  n/a
01926>       [DT= 1.00]  SUM=  07:815       33.20   12.578 No_date    1:11    75.80  n/a
01927> # SWMF B Block
01928>  007:0037---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01929>      DESIGN STANDHYD    02:455        2.95     .946 No_date    1:10    69.06 .692
01930>       [XIMP=.50:TIMP=.50]
01931>       [SLP=****:DT= 1.00]
01932>       [LOSS= 2 :CN= 63.0]
01933> # Total Flow to SWM Facility (includes SWM Block)
01934>  007:0038---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01935>      ADD HYD            07:815       33.20   12.578 No_date    1:11    75.80  n/a
01936>                       + 02:455        2.95     .946 No_date    1:10    69.06  n/a
01937>       [DT= 1.00]  SUM=  06:820       36.15   13.407 No_date    1:11    75.25  n/a
01938>  007:0039---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01939>      ROUTE RESERVOIR -> 06:820       36.15   13.407 No_date    1:11    75.25  n/a
01940>       [RDT= 1.00] out<- 08:SWMB      36.15    1.513 No_date    2:01    75.25  n/a
01941>      {MxStoUsed=.2150E+01}
01942> # Open Space (Main Channel Area)
01943>  007:0040---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01944>      DESIGN NASHYD      02:445        7.36     .629 No_date    1:35    32.47 .325
01945>       [CN= 56.0: N= 3.00]
01946>       [Tp=  .30:DT= 1.00]
01947> # Total Flow at Property Line in Channel
01948>  007:0041---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01949>      ADD HYD            01:SWMA      26.56    1.972 No_date    1:56    66.68  n/a
01950>                       + 02:445        7.36     .629 No_date    1:35    32.47  n/a
01951>                       + 05:SWMC      12.67    1.165 No_date    1:10    83.48  n/a
01952>                       + 08:SWMB      36.15    1.513 No_date    2:01    75.25  n/a
01953>       [DT= 1.00]  SUM=  06:825       82.74    5.093 No_date    1:54    69.95  n/a
01954> # Open Space (South Woodlot)
01955>  007:0042---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01956>      DESIGN NASHYD      01:450        6.27     .627 No_date    1:31    34.27 .343
01957>       [CN= 58.0: N= 3.00]
01958>       [Tp=  .24:DT= 1.00]
01959> # West Woodlot
01960>  007:0043---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01961>      DESIGN NASHYD      03:460        4.24     .283 No_date    2:08    43.29 .434
01962>       [CN= 67.0: N= 3.00]
01963>       [Tp=  .73:DT= 1.00]
01964> # Total Flow from Subject Site
01965>  007:0044---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
01966>      ADD HYD            01:450        6.27     .627 No_date    1:31    34.27  n/a
01967>                       + 06:825       82.74    5.093 No_date    1:54    69.95  n/a
01968>                       + 03:460        4.24     .283 No_date    2:08    43.29  n/a
01969>       [DT= 1.00]  SUM=  02:830       93.25    5.750 No_date    1:52    66.34  n/a
01970>   ** END OF RUN :   7
01971> ****************************************************************************
01972> ****************************************************************************
01973>
01974>
01975>
01976>
01977>
01978>  RUN:COMMAND#
01979>  008:0001----------------------------------------------------------------------
01980>      START
01981>       [TZERO =    .00 hrs on        0]
01982>       [METOUT=   2   (1=imperial, 2=metric output)]
01983>       [NSTORM=   1 ]
01984>       [NRUN  =   8 ]
01985> #****************************************************************************
01986> #  Project Name: [Activa Waterloo East Lands]    Project Number: [1603-10788]
01987> #  Date        : 05-14 -2010
01988> #  Modeller    : [original M.Ninomiya- revisions M.Ryan]
01989> #  Company     : Stantec Consulting Ltd. (Kitchener)
01990> #  License #   :  4730904
01991> #
01992> #  Existing Conditions Model for Waterloo East Lands
01993> #  Soils data obtained from Hydrogeological and Geothechnical Study
01994> #           Activa Waterloo East Lands (Naylor, 2006)
01995> #  Re-run using City of Waterloo IDF Parameters
01996> #            Final Design Submission
01997> #
01998> #****************************************************************************
01999>  008:0002----------------------------------------------------------------------
02000>      READ STORM
02001>       Filename = Storm.001
02002>       Comment  = CHICAGO STORM, 10 mm 4 hour Chicago Storm
02003>       [SDT= 5.00:SDUR=   4.00:PTOT=  10.00]
02004> # ========================================================
02005> # Existing Drainage Area (EAST & FAR WEST)
02006> # ========================================================
02007> # Northeast area draining east
02008>  008:0003---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02009>      DESIGN NASHYD      01:150        1.76     .002 No_date    2:23     .90 .090
02010>       [CN= 78.0: N= 3.00]
02011>       [Tp=  .41:DT= 1.00]
02012> # Northeast area draining east (External to site)
02013>  008:0004---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02014>      DESIGN NASHYD      02:155        6.22     .006 No_date    2:25     .81 .081
02015>       [CN= 76.0: N= 3.00]
02016>       [Tp=  .43:DT= 1.00]
02017> # East Area draining south to creek
02018>  008:0005---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02019>      DESIGN NASHYD      03:105       11.58     .008 No_date    2:20     .64 .064
02020>       [CN= 71.0: N= 3.00]
02021>       [Tp=  .39:DT= 1.00]
02022> # Target flow for SWM Facility A
02023>  008:0006---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02024>      ADD HYD            01:150        1.76     .002 No_date    2:23     .90  n/a
02025>                       + 02:155        6.22     .006 No_date    2:25     .81  n/a
02026>                       + 03:105       11.58     .008 No_date    2:20     .64  n/a
02027>       [DT= 1.00]  SUM=  09:900       19.56     .016 No_date    2:22     .72  n/a
02028> # west woodlot area draining southwest
02029>  008:0007---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02030>      DESIGN NASHYD      04:140        4.24     .002 No_date    3:17     .54 .054
02031>       [CN= 67.0: N= 3.00]
02032>       [Tp=  .73:DT= 1.00]
02033> # ========================================================
02034> # Existing Drainage Area (CENTRAL)
02035> # ========================================================
02036> # External Area Draining onto Property
02037>  008:0008---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02038>      DESIGN NASHYD      05:200        9.49     .008 No_date    2:34     .74 .074
02039>       [CN= 74.0: N= 3.00]
02040>       [Tp=  .48:DT= 1.00]
02041> # External Area Draining onto Property
02042>  008:0009---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02043>      DESIGN NASHYD      06:205        4.90     .005 No_date    2:11     .90 .090
02044>       [CN= 78.0: N= 3.00]
02045>       [Tp=  .33:DT= 1.00]
02046> # West area draining to tile drain location
02047>  008:0010---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02048>      DESIGN NASHYD      07:100       23.62     .018 No_date    2:56     .74 .074
02049>       [CN= 74.0: N= 3.00]
02050>       [Tp=  .62:DT= 1.00]
02051> # Total Flow to Point A
02052>  008:0011---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02053>      ADD HYD            05:200        9.49     .008 No_date    2:34     .74  n/a
02054>                       + 06:205        4.90     .005 No_date    2:11     .90  n/a
02055>                       + 07:100       23.62     .018 No_date    2:56     .74  n/a
02056>       [DT= 1.00]  SUM=  08:505       38.01     .029 No_date    2:44     .76  n/a
02057> # East Area draining north to creek
02058>  008:0012---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02059>      DESIGN NASHYD      05:110        6.49     .003 No_date    2:43     .52 .052
02060>       [CN= 66.0: N= 3.00]
02061>       [Tp=  .54:DT= 1.00]
02062> # Total Flow at Point B
02063>  008:0013---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02064>      ADD HYD            03:105       11.58     .008 No_date    2:20     .64  n/a
02065>                       + 08:505       38.01     .029 No_date    2:44     .76  n/a
02066>                       + 05:110        6.49     .003 No_date    2:43     .52  n/a
02067>       [DT= 1.00]  SUM=  07:510       56.08     .041 No_date    2:39     .71  n/a
02068> # Subtotal of total flow from site
02069>  008:0014---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02070>      ADD HYD            01:150        1.76     .002 No_date    2:23     .90  n/a
02071>                       + 04:140        4.24     .002 No_date    3:17     .54  n/a
02072>                       + 07:510       56.08     .041 No_date    2:39     .71  n/a
02073>       [DT= 1.00]  SUM=  03:515       62.08     .045 No_date    2:40     .70  n/a
02074> # Southeast area draining south
02075>  008:0015---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02076>      DESIGN NASHYD      01:115        9.93     .007 No_date    2:18     .62 .062
02077>       [CN= 70.0: N= 3.00]
02078>       [Tp=  .38:DT= 1.00]
02079> # Southeast area draining east
02080>  008:0016---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02081>      DESIGN NASHYD      08:120       10.02     .006 No_date    2:02     .48 .048
02082>       [CN= 64.0: N= 3.00]
02083>       [Tp=  .26:DT= 1.00]
02084> # west area draining east to area 115
02085>  008:0017---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02086>      DESIGN NASHYD      04:125        2.19     .002 No_date    2:29     .67 .067
02087>       [CN= 72.0: N= 3.00]
02088>       [Tp=  .45:DT= 1.00]
02089> # Southwest area draining south
02090>  008:0018---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02091>      DESIGN NASHYD      07:130        3.33     .004 No_date    1:58     .90 .090
02092>       [CN= 78.0: N= 3.00]
02093>       [Tp=  .23:DT= 1.00]
02094> #  Target flow for SWM Facility B
02095>  008:0019---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02096>      ADD HYD            01:115        9.93     .007 No_date    2:18     .62  n/a
02097>                       + 04:125        2.19     .002 No_date    2:29     .67  n/a
02098>                       + 05:110        6.49     .003 No_date    2:43     .52  n/a
02099>                       + 07:130        3.33     .004 No_date    1:58     .90  n/a
02100>       [DT= 1.00]  SUM=  09:905       21.94     .015 No_date    2:20     .64  n/a
02101> #  Total flow from subject site w/o external area for future development
02102>  008:0020---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02103>      ADD HYD            01:115        9.93     .007 No_date    2:18     .62  n/a
02104>                       + 08:120       10.02     .006 No_date    2:02     .48  n/a
02105>                       + 03:515       62.08     .045 No_date    2:40     .70  n/a
02106>                       + 04:125        2.19     .002 No_date    2:29     .67  n/a
02107>                       + 07:130        3.33     .004 No_date    1:58     .90  n/a
02108>       [DT= 1.00]  SUM=  06:520       87.55     .061 No_date    2:32     .67  n/a
02109> #  Total flow from subject site and external area for future development
02110>  008:0021---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02111>      ADD HYD            02:155        6.22     .006 No_date    2:25     .81  n/a
02112>                       + 06:520       87.55     .061 No_date    2:32     .67  n/a
02113>       [DT= 1.00]  SUM=  03:525       93.77     .067 No_date    2:31     .68  n/a
02114> # ========================================================
02115> # PROPOSED
02116> # ========================================================
02117> # Single Family Residential Area (On-site) including park draining to SWM A
02118>  008:0022---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02119>      DESIGN STANDHYD    02:405        9.19     .084 No_date    1:42    4.66 .466
02120>       [XIMP=.45:TIMP=.55]
02121>       [SLP=2.00:DT= 1.00]
02122>       [LOSS= 2 :CN= 74.0]
02123> # Single Family Residential Area (External)to SWM A
02124>  008:0023---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02125>      DESIGN STANDHYD    03:410        6.22     .060 No_date    1:41    4.63 .463
02126>       [XIMP=.45:TIMP=.55]
02127>       [SLP=2.00:DT= 1.00]
02128>       [LOSS= 2 :CN= 73.0]
02129> # North East External Area- assumed remains agricultural
02130>  008:0024---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02131>      DESIGN NASHYD      04:200        9.41     .007 No_date    2:34     .74 .074
02132>       [CN= 74.0: N= 3.00]
02133>       [Tp=  .48:DT= 1.00]
02134> # Total Flow to inlet of SWM Facility A
02135>  008:0025---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02136>      ADD HYD            02:405        9.19     .084 No_date    1:42    4.66  n/a
02137>                       + 03:410        6.22     .060 No_date    1:41    4.63  n/a
02138>                       + 04:200        9.41     .007 No_date    2:34     .74  n/a
02139>       [DT= 1.00]  SUM=  05:800       24.82     .145 No_date    1:42    3.17  n/a
02140> # SWM Blk A including a few rear yards
02141>  008:0026---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02142>      DESIGN STANDHYD    01:415        1.74     .024 No_date    1:36    4.86 .486
02143>       [XIMP=.50:TIMP=.50]
02144>       [SLP=****:DT= 1.00]
02145>       [LOSS= 2 :CN= 66.0]
02146> # Total Flow contributing to SWMF A
02147>  008:0027---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02148>      ADD HYD            05:800       24.82     .145 No_date    1:42    3.17  n/a
02149>                       + 01:415        1.74     .024 No_date    1:36    4.86  n/a
02150>       [DT= 1.00]  SUM=  02:805       26.56     .163 No_date    1:41    3.28  n/a
02151>  008:0028---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02152>      ROUTE RESERVOIR -> 02:805       26.56     .163 No_date    1:41    3.28  n/a
02153>       [RDT= 1.00] out<- 01:SWMA      26.56     .010 No_date    4:34    3.28  n/a
02154>      {MxStoUsed=.7663E-01}
02155> # Commercial/Employment area
02156>  008:0029---------------ID:NHYD------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02157>      DESIGN STANDHYD    02:430       15.11     .230 No_date    1:44    7.68 .768
02158>       [XIMP=.80:TIMP=.90]
02159>       [SLP=2.00:DT= 1.00]
02160>       [LOSS= 2 :CN= 74.0]
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02161> # north west External area - assumed remains agricultural
02162>  008:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02163>      DESIGN NASHYD      03:205        4.90     .005 No_date    2:11     .90 .090
02164>        [CN= 78.0: N= 3.00]
02165>        [Tp=  .33:DT= 1.00]
02166> # External Area West of Commercial Lands
02167>  008:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02168>      DESIGN NASHYD      05:465         .32     .000 No_date    2:02     .59 .059
02169>        [CN= 69.0: N= 3.00]
02170>        [Tp=  .26:DT= 1.00]
02171> # Total Flow to Commercial SWM Facility
02172>  008:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02173>      ADD HYD            02:430       15.11     .230 No_date    1:44    7.68  n/a
02174>                       +  03:205        4.90     .005 No_date    2:11     .90  n/a
02175>                       +  05:465         .32     .000 No_date    2:02     .59  n/a
02176>        [DT= 1.00]  SUM=  04:810       20.33     .233 No_date    1:44    5.93  n/a
02177>  008:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02178>      ROUTE RESERVOIR -> 04:810       20.33     .233 No_date    1:44    5.93  n/a
02179>        [RDT= 1.00] out<- 05:SWMC      20.33     .083 No_date    2:43    5.93  n/a
02180>              overflow <= 09:ComOVF      .00     .000 No_date    0:00     .00  n/a
02181>      {MxStoUsed=.5035E-01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
02182> # Total Multi-residential area draining to SWMF B
02183>  008:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02184>      DESIGN STANDHYD    03:425        6.23     .086 No_date    1:41    6.26 .626
02185>        [XIMP=.65:TIMP=.75]
02186>        [SLP=2.00:DT= 1.00]
02187>        [LOSS= 2 :CN= 67.0]
02188> # Single Family Residential, park and commercial area draining to SWMF B
02189>  008:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02190>      DESIGN STANDHYD    06:440       19.31     .161 No_date    1:45    4.50 .451
02191>        [XIMP=.45:TIMP=.55]
02192>        [SLP=2.00:DT= 1.00]
02193>        [LOSS= 2 :CN= 66.0]
02194> # Total Flow to SWM Facility B (Inlet Flow)
02195>  008:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02196>      ADD HYD            03:425        6.23     .086 No_date    1:41    6.26  n/a
02197>                       +  06:440       19.31     .161 No_date    1:45    4.50  n/a
02198>                       +  09:ComOVF      .00     .000 No_date    0:00     .00  n/a
02199>        [DT= 1.00]  SUM=  07:815       25.54     .241 No_date    1:44    4.93  n/a
02200> # SWMF B Block
02201>  008:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02202>      DESIGN STANDHYD    02:455        2.95     .039 No_date    1:37    4.83 .483
02203>        [XIMP=.50:TIMP=.50]
02204>        [SLP=****:DT= 1.00]
02205>        [LOSS= 2 :CN= 63.0]
02206> # Total Flow to SWM Facility (includes SWM Block)
02207>  008:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02208>      ADD HYD            07:815       25.54     .241 No_date    1:44    4.93  n/a
02209>                       +  02:455        2.95     .039 No_date    1:37    4.83  n/a
02210>        [DT= 1.00]  SUM=  06:820       28.49     .268 No_date    1:43    4.92  n/a
02211>  008:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02212>      ROUTE RESERVOIR -> 06:820       28.49     .268 No_date    1:43    4.92  n/a
02213>        [RDT= 1.00] out<- 08:SWMB      28.49     .018 No_date    4:22    4.92  n/a
02214>      {MxStoUsed=.1237E+00}
02215> # Open Space (Main Channel Area)
02216>  008:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02217>      DESIGN NASHYD      02:445        7.36     .003 No_date    2:07     .35 .035
02218>        [CN= 56.0: N= 3.00]
02219>        [Tp=  .30:DT= 1.00]
02220> # Total Flow at Property Line in Channel
02221>  008:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02222>      ADD HYD            01:SWMA      26.56     .010 No_date    4:34    3.28  n/a
02223>                       +  02:445        7.36     .003 No_date    2:07     .35  n/a
02224>                       +  05:SWMC      20.33     .083 No_date    2:43    5.93  n/a
02225>                       +  08:SWMB      28.49     .018 No_date    4:22    4.92  n/a
02226>        [DT= 1.00]  SUM=  06:825       82.74     .104 No_date    3:13    4.24  n/a
02227> # Open Space (South Woodlot)
02228>  008:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02229>      DESIGN NASHYD      01:450        6.27     .003 No_date    2:00     .38 .038
02230>        [CN= 58.0: N= 3.00]
02231>        [Tp=  .24:DT= 1.00]
02232> # West Woodlot
02233>  008:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02234>      DESIGN NASHYD      03:460        4.24     .002 No_date    3:17     .54 .054
02235>        [CN= 67.0: N= 3.00]
02236>        [Tp=  .73:DT= 1.00]
02237> # Total Flow from Subject Site
02238>  008:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
02239>      ADD HYD            01:450        6.27     .003 No_date    2:00     .38  n/a
02240>                       +  06:825       82.74     .104 No_date    3:13    4.24  n/a
02241>                       +  03:460        4.24     .002 No_date    3:17     .54  n/a
02242>        [DT= 1.00]  SUM=  02:830       93.25     .108 No_date    3:12    3.81  n/a
02243>  008:0002---------------------------------------------------------------------------
02244>       FINISH
02245> ---------------------------------------------------------------------------
02246> ***************************************************************************
02247>      WARNINGS / ERRORS / NOTES
02248>      -------------------------
02249>    Simulation ended on 2010-05-15     at 16:02:15
02250> ===========================================================================
02251>
02252>
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APPENDIX C

Design Calculations

1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo
SCS Curve Number Determination
Existing Conditions

Site Soils: (as per Geotechnical Investigation, Naylor Engineering, February 2006)

Soil Type	Hydrologic Soil Group
Sand	AB
Sand and Gravel	A
Silt	BC
Silt Till	BC

TABLE OF CURVE NUMBERS (CN's)

Land Use	Hydrologic Soil Type							Manning's
	A	AB	B	BC	C	CD	D	'n'
Meadow	50	54	58	64.5	71	74.5	78	0.40
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.40
Long Grass	55	60	65	72	79	81.5	84	0.30
Lawns	60	65.5	71	77	83	86	89	0.25
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17
Crop	66	70	74	78	82	84	86	0.13
Fallow (Bare)	77	82	86	89	91	93	94	0.05
Impervious	98	98	98	98	98	98	98	0.01
Wetland	50	50	50	50	50	50	50	0.15

HYDROLOGIC SOIL TYPE (%) - Existing Conditions

Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
100		50.0		50.0				100
105	40.0	5.0		55.0				100
110	80.0	5.0		15.0				100
115	30.0	50.0		20.0				100
120	10.0	80.0		10.0				100
125		80.0		20.0				100
130		50.0		50.0				100
140				100.0				100
150				100.0				100
155			50.0	50.0				100
200		50.0		50.0				100
205				100.0				100

LAND USE (%) - Existing Conditions

Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Wetland	Impervious	Total
100						100				100
105		10				90				100
110		10				90				100
115						100				100
120		45				55				100
125						100				100
130						85			15	100
140		100								100
150						100				100
155						100				100
200						100				100
205						100				100

CURVE NUMBER (CN) - Existing Conditions

Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Wetland	Impervious	Weighted CN	IA	Manning's 'n'
100	0.0	0.0	0.0	0.0	0.0	74.0	0.0	0.0	0.0	74.0	8.92	0.13
105	0.0	6.0	0.0	0.0	0.0	65.5	0.0	0.0	0.0	71.0	10.37	0.16
110	0.0	5.3	0.0	0.0	0.0	61.2	0.0	0.0	0.0	66.0	13.08	0.16
115	0.0	0.0	0.0	0.0	0.0	70.4	0.0	0.0	0.0	70.0	10.89	0.13
120	0.0	25.2	0.0	0.0	0.0	38.7	0.0	0.0	0.0	64.0	14.29	0.25
125	0.0	0.0	0.0	0.0	0.0	71.6	0.0	0.0	0.0	72.0	9.88	0.13
130	0.0	0.0	0.0	0.0	0.0	62.9	0.0	0.0	14.7	78.0	7.16	0.11
140	0.0	67.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.0	12.51	0.40
150	0.0	0.0	0.0	0.0	0.0	78.0	0.0	0.0	0.0	78.0	7.16	0.13
155	0.0	0.0	0.0	0.0	0.0	76.0	0.0	0.0	0.0	76.0	8.02	0.13
200	0.0	0.0	0.0	0.0	0.0	74.0	0.0	0.0	0.0	74.0	8.92	0.13
205	0.0	0.0	0.0	0.0	0.0	78.0	0.0	0.0	0.0	78.0	7.16	0.13

** AMC II assumed
** Hydrological Soil Group taken from MTO Drainage Manual for each soil type

1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo
SCS Curve Number Determination
Proposed Conditions - including SWM control

Site Soils: (as per Geotechnical Investigation, Naylor Engineering, February 2006)

Soil Type	Hydrologic Soil Group
Sand	AB
Sand and Gravel	A
Silt	BC
Silt Till	BC

TABLE OF CURVE NUMBERS (CN's)

Land Use	Hydrologic Soil Type							Manning's
	A	AB	B	BC	C	CD	D	'n'
Meadow	50	54	58	64.5	71	74.5	78	0.40
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.40
Long Grass	55	60	65	72	79	81.5	84	0.30
Lawns	60	65.5	71	77	83	86	89	0.25
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17
Crop	66	70	74	78	82	84	86	0.13
Fallow (Bare)	77	82	86	89	91	93	94	0.05
Wetland	50	50	50	50	50	50	50	0.13
Streets, paved	98	98	98	98	98	98	98	0.014

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions

Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
200		50		50				100
205				100				100
405		30		70				100
410			60	40				100
415	50			50				100
420	100							100
425		90		10				100
430		30		70				100
435		100						100
440	40	40		20				100
445	70			30				100
450		80		20				100
455		100						100
460				100				100
465				100				100

LAND USE (%) - Proposed Conditions

Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Wetland	No Pervious	Total
200						100				100
205						100				100
405				100						100
410				100						100
415			50	50						100
420				100						100
425				100						100
430				100						100
435				100						100
440				100						100
445		80	20							100
450		100								100
455			50	50						100
460		100								100
465		80		20						100

CURVE NUMBER (CN) - Proposed Conditions

Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Builtup	No Pervious	Weighted CN	IA	Manning's 'n'
200	0.0	0.0	0.0	0.0	0.0	74.0	0.0	0.0	0.0	74	8.92	0.13
205	0.0	0.0	0.0	0.0	0.0	78.0	0.0	0.0	0.0	78	7.16	0.13
405	0.0	0.0	0.0	73.6	0.0	0.0	0.0	0.0	0.0	74	8.92	0.25
410	0.0	0.0	0.0	73.4	0.0	0.0	0.0	0.0	0.0	73	9.39	0.25
415	0.0	0.0	31.8	34.3	0.0	0.0	0.0	0.0	0.0	66	13.08	0.28
420	0.0	0.0	0.0	60.0	0.0	0.0	0.0	0.0	0.0	60	16.93	0.25
425	0.0	0.0	0.0	66.7	0.0	0.0	0.0	0.0	0.0	67	12.51	0.25
430	0.0	0.0	0.0	73.6	0.0	0.0	0.0	0.0	0.0	74	8.92	0.25
435	0.0	0.0	0.0	65.5	0.0	0.0	0.0	0.0	0.0	66	13.08	0.25
440	0.0	0.0	0.0	65.6	0.0	0.0	0.0	0.0	0.0	66	13.08	0.25
445	0.0	44.1	12.0	0.0	0.0	0.0	0.0	0.0	0.0	56	19.96	0.38
450	0.0	57.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58	18.39	0.40
455	0.0	0.0	30.0	32.8	0.0	0.0	0.0	0.0	0.0	63	14.92	0.28
460	0.0	67.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67	12.51	0.40
465	0.0	53.6	0.0	15.4	0.0	0.0	0.0	0.0	0.0	69	11.41	0.37

** post development catchments concerned with pervious CN values only
** AMC II assumed
** Hydrological Soil Group taken from MTO Drainage Manual for each soil type

1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo
SWMHYMO Parameters

Existing Conditions

Catchment Number	Area Description	SWMHYMO Command	Area (ha)	CN	TIMP	XIMP	Slope (%)	Length (m)	Tc (hrs)	Tp (hrs)
100	West area draining to tile drain location	DESIGN NASHYD	23.62	74			1.20	500	1.03	0.618
105	East area draining south to creek	DESIGN NASHYD	11.58	71			3.00	360	0.65	0.387
110	East area draining north to creek	DESIGN NASHYD	6.49	66			1.70	475	0.89	0.537
115	Southeast area draining south	DESIGN NASHYD	9.93	70			2.90	335	0.63	0.378
120	Southeast area draining east	DESIGN NASHYD	10.02	64			5.70	250	0.44	0.261
125	West area draining to east into Catchment 115	DESIGN NASHYD	2.19	72			0.40	130	0.75	0.453
130	Southwest area draining south	DESIGN NASHYD	3.33	78			2.10	100	0.38	0.230
140	West area draining west	DESIGN NASHYD	4.24	67			0.25	250	1.22	0.733
150	Notheast area draining east	DESIGN NASHYD	1.76	78			1.00	200	0.69	0.415
155	External lands to the east (proposed residential)	DESIGN NASHYD	6.22	76			2.40	375	0.71	0.426
200	Northeastern external Area Draining south into site	DESIGN NASHYD	9.49	74			2.00	425	0.80	0.481
205	Northwestern external Area Draining south into site	DESIGN NASHYD	4.90	78			2.00	200	0.55	0.330
			93.77							

Proposed Conditions

Catchment Number	Area Description	SWMHYMO Command	Area (ha)	CN	TIMP	XIMP	Slope (%)	Length (m)	Tc (hrs)	Tp (hrs)
405	Single Family Residential (On-site) to SWM A	DESIGN STANDHYD	9.19	74	0.55	0.45	2.0			
410	Single Family Residential (External) to SWM A	DESIGN STANDHYD	6.22	73	0.55	0.45	2.0			
415	SWM Blk. A (including a few rear yards)	DESIGN STANDHYD	1.74	66	0.50	0.50	10.0			
200	North External Area SWM Blk A	DESIGN NASHYD	9.41	74			2.0	425	0.80	0.481
425	Multi-Residential	DESIGN STANDHYD	6.23	67	0.75	0.75	2.0			
430	Commercial (Employment) Block	DESIGN STANDHYD	15.11	74	0.90	0.80	2.0			
440	Single Family Residential & Small commercial area & open space block	DESIGN STANDHYD	19.31	66	0.55	0.45	2.0			
445	Open Space (Channel)	DESIGN NASHYD	7.36	56			3.0	222	0.51	0.304
450	Open Space (South Woodlot)	DESIGN NASHYD	6.27	58			4.7	204	0.42	0.252
455	SWM Blk. B	DESIGN STANDHYD	2.95	63	0.50	0.50	10.0			
460	West Woodlot	DESIGN NASHYD	4.24	67			0.3	250	1.22	0.733
465	External Area draining to Commercial Block	DESIGN NASHYD	0.32	69			0.3	35	0.43	0.258
205	North External Area to SWM Blk B	DESIGN NASHYD	4.90	78			2.0	200	0.55	0.330
			93.25							

Total area draining to SWMF A (North) including SWM Block =	26.56	ha	
Total area draining to SWMF A (North) requiring quality control =	17.15	ha	includes the swm block
Total area draining to SWMF B (South) including SWM Block =	53.06	ha	
Total area draining to SWMF B (South) requiring quality control =	28.49	ha	includes the swm block

Notes:

CN calculated for pervious areas only for DESIGN STANDHYD. CN is a weighed average for DESIGN NASHYD

TIMP ..... ► *Total percent impervious*

XIMP ..... ► *Percent impervious directly connected*

Time of Concentration calculated using the Airport Method ► $Tc = [\ 3.26\ (1.1-C)\ L^{0.5}\ ] / S^{0.33}$

Where: *C = Runoff Coefficient = 0.2 for undeveloped areas*
L = Length of Overland Flow (m)
= (Area/1.5)^0.5
S = Slope (%)

Time to Peak ..... ► *Tp = 0.6Tc*

1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo

Stormwater Quality Volumetric Requirements

Facility	Drainage Area (ha)[2]	Total % Imp.	Level	Water Quality Unit Volume Requirements[1]			Water Quality Volume Requirements		
				Total Unit Volume (m^3/ha)	Permanent Pool (m^3/ha)	Extended Detention (m^3/ha)	Permanent Pool (m^3)	Extended Detention (m^3)	Total MOEE Volume
SWMF A	17.15	55%	1	105	65	40	1,115	686	1,801
SWMF B	28.49	60%	1	110	70	40	1,994	1,140	3,134

[1] Water quality unit volume requirements based on Table 3.2, Stormwater Management Planning & Design Manual (MOE 2003), Protection Level "Enhanced" (Lev

[2] Drainage Area for Quality control represents total drainage area to SWM Facility less the areas external to the subject development

For use in Interpolation of above formulae

	Wetpond				Wetland			
%	35	55	70	85	35	55	70	85
Enhanced / Level 1	140	190	225	250	80	105	120	140
Normal / Level 2	90	110	130	150	60	70	80	90
Basic / Level 3/4	60	75	85	95	60	60	60	60

1603-10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - SWM Facility A
SWM Basin Stage-Storage-Discharge Calculations

	Rating Curve						Volume Estimation								Outlet Rised Structure Controls									
					Drawdown (hrs)			Forebay		Main Pond		Forebay + Main Pond		Total											
	Elevation (m)	Discharge (m^3/s)	Total Storage (m^3)	Active Storage* (m^3)	Increment	Total	Elevation (m)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Volume (m^3)	Elevation (m)	Orifice #1 (m^3/s)	Orifice #2 (m^3/s)	DICB (m^3/s)	lead ove DICB (m	Orifice #3 (m^3/s)	Control	Spillway (m^3/s)	Total Flow (m^3/s)	Parameters
Forebay Invert	323.20						323.20	365							323.20									Orifice #1
	323.30		38				323.30	393	38					38	323.30									Orifice #1 Invert Elev. (m) 324.70 | Orifice Coeff. 0.60
	323.40		79				323.40	420	79					79	323.40									Orifice Mid-point Elev. (m) 324.78 | Perimeter (m) 0.50
	323.50		122				323.50	448	122					122	323.50									Orifice #1Diam.(mm) 160 | Area (m^2) 0.020
	323.60		168				323.60	475	168					168	323.60									Weir Coefficient (Sharp) 1.8 | Orientation Vertical
Top of Sed Storage	323.70		217				323.70	503	217					217	323.70									Orifice #2
	323.80		269				323.80	541	269					269	323.80									Orifice #2 Invert Elev. (m) 324.80 | Orifice Coeff. 0.60
	323.90		325				323.90	579	325					325	323.90									Orifice Mid-point Elev. (m) 324.95 | Perimeter (m) 0.94
	324.00		385				324.00	616	385					385	324.00									Orifice #2 Diam.(mm) 300 | Area (m^2) 0.071
	324.10		448				324.10	654	448					448	324.10									Weir Coefficient (Sharp) 1.8 | Orientation Vertical
	324.20		517				324.20	716	517					517	324.20									DDICB Inlet Structure
	324.30		592				324.30	778	592					592	324.30									CB T/G Invert (m) 325.50 | Area (m^2) 0.720
	324.40		673				324.40	841	673	5120				673	324.40									Catchbasin Size (mm) 1200 | Perimeter (m) 3.600
	324.50		609				324.50	903	87	5324	522			609	324.50									by 600 | Grate Slope (z:1) 4
	324.60		1245				324.60	965	181	5527	1065			1,245	324.60									Orifice #3
Permanent Pool	324.70		1908				324.70	1027	280	5731	1628	6758		1,908	324.70									Orifice #2 Invert Elev. (m) 324.70 | Orifice Coeff. 0.60
	324.80	0.008	2597	689	25.3	25.3	324.80					7029	689	2,597	324.80	0.008				0.015			0.008	Orifice Mid-point Elev. (m) 324.94 | Perimeter (m) 1.49
	324.90	0.030	3314	1406	10.5	35.9	324.90					7301	1406	3,314	324.90	0.019	0.012			0.057			0.030	Orifice #2 Diam.(mm) 475 | Area (m^2) 0.177
	325.00	0.067	4057	2150	4.2	40.1	325.00					7572	2150	4,057	325.00	0.025	0.042			0.118			0.067	Weir Coefficient (Sharp) 1.8 | Orientation Vertical
	325.10	0.103	4828	2920	2.5	42.6	325.10					7843	2920	4,828	325.10	0.030	0.073			0.190			0.103	Emergency Overflow Spillway
	325.20	0.129	5626	3718	1.9	44.5	325.20					8115	3718	5,626	325.20	0.035	0.094			0.241			0.129	Spillway Invert (m) 325.70 | Spillway Length (m) 8.5
	325.30	0.150	6451	4543	1.6	46.2	325.30					8386	4543	6,451	325.30	0.039	0.111			0.284			0.150	Weir Coefficient (Broad) 1.7 | Side Slopes (H:V) (?:1) 5.0
	325.40	0.168	7303	5395	1.5	47.7	325.40					8657	5395	7,303	325.40	0.042	0.126			0.320			0.168	
	325.50	0.185	8182	6275	1.4	49.1	325.50					8929	6275	8,182	325.50	0.045	0.139			0.353			0.185	
	325.60	0.334	9089	7181	1.0	50.0	325.60					9200	7181	9,089	325.60	0.048	0.151	0.134	0.100	0.383	0.134		0.334	
	325.70	0.611	10022	8115	0.5	50.6	325.70					9471	8115	10,022	325.70	0.051	0.163	0.398	0.200	0.411	0.398	0.000	0.611	
	325.80	1.124	10983	9075	0.31	50.9	325.80					9743	9075	10,983	325.80	0.054	0.173	0.834	0.300	0.437	0.437	0.459	1.124	
	325.90	2.009	11971	10063	0.18	51.1	325.90					10014	10063	11,971	325.90	0.057	0.183	1.440	0.400	0.462	0.462	1.307	2.009	
	326.00	3.151	12986	11078	0.11	51.2	326.00					10285	11078	12,986	326.00	0.059	0.192	2.048	0.500	0.485	0.485	2.414	3.151	
	326.10	4.507	14028	12120	0.076	51.3	326.10					10557	12120	14,028	326.10	0.061	0.201	2.526	0.600	0.508	0.508	3.737	4.507	
	326.20	6.054	15097	13190	0.056	51.3	326.20					10828	13190	15,097	326.20	0.064	0.210	3.045	0.700	0.529	0.529	5.251	6.054	

Orifice Equation Used: $Q = C \cdot A \cdot (2 \cdot g \cdot h)^{0.5}$ where

C = orifice coefficient
A = area of orifice
g = acceleration due to gravity
h = head above centre line of orifice
Note: Sharp crested weir equation with equivalent linear length used for calculating orifice flow rates when head is below centre line

Sharp crested semi-circular weir equation

$Q = C^* D^{2.5} * (H/D)^{1.88}$

where
C = sharp crested semi-circular weir coefficient
D = diameter of orifice
H = head above orifice invert
Note: used when water elevation is below mid-point of orifice

Weif Flow $Q = C_{wb}^* L^* H^{1.5} + C_{wt}^* S^* H^{2.5}$

where
L = bottom width of spillway
H = head above weir invert
S = side slopes (ratio of H:V)
C_{wt} = weir coefficient (triangular)
C_{wb} = weir coefficient (broad-crested)

1603-10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - SWM Facility A

Sediment Forebay Sizing Calculations - Based on 5-year Storm

Using MOE - SWM Manual Criteria (2003)

STORMWATER MANAGEMENT FACILITY

Settling

Dist = sqrt(r*Q_p/v_s)

= **8.0** **m**

r : 1 = l to w ratio — r = 2.40

Q_p = peak SWM outflow for water quality portion of E.D. zone — Q_p = 0.0080

v_s = settling velocity for 0.15 mm particles (m/s) — v_s = 0.0003

Dispersion Length

Dist = 8Q/dv

= **39.8** **m**

Q = 5 yr max inlet flow (m^3/s) — Q = 2.490

d = depth of perm pool in forebay above sediment storage (m) — d = 1

v_f = desired vel in forebay (m/s) — v_f = 0.5

Velocity

v = Q/A

= **0.15** **m/s**

y = total depth of forebay from perm. pool (m) (above sediment storage) — y = 1

b = bottom width (avg) of forebay (m) — b = 17

Q = 5 yr inlet flow (m^3/s) — Q = 2.490

A = cross-sectional area (m^2) — A = 17

Target velocity = 0.15 — V_{targ} = 0.15

Therefore, **Velocity Target Satisfied**

Cleanout Frequency

Table 6.3 MOE SWMPD Guidelines

cleanout = Vol/(load*A_{sew}*effic)

= **8.2** **years**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 17.50

Imp = Percent Impervious (%) — Imp = 55%

load = Sediment Loading (m^3/ha) — load = 1.9

effic = Removal Efficiency (%) — effic = 80%

Targ = Cleanout Frequency Target (years) — Targ = 7

Vol = Sediment volume (m^3) (0.5m depth) — Vol = 217

Therefore, **Cleanout Frequency Satisfied**

Surface Area Check

SA_f/SA_{pp} = **15%**

SA_f = Forebay Surface Area (m^2) — SA_f = 1,027

SA_{pp} = Total Permanent Pool Surface Area (m^2) — SA_{pp} = 6,758

Targ = Forebay size (as % of Permanent Pool Area) — Targ = 33%

Therefore, **The forebay size is OK!**

Notes

1. Total depth and cross-sectional area are 'worst-case' values, representative of conditions just prior to sediment clean-out
2. Interpolated based on percent impervious
3. Volume of bottom 0.5 m depth, the maximum sediment accumulation depth

1603-10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - SWM Facility A

Sediment Forebay Sizing Calculations - Based on 10-year Storm

Using MOE - SWM Manual Criteria (2003)

STORMWATER MANAGEMENT FACILITY

Settling

Dist = sqrt(r*Q_p/v_s)

= **8.0** **m**

r : 1 = l to w ratio — r = 2.40

Q_p = peak SWM outflow for water quality portion of E.D. zone — Q_p = 0.0080

v_s = settling velocity for 0.15 mm particles (m/s) — v_s = 0.0003

Dispersion Length

Dist = 8Q/dv

= **26.1** **m**

Q = **10 yr** max inlet flow (m^3/s) — Q = 3.170

d = depth of perm pool in forebay above sediment storage (m) — d = 1.94

v_f = desired vel in forebay (m/s) — v_f = 0.5

Velocity

v = Q/A

= **0.08** **m/s**

y = total depth of forebay from perm. pool (m) (above sediment storage) — y = 1.94

b = bottom width (avg) of forebay (m) — b = 17

Q = **10 yr** inlet flow (m^3/s) — Q = 3.170

A = cross-sectional area (m^2) — A = 40

Target velocity = 0.15 — V_{targ} = 0.15

Therefore, **Velocity Target Satisfied**

Cleanout Frequency

Table 6.3 MOE SWMPD Guidelines

cleanout = Vol/(load*A_{sew}*effic)

= **8.2** **years**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 17.50

Imp = Percent Impervious (%) — Imp = 55%

load = Sediment Loading (m^3/ha) — load = 1.9

effic = Removal Efficiency (%) — effic = 80%

Targ = Cleanout Frequency Target (years) — Targ = 7

Vol = Sediment volume (m^3) (0.5m depth) — Vol = 217

1603-10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - SWM Facility B
SWM Basin Stage-Storage-Discharge Calculations

	Rating Curve					
	Elevation (m)	Discharge (m^3/s)	Total Storage (m^3)	Active Storage* (m^3)	Drawdown (hrs) Increment	Drawdown (hrs) Total
Forebay Invert	315.90					
	316.00					
	316.10		443			
	316.20		675			
	316.30		913			
Top of Sed Storage	316.40		1159			
	316.50		1411			
	316.60		1671			
	316.70		1937			
	316.80		2210			
	316.90		2493			
	317.00		2788			
	317.10		3095			
	317.20		824			
	317.30		1367			
Infiltration Gallery	317.40		2268			
	317.50		3207			
	317.60	0.011	4183	975	24.4	24.4
	317.70	0.039	5194	1986	11.1	35.5
	317.80	0.064	6241	3034	5.6	41.1
	317.90	0.081	7325	4117	4.2	45.3
	318.00	0.229	8444	5237	2.0	47.3
	318.10	0.274	9600	6392	1.3	48.6
	318.20	0.304	10791	7584	1.1	49.7
	318.30	0.331	12019	8812	1.1	50.8
	318.40	0.356	13283	10076	1.0	51.8
	318.50	0.379	14583	11376	1.0	52.8
	318.60	0.401	15919	12712	1.0	53.8
	318.70	0.422	17291	14084	0.9	54.7
	318.80	0.441	18700	15492	0.91	55.6
	318.90	0.460	20144	16937	0.89	56.5
	319.00	0.479	21625	18417	0.88	57.4
	319.10	0.847	23141	19934	0.64	58.0
	319.20	1.507	24694	21486	0.37	58.4
	319.30	2.361	26283	23075	0.23	58.6
	319.40	3.373	27907	24700	0.16	58.8
	319.50	4.524	29568	26361	0.12	58.9

	Volume Estimation							
		Forebay		Main Pond		Forebay + Main Pond		Total
	Elevation (m)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Volume (m^3)
Forebay Invert	315.90	2145						
	316.00	2,214	218					
	316.10	2,283	443					443
	316.20	2,352	675					675
	316.30	2,421	913					913
Top of Sed Storage	316.40	2,490	1159					1,159
	316.50	2,559	1411					1,411
	316.60	2,628	1671					1,671
	316.70	2,697	1937					1,937
	316.80	2,766	2210					2,210
	316.90	2,888	2493					2,493
	317.00	3,010	2788					2,788
	317.10	3,132	3095	4909				3,095
	317.20	3,254	319	5177	504			824
	317.30	3,376	332	5444	1035			1,367
Infiltration Gallery	317.40	3,498	675	5712	1593	9210		2,268
	317.50					9571	939	3,207
	317.60					9932	1914	4,183
	317.70					10293	2925	5,194
	317.80					10654	3973	6,241
	317.90					11015	5056	7,325
	318.00					11376	6176	8,444
	318.10					11737	7331	9,600
	318.20					12098	8523	10,791
	318.30					12459	9751	12,019
	318.40					12820	11015	13,283
	318.50					13180	12315	14,583
	318.60					13541	13651	15,919
	318.70					13902	15023	17,291
	318.80					14263	16431	18,700
	318.90					14624	17876	20,144
	319.00					14985	19356	21,625
	319.10					15346	20873	23,141
	319.20					15707	22425	24,694
	319.30					16068	24014	26,283
	319.40					16429	25639	27,907
	319.50					16790	27300	29,568

	Outlet Rised Structure Controls							
	Elevation (m)	Orifice #1 (m^3/s)	DICB (m^3/s)	Orifice #3 (m^3/s)	Control	Spillway (m^3/s)	Total Flow (m^3/s)	Parameters
Forebay Invert	315.90							
	316.00							Orifice #1
	316.10							Orifice #1 Invert Elev. (m) 317.50 / Orifice Coeff. 0.60
	316.20							Orifice Mid-point Elev. (m) 317.64 / Perimeter (m) 0.86
	316.30							Orifice #1Diam.(mm) 275 / Area (m^2) 0.059
Top of Sed Storage	316.40							Weir Coefficient (Sharp) 1.8 / Orientation Vertical
	316.50							DDICB Inlet Structure
	316.60							CB T/G Invert (m) 317.90 / Area (m^2) 0.720
	316.70							Catchbasin Size (mm) 1200 / Perimeter (m) 3.600
	316.80							by 600 / Grate Slope (z:1) 4
	316.90							
	317.00							
	317.10							
	317.20							
	317.30							
Infiltration Gallery	317.40							
	317.50							
	317.60	0.011		0.013			0.011	Orifice #3 (In DDICB)
	317.70	0.039		0.040			0.039	Orifice #2 Invert Elev. (m) 317.50 / Orifice Coeff. 0.60
	317.80	0.064		0.090			0.064	Orifice Mid-point Elev. (m) 317.68 / Perimeter (m) 1.10
	317.90	0.081		0.121			0.081	Orifice #2 Diam.(mm) 350 / Area (m^2) 0.096
	318.00	0.095	0.134	0.146	0.134		0.229	Weir Coefficient (Sharp) 1.8 / Orientation Vertical
	318.10	0.107	0.398	0.167	0.167		0.274	Emergency Overflow Spillway
	318.20	0.118	0.834	0.185	0.185		0.304	Spillway Invert (m) 319.00 / Spillway Length (m) 6.5
	318.30	0.128	1.440	0.202	0.202		0.331	Weir Coefficient (Broad) 1.7 / Side Slopes (H:V) (?:1) 12.5
	318.40	0.138	2.048	0.218	0.218		0.356	
	318.50	0.147	2.526	0.232	0.232		0.379	
	318.60	0.155	3.045	0.246	0.246		0.401	
	318.70	0.163	3.583	0.259	0.259		0.422	
	318.80	0.170	4.107	0.271	0.271		0.441	
	318.90	0.177	4.622	0.283	0.283		0.460	
	319.00	0.184	4.854	0.294	0.294	0.000	0.479	
	319.10	0.191	4.854	0.305	0.305	0.350	0.847	
	319.20	0.197	4.854	0.316	0.316	0.994	1.507	
	319.30	0.204	4.854	0.326	0.326	1.832	2.361	
	319.40	0.210	4.854	0.336	0.336	2.828	3.373	
	319.50	0.215	4.854	0.345	0.345	3.964	4.524	

Orifice Equation Used: $Q = C \cdot A \cdot (2 \cdot g \cdot h)^{0.5}$ where

C = orifice coefficient
A = area of orifice
g = acceleration due to gravity
h = head above centre line of orifice
Note: Sharp crested weir equation with equivalent linear length used for calculating orifice flow rates when head is below centre line

Sharp crested semi-circular weir equation

$Q = C * D^{2.5} * (H/D)^{1.88}$
where
C = sharp crested semi-circular weir coefficient
D = diameter of orifice
H = head above orifice invert
Note: used when water elevation is below mid-point of orifice

Weif Flow $Q = C_{wb} * L * H^{1.5} + C_{wt} * S * H^{2.5}$

where
L = bottom width of spillway
H = head above weir invert
S = side slopes (ratio of H:V)
C_{wt} = weir coefficient (triangular)
C_{wb} = weir coefficient (broad-crested)

1603-10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - SWM Facility B

Sediment Forebay Sizing Calculations - Based on 5-year Storm

Using MOE - SWMPD Manual Criteria (2003)

STORMWATER MANAGEMENT FACILITY

Settling

Dist = sqrt(r*Q_p/v_s)

= **9.8** **m**

r : 1 = l to w ratio — r = 2.60

Q_p = peak SWM outflow for water quality portion of E.D. zone — Q_p = 0.0110

v_s = settling velocity for 0.15 mm particles (m/s) — v_s = 0.0003

Dispersion Length

Dist = 8Q/dv

= **65.4** **m**

Q = 5yr max inlet flow (m^3/s) — Q = 4.090

d = depth of perm pool in forebay above sediment storage (m) — d = 1

v_f = desired vel in forebay (m/s) — v_f = 0.5

Velocity

v = Q/A

= **0.13** **m/s**

y = total depth of forebay from perm. pool (m) — y = 1

b = bottom width (avg) of forebay (m) — b = 30

Q = 5 yr inlet flow (m^3/s) — Q = 4.090

A = cross-sectional area (m^2) — A = 32

Target velocity = 0.15 — V_{targ} = 0.15

Therefore, **Velocity Target Satisfied**

Cleanout Frequency

Table 6.3 MOE SWMPD Guidelines

cleanout = Vol/(load*A_{sew}*effic)

= **25.0** **years**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 28.49

Imp = Percent Impervious (%) — Imp = 57%

load = Sediment Loading (m^3/ha) — load = 2.0

effic = Removal Efficiency (%) — effic = 80%

Targ = Cleanout Frequency Target (years) — Targ = 7

Vol = Sediment volume (m^3) (**0.5**m depth) — Vol = 1,159

Therefore, **Cleanout Frequency Satisfied**

Surface Area Check

SA_f/SA_{pp} = **38%**

SA_f = Forebay Surface Area (m^2) — SA_f = 3,498

SA_{pp} = Total Permanent Pool Surface Area (m^2) — SA_{pp} = 9,210

Targ = Forebay size (as % of Permanent Pool Area) — Targ = 33%

Notes

1. Total depth and cross-sectional area are 'worst-case' values, representative of conditions just prior to sediment clean-out
2. Interpolated based on percent impervious
3. Volume of bottom 0.5 m depth, the maximum sediment accumulation depth

1603-10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - SWM Facility B

Sediment Forebay Sizing Calculations - Based on 10-year flow rates

Using MOE - SWMPD Manual Criteria (2003)

STORMWATER MANAGEMENT FACILITY

Settling

Dist = sqrt(r*Q_p/v_s)

= **9.8** **m**

r : 1 = l to w ratio — r = 2.60

Q_p = peak SWM outflow for water quality portion of E.D. zone — Q_p = 0.0110

v_s = settling velocity for 0.15 mm particles (m/s) — v_s = 0.0003

Dispersion Length

Dist = 8Q/dv

= **46.4** **m**

Q = **10 yr** max inlet flow (m^3/s) - as per request by GRCA — Q = 5.980

d = depth of perm pool in forebay above sediment storage (m) — d = 2.06

v_f = desired vel in forebay (m/s) — v_f = 0.5

Velocity

v = Q/A

= **0.08** **m/s**

y = total depth of forebay from perm. pool (m) — y = 2.06

b = bottom width (avg) of forebay (m) — b = 35

Q = 10 yr inlet flow (m^3/s) — Q = 5.980

A = cross-sectional area (m^2) — A = 76

Target velocity = 0.15 — V_{targ} = 0.15

Therefore, **Velocity Target Satisfied**

Cleanout Frequency

Table 6.3 MOE SWMPD Guidelines

cleanout = Vol/(load*A_{sew}*effic)

= **25.0** **years**

A_{sew} = Contributing Sewer Area (ha) — A_{sew} = 28.49

Imp = Percent Impervious (%) — Imp = 57%

load = Sediment Loading (m^3/ha) — load = 2.0

effic = Removal Efficiency (%) — effic = 80%

Targ = Cleanout Frequency Target (years) — Targ = 7

Vol = Sediment volume (m^3) (**0.5**m depth) — Vol = 1,159

1603 10788 - Carriage Crossing Subdivision (prev. Rural East Lands) - City of Waterloo

Right-of-Way Capacity Calculations - Based on 18 m width (within 20 m width)

Spring Garden Drive

Catchments draining to downstream location
200 405 410 (when it is developed)

Flow rate (100 year - 5 year storm sewer flow except for catchment 200)

Q = 3.2 m^3/s

Deerfoot Trail

Portions of Catchments draining to downstream location
205 430 425 440

Flow rate (100 year - 5 year storm sewer flow except for catchment 205)

Q= 6.62 m^3/s

Assumed 55% of flow goes to Deerfoot Trail

$\therefore$ 3.6 m^3/s

Manor Ridge Crescent

Same portions of catchments that drain to Deerfoot Trail

Assumed 45% of the flow

Q= 3.0 m^3/s

Set up FlowMaster (see attached) to analyze the highest flow rate, i.e. at Deerfoot Trail

Results

Flows are conveyed within the ROW and do not exceed 0.3 m of depth

Worksheet for Carriage Crossing - 18 m ROW at Manor Ridge Crescent

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	m/m
Discharge	3.60	m³/s

Section Definitions

Station (m)	Elevation (m)
-0+02	0.26
0+00	0.21
0+04.3	0.15
0+04.31	0.00
0+09	0.07
0+13.7	0.00
0+13.71	0.15
0+18	0.21
0+20	0.26

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+02, 0.26)	(0+04.3, 0.15)	0.025
(0+04.3, 0.15)	(0+13.71, 0.15)	0.016
(0+13.71, 0.15)	(0+20, 0.26)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.26	m
Elevation Range	0.000 to 0.257 m	

Worksheet for Carriage Crossing - 18 m ROW at Manor Ridge Crescent

Results

Flow Area		2.97	m²
Wetted Perimeter		22.293	m
Hydraulic Radius		0.13	m
Top Width		22.000	m
Normal Depth		0.26	m
Critical Depth		0.27	m
Critical Slope		0.00894	m/m
Velocity		1.21	m/s
Velocity Head		0.07	m
Specific Energy		0.34	m
Froude Number		1.05	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	m
Length	0.000	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.26	m
Critical Depth	0.27	m
Channel Slope	0.01000	m/m
Critical Slope	0.00894	m/m

Carriage Crossing (formerly Rural East District) Subdivision
Water Balance and Infiltration Calculations

Existing Drainage Conditions

The soils are:	Sand (Cultivated)	231	mm/yr	Infiltration Rate (1)			
	Silt (Cultivated)	175	mm/yr	Infiltration Rate (1)			
Topography:	Rolling Land						
						Open Water	
Area with:	Sand (Cultivated)	37.3	ha	% Impervious	5%	0.0	ha
	Silt (Cultivated)	25.2	ha	% Impervious	5%	0.0	
	Total	62.5	ha (2)	% Impervious	0%	0.0	ha

	Sand (Cultivated)	Silt (Cultivated)	
Precipitation	907.9	907.9	mm/yr (3)
Evapotranspiration (ET*(1-%IMP))	499.3	551.6	mm/yr (4)
Infiltration (INFIL*(1-IMP%)	219.7	166.3	mm/yr (1)
Evaporation (Open Water)	0.0	0.0	mm/yr
Runoff = P-EV-INFIL-EV(Open Water)	188.9	190.1	mm/yr

	Total		Total	
Precipitation	567,165	m^3/yr	908	mm/yr
Total Evapotranspiration (pre)	325,077	m^3/yr	520	mm/yr
Total Infiltration (pre)	123,789	m^3/yr	198	mm/yr
Total Evaporation (pre)	0	m^3/yr	0	mm/yr
Total Runoff (pre)	118,300	m^3/yr	189	mm/yr

Proposed Drainage Conditions

Surface Water Regime

The soils are:	Sand (Urban Lawns)	231	mm/yr	Infiltration Rate (1)			
	Silt (Urban Lawns)	175	mm/yr	Infiltration Rate (1)			
Topography:	Rolling to Hilly Land (~2%)						
						Water	
Area with:	Sand (Urban Lawns)	37.3	ha	% Impervious	59%	1.6	ha (6)
	Silt (Urban Lawns)	25.2	ha	% Impervious	60%		
	Total	62.5	ha (2)	% Impervious		1.6	ha

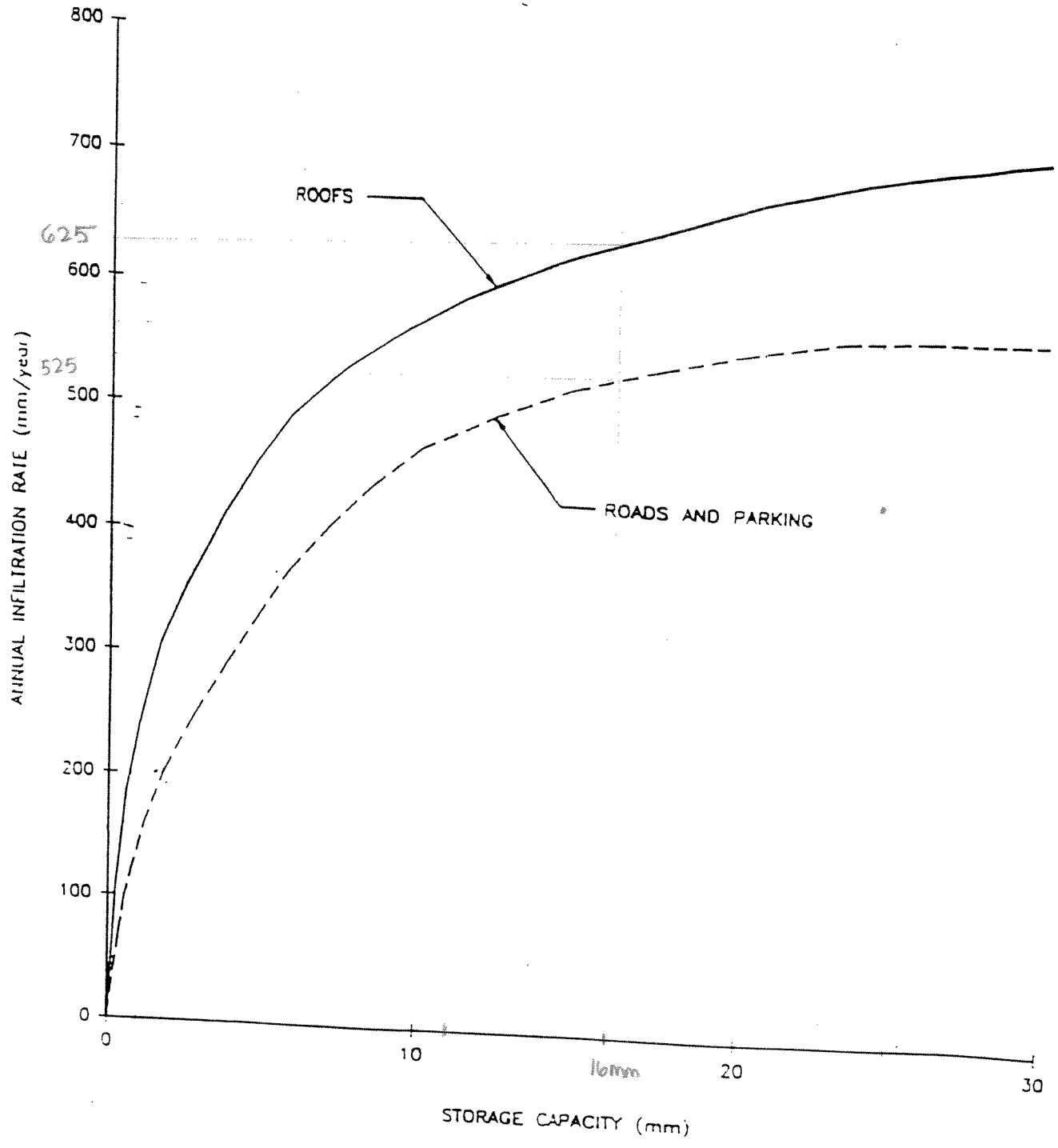
	Sand (Urban Lawns)	Silt (Urban Lawns)	
Precipitation	907.9	907.9	mm/yr (3)
Evapotranspiration (ET*(1-%IMP))	198.8	222.5	mm/yr (4)
Infiltration (INFIL*(1-IMP%)	90.7	70.0	mm/yr (1)
Evaporation (Open Water)	28.2	0.0	mm/yr (5)
Runoff = P-EV-INFIL-EV(Open Water)	590.2	615.4	mm/yr

	Total		Total	
Precipitation	567,438	m^3/yr	907.9	mm/yr
Total Evapotranspiration (post)	130,228	m^3/yr	208.4	mm/yr
Total Infiltration (post)	51,469	m^3/yr	82.4	mm/yr
Total Evaporation (post)	10,530	m^3/yr	16.8	mm/yr
Total Runoff (post)	375,210	m^3/yr	600.3	mm/yr

Infiltration Post Development is	**51,469 m^3/yr**	82.4 mm/yr
Total Infiltration Deficit:	**-72,319 m^3/yr**	-115.7 mm/yr
Total Runoff Surplus:	**256,910 m^3/yr**	411.1 mm/yr

Infiltration Augmentation		
Soakaway Pits		
Larger Lots (South of Tributary)		
Individual House Area (Single - weighted average) :	230	m^2
Soakaway Pit Sized to Capture 25 mm Rainfall Events	725	mm/year (7)
Additional Infiltration per Single House in Sand or Sand & Gravel	167	m^3/year
	Required	Available
Number of Single Houses Used for Soakaway Pits (located in Sand or Sand & Gravel)	118	118
includes 11 single family dwellings from the northern portion of the site		
Infiltration for Larger Lots	19677	m^3/year
Smaller Lots (North of Tributary)		
Individual House Area (Single - weighted average) :	135	m^2
Soakaway Pit Sized to Capture 25 mm Rainfall Events	725	mm/year (7)
Additional Infiltration per Single House	98	m^3/year
	Required	Available
Number of Single Houses Used for Soakaway Pits (located in Sand or Sand & Gravel)	28	28
Infiltration for Smaller Lots	0	m^3/year
Sub total - Soakaway Pit Infiltration from Individual Houses	19677	m^3/year
Infiltration Gallery in SWM Basin B (South Basin)		
Road area and driveway area draining to Basin B	49314	m^2
Roof top area from Multi Residential (assumed 40% of footprint)	24000	m^2
Available dead storage above permanent pool directed to infiltration gallery	975	m^3
Available storage in infiltration gallery	200	m^3
Total Volume storage	1,175	m^3
Rainfall event required to fill the dead storage and infiltration gallery - based on rooftop & roads	16	mm
Therefore, annual infiltration rate for road area (based on 16 mm storm)	525	mm/year
Annual infiltration rate for roof tops (based on 16 mm storm)	625	mm/year
Sub total - SWM Basin B infiltration	40,890	m^3/year
Total Added Infiltration	**60,566**	**m^3/year**
Total Post Development Infiltration:	**112,035**	**m^3/yr**
Final Infiltration Deficit:	**-11,753**	**m^3/yr**
Percentage of Final Infiltration Deficit:	**-9%**	

(1) Infiltration rate based on infiltration rates in the Hydrogeological and Geotechnical Study (Naylor, February 2008)Engineering Associates, February 2006)
(2) Two woodlot areas that will remain undisturbed (9.7 ha) were not included in the analysis as they will be maintained in post development conditions.
(3) Precipitation based on: *Water Budget Means for the Period 1971-2000 for the Waterloo -Wellington Area.*
(4) Evapotranspiration values based on computed from climate data obtained from data obtained from the Meteorological Service of Canada (MSC) for the Waterloo Wellington Airport for data encompassing 1971 to 2001
(5) Open water evaporation (650 mm/yr) based on Environment Canada Calculated Lake Evaporation Data, 1951-1980 (Ontario Climate Centre)
(6) Includes the permanent pool area of the forebay and wetland areas
(7) Value is based on *Sun Valley Property Stormwater Management Report* (Paragon/Stantec, 1992)



SCALE: 1:200 HORZ.
1:5000 VERT.

PARAGON ENGINEERING LIMITED CONSULTING ENGINEERS SUITE 300 871 VICTORIA ST. N. KITCHENER ONTARIO N2B 3S4	INFILTRATION TRENCH DESIGN CURVES	SCALE: AS SHOWN	DATE: JUNE 1992
	FORMER SUN VALLEY PROPERTY	PROJECT NO. 3-3691	FIGURE C1

Estimated Infiltration Rate - Sandy Soil Gallery in SWM Facility B
Clear Stone

		Units
Annual Infiltration rate	525	mm/yr
Non Roof Drainage Area	49000	m^2
Runoff	16	mm
Total Volume of Dead Storage in Pond	975.0	m^3
Total Length of Gallery	200	m
Gallery Height	1	m
Void Ratio of Infiltration Gallery Stone	0.4	
Total Width of Gallery	2.5	m
Total Expected Annual Infiltration	25725	m^3/year
Surface Area	500	m^2
Assumed Infiltration rate[3]	144	mm/hr
Drawdown Time	7	hrs

Note:

(1) Annual infiltration rates are based on Figure C1 from the Former Sun Valley Property Stormwater Management Report, (Paragon/Stantec, 1992)

(2) Calculations based on storage available in pond above permanent pool to be directed into the infiltration gallery

Soakaway Pit Sizing - Carriage Crossing Subdivision

Allowable depth of gallery (m) based on Equation 4.2 from MOE SWM Manual (2003)

$$d = \frac{PT}{1000}$$

where

d = maximum allowable depth of the soakaway pit (m)
P = percolation rate of surrounding native soils (mm/hr)
T = Drawdown time (24 -48 hrs)

Soakaway Pits for Single Family Dwellings in Sandy Soils

		Units
Annual Infiltration rate	725	mm/yr
Runoff	25	mm
Roof top area (Larger Lot)	230	m^2
Runoff volume during 25 mm storm	5.75	m^3
Clearstone void ratio	0.4	
Volume of Infiltration Gallery required	14.38	m^3
Drawdown time target	24	hrs
Depth of infiltration gallery required to meet infiltration target	3.46	m
Actual depth of infiltration gallery	1	m
Total Length of Gallery	5.0	m
Total Width of Gallery	3.0	m
Volume provided in soakaway pit	15.0	m^3
Percolation rate [3]	144	mm/hr
Drawdown time	6.9	hrs

Note:

(1) Annual infiltration rates are based on Figure C1 from the Former Sun Valley Property Stormwater Management Report, (Paragon/Stantec, 1992)

(2) Calculations based on total roof top area during a 25 mm storm being directed to soakaway pit

(3) Percolation rate provided by Naylor Engineering (personal communication, April 27, 2010)

Soakaway Pit Sizing - Carriage Crossing Subdivision

Soakaway Pits for individual smaller lot in Silty soils

		Units
Runoff	25	mm
Roof top area (Smaller Lots)	135	m^2
Runoff volume during 25 mm storm	3.375	m^3
Clearstone void ratio	0.4	
Volume of Infiltration Gallery required	8.44	m^3
Depth of infiltration gallery	1	m
Total Length of Gallery	3.4	m
Total Width of Gallery	2.5	m
Volume provided in infiltration gallery	8.5	m^3

Note:

(1) Annual infiltration rates are based on Figure C1 from the Former Sun Valley Property Stormwater Management Report, (Paragon/Stantec, 1992)

(2) Calculations based on total roof top area during a 25 mm storm being directed to soakaway pit

APPENDIX D

GRCA Final SWM Submission Checklist

GRCA FINAL SWM SUBMISSION CHECKLIST

This checklist is intended for use by the Consultant to ensure that all components of a Final SWM submission are included in an effort towards minimizing the time requirements of the revie and approval process. Along with the Preconsultation Checklist and Preliminary SWM Checklist, it will serve as a quick reference to review staff that all required supporting infomation has been provided. This checklist should be included with the Final SWM submission. The checklist was created in conjunction with the Homebuilders Association/GRCA Liaison Committee and will be updated periodically, with the current version available for download from the GRCA website (www.grandriver.ca).

Project Name Carriage Crossing Subdivision (prev. Rural East) **ID#** 30T-08401

Main Report			
Background Report(s) Summary	Yes	No	N/A
SWM Objectives / Criteria Summary	Yes	No	N/A
Description of Existing Conditions incl. Topography, Surface Drainage (with Externals), Soils, GW Characteristics	Yes	No	N/A
Infiltration - Requirements, Proposed Strategy, Results	Yes	No	N/A
Water Quality - Requirements, Proposed Strategy, Results	Yes	No	N/A
Erosion Protection for Receivers - Requirements, Proposed Strategy, Results	Yes	No	N/A
Water Quantity - Requirements, Proposed Strategy, Results	Yes	No	N/A
Summary of Monitoring Programs completed, on-going, or anticipated	Yes	No	N/A
Erosion Potential Evaluation and Anticipated Control Strategy	Yes	No	N/A
Reports / Plans signed and sealed	Yes	No	N/A

Figures / Plans			
Location Plan	Yes	No	N/A
Pre-Development Storm Drainage Boundaries - include existing topographic information	Yes	No	N/A
Post-Development Storm Drainage Boundaries - include proposed grading information	Yes	No	N/A
Schematic Representations of Pre- and Post-Development Hydrologic Models	Yes	No	N/A
Plans and Profiles for SWMF's and Outlet Configurations	Yes	No	N/A
Grading Plan(s) - should include delineation of Constraint Areas and associated Buffers	Yes	No	N/A
Cut/Fill Plan(s) - required primarily in floodplain areas or where GW table may be an issue	Yes	No	N/A
GW Elevations Plan - relative to proposed grades (required primarily in areas where GW table may be an issue)	Yes	No	N/A
SWMF Landscape Plan(s)	Yes	No	N/A
Erosion and Sediment Control Plan(s)	Yes	No	N/A

Appendices			
Pre-Consultation Checklist	Yes	No	N/A
Hydrologic Modeling Input Parameters with Supporting Justification (calcs and/or references)	Yes	No	N/A
Stage-Storage-Discharge Table for SWMF (include sample equations and outlet characteristics)	Yes	No	N/A
Sediment Forebay Sizing Calculations (including Settling / Dispersion Lengths and Cleanout Frequency requirements)	Yes	No	N/A
Sizing analysis for all other components of the SWM system - conveyance, stability, etc.			
Pre-Development Hydrologic Analysis	Yes	No	N/A
Post-Development Hydrologic Analysis	Yes	No	N/A
Pre-Development Hydraulic Analysis	Yes	No	N/A
Post-Development Hydraulic Analysis	Yes	No	N/A
Water Balance Analysis	Yes	No	N/A
Geotech./Hydrogeo. Report & Plan(s) (may be same as at Preliinary design) - incl. GW contour mapping where GW table may be an is	Yes	No	N/A

Additional Items and/or Clarification Notes (attach additional information as required)

519-886-9400

Consultant Team Contact Info:	Landowner Contact Info:	Checklist Prepared by::
Joe Grubb 585-7279 Melissa Ryan 585-7111 Stantec Consulting Ltd.	Peter Armbruster (Activa Holdings Inc)	Melissa Ryan
	GRCA Contact Info: John Brum, 519-621-2761 xt. 231	Date: May 17/2010

GRCA PRECONSULTATION CHECKLIST

The objective of the Preconsultation process is the definition of a terms of reference for the reporting and analysis required to support a proposed development application. This checklist is intended to provide a brief synopsis of the expectations of both the GRCA and the Consultant team, and should be completed jointly, prior to the initiation of studies and/or detailed design work. It is anticipated that the preparation of this checklist will help ensure complete submissions thereby minimizing the time and effort spent in the review / approval process. This checklist should be included with all submissions. The checklist was created in conjunction with the Homebuilders Association/GRCA Liaison Committee and will be updated periodically, with the current version available for download from the GRCA website (www.grandriver.ca).

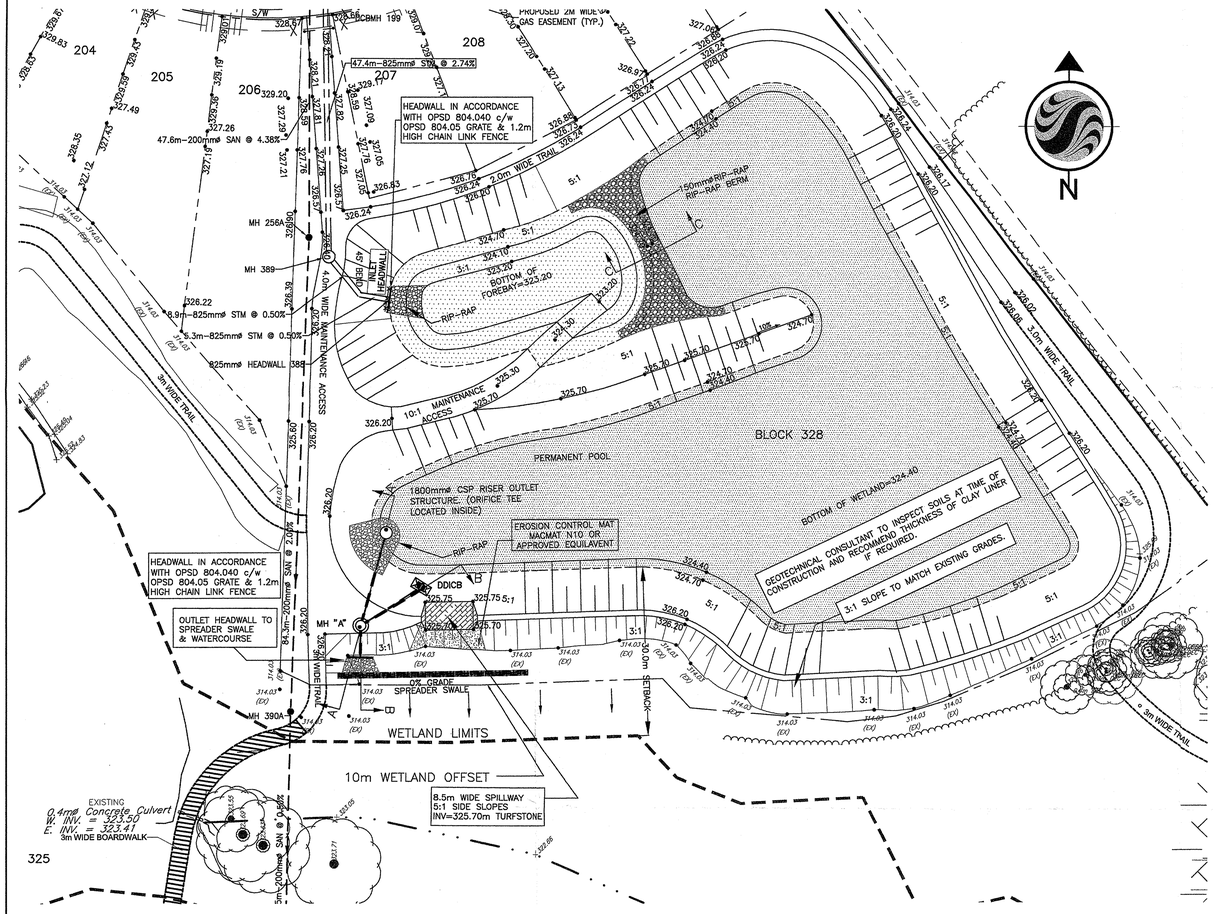
Project Name / Type of Application (sub'n, sev, condo,...)				ID #			General Location (attach Plan)		
Watershed Study or Master Drainage Plan / Watercourse Name				Development Area		ha	Legal Outlet Available?	Yes	No
Known Environmental Opportunities and Constraints	Watercourse	Regulatory Floodplain	Valley Land	Wetland	Steep Slope	Scheduled Area	Other :		
	Wellhead Protection Area	ANSI	Wildlife Habitat	Endangered Species Habitat	ESPA	Woodlands	instream timing window		
Surface Runoff Receiver	Major River	Creek	Municipal Drain	Unnamed Trib.	Existing Storm Sewer	Wetland	Internally Drained	Other :	
Watercourse Receiver	Cold Water	Warm Water	Water Supply	N/A	Other :				
Groundwater Receiver	Wellhead	Wetland	Local Stream	Regional Groundwater	N/A	Other :			
Development Concept	Single Residential	Multi-residential	Mixed	Rural Estate Residential	Commercial	Industrial	Other:		
Monitoring Requirements									
Permit Requirements									
Timelines / Expectations									

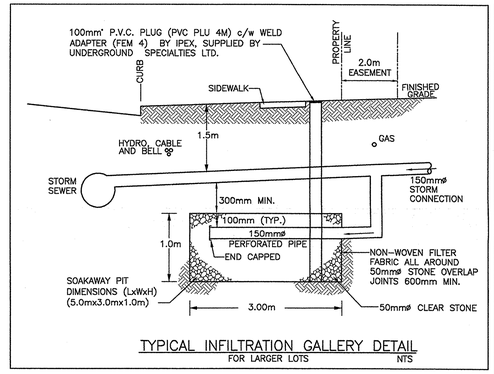
SWM Criteria SWS Requirements									
Water Quantity	Match Pre-devel Flows for : 2 5 10 25 50 100		Regional Flows	Unit Flows	Downstream Constraints	Other :			
Hydrologic Approach (Exis.Model?, Software, Discrete vs. Continuous)			**Hydraulic Approach (Existing Model?, Software)**				**Rainfall Data (Location, Duration)**		
Water Quality	Level 1 (Enhanced)	Level 2 (Normal)	Level 3 (Basic)	Downstream Constraints	PWQO	Bacteria	Temperature	None	Other :
Stream Erosion	13 mm 25 mm	2 yr Vol 5 yr Vol	Existing Water Balance	Shear Stress	Critical Velocity	Impulse	Distributed Runoff Control	N/A	Other :
Recharge Quantity	None	25 mm Rooftop	Match Pre-development Infiltration	Match Pre-development Runoff	Match Baseflow	Other :			
Recharge Quality	None	Resid. Rooftops Only	All Rooftops	Some Roads	All Roads	Other :			

Environmental Opportunities and Constraints - Requirements						
Floodplain Analysis	One Zone	Two Zone	Special Policy Area	Site Specific	N/A	Other :
Geotechnical Slope Analysis	Stability	Toe Erosion	Structural	Factor of Safety	N/A	Other :
EIS required based on known Environmental Constraints listed above?	Yes	No	Please ensure all relevant resource issues and environmental constraint lines are shown on associated Plans (Draft Plan, Constraint Mapping, Grading Plans, etc.)			

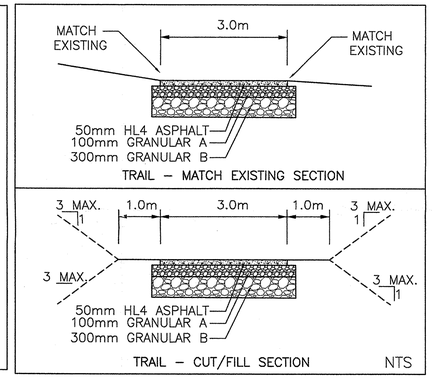
Other Criteria & Additional Notes (attach additional information as required)

Consultant Team Contact Info:	Landowner Contact Info:	Checklist Prepared by::
	GRCA Contact Info:	Date:

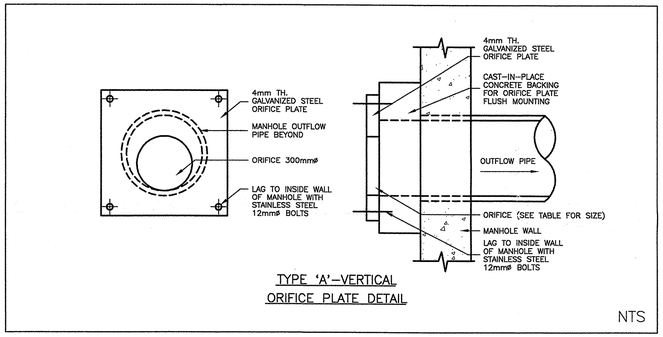




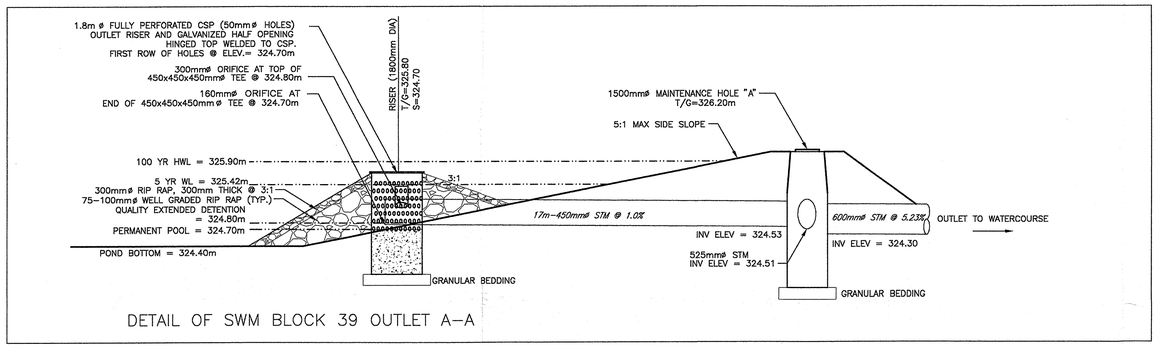
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FOR LARGER LOTS NTS



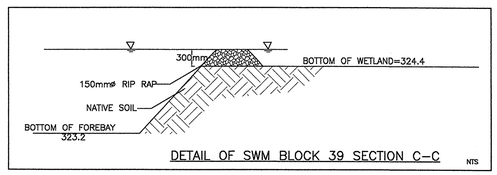
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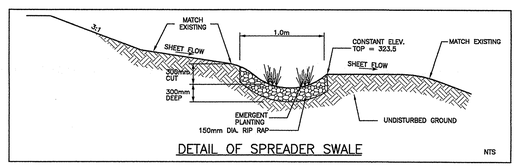
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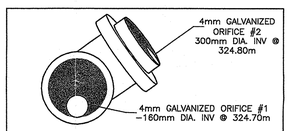
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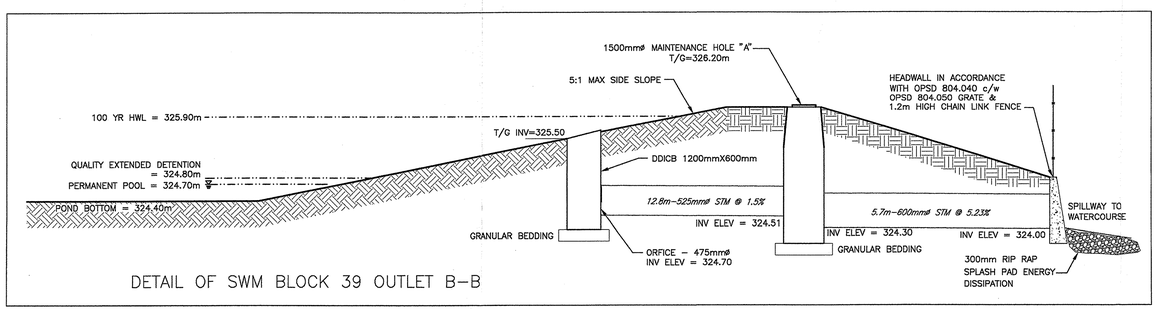
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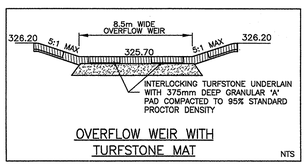
DETAIL OF SPREADER SWALE
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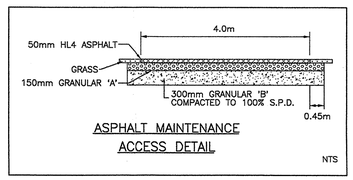
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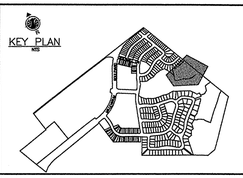
DETAIL OF SWM BLOCK 39 OUTLET B–B



OVERFLOW WEIR WITH TURFSTONE MAT
NTS



ASPHALT MAINTENANCE ACCESS DETAIL
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The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them. Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

NOTES

INT.	DATE	REVISIONS
–	–	–

Stantec
49 Frederick Street
Kitchener, ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.8664
www.stantec.com

CITY OF WATERLOO

THE CITY OF Waterloo

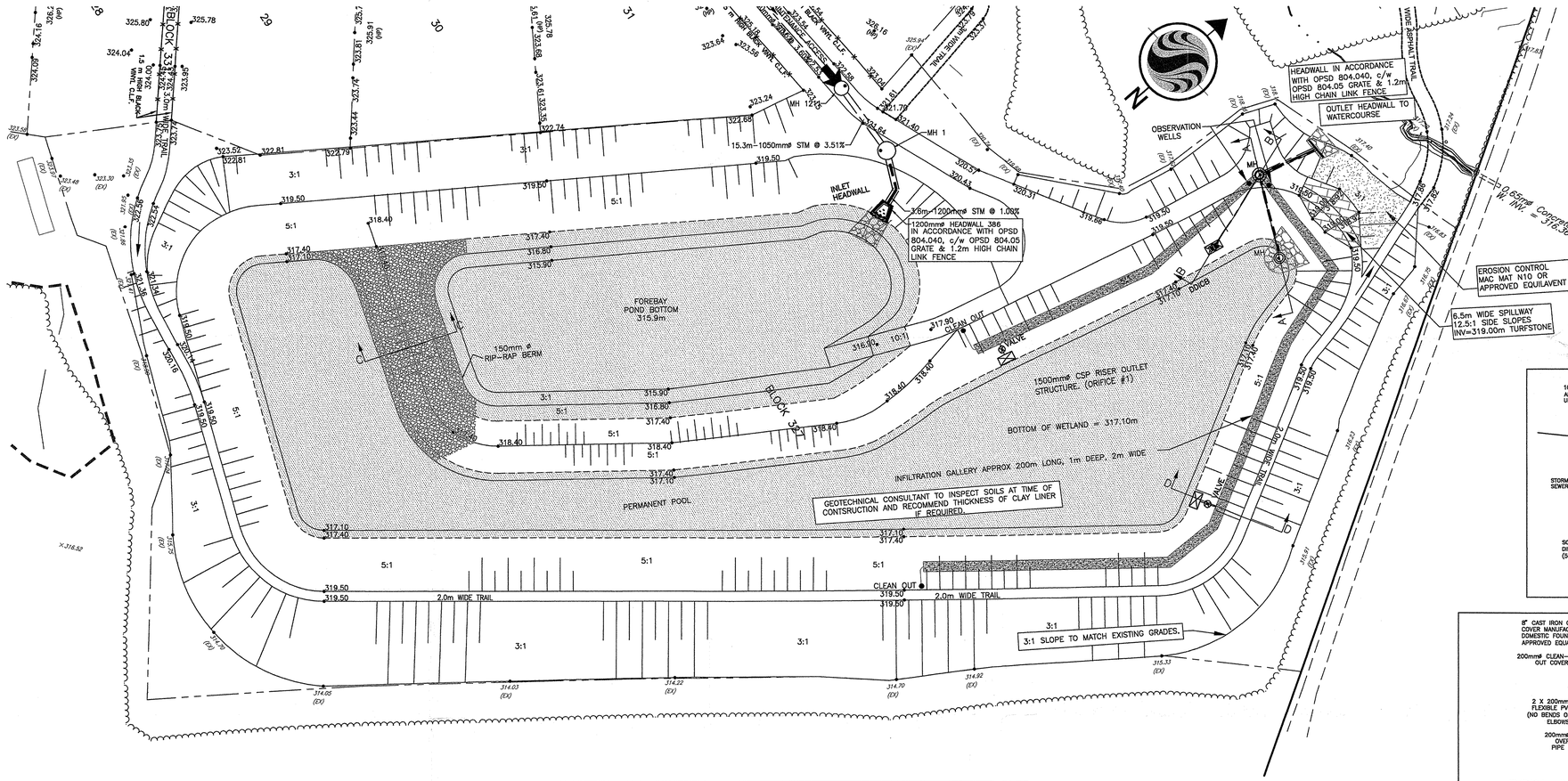
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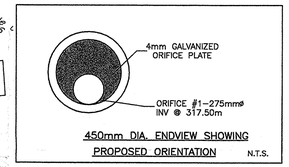
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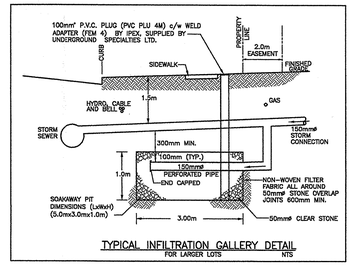
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		CHECKED BY:	J.L.G.
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FIELD BK.	PAGE / DATE		

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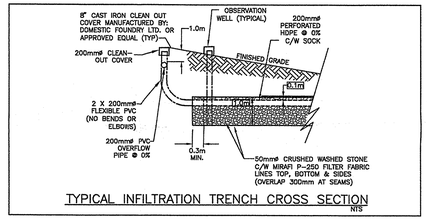




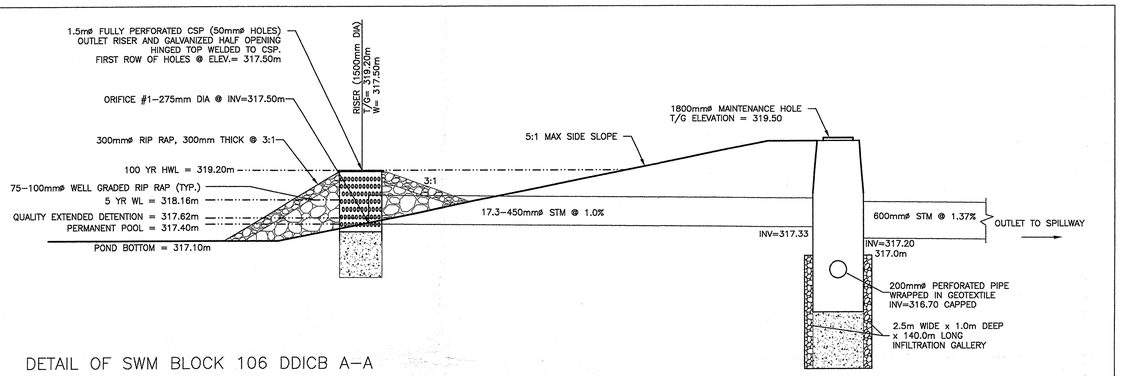
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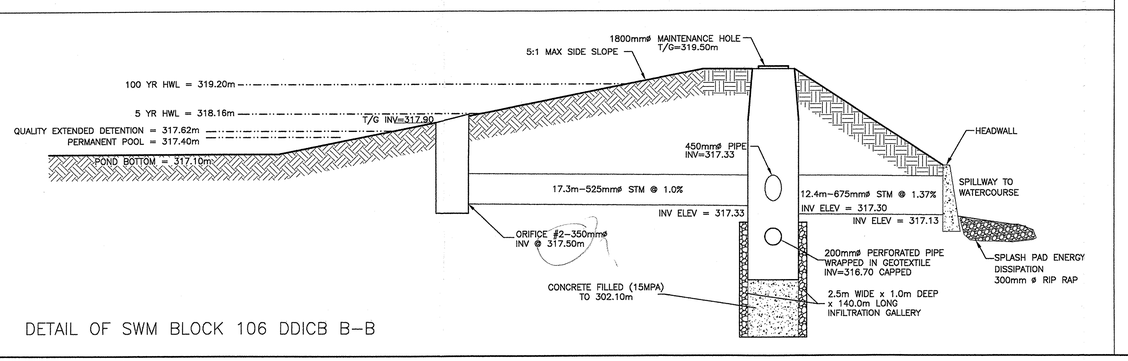
TYPICAL INFILTRATION GALLERY DETAIL FOR LARGER LOTS NTS



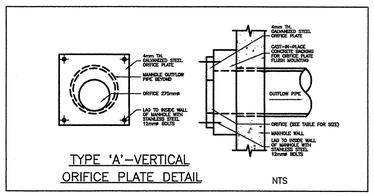
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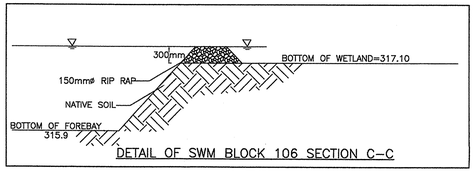
DETAIL OF SWM BLOCK 106 DDICB A-A



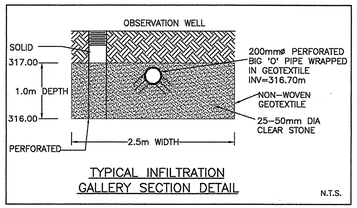
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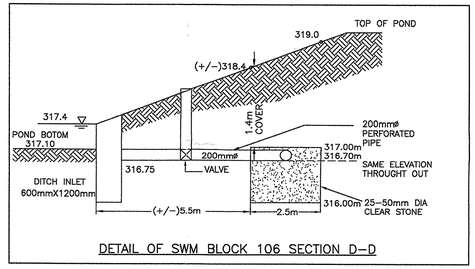
TYPE 'A'-VERTICAL ORIFICE PLATE DETAIL NTS



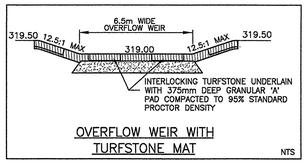
DETAIL OF SWM BLOCK 106 SECTION C-C



TYPICAL INFILTRATION GALLERY SECTION DETAIL N.T.S.

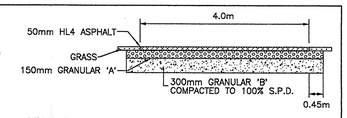


DETAIL OF SWM BLOCK 106 SECTION D-D



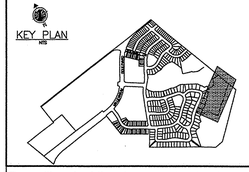
OVERFLOW WEIR WITH TURFSTONE MAT NTS

NOTE
MINIMUM RADIUS TO BE 10.0m (11.5m CENTERLINE)
MAXIMUM SLOPE TO BE 10:1



ASPHALT MAINTENANCE ACCESS DETAIL NTS

KEY PLAN NTS



The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them. Drawings shall not be used for construction unless sealed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

NOTES

INT.	DATE	REVISIONS
–	–	–

Stantec
49 Frederick Street
Kitchener, ON Canada
N2H 6M7
Tel. 519.579.4410
Fax. 519.579.8664
www.stantec.com

CITY OF WATERLOO

THE CITY OF Waterloo

LICENSED PROFESSIONAL ENGINEER S. R. BROWN May 19/10 PROVINCE OF ONTARIO

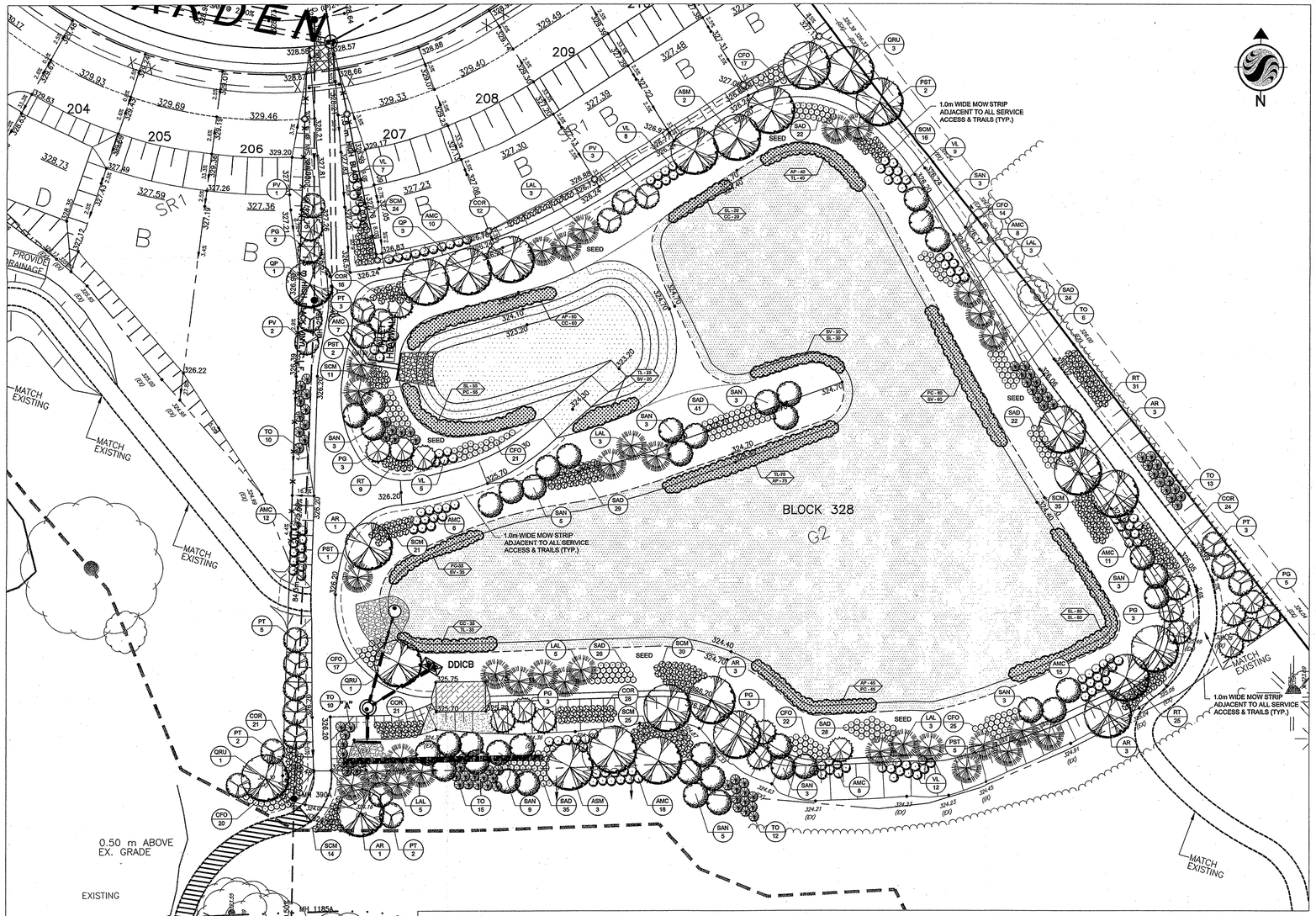
SEAL

TITLE:
30T-08401
CARRIAGE CROSSING SUBDIVISION
POND "B"

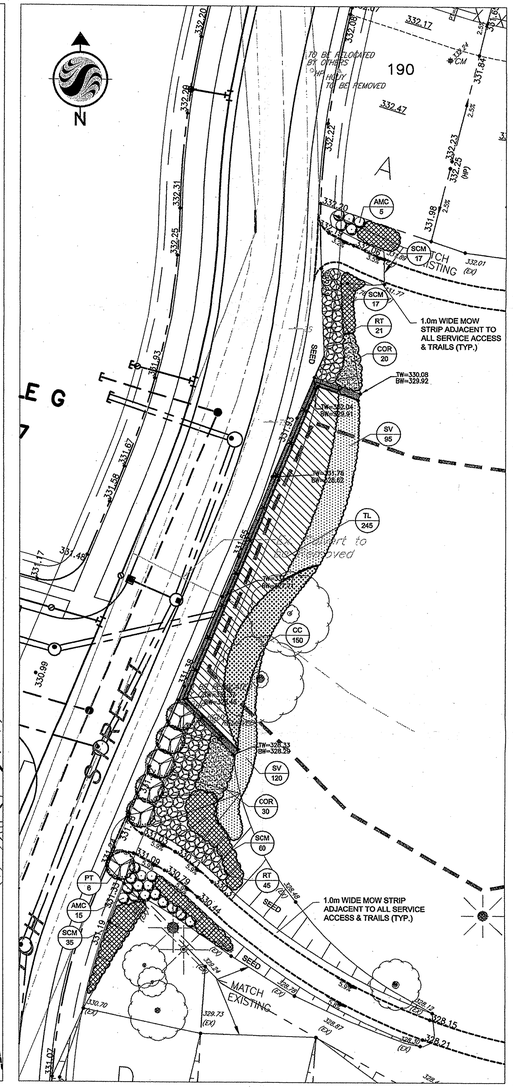
DATE: 10.03.17	DESIGNED BY: M.R.
SCALE : 1:500	DRAWN BY: A.F.
FILE NO. 160310788	CHECKED BY: J.L.G.
FIELD BK. / PAGE / DATE	DRAWING NO: SWM-B

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2010/05/19 3:11 PM By: Stephanie Adams

POND 'A' PLANTING PLAN:



MITIGATION & ENHANCEMENT PLANTING PLAN GREY SILO ROAD - WETLAND BLOCK 325:



POND 'A' PLANT SCHEDULE:

SYM	Qty	Botanical Name	Common Name	CAL (mm)	Ht. (cm)	Root	Remarks
DECIDUOUS TREES:							
AR	14	Acer rubrum	Red Maple	50		W.B.	
ASM	8	Acer saccharinum	Silver Maple	50		W.B.	
PT	15	Populus tremuloides	Trembling Aspen		300	B.R.	
PV	6	Prunus virginiana	Chokecherry		100	3 Gal.	
QP	4	Quercus palustris	Pin Oak		250	15 Gal.	
QRU	5	Quercus rubra	Red Oak		250	15 Gal.	
SAN	50	Salix nigra	Black Willow		60	1 Gal.	
CONIFEROUS TREES:							
LAL	22	Larix laricina	American Larch		200	W.B.	
PG	19	Picea glauca	White Spruce		150	W.B.	
PST	10	Pinus strobus	White Pine		180	W.B.	
TO	66	Thuja occidentalis	White Cedar		100	5 Gal. F.P.	
DECIDUOUS SHRUBS:							
AMC	95	Amelanchier canadensis	Serviceberry		80	3 Gal.	Clump
CFO	136	Cornus racemosa	Grey Dogwood		60	3 Gal.	
COR	137	Cornus sericea	Red Osier Dogwood		60	3 Gal.	
RT	65	Rhus typhina	Staghorn Sumac		125	B.R.	
SAD	246	Salix discolor	Pussy Willow		60	B.R.	
SCM	176	Sambucus canadensis	American Elder		80	B.R.	
VL	61	Viburnum lentago	Nannyberry		60	3 Gal.	
EMERGENTS AND SUBMERGENTS:							
AP	220	Alisma plantago - aquatica	Water Plantain			PLUG	
CC	195	Calamagrostis canadensis	Canadian Blue Joint			PLUG	
PC	195	Pontederia cordata	Pickerelweed			PLUG	
SV	150	Scirpus validus	Softstem Bulrush			PLUG	
SL	185	Sagittaria latifolia	Common Arrowhead			PLUG	

MITIGATION & ENHANCEMENT PLANT SCHEDULE:

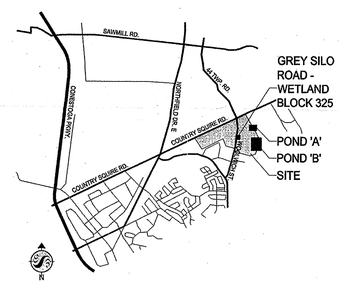
SYM	Qty	Botanical Name	Common Name	CAL (mm)	Ht. (cm)	Root	Remarks
DECIDUOUS TREES:							
PT	6	Populus tremuloides	Trembling Aspen		300	B.R.	
DECIDUOUS SHRUBS:							
AMC	20	Amelanchier canadensis	Serviceberry		80	3 Gal.	Clump
COR	50	Cornus sericea	Red Osier Dogwood		60	3 Gal.	1.0 m O.C.
RT	66	Rhus typhina	Staghorn Sumac		125	B.R.	
SCM	129	Sambucus canadensis	American Elder		80	B.R.	1.0 m O.C.
EMERGENTS AND SUBMERGENTS:							
CC	150	Calamagrostis canadensis	Canadian Blue Joint			PLUG	0.5 m O.C.
SV	215	Scirpus validus	Softstem Bulrush			PLUG	0.5 m O.C.
TL	245	Typha latifolia	Broadleaf Cattail			PLUG	1.0 m O.C.

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N2H 6M7
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Fax. 519.579.8664
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Key Map



Legend

- Proposed Deciduous Trees
- Proposed Coniferous Trees
- Proposed Shrubs
- Proposed Aquatic Plants
- Demarcation Posts
- Plant Identification Key
- Aquatic Plant Identification Key
- Existing Tree — Refer to Tree Management Drawings, Stantec Consulting Ltd.

Revision	By	Appd.	YY.MM.DD

File Name: 160310788_SWM_Planting_Plan.dwg	DG	LG	DG	10.05.11
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — Leo F. Guppenberger — OALA — MAY. 19. 10 — MEMBER

Client/Project

ACTIVA HOLDINGS INC.

CARRIAGE CROSSING SUBDIVISION
Waterloo ON Canada

Title

SWM FACILITY POND 'A' & BUFFER PLANTING PLAN

Project No.	Scale				
160310788	1:400	0	4	12	20m
Drawing No.	Sheet		Revision		
L-1	1 of 3		0		

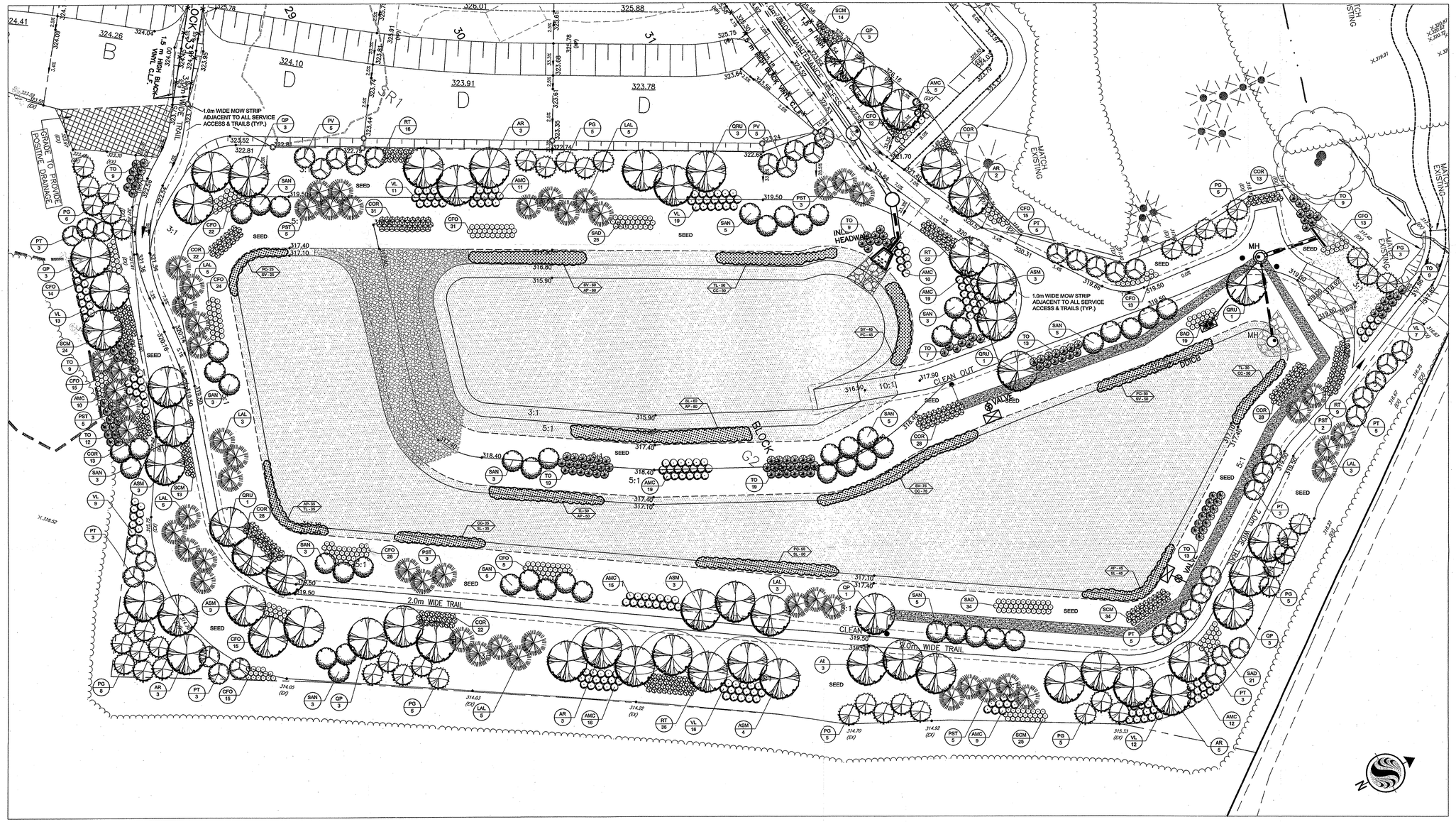
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2010/05/19 2:02 PM By: Simonitis, Domenic

ORIGINAL SHEET – ARCH D

POND 'B' PLANT SCHEDULE:

SYM	Qty	Botanical Name	Common Name	CAL (mm)	Ht. (cm)	Root	Remarks
DECIDUOUS TREES:							
AR	19	Acer rubrum	Red Maple	50		W.B.	
ASM	16	Acer saccharinum	Silver Maple	50		W.B.	
PT	30	Populus tremuloides	Trembling Aspen		300	B.R.	
PV	10	Prunus virginiana	Chokecherry		100	3 Gal.	
QP	16	Quercus palustris	Pin Oak		250	15 Gal.	
QRU	6	Quercus rubra	Red Oak		250	15 Gal.	
SAN	46	Salix nigra	Black Willow		60	1 Gal.	
CONIFEROUS TREES:							
LAL	29	Larix laricina	American Larch		200	W.B.	
PG	47	Picea glauca	White Spruce		150	W.B.	
PST	23	Pinus strobus	White Pine		180	W.B.	
TO	128	Thuja occidentalis	White Cedar		100	5.Gal. F.P.	
DECIDUOUS SHRUBS:							
AMC	126	Amelanchier canadensis	Serviceberry		80	3 Gal.	Clump
CFO	222	Cornus racemosa	Grey Dogwood		60	3 Gal.	
COR	192	Cornus sericea	Red Osier Dogwood		60	3 Gal.	
RT	83	Rhus typhina	Staghorn Sumac		125	B.R.	
SAD	99	Salix discolor	Pussy Willow		60	B.R.	
SCM	127	Sambucus canadensis	American Elder		80	B.R.	
VL	87	Viburnum lentago	Nannyberry		60	3 Gal.	
EMERGENTS AND SUBMERGENTS:							
AP	270	Alisma plantago - aquatica	Water Plantain			PLUG	
CC	190	Calamagrostis canadensis	Canadian Blue Joint			PLUG	
PC	170	Pontederia cordata	Pickerelweed			PLUG	
SV	255	Scirpus validus	Softstem Bulrush			PLUG	
SL	210	Sagittaria latifolia	Common Arrowhead			PLUG	
TL	170	Typha latifolia	Broadleaf Cattail			PLUG	

POND 'B' PLANTING PLAN:

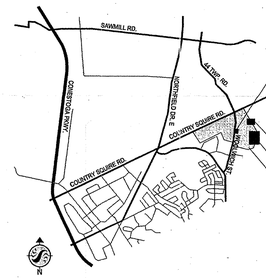


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Key Map



Legend

- Proposed Deciduous Trees
- Proposed Coniferous Trees
- Proposed Shrubs
- Proposed Aquatic Plants
- Demarcation Posts
- PT 5 — Plant Identification Key
- SV-45 / PC-45 — Aquatic Plant Identification Key
- Existing Tree — Refer to Tree Management Drawings, Stantec Consulting Ltd.

Revision	By	Appd.	YY.MM.DD
File Name: 160310788_SWM_Planting_Plan.dwg	DG Dwn.	LG Chkd.	DG Dsgn.	10.05.11 YY.MM.DD

Permit-Seal

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — Lee F. Gutpell — OALA — MAY. 19. 10 — MEMBER

Client/Project

ACTIVA HOLDINGS INC.

CARRIAGE CROSSING SUBDIVISION
Waterloo ON Canada

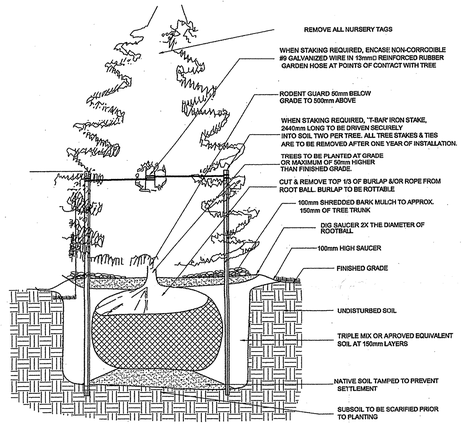
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SWM FACILITY POND 'B' & BUFFER PLANTING PLAN

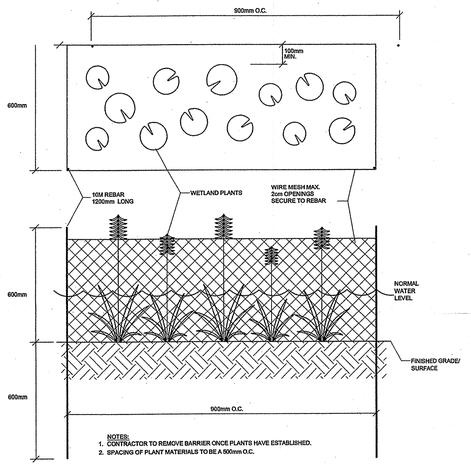
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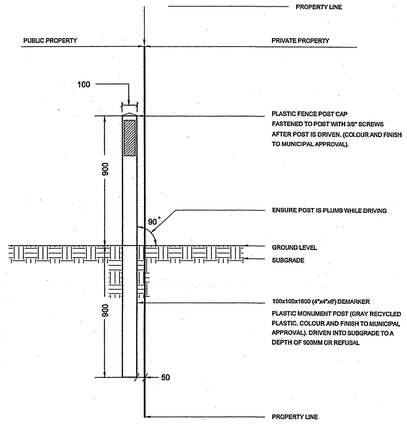
ORIGINAL SHEET – ARCH D



D 1 — CONIFEROUS TREE PLANTING DETAIL — N.T.S.



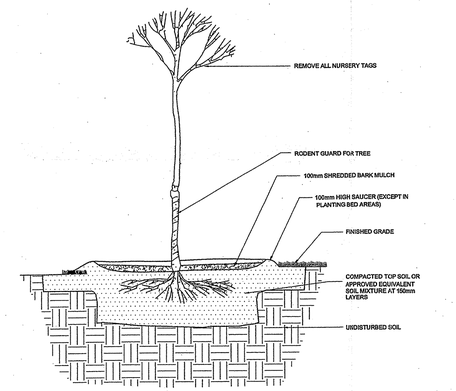
D 4 — PROTECTIVE BARRIER FOR WETLAND PLANTINGS — N.T.S.



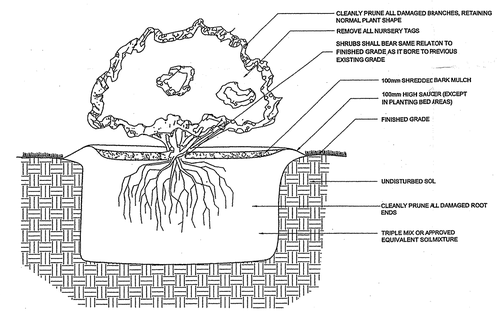
D 7 — DEMARCATION MONUMENT POST SECTION — N.T.S.

D 2 — DECIDUOUS TREE PLANTING DETAIL — N.T.S.

D 5 — SHRUB PLANTING DETAIL — N.T.S.



D 3 — deciduous bareroot whip planting detail — N.T.S.



D 6 — BAREROOT SHRUB PLANTING DETAIL — N.T.S.

PLANTING NOTES:

1. The Contractor must notify the Landscape Architect prior to the commencement of any planting.
2. The Landscape Architect is to be contacted for inspection and written approval prior to plant material arriving on site. The Landscape Architect reserves the right to reject any plant materials that have not been inspected and approved.
3. Plant material collected from wild sources will not be accepted. The Landscape Architect reserves the right to require that supplier invoices be submitted for inspection and approval prior to acceptance.
4. Plant materials specified for this project will conform to the Canadian Nursery Landscape Association (CNLA) for size, variety, and condition as indicated on the plant schedule shown on these drawings. Any plant materials that do not conform (in the sole opinion of the Landscape Architect) will be promptly removed from the site and replaced by the Contractor at no additional cost to the Owner or project.
5. Do not make substitutions of materials, products or quantities without the prior written permission of the Landscape Architect.
6. Remove dead and/or damaged branches on trees or shrubs. All pruning shall be performed in accordance with standard horticultural practices and appropriate timing for each species.
7. Plants are not to be installed during extreme heat, drought, or other undesireable conditions. Thouroughly water all plants immediately after installation. Contractor not to proceed in uncertainty. Contact Landscape Architect for direction. The Contractor is required to water plant material regularly or as directed by the Landscape Architect during construction and the two year warranty period. Plants will be watered within 48 hours of a written request by the Landscape Architect. Failure to do so after the second request will result in this work being undertaken by others. The cost of this work shall be deducted from the total contract price.
8. Do not plant in drainage swales. Where proposed drainage swales conflict with proposed plantings, contact the Landscape Architect for direction.
9. All trees and shrubs are to be planted in accordance with the planting details shown on this drawing.
10. Minor field adjustments to plant material locations may be necessary to respond to the locations of existing plants. Contractor to review with Landscape Architect where relocations are necessary. Contractor must receive approval from Landscape Architect prior to installation.
11. Shredded pine mulch or an approved other will be spread uniformly in all planting beds and around the base of all trees and shrubs to a depth of 100mm. Do not place mulch in direct contact with trunks; allow a 25mm mulch free ring around trunks. Provide a sample of mulch to the Landscape Architect for approval prior to installation.
12. All landscape works will be guaranteed for a period of two years following inspection substantial completion. Plant material, which is not in a healthy growing condition two years after inspection, shall be replaced to the satisfaction of the City of Waterloo.
13. The Contractor is responsible for location of all underground services prior to excavation of tree pits and shrub beds.
14. All T-bars and associated guy wires and hoses to be removed at the conclusion of the warranty period.
15. The Landscape Architect reserves the right to refuse acceptance of any plant material displaying poor growth habits, injury or disease. Any plant material rejected by the Landscape Architect will be promptly removed from the site and replaced with material of acceptable quality at no additional cost to the project.

WET MEADOW MARSH SEED MIX:

Available from: OSC, 330 Phillip St. P.O. Box 7, Waterloo, ON, N2J 3Z6 Phone: 519-886-0557

7% Blue Vervain (*Verbena hastata*)
5% Dark Green Bulrush (*Scirpus atrovirens*)
1% Flat Topped Aster (*Aster umbellatus)*
30% Fox Sedge (*Carex vulpinoidea*)
1% Joe Pye Weed (*Eupatorium fistulosum*)
5% Lurid Sedge (*Carex lurida)*
2% New England Aster (*Aster novae-anglais*)
1% Soft Rush (*Juncus effusus*)
1% Rice Catgrass (*Leersia orzoides*)
1% Swamp Milkweed (*Asclepias incarnata)*
35% Virginia Wild Rye (*Elymus virginicus)*
1% Wild Iris (*Iris versiclour*)
10% Wool Grass (*Scirpus cyperinus*)

Sow seed mix at rate of 22-25 kg/ha with nurse crop of annual rye grass

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49 Frederick Street
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Legend

Revision	By	Appd.	YY.MM.DD

File Name: 160310788_SWM_Planting_Plan.dwg	Dwn. DG	Chkd. LG	Dsgn. DG	YY.MM.DD 10.05.11

Permit-Seal

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — Leo F. Guglietti — OALA — MAY·19·10 — MEMBER

Client/Project
ACTIVA HOLDINGS INC.

CARRIAGE CROSSING SUBDIVISION
Waterloo ON Canada

Title
SWM FACILITY & BUFFER LANDSCAPE DETAILS

Project No.	Scale	
160310788		
Drawing No.	**Sheet**	**Revision**
L-3	3 of 3	0

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2010/05/19 2:39 PM By: dcrocetto, Donatella

ORIGINAL SHEET – ARCH D

Appendix D
Water Distribution System

Region of Waterloo

ENGINEERING AND
ENVIRONMENTAL SERVICES
Water and Wastewater Services
150 Frederick Street 7th Floor
Kitchener Ontario N2G 4J3 Canada
Telephone: 519-575-4400; TTY: 519-575-4608
Email: waterservices@regionofwaterloo.ca
www.regionofwaterloo.ca/water

Hitesh Lad, M.Eng. P.Eng
Stantec
100-300 Hagey Boulevard
Waterloo ON N2L 0A4
T: 519-498-2809
E: Hitesh.Lad@stantec.com

Date: August 9, 2023

Dear: Hitesh Lad

Re: Millennium Boulevard Lands, Waterloo

Please find the results of the modeling simulations for boundary conditions requested on July 19th, 2023. The results include a figure showing the location of the node from the Region's model. Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands and available fire flows for node JCT_20511 located the intersection of Oak Park Dr and Millennium Blvd, Waterloo. The diurnal 24-hour demand distribution accounts for the minimum hour and peak hour peaking factors. The maximum pressure on the average day represents the minimum hour, and the minimum pressure on the maximum day represents the peak hour.

Table 1 – Modeling Results

Node	Elevation (mASL)	Demand		Fire Flow Results	
		Ave Day (L/s)	Max Day (L/s)	Design Flow (L/s)	Design Pressure (m)
JCT_20511	331.0	3.25	6.50	252.5	16.1

A fire flow analysis shows the maximum flow available at a node with an associated design pressure during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

If you have any questions, please contact me

Kevin Dolishny P.Eng.
Senior Engineer, Water Services
c. 226.751.4551
e. kdolishny@regionofwaterloo.ca

Wat 4 Intersection of Oak Park Dr and Millennium Blvd, Waterloo

JCT_20511 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	1.88	379.66	48.66
01:00 hrs	1.40	380.13	49.13
02:00 hrs	1.62	382.40	51.40
03:00 hrs	1.75	382.53	51.53
04:00 hrs	1.56	382.85	51.85
05:00 hrs	1.27	383.08	52.08
06:00 hrs	2.01	382.48	51.48
07:00 hrs	4.32	379.00	48.00
08:00 hrs	5.26	378.21	47.21
09:00 hrs	4.32	378.14	47.14
10:00 hrs	4.22	378.80	47.80
11:00 hrs	4.03	378.79	47.79
12:00 hrs	3.80	378.87	47.87
13:00 hrs	3.61	378.20	47.20
14:00 hrs	3.35	378.19	47.19
15:00 hrs	3.12	378.19	47.19
16:00 hrs	3.31	378.09	47.09
17:00 hrs	3.51	378.80	47.80
18:00 hrs	4.06	378.89	47.89
19:00 hrs	4.42	378.92	47.92
20:00 hrs	4.45	378.99	47.99
21:00 hrs	4.16	378.32	47.32
22:00 hrs	3.67	378.39	47.39
23:00 hrs	2.92	378.70	47.70

JCT_20511 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	3.05	378.63	47.63
01:00 hrs	1.88	379.26	48.26
02:00 hrs	2.40	379.44	48.44
03:00 hrs	2.86	381.52	50.52
04:00 hrs	2.73	381.83	50.83
05:00 hrs	2.27	381.99	50.99
06:00 hrs	4.22	380.11	49.11
07:00 hrs	8.77	377.92	46.92
08:00 hrs	10.27	376.85	45.85
09:00 hrs	7.34	378.18	47.18
10:00 hrs	5.72	377.23	46.23
11:00 hrs	5.33	378.40	47.40
12:00 hrs	4.68	378.39	47.39
13:00 hrs	5.98	378.30	47.30
14:00 hrs	7.86	378.27	47.27
15:00 hrs	6.56	377.46	46.46
16:00 hrs	8.77	377.25	46.25
17:00 hrs	9.23	377.84	46.84
18:00 hrs	10.79	377.69	46.69
19:00 hrs	11.57	377.13	46.13
20:00 hrs	11.44	375.59	44.59
21:00 hrs	10.27	377.42	46.42
22:00 hrs	6.95	378.26	47.26
23:00 hrs	4.87	378.45	47.45

Average Day HGL:	379.53	**Maximum Day HGL:**	378.48
Minimum Hour:	383.08	**Peak Hour:**	375.59

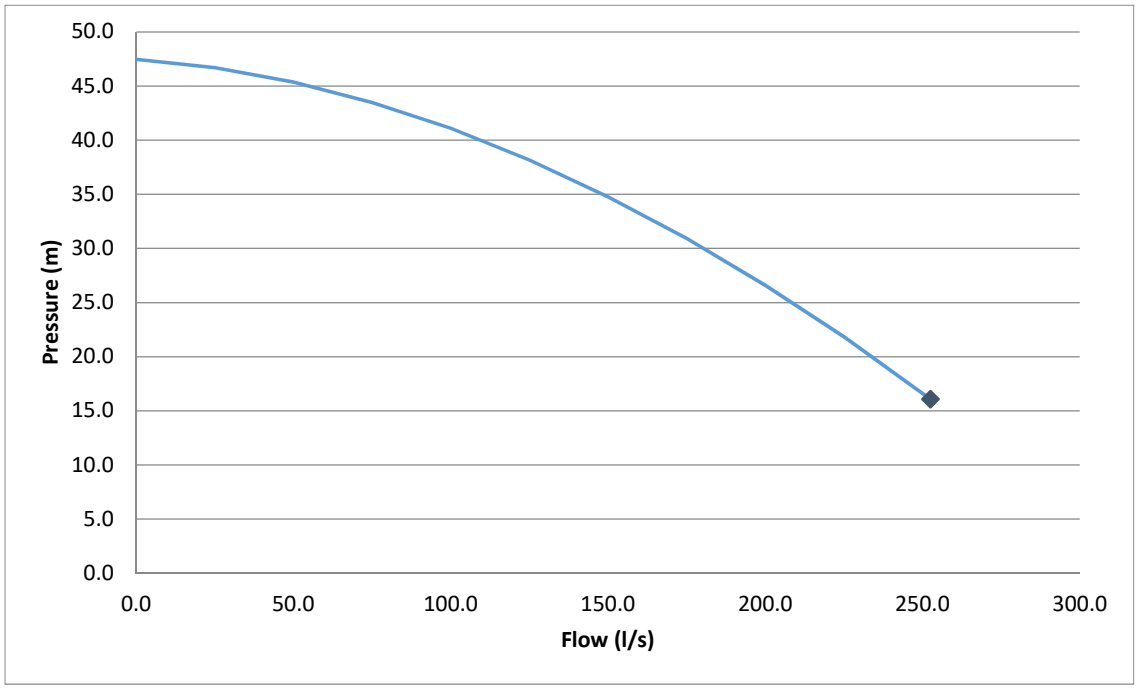
Available Flow (L/s)	Residual Pressure (m)
0.0	47.5
25.0	46.7
50.0	45.4
75.0	43.5
100.0	41.1
125.0	38.2
150.0	34.8
175.0	30.9
200.0	26.6
225.0	21.8
250.0	16.6
252.5	16.1

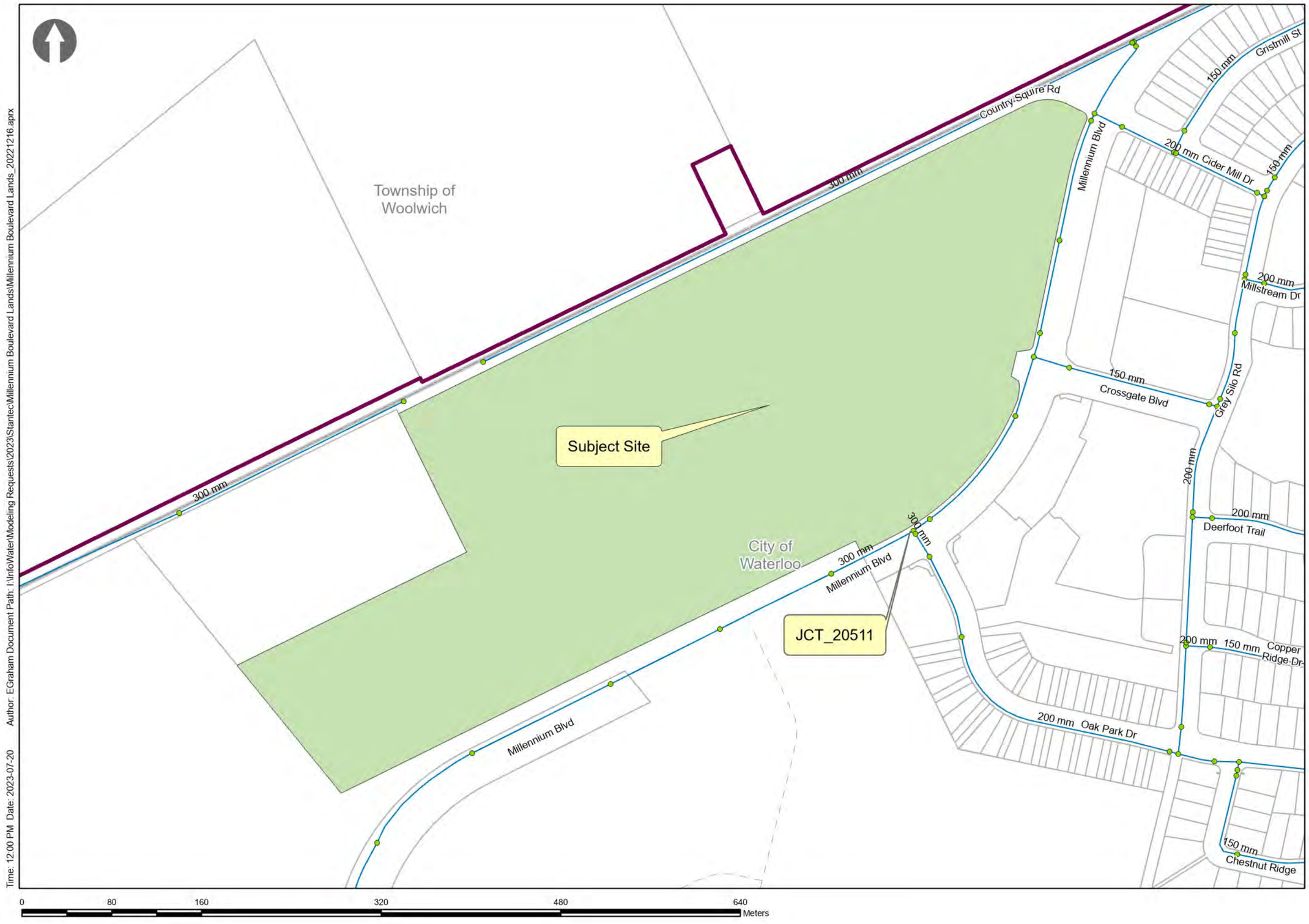
Fire Flow Analysis

Fire Flow Node:	JCT_20511
Design Flow (L/s):	252.5
Design Pressure (m):	16.1

Design Flow: *The final adjusted flow at the node to maintain the minimum desigr pressure (14m (140 kPa)) at ALL locations within the pressure zone.*

Design Pressure: *The lowest allowable pressure at the node to maintain the minimum desigr pressure (14m (140 kPa)) at ALL locations within the pressure zone.*





Region of Waterloo

ENGINEERING AND ENVIRONMENTAL SERVICES
Water and Wastewater Services
150 Frederick Street
Kitchener ON Canada N2G 4J3
Telephone: (519) 575-4426
www.regionofwaterloo.ca

Junction
- Active

Pipe
- Active

Non modelling data Layer
- Subject Site
- Assessment Parcels (MPAC)
- Regional Municipal Boundaries

Millennium Boulevard Lands, Waterloo

Author: EGraham Document Path: I:\InfoWater\Modeling Requests\2023\Stantec\Millennium Boulevard Lands\Millennium Boulevard Lands_20221216.aprx
Time: 12:00 PM Date: 2023-07-20

160310788 - Millennium Boulevard Lands, Waterloo

Nodal Data Input - Water Demand Calculation

30-Aug-23

Location	Node No.	Residential						Commercial		External Demand	Avg Day Demand	Min. Hour Demand	Max Day Demand	Peak Hour Demand	Fire Flow Demand
		Single Family		Multi Family											
		Units	Demand	Townhouse Units	Demand	Stacked Town Units	Demand	Area	Demand						
			(L/s)	(ha)	(L/s)		(L/s)	(ha)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
Input Node	J1														
Street Three - Commercial Block 20	J2							0.41	0.21		0.21	0.10	0.41	0.62	133
Street Three - Multi-Family Block 17	J3			24	0.14	96	0.52				0.66	0.33	1.32	1.98	133
Street Three - Residential Blocks 8, 9 & 14	J4	12	0.11			32	0.17				0.28	0.14	0.56	0.84	133
Street One - Residential Block 1	J5	23	0.21								0.21	0.10	0.42	0.63	100
Street One - Residential Blocks 10 & 11	J6			12	0.07						0.07	0.04	0.14	0.22	133
Street One - Multi-Family Block 1	J7					208	1.12				1.12	0.56	2.24	3.36	133
Street One - Residential Blocks 5,6,12 & 13	J8	9	0.08	54	0.32						0.41	0.20	0.81	1.22	133
Street One - Multi-Family Blocks 1 & 2 (Stg 3)	J9			35	0.21						0.21	0.10	0.42	0.63	133
Street One - Residential Block 3	J10			8	0.05						0.05	0.02	0.10	0.14	133
Street One - Residential Blocks 2, 4 and 16	J11	33	0.30								0.30	0.15	0.60	0.90	100
Intermediate Node	J12														
Street Two - Multi-Family Block 16	J13					84	0.45				0.45	0.23	0.91	1.36	133
TOTAL		77	0.70	133	0.80	420.0	2.26	0.41	0.21		3.97	1.98	7.93	11.90	

Specific Usage Rates

Land Use	Average Day		Source
Residential	3.49	c/units	Region of Waterloo Water Supply and Distribution Optimization Master Plan, 2015
(Single Family)	225	L/c/d	
Residential	2.30	c/units	
(Townhouse Units)	225	L/c/d	
Residential	2.07	c/units	
(Stacked Town Units)	225	L/c/d	
Commercial	0.50	L/s/ha	
Peaking Factors:			
Residential	min	0.50	Region of Waterloo Design Criteria (3,000-10,000 people)
	avg	1.00	
	max	2.00	
	peak	3.00	

400 Millennium Boulevard, Waterloo
Scenario: Max_Day + 133 L/s Fire Flow
Active Scenario: Max_Day + 133 L/s Fire Flow



400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Avg_Day

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	379.53	470
J-2	333.30	0.21	379.53	452
J-3	333.20	0.66	379.53	453
J-4	333.95	0.28	379.53	446
J-5	334.75	0.21	379.53	438
J-6	334.75	0.07	379.53	438
J-7	334.10	1.12	379.53	445
J-8	334.80	0.41	379.53	438
J-9	335.40	0.21	379.53	432
J-10	335.40	0.05	379.53	432
J-11	334.80	0.30	379.53	438
J-12	334.30	0.00	379.53	443
J-13	334.20	0.45	379.53	444

400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Max_Day

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	378.43	459
J-2	333.30	0.42	378.43	442
J-3	333.20	1.32	378.42	443
J-4	333.95	0.56	378.42	435
J-5	334.75	0.42	378.42	427
J-6	334.75	0.14	378.42	427
J-7	334.10	2.24	378.42	434
J-8	334.80	0.82	378.42	427
J-9	335.40	0.42	378.42	421
J-10	335.40	0.10	378.42	421
J-11	334.80	0.60	378.42	427
J-12	334.30	0.00	378.42	432
J-13	334.20	0.90	378.42	433

400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Peak_Hour

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	375.59	432
J-2	333.30	0.63	375.58	414
J-3	333.20	1.98	375.58	415
J-4	333.95	0.84	375.57	407
J-5	334.75	0.63	375.57	399
J-6	334.75	0.21	375.57	399
J-7	334.10	3.36	375.57	406
J-8	334.80	1.23	375.56	399
J-9	335.40	0.63	375.56	393
J-10	335.40	0.15	375.56	393
J-11	334.80	0.90	375.56	399
J-12	334.30	0.00	375.56	404
J-13	334.20	1.35	375.56	405

400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Min_Hour

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	383.08	505
J-2	333.30	0.11	383.08	487
J-3	333.20	0.33	383.08	488
J-4	333.95	0.14	383.08	481
J-5	334.75	0.11	383.08	473
J-6	334.75	0.04	383.08	473
J-7	334.10	0.56	383.08	479
J-8	334.80	0.21	383.08	473
J-9	335.40	0.11	383.08	467
J-10	335.40	0.03	383.08	467
J-11	334.80	0.15	383.08	473
J-12	334.30	0.00	383.08	477
J-13	334.20	0.23	383.08	478

400 Millennium Boulevard, Waterloo
Fire Flow Node FlexTable: Fire Flow Report
Active Scenario: Max_Day + 100 Ls Fire Flow

Label	Satisfies Fire Flow Constraints?	Flow (Total Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (System Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)
J-1	True	100.00	105.00	140	389	140	351	J-9
J-2	True	100.42	105.42	140	366	140	345	J-9
J-3	True	101.32	106.32	140	363	140	342	J-9
J-4	True	100.56	105.56	140	350	140	336	J-9
J-5	True	100.42	105.42	140	330	140	329	J-10
J-6	True	100.14	105.14	140	322	140	332	J-10
J-7	True	102.24	107.24	140	331	140	331	J-6
J-8	True	100.82	105.82	140	309	140	309	J-9
J-9	True	100.42	105.42	140	297	140	305	J-10
J-10	True	100.10	105.10	140	296	140	305	J-9
J-11	True	100.60	105.60	140	310	140	312	J-10
J-12	True	100.00	105.00	140	276	140	277	J-13
J-13	True	100.90	105.90	140	253	140	276	J-12

400 Millennium Boulevard, Waterloo
Fire Flow Node FlexTable: Fire Flow Report
Active Scenario: Max_Day + 133 L/s Fire Flow

Label	Satisfies Fire Flow Constraints?	Flow (Total Needed) (L/s)	Flow (Total Available) (L/s)	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Pressure (System Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Junction w/ Minimum Pressure (System)
J-1	True	133.00	138.00	140	347	140	309	J-9
J-2	True	133.42	138.42	140	320	140	299	J-9
J-3	True	134.32	139.32	140	315	140	294	J-9
J-4	True	133.56	138.56	140	298	140	284	J-9
J-5	True	133.42	138.42	140	271	140	272	J-10
J-6	True	133.14	138.14	140	257	140	277	J-10
J-7	True	135.24	140.24	140	268	140	272	J-6
J-8	True	133.82	138.82	140	235	140	240	J-9
J-9	True	133.42	138.42	140	220	140	233	J-10
J-10	True	133.10	138.10	140	219	140	233	J-9
J-11	True	133.60	138.60	140	237	140	245	J-10
J-12	True	133.00	138.00	140	178	140	179	J-13
J-13	True	133.90	138.65	140	140	140	179	J-12

400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Max_Day + 100 L/s Fire Flow at J-11

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	371.85	395
J-2	333.30	0.42	371.31	372
J-3	333.20	1.32	370.99	370
J-4	333.95	0.56	370.43	357
J-5	334.75	0.42	369.70	342
J-6	334.75	0.14	369.94	344
J-7	334.10	2.24	370.15	353
J-8	334.80	0.82	369.28	337
J-9	335.40	0.42	368.71	326
J-10	335.40	0.10	368.24	321
J-11	334.80	100.60	367.43	319
J-12	334.30	0.00	369.28	342
J-13	334.20	0.90	369.28	343

400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Max_Day+133 L/s Fire Flow at J-10

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	367.65	354
J-2	333.30	0.42	366.76	327
J-3	333.20	1.32	366.22	323
J-4	333.95	0.56	365.28	307
J-5	334.75	0.42	364.45	291
J-6	334.75	0.14	364.72	293
J-7	334.10	2.24	364.96	302
J-8	334.80	0.82	362.08	267
J-9	335.40	0.42	360.42	245
J-10	335.40	133.10	359.05	231
J-11	334.80	0.60	361.83	264
J-12	334.30	0.00	362.08	272
J-13	334.20	0.90	362.08	273

400 Millennium Boulevard, Waterloo

FlexTable: Junction Table

Active Scenario: Max_Day+133 L/s Fire Flow at J-13

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
J-1	331.50	0.00	367.65	354
J-2	333.30	0.42	366.76	327
J-3	333.20	1.32	366.22	323
J-4	333.95	0.56	365.28	307
J-5	334.75	0.42	364.83	294
J-6	334.75	0.14	364.97	296
J-7	334.10	2.24	365.10	303
J-8	334.80	0.82	360.07	247
J-9	335.40	0.42	361.08	251
J-10	335.40	0.10	361.93	260
J-11	334.80	0.60	363.42	280
J-12	334.30	0.00	354.15	194
J-13	334.20	133.90	350.34	158

400 Millennium Boulevard, Waterloo

FlexTable: Pipe Table

Active Scenario: Max_Day + 100 L/s Fire Flow at J-11

Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (L/s)	Velocity (m/s)
P-1	67	J-1	J-2	300.0	150.0	1.330	107.94	1.53
P-2	29	J-2	J-3	300.0	150.0	1.330	107.52	1.52
P-3	74	J-3	J-4	300.0	150.0	1.330	106.20	1.50
P-4	80	J-4	J-5	200.0	150.0	1.330	42.97	1.37
P-5	92	J-5	J-6	200.0	150.0	1.330	-22.23	0.71
P-6	77	J-6	J-7	200.0	150.0	1.330	-22.37	0.71
P-7	91	J-7	J-4	200.0	150.0	1.330	-24.61	0.78
P-8	177	J-4	J-8	200.0	150.0	1.330	38.06	1.21
P-9	88	J-8	J-9	200.0	150.0	1.330	36.34	1.16
P-10	71	J-9	J-10	200.0	150.0	1.330	35.92	1.14
P-11	136	J-10	J-11	200.0	150.0	1.330	35.82	1.14
P-12	125	J-11	J-5	200.0	150.0	1.330	-64.78	2.06
P-13	77	J-8	J-12	200.0	150.0	1.330	0.90	0.03
P-14	42	J-12	J-13	200.0	150.0	1.330	0.90	0.03
P-15	22	R-1	PMP-1	1,000.0	150.0	0.000	107.94	0.14
P-16	21	PMP-1	J-1	1,000.0	150.0	0.000	107.94	0.14
P-17	27	R-1	J-1	1,000.0	150.0	0.000	(N/A)	(N/A)

400 Millennium Boulevard, Waterloo

FlexTable: Pipe Table

Active Scenario: Max_Day+133 L/s Fire Flow at J-10

Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (L/s)	Velocity (m/s)
P-1	67	J-1	J-2	300.0	150.0	1.330	140.94	1.99
P-2	29	J-2	J-3	300.0	150.0	1.330	140.52	1.99
P-3	74	J-3	J-4	300.0	150.0	1.330	139.20	1.97
P-4	80	J-4	J-5	200.0	150.0	1.330	46.34	1.47
P-5	92	J-5	J-6	200.0	150.0	1.330	-24.04	0.77
P-6	77	J-6	J-7	200.0	150.0	1.330	-24.18	0.77
P-7	91	J-7	J-4	200.0	150.0	1.330	-26.42	0.84
P-8	177	J-4	J-8	200.0	150.0	1.330	65.88	2.10
P-9	88	J-8	J-9	200.0	150.0	1.330	64.16	2.04
P-10	71	J-9	J-10	200.0	150.0	1.330	63.74	2.03
P-11	136	J-10	J-11	200.0	150.0	1.330	-69.36	2.21
P-12	125	J-11	J-5	200.0	150.0	1.330	-69.96	2.23
P-13	77	J-8	J-12	200.0	150.0	1.330	0.90	0.03
P-14	42	J-12	J-13	200.0	150.0	1.330	0.90	0.03
P-15	22	R-1	PMP-1	1,000.0	150.0	0.000	140.94	0.18
P-16	21	PMP-1	J-1	1,000.0	150.0	0.000	140.94	0.18
P-17	27	R-1	J-1	1,000.0	150.0	0.000	(N/A)	(N/A)

400 Millennium Boulevard, Waterloo

FlexTable: Pipe Table

Active Scenario: Max_Day+133 L/s Fire Flow at J-13

Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (L/s)	Velocity (m/s)
P-1	67	J-1	J-2	300.0	150.0	1.330	140.94	1.99
P-2	29	J-2	J-3	300.0	150.0	1.330	140.52	1.99
P-3	74	J-3	J-4	300.0	150.0	1.330	139.20	1.97
P-4	80	J-4	J-5	200.0	150.0	1.330	33.54	1.07
P-5	92	J-5	J-6	200.0	150.0	1.330	-17.14	0.55
P-6	77	J-6	J-7	200.0	150.0	1.330	-17.28	0.55
P-7	91	J-7	J-4	200.0	150.0	1.330	-19.52	0.62
P-8	177	J-4	J-8	200.0	150.0	1.330	85.58	2.72
P-9	88	J-8	J-9	200.0	150.0	1.330	-49.14	1.56
P-10	71	J-9	J-10	200.0	150.0	1.330	-49.56	1.58
P-11	136	J-10	J-11	200.0	150.0	1.330	-49.66	1.58
P-12	125	J-11	J-5	200.0	150.0	1.330	-50.26	1.60
P-13	77	J-8	J-12	200.0	150.0	1.330	133.90	4.26
P-14	42	J-12	J-13	200.0	150.0	1.330	133.90	4.26
P-15	22	R-1	PMP-1	1,000.0	150.0	0.000	140.94	0.18
P-16	21	PMP-1	J-1	1,000.0	150.0	0.000	140.94	0.18
P-17	27	R-1	J-1	1,000.0	150.0	0.000	(N/A)	(N/A)