BURNSIDE

Block 18 of Plan 51M-917 Fesserton Functional Servicing Report & SWM Brief

2801829 Ontario Inc.

Block 18 of Plan 51M-917 Fesserton Functional Servicing Report & SWM Brief

2801829 Ontario Inc.

R.J. Burnside & Associates Limited
3 Ronell Crescent
Collingwood ON L9Y 4J6 CANADA

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R.J. Burnside & Associates Limited

Report Prepared By:

Michelle Zettel, P.Eng.
Project Engineer
MLZ:sp

Report Reviewed By:

Curtis Scobie, P.Eng.
Project Engineer
CAS:sp

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1.0 Introduction and Background

R.J. Burnside & Associates Limited (Burnside) has been retained by 2801829 Ontario Inc. to prepare a Functional Servicing Report and Stormwater Management Brief in support of the proposed residential subdivision development known as Block 18 of Plan 51M-917 in Fesserton. This Report will support the application for Zoning By-law Amendment and Plan of Subdivision by demonstrating that the subject lands can be provided with appropriate servicing in accordance with applicable regulatory requirements and criteria.

1.1 Site Description and Context

The subject subdivision land is located north of Fesserton Sideroad between Georgian Heights Boulevard and Highway 16. The proposed development is largely surrounded by residential lots, with a 20 m access to Fesserton Sideroad. Figure 1 has been prepared to show the general location of the site, located within the 'Figures' Section at the back of this Report.

It is proposed to develop the property into 14 estate residential lots, fronting a single proposed road that will bisect the site from South to North.

1.2 Background Studies and Documents

The servicing concepts presented within this report have been developed to comply with the infrastructure and stormwater management servicing framework that has been established for this area. The following documents, studies and report have been reviewed in preparation of this Report:

- Environmental Impact Study Block 18 Fesserton, Azimuth Environmental Consulting, Inc., December 2020;
- Environmental Subsurface Investigation, Soil Engineers Ltd., May 29, 2019;
- Township of Severn Engineering Design Criteria, C.C. Tatham & Associates Ltd., May 2014; and
- Fesserton Hydrogeological Assessment, Burnside, January 2021.

1.3 Existing Site Conditions

The proposed subdivision is generally divided into a north half and a south half, bisected by an unnamed watercourse flowing from west to east. This stream will be referred to as the main watercourse throughout this document. North of the main watercourse the property is wooded with steep slopes between 10% and 30% from west to east. South of the main watercourse was previously used for quarry purposes, with fill added in after operations ceased. This area has since taken on wetland qualities. Slopes on the south

side vary between the steep slopes seen north of the watercourse down to as flat as 1% in the fill areas. There is also a smaller southerly watercourse that crosses the site from west to east.

To the east of the site is an abandoned rail corridor. The railbed and drainage features of the corridor remain, however the tracks and railway ties have been removed. An existing 675 mm culvert running through the railway berm provides an outlet for the main watercourse.

1.3.1 Soils Conditions

The Simcoe County Soils Map indicates that the soils throughout the proposed subdivision are comprised of steep Vasey Sandy Loam, characterized as having moderately low runoff potential.

An initial geotechnical investigation (Soil Engineers Ltd., 2019) was completed to ensure there was no contamination of the fill on the south side of the site. The study found only slightly elevated levels of xylenes in one of the boreholes.

A complete geotechnical investigation is currently underway to assess a variety of parameters, including, but not limited to, soil types and groundwater seeps across the site, as well as slope stability.

1.3.2 Groundwater Conditions

Groundwater monitoring has been completed utilizing monitoring wells on site. Complete details can be found in the Hydrogeological Report prepared under separate cover.

2.0 Water Supply and Distribution

There is currently no watermain located in the vicinity of the site; individual drilled wells will service the proposed development. Refer to the Hydrogeological Assessment under separate cover.

3.0 Wastewater Servicing

Municipal sanitary services are not available in the vicinity of the subject site; therefore, the proposed development will need to be serviced by private onsite sewage systems. The development consists of 14 lots that are proposed to be serviced by individual septic systems, designed to meet the current Ontario Building Code standards. Septic systems will be fully designed at the home construction stage, when fixture counts for the houses are known. Refer to the Hydrogeological Assessment under separate cover for any further constraints for the septic systems.

4.0 Site Grading

The site grading design will take into consideration the following requirements and constraints:

- Conform to the Township of Severn standards and grading criteria;
- Match existing boundary grading conditions;
- Minimize cut to fill operations and work towards achieving a balanced site;
- Maximize the area of tree preservation;
- Provide minimum cover on proposed servicing; and
- Provide overland flow conveyance for major storm conditions.

The proposed development road will generally slope towards the south to match the pre-development drainage patterns as much as possible, with low points adjacent to each pond. Minimum slopes will be maintained across the site to ensure proper drainage. The street will be designed to provide positive drainage to one of the two proposed ponds. Due to the steep grades present across the existing site, retaining walls will be utilized where necessary to match into existing grades at the site boundary and transition yard grades as needed.

5.0 Stormwater Management

5.1 Existing Storm Drainage

Under existing conditions, the site drainage falls from west to east at relatively steep grades. The site drainage can generally be divided into three main outlets as follows:

- Outlet 1: The north end of the site consists of a native woodlot, and generally sheet flows from west to east with no specific outlet path.
- Outlet 2: The central area of the site comprises of a main channel that bisects the site from west to east. Two small tributaries exist south of the channel conveying site drainage to the main channel. The channel ultimate outlets through a culvert in the downstream rail berm, just beyond the site boundary.
- Outlet 3: The southern portion of the site was previously developed for quarry purposes, leaving a wide flat area which has become a wetland. The south part of the site discharges through a culvert under the existing driveway into a small tributary (south watercourse).

External drainage areas also contribute to each outlet. Relatively small external drainage, consisting of estate residential lots, sheet flows onto the subject site and contributes to Outlets 1 and 3. A large upstream drainage area is tributary to the main channel that flows to Outlet 2. Please refer to Figures 4a and 4b for the pre-development drainage catchments.

A PCSWMM Stormwater management model was developed to determine the target peak runoff flows from the site. The PCSWMM model allows for the combination of hydraulic and hydrologic modeling components. Please refer to Appendix A for a complete summary of pre-development catchments parameters applied. These parameters include the area, width, imperviousness, slope, depression storage as well as Manning's 'n' values for overland flow. Aerial imagery and survey data were used to determine appropriate values for these parameters.

For modeling purposes, the Curve Number infiltration method was applied, requiring a Curve Number input. Simcoe County Soil Maps indicate that the internal and external catchments are comprised of Vasey Sandy Loam, which falls within the AB hydrologic soils group. The boreholes completed on the south side of the site generally indicated a silty sand fill over a native layer of silty sand to sandy silt, supporting an AB soil type. Appropriate Curve Numbers were applied based on the soil type and land use.

Both the 24-hour SCS design storm as well as the 4-hour Chicago storm were modelled, with the results shown below. Complete modeling results can be found in Appendix A.

Table 1: Pre-Development Peak Runoff Flows

	Peak Runoff Flow (m^3/s)		
Design Storm	**Outlet 1**	**Outlet 2**	**Outlet 3**
4-hour Chicago Storms			
2-Year	0.04	1.66	0.06
5-Year	0.05	1.95	0.07
10-Year	0.06	2.12	0.09
25-Year	0.07	2.35	0.10
50-Year	0.08	2.51	0.11
100-Year	0.08	2.65	0.12
24-hour SCS Storms			
2-Year	0.02	1.06	0.03
5-Year	0.03	1.42	0.04
10-Year	0.03	1.65	0.05
25-Year	0.04	1.93	0.10
50-Year	0.07	2.18	0.17
100-Year	0.10	2.47	0.26

As noted in the table above, the Chicago storm and the SCS storm govern depending on the outlet and storm event. Therefore, both storms have been carried through to post development conditions.

5.2 Proposed Storm Drainage

The Proposed drainage system will consist of roadside ditches conveying runoff through the development to one of the two proposed ponds. The site is divided from north to south by the main watercourse. Stormwater will be addressed based on lands north of the main watercourse and lands south of the main watercourse.

The north half of the site are to drain via ditches to the north pond which will provide quantity and quality control. To reduce the size of the pond area required, rock check dams have been provided on the north ditches to provide additional storage and quality control. A small external drainage area will also be captured within the north pond as shown on Figures 5a and 5b.

The south side of the site will flow through the proposed roadside ditches to the south pond. The South pond is located on the east side of the proposed right of way and will provide quantity and quality control, before discharging to the small watercourse that traverses the south end of the property. Similar to the north drainage, a small external drainage area will also be captured within the south pond. The remaining external drainage area will flow through the main channel bisecting the site and will not be altered by the proposed stormwater management.

A small area of rear yards at the very north limits of the site will discharge uncontrolled to the east as per existing conditions. Soakaway pits can be provided on these two lots to provide some minor stormwater management for any clean rear roof drainage. Refer to Figures 5a and 5b for all the proposed drainage catchments and flow patterns.

Each pond will be designed with an emergency overflow weir. In case of an event exceeding the 100-year design storm, or a blockage of the regular outlet, all flows will be safely conveyed through the ponds to their respective outlet watercourse.

5.2.1 Proposed Quantity Control

Stormwater management criteria for the Township of Severn indicate that post-development 5-year through 100-year runoff events shall not exceed the pre-development runoff events, respectively. As such, the proposed stormwater management plan will control discharge to the pre-development rates.

Quantity control for the site will be provided through 2 ponds, as well as soakaway pits where necessary on lots 5 and 6. For the north half of the site, 530 m^3 of active storage in the north pond will provide the necessary quantity control for the area draining to the pond. Soakaway pits will provide rear yard quantity control for lots 5 and 6. The south pond provides 1770 m^3 of active storage to provide quantity control on the south side of the site.

The hydrologic modeling program PCSWMM was also used to determine the post-development peak flows, with quantity control in place. The PCSWMM input parameters for the proposed subcatchments are found in Appendix B. The peak flows to each of the three outlets described in Section 5.1 are summarized in the following Table, with complete modelling details and outputs found in Appendix B.

Table 2: Pre to Post Development Peak Runoff Flows

Design Storm	Peak Runoff Flow (m^3/s)					
	Outlet 1		Outlet 2		Outlet 3	
	Pre	Post	Pre	Post	Pre	Post
4-hour Chicago Storms						
2-Year	0.04	0.07	1.66	1.33	0.06	0.01
5-Year	0.05	0.09	1.95	1.81	0.07	0.02
10-Year	0.06	0.11	2.12	1.94	0.09	0.02
25-Year	0.07	0.12	2.35	2.13	0.10	0.03
50-Year	0.08	0.14	2.51	2.30	0.11	0.04
100-Year	0.08	0.15	2.65	2.45	0.12	0.05
24-hour SCS Storms						
2-Year	0.02	0.03	1.06	0.92	0.03	0.02
5-Year	0.03	0.05	1.42	1.31	0.04	0.03
10-Year	0.03	0.06	1.65	1.59	0.05	0.04
25-Year	0.04	0.08	1.93	1.94	0.10	0.10
50-Year	0.07	0.10	2.18	2.18	0.17	0.16
100-Year	0.10	0.12	2.47	2.47	0.26	0.23

As per the results above, sufficient storage can be provided through the ditches and stormwater management ponds for Outlets 2 and 3. The details of the Outlet structure will be finalized during the detailed design stage, with the above targets noting that the required volumes can be achieved in the areas provided. As shown above, Outlet 1 only has a slight increase in outflow with no controls included within the model. Once a better understanding of building size is known for lots 5 and 6, appropriate soakaway pits will be sized to meet the pre-development targets.

5.2.2 Proposed Quality Control

On the north side of the site, quality control will be achieved through flat bottomed ditches, permanent pool and extended detention. Vegetated open channels, such as the proposed ditches, have been found to provide high levels of quality control by allowing filtration of the runoff and reducing flow velocities so that the sediment will drop out of suspension. This will be further enhanced by adding in rock check dams to reduce the velocity of the runoff. As noted in Appendix B, 186 m^3 of permanent pool and 120 m^3 of extended detention will be required to achieve enhanced level quality control (MOE, 2003). Through a combination of storage in the ditches and in the north pond, the

permanent pool and extended detention objectives will be met. As shown in Appendix B, the ditches on the north side of the site will provide 190 m^3 of storage, which will provide permanent pool and extended detention benefits. In addition, 75m^3 of permanent pool, and 93 m^3 of extended detention will be provided in the north pond itself.

Quality control for the south half of the site will be achieved through permanent pool and extended detention in the pond. As per Appendix B, to achieve 80% Total Suspended Solids (TSS) removal for enhanced level of quality control 265 m^3 and 181 m^3 of permanent pool and extended detention will be required, respectively. The pond design has provided 808 m^3 or permanent pool and 225 m^3 of extended detention, exceeding the requirements.

Through detailed design, separate forebays and main cells will be broken out of the pond areas established within this Functional Servicing Report (FSR). This will further ensure the quality control targets are achieved.

5.3 Future Stormwater Considerations

The above stormwater management design demonstrates that there is sufficient room in the proposed pond blocks and right of way to achieve the necessary quality and quantity control targets.

Through detailed design, several other considerations will be reviewed to ensure a complete and safe design. This will include a geotechnical assessment of the pond grading and berms to ensure the long-term stability of the proposed stormwater management infrastructure.

Further analysis of the main watercourse bisecting the property will also be required. This will combine a floodplain analysis and culvert sizing for the proposed road crossing. Areas of flood concern will also be identified to ensure existing and future buildings are protected. Any erosion concerns on the main channel will also be identified with appropriate setbacks and mitigation measures identified.

6.0 Erosion and Sediment Control

Erosion and sediment control will be implemented for all construction activities, including tree removal, topsoil stripping, earth moving operations, foundation excavation, septic system construction, and stockpiling of materials. Detailed erosion and sediment control/construction management plans and reports will be prepared during detailed design, in support of necessary permit application. Erosion and Sediment Control Plans will be designed in conformance with the Township of Severn and the Ministry of the Environment, Conservation and Parks (MECP) guidelines.

Erosion and sediment control strategies are expected to include the following:

- Perimeter heavy duty silt fence and double silt fence/straw bale barriers along sensitive outfall areas;
- Immediately following construction, all disturbed areas to be graded to design pre-grades and organic soil added with appropriate seed mix. Site to be re-vegetated as soon as conditions allow;
- Gravel mud mats and vehicle wash-down stations at construction vehicle access points to minimize off-site tracking of sediments;
- Temporary sediment ponds/basins as required;
- Routine inspection, monitoring, and repair as necessary of all temporary erosion and sediment control measures during construction; and
- Removal of temporary controls once the areas they serve are restored and stable.

A full set of erosion and sediment control plans will be provided at detailed design.

7.0 Conclusion and Recommendations

This report addresses the requirement for submission of a Functional Servicing Report to support the Draft plan application for the subdivision. The following conclusions are presented:

- Water servicing will be provided through individual lot wells;
- Wastewater servicing will be provided through on-site septic systems;
- Grading will conform to municipal standards for both the proposed Street and the subject lots;
- Erosion control will be provided throughout all stages of construction using sediment fence, sediment traps / basins, mud-mat, all to meet the requirements of the Township of the MECP; and
- Stormwater quantity and quality control will be achieved through open ditches, two stormwater management ponds and soakaway pits.

This Functional Servicing Report demonstrates that the proposed subdivision can be developed to meet all application requirements and standards, we trust this is sufficient for Draft Plan approval which will allow for the development to proceed to detailed design.

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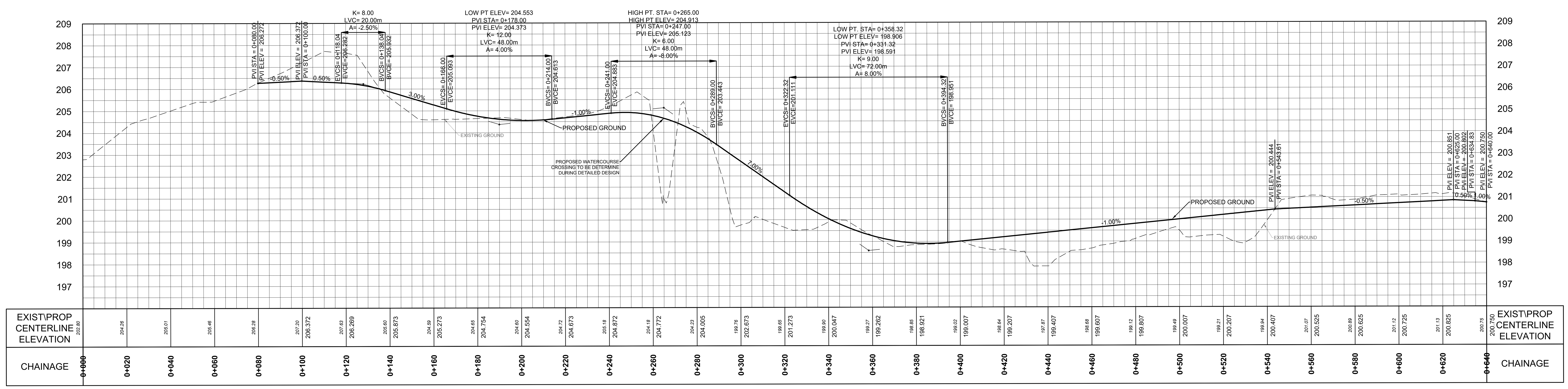
[THE DIFFERENCE IS OUR PEOPLE]

Figures

EXISTING CULVERT
EXISTING WATERCOURSE & ENVIRONMENTAL EASEMENT
EXISTING WATERCOURSE
EXISTING PATHWAY
EXISTING VEGETATION
EXISTING CULVERT
EXISTING WATERCOURSE
EXISTING DRIVEWAY & CULVERT
2950 FESSERTON SIDEROAD EXISTING RESIDENTIAL
2964 FESSERTON SIDEROAD EXISTING RESIDENTIAL
2988 FESSERTON SIDEROAD EXISTING RESIDENTIAL
FESSERTON SIDEROAD
FESSERTON SIDEROAD (ROAD ALLOWANCE BETWEEN LOTS 6 AND 7) (PARTIALLY ASSUMED)
EDGE OF PAVEMENT APPROXIMATE ROAD CENTRE LINE
EAST HALF OF LOT 6, CONCESSION 11
REGISTERED PLAN 51M-917
BLOCK 18 PIN 58508-0292(LT)
PART 1 PLAN 51R-39845 PIN 58508-0291(LT)
PART 1 PLAN 51R-39845 PIN 58508-0292(LT)
PART 1 PLAN 51R-39845 PIN 58508-0293(LT)
PART 1 PLAN 51R-39845 PIN 58508-0294(LT)
PART 1 PLAN 51R-39845 PIN 58508-0295(LT)
PART 1 PLAN 51R-39845 PIN 58508-0296(LT)
LOT 10 PIN 58508-0285(LT)
LOT 11 PIN 58508-0286(LT)
LOT 12 PIN 58508-0287(LT)
LOT 13 PIN 58508-0288(LT)
LOT 14 PIN 58508-0289(LT)
LOT 15 PIN 58508-0290(LT)
LOT 16 PIN 58508-0291(LT)
LOT 17 PIN 58508-0293(LT)
1607 GEORGIAN HEIGHTS BOULEVARD
1617 GEORGIAN HEIGHTS BOULEVARD
1625 GEORGIAN HEIGHTS BOULEVARD
1635 GEORGIAN HEIGHTS BOULEVARD
1645 GEORGIAN HEIGHTS BOULEVARD
1665 GEORGIAN HEIGHTS BOULEVARD
1675 GEORGIAN HEIGHTS BOULEVARD
1685 GEORGIAN HEIGHTS BOULEVARD
1695 GEORGIAN HEIGHTS BOULEVARD
GEORGIAN HEIGHTS BOULEVARD
1606 GEORGIAN HEIGHTS BOULEVARD
1616 GEORGIAN HEIGHTS BOULEVARD
1626 GEORGIAN HEIGHTS BOULEVARD
1636 GEORGIAN HEIGHTS BOULEVARD
1646 GEORGIAN HEIGHTS BOULEVARD
1656 GEORGIAN HEIGHTS BOULEVARD
1666 GEORGIAN HEIGHTS BOULEVARD
1678 GEORGIAN HEIGHTS BOULEVARD
TOP OF BANK
WWF
FENCE
PATHWAY
DRIVEWAY
N37°14'15"E
N37°08'45"E
N37°39'50"W 71.123
N44°21'35"W 106.756
N48°59'40"W 108.082
N51°57'45"W 67.046
N38°40'07"E 24.980
N38°16'30"W C=99.95 A=99.97 R=781.71
N49°34'01"W C=109.29 A=109.29 R=790.83
N43°58'32"W C=54.89 A=54.89 R=786.26
N40°08'30"W 61.786
N35°48'55"W 36.557
N33°28'30"W 69.833
N33°30'50"W 61.902
N33°28'40"W 105.755
N56°56'00"W 70.110
N56°16'30"E 110.964
N37°08'45"E
N60°44'20"W
N56°56'00"W
N56°16'30"E
N38°40'07"E
N37°39'50"W
N44°21'35"W
N48°59'40"W
N51°57'45"W
N33°28'30"W
N33°30'50"W
N33°28'40"W
N56°56'00"W
N56°16'30"E
N60°44'20"W
0 10 20 40 60
Metres
BURNSIDE
Figure Title
BLOCK 18 - FESSERTON
EXISTING CONDITIONS
Client
MORTGAGE FUNDING
Drawn MH
Checked BH
Date 20/11/24
Scale 1:750
Project No. 300050086
Figure No. FIG1

2964 FESSERTON SIDEROAD EXISTING RESIDENTIAL
2950 FESSERTON SIDEROAD EXISTING RESIDENTIAL
2988 FESSERTON SIDEROAD EXISTING RESIDENTIAL
15m ENVIRONMENTAL SETBACK
MAIN WATERCOURSE
10m ENVIRONMENTAL EASEMENT
SOUTH WATERCOURSE
SOUTH SWMF REFER TO FIG6 FOR DETAILS
NORTH SWMF REFER TO FIG6 FOR DETAILS
AREA TO BE FILLED WITH ENGINEERED FILL
POND OUTLET
OUTLET 1
OUTLET 2
OUTLET 3
RETAINING WALL TO BE DESIGNED BY STRUCTURAL ENGINEER
DRIVEWAY CULVERTS REQUIRED ON EVERY LOT
ROAD CROSSING CULVERT
PROPOSED WATERCOURSE CROSSING TO BE DETERMINED DURING DETAILED DESIGN
BLOCK 14 (4288 m² / 0.43 HA.)
BLOCK 15 (4451 m² / 0.44 HA.)
1607 GEORGIAN HEIGHTS BOULEVARD
1617 GEORGIAN HEIGHTS BOULEVARD
1625 GEORGIAN HEIGHTS BOULEVARD
1635 GEORGIAN HEIGHTS BOULEVARD
1645 GEORGIAN HEIGHTS BOULEVARD
1665 GEORGIAN HEIGHTS BOULEVARD
1675 GEORGIAN HEIGHTS BOULEVARD
1685 GEORGIAN HEIGHTS BOULEVARD
1695 GEORGIAN HEIGHTS BOULEVARD
LEGEND
EXISTING CONTOURS
PROPERTY LINES
SET BACK LINES
PROPOSED DITCH LINE
PROPOSED EDGE OF SHOULDER
PROPOSED EDGE OF PAVEMENT
PROPOSED CENTERLINE
PROPOSED SPOT ELEVATIONS
EXISTING SPOT ELEVATIONS
TOP OF WALL ELEVATIONS
BOTTOM OF WALL ELEVATIONS
0 10 20 40 60
Metres
BURNSIDE
Figure Title
BLOCK 18 - FESSERTON
GENERAL GRADING & SERVICING FIGURE
Client
MORTGAGE FUNDING
Drawn MH
Checked BH
Date 20/11/24
Scale 1:750
Project No. 300050086
Figure No. FIG2



TYPICAL SECTION
STA 0+130 TO STA 0+640

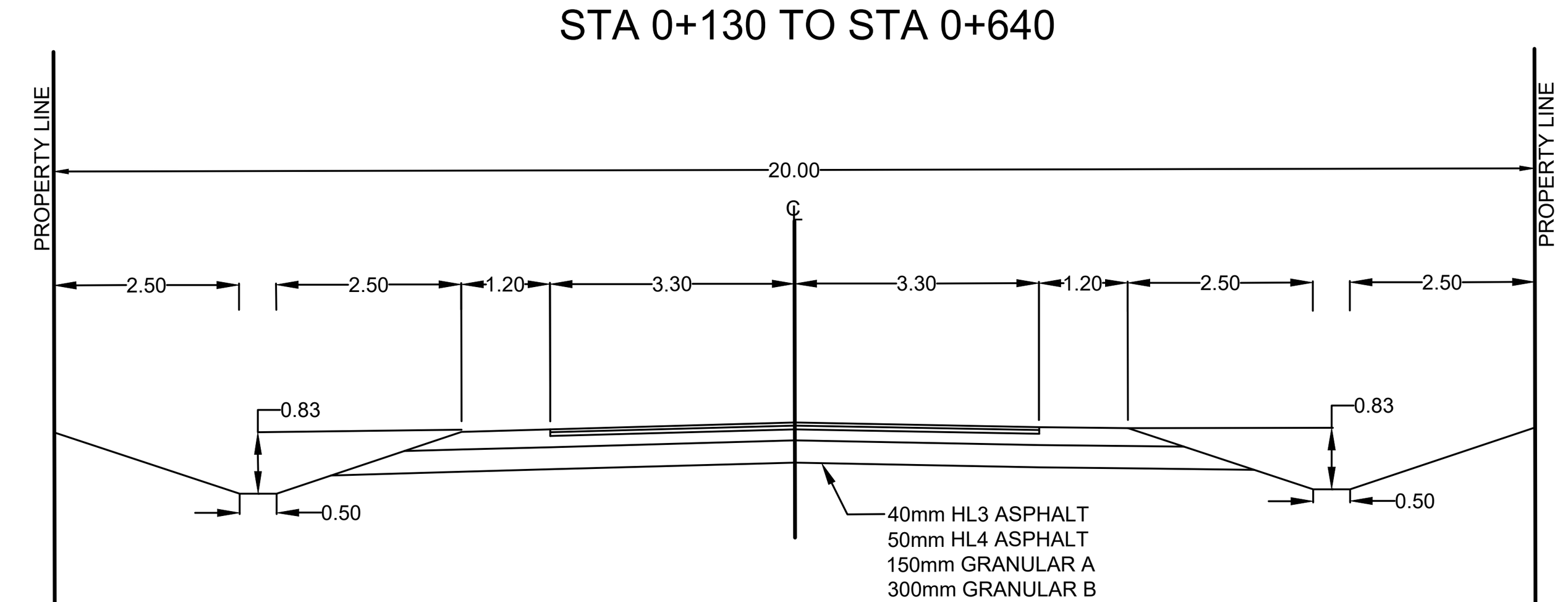


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Figure Title	BLOCK 18 - FESSERTON
	PLAN & PROFILE
Client	MORTGAGE FUNDING
Drawn	MH
Checked	BH
Date	20/11/24
Scale	1:1000
Project No.	300050086
Figure No.	FIG3

REFER TO FIG4b FOR DETAILS

LEGEND

- S3 / 0.31 — CATCHMENT I.D. / CATCHMENT AREA (ha)
- OVERLAND FLOW ROUTE
- LIMIT OF DRAINAGE BOUNDARY

0 10 20 40 60
Metres

BURNSIDE

Client	Figure Title	
MORTGAGE FUNDING	BLOCK 18 - FESSERTON	
	PRE-DEVELOPMENT DRAINAGE FIGURE	
Drawn: MH	Checked: MZ	Date: 20/11/23
Scale: 1:750	Project No.: 300050086	Figure No.: FIG4A

LEGEND

- S3 — CATCHMENT I.D.
- 0.31 — CATCHMENT AREA (ha)
- OVERLAND FLOW ROUTE
- LIMIT OF DRAINAGE BOUNDARY

BURNSIDE

Figure Title	BLOCK 18 - FESSERTON PRE-DEVELOPMENT DRAINAGE FIGURE
Client	MORTGAGE FUNDING
Drawn	MH
Checked	MZ
Date	19/10/15
Scale	1:2500
Project No.	300050086
Figure No.	FIG4B

OUTLET 1
OUTLET 2
OUTLET 3
SOUTH WATERCOURSE
MAIN WATERCOURSE
2950 FESSERTON SIDEROAD
EXISTING RESIDENTIAL
2964 FESSERTON SIDEROAD
EXISTING RESIDENTIAL
2988 FESSERTON SIDEROAD
EXISTING RESIDENTIAL
FESSERTON SIDEROAD
SOUTH SWMF REFER TO FIG6 FOR DETAILS
BLOCK 14 (4288 m² / 0.43 HA.)
NORTH SWMF REFER TO FIG6 FOR DETAILS
BLOCK 15 (4451 m² / 0.44 HA.)
S1
0.86
S2
2.96
S2a
1.89
S3
4.53
EXT1
0.34
EXT2
2.23
EXT2a
78.74
EXT3
3.20
1
2
3
4
5
6
7
8
9
10
11
12
13
14
1607 GEORGIAN HEIGHTS BOULEVARD
1645 GEORGIAN HEIGHTS BOULEVARD
1635 GEORGIAN HEIGHTS BOULEVARD
1625 GEORGIAN HEIGHTS BOULEVARD
1617 GEORGIAN HEIGHTS BOULEVARD
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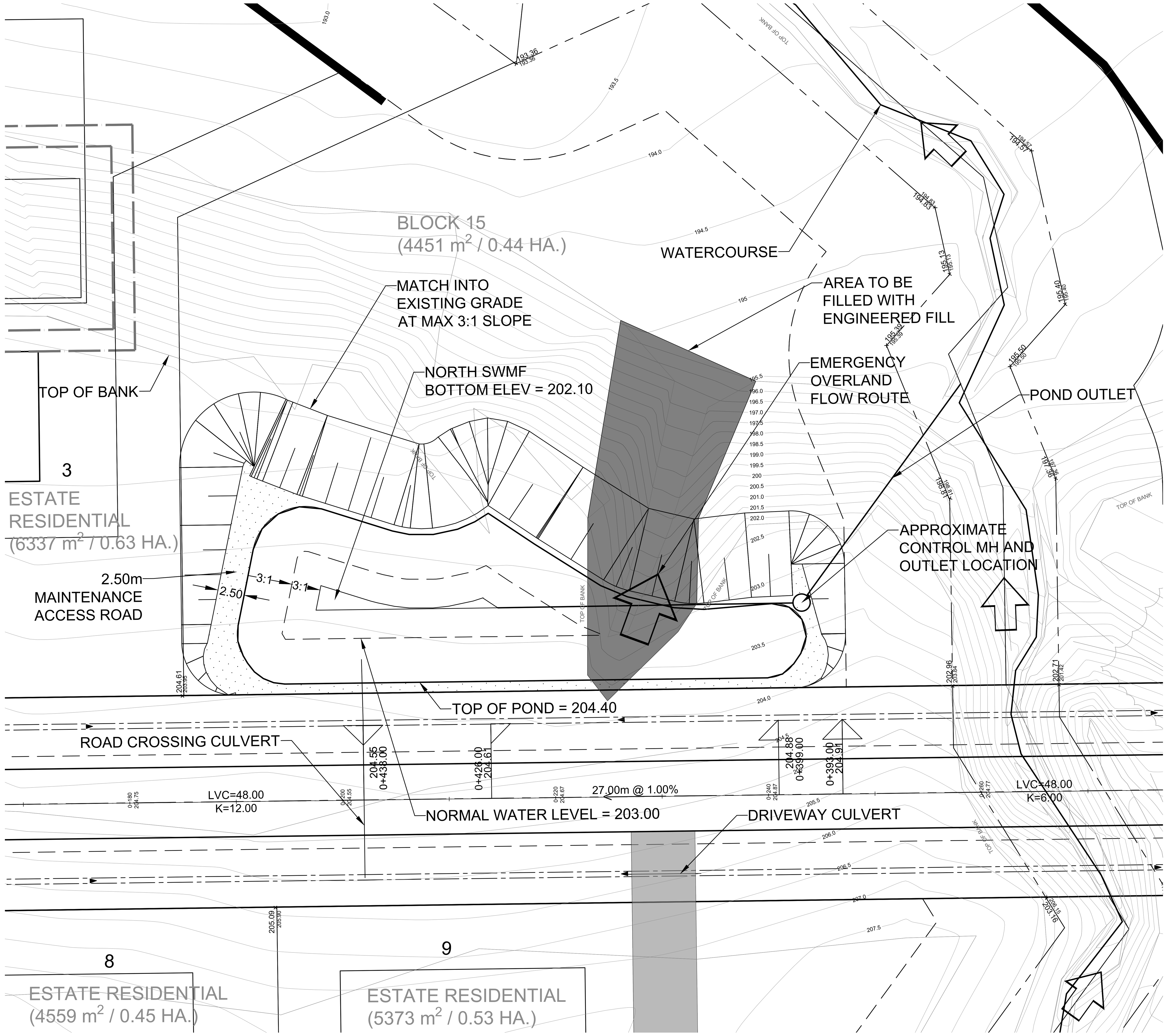
1685 GEORGIAN HEIGHTS BOULEVARD
1675 GEORGIAN HEIGHTS BOULEVARD
1695 GEORGIAN HEIGHTS BOULEVARD
GEORGIAN HEIGHTS BOULEVARD
1646 GEORGIAN HEIGHTS BOULEVARD
1656 GEORGIAN HEIGHTS BOULEVARD
1636 GEORGIAN HEIGHTS BOULEVARD
1626 GEORGIAN HEIGHTS BOULEVARD
1616 GEORGIAN HEIGHTS BOULEVARD
1606 GEORGIAN HEIGHTS BOULEVARD
REFER TO FIG5b FOR DETAILS
LEGEND
S3
0.31
CATCHMENT I.D.
CATCHMENT AREA (ha)
OVERLAND FLOW ROUTE
LIMIT OF DRAINAGE BOUNDARY
ROAD FLOW ROUTE
WATERCOURSE FLOW ROUTE
Metres
BURNSIDE
Figure Title
BLOCK 18 - FESSERTON
POST-DEVELOPMENT DRAINAGE FIGURE
Client
MORTGAGE FUNDING
Drawn MH
Checked MZ
Date 19/10/15
Figure No.
FIG5A
Scale 1:750
Project No. 300050086

LEGEND

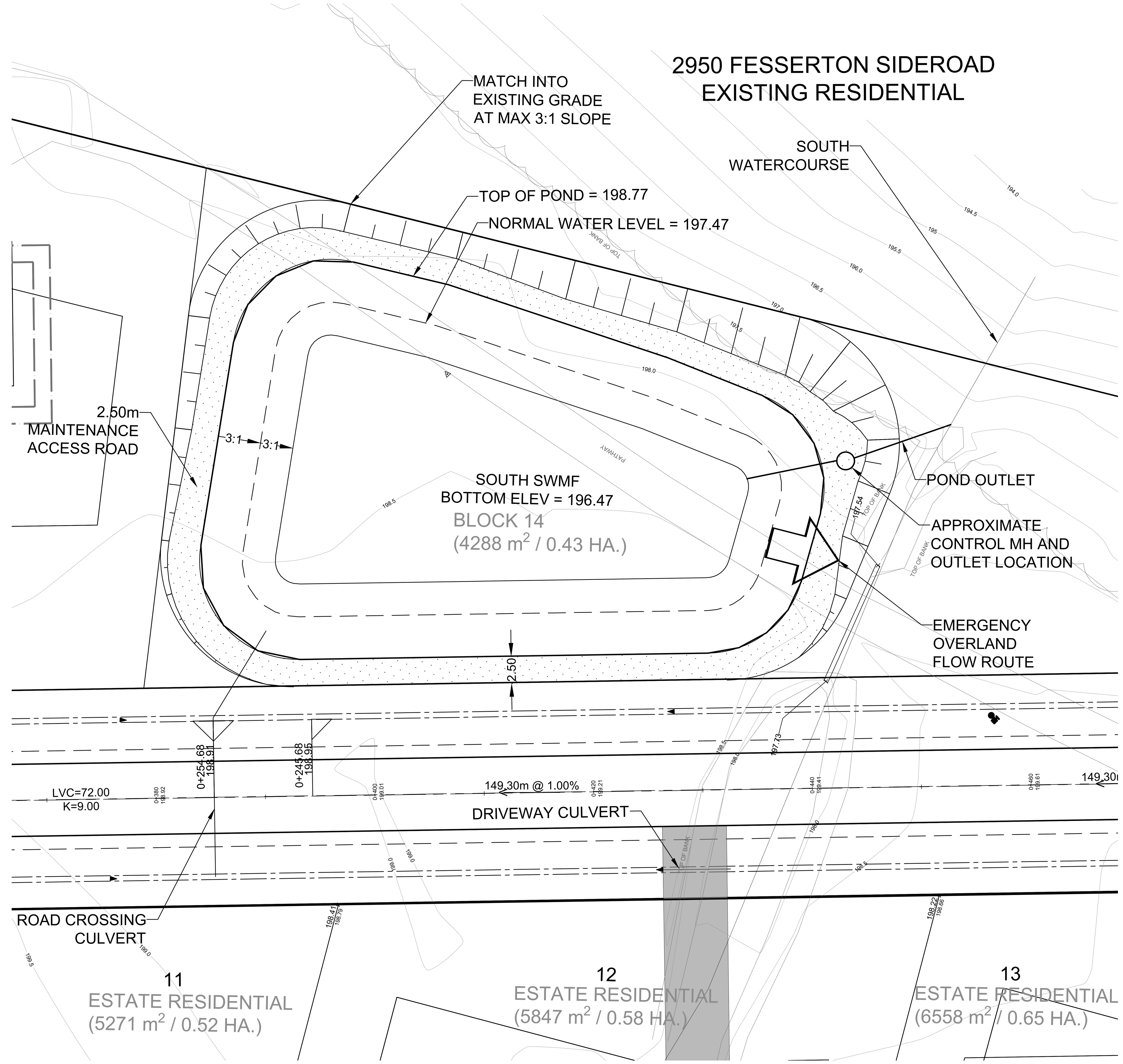
- S3 / 0.31 — CATCHMENT I.D. / CATCHMENT AREA (ha)
- OVERLAND FLOW ROUTE
- LIMIT OF DRAINAGE BOUNDARY
- ROAD FLOW ROUTE
- WATERCOURSE FLOW ROUTE

0 50 100 150 200
Metres

BURNSIDE	Figure Title: **BLOCK 18 - FESSERTON** POST-DEVELOPMENT DRAINAGE FIGURE		
Client: **MORTGAGE FUNDING**	Drawn: MH · Checked: MZ · Date: 19/10/15	Scale: 1:2500 · Project No.: 300050086	Figure No.: **FIG5B**



NORTH STORMWATER MANAGEMENT FACILITY



SOUTH STORMWATER MANAGEMENT FACILITY

BURNSIDE	Figure Title: BLOCK 18 - FESSERTON STORMWATER MANAGEMENT PLAN		
Client: MORTGAGE FUNDING	Drawn: MH Checked: MZ Scale: 1:250	Date: 20/11/24 Project No. 300050086	Figure No. FIG6

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Appendix A

Pre-Development Stormwater Management

TITLE: **PRE-DEVELOPMENT CATCHMENTS**
Project: BLOCK 18 FESSERTON
RJB# 300050086
Date: 8/14/2020
Author: M. Zettel
Checked By:

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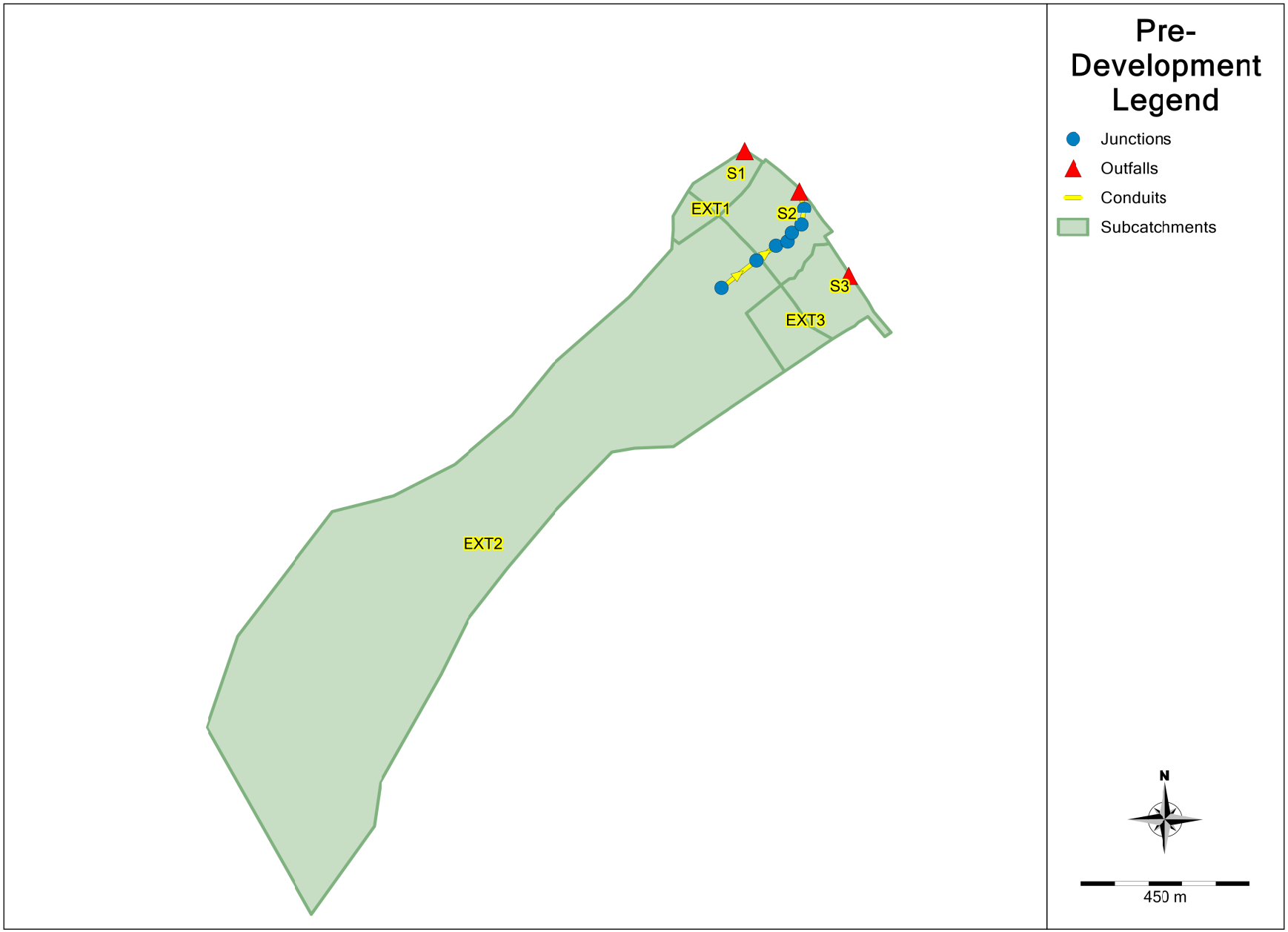
CATCHMENT	AREA (m2)	AREA (ha)	Imp Area (ha)	Imp%	Nearby Boreholes	Soils	Hydrologic Soil Group	Flow Length	CNII	CNIII	Ia (mm)
S1	16700	1.67	0.00	0	None	Sandy Loam	AB	180.0	46	66.2	10.0
S2	50400	5.04	0.00	0	None	Sandy Loam	AB	130.0	46	66.2	10.0
S3	35400	3.54	0.00	0	BH1-5	Silty Sand to Silty Clay	AB	120.0	46	66.2	8.0
EXT1	9000	0.90	0.10	11	None	Sandy Loam	AB	120.0	46	66.2	10.0
EXT2	811800	81.18	6.01	7	None	Sandy Loam	AB	400.0	46	66.2	10.0
EXT3	24300	2.43	0.15	6	None	Sandy Loam	AB	125.0	46	66.2	10.0
Total	947600	**94.76**	6.26								

Notes

CNIII=(23CNII)/(10+0.13CNII)


S1
EXT1
S2
S3
EXT3
EXT2
Pre-Development Legend
Junctions
Outfalls
Conduits
Subcatchments
N
450 m

100-Year SCS 24 Hour

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

WARNING 02: maximum depth increased for Node J4
WARNING 02: maximum depth increased for Node J5
WARNING 02: maximum depth increased for Node J6
WARNING 02: maximum depth increased for Node J7

*************
Element Count
*************
Number of rain gages ...... 12
Number of subcatchments ... 6
Number of nodes ........... 10
Number of links ........... 7
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
100yr_Chicago_4h     100yr_Chicago_4h             INTENSITY    5 min.
10yr_Chicago_4h      10yr_Chicago_4h              INTENSITY    5 min.
25yr_Chicago_4h      25yr_Chicago_4h              INTENSITY    5 min.
2yr_Chicago_4h       2yr_Chicago_4h               INTENSITY    5 min.
50yr_Chicago_4h      50yr_Chicago_4h              INTENSITY    5 min.
5yr_Chicago_4h       5yr_Chicago_4h               INTENSITY    5 min.
B_100yr_SCS_Type_II_123.4mm B_100yr_SCS_Type_II_123.4mm    INTENSITY   15 min.
B_10yr_SCS_Type_II_85.6mm B_10yr_SCS_Type_II_85.6mm      INTENSITY   15 min.
B_25yr_SCS_Type_II_101.0mm B_25yr_SCS_Type_II_101.0mm     INTENSITY   15 min.
B_2yr_SCS_Type_II_55.2mm B_2yr_SCS_Type_II_55.2mm       INTENSITY   15 min.
B_50yr_SCS_Type_II_112.2mm B_50yr_SCS_Type_II_112.2mm     INTENSITY   15 min.
B_5yr_SCS_Type_II_73.7mm B_5yr_SCS_Type_II_73.7mm       INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                         Area     Width    %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
EXT1                         0.90     75.33     11.00    6.5000 B_100yr_SCS_Type_II_123.4mm OF1
```

EXT2	81.18	2029.61	7.00	2.5000	B_100yr_SCS_Type_II_123.4mm J2
EXT3	2.43	194.06	6.00	8.5000	B_100yr_SCS_Type_II_123.4mm OF3
S1	1.67	92.79	0.00	12.4940	B_100yr_SCS_Type_II_123.4mm OF1
S2	5.04	387.81	0.00	11.6450	B_100yr_SCS_Type_II_123.4mm OF2
S3	3.54	294.85	0.00	9.8420	B_100yr_SCS_Type_II_123.4mm OF3

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J2	JUNCTION	222.00	3.00	0.0	
J3	JUNCTION	210.00	3.00	0.0	
J4	JUNCTION	206.00	3.14	0.0	
J5	JUNCTION	204.00	5.45	0.0	
J6	JUNCTION	201.00	5.47	0.0	
J7	JUNCTION	194.00	5.47	0.0	
J8	JUNCTION	193.00	3.00	0.0	
OF1	OUTFALL	200.22	0.00	0.0	
OF2	OUTFALL	192.24	0.32	0.0	
OF3	OUTFALL	193.43	0.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J2	J3	CONDUIT	118.9	10.1468	0.0500
C3	J3	J4	CONDUIT	65.3	6.1415	0.0500
C4	J4	J5	CONDUIT	32.9	6.0864	0.0500
C5	J5	J6	CONDUIT	26.0	11.6170	0.0500
C6	J6	J7	CONDUIT	33.9	21.0953	0.0500
C7	J7	J8	CONDUIT	42.3	2.3643	0.0500
C8	J8	OF2	CONDUIT	47.8	1.5910	0.0500

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	Transect1	1.78	47.48	0.79	60.00	1	257.53

C3	Transect2	1.72	32.71	0.54	59.57	1	107.26
C4	Transect3	3.14	57.27	1.09	60.00	1	299.13
C5	Transect4	5.45	46.82	2.00	36.87	1	505.98
C6	Transect5	5.47	219.03	3.79	60.00	1	4892.68
C7	Transect6	0.96	13.63	0.40	33.15	1	22.79
C8	Transect7	0.32	4.28	0.12	35.00	1	2.64

****
Transect Summary
****

Transect Transect1
Area:

0.0004	0.0014	0.0026	0.0042	0.0060
0.0080	0.0104	0.0134	0.0172	0.0216
0.0267	0.0325	0.0390	0.0462	0.0540
0.0624	0.0716	0.0814	0.0918	0.1030
0.1148	0.1273	0.1404	0.1542	0.1687
0.1848	0.2027	0.2224	0.2439	0.2672
0.2923	0.3192	0.3482	0.3797	0.4123
0.4456	0.4798	0.5148	0.5506	0.5873
0.6248	0.6631	0.7023	0.7424	0.7832
0.8250	0.8675	0.9109	0.9552	1.0000

Hrad:

0.0224	0.0552	0.0844	0.1111	0.1366
0.1612	0.1755	0.1785	0.1883	0.2022
0.2191	0.2376	0.2571	0.2772	0.2976
0.3184	0.3394	0.3606	0.3820	0.4035
0.4251	0.4468	0.4686	0.4904	0.4992
0.4892	0.4854	0.4862	0.4905	0.4975
0.5067	0.5175	0.5292	0.5325	0.5638
0.5948	0.6259	0.6558	0.6851	0.7141
0.7428	0.7712	0.7994	0.8274	0.8551
0.8826	0.9100	0.9371	0.9663	1.0000

Width:

0.0178	0.0247	0.0309	0.0370	0.0432
0.0494	0.0588	0.0747	0.0905	0.1062
0.1214	0.1363	0.1511	0.1659	0.1806
0.1954	0.2102	0.2250	0.2398	0.2545
0.2693	0.2841	0.2989	0.3136	0.3372
0.3772	0.4171	0.4571	0.4971	0.5370
0.5770	0.6169	0.6733	0.7134	0.7316
0.7496	0.7671	0.7855	0.8042	0.8229
0.8417	0.8604	0.8791	0.8979	0.9166

```
            0.9353     0.9541     0.9728     0.9890     1.0000

Transect Transect2
Area:
            0.0004     0.0016     0.0034     0.0054     0.0077
            0.0103     0.0130     0.0162     0.0199     0.0244
            0.0296     0.0352     0.0411     0.0472     0.0536
            0.0605     0.0679     0.0757     0.0839     0.0926
            0.1017     0.1113     0.1214     0.1322     0.1435
            0.1556     0.1683     0.1816     0.1957     0.2104
            0.2259     0.2428     0.2615     0.2821     0.3046
            0.3290     0.3553     0.3839     0.4153     0.4580
            0.5049     0.5548     0.6066     0.6595     0.7135
            0.7685     0.8247     0.8819     0.9402     1.0000
Hrad:
            0.0311     0.0599     0.1100     0.1555     0.1977
            0.2377     0.2760     0.2899     0.2986     0.3137
            0.3329     0.3779     0.4240     0.4651     0.4949
            0.5249     0.5550     0.5853     0.6157     0.6455
            0.6738     0.7019     0.7221     0.7436     0.7637
            0.7834     0.8044     0.8264     0.8493     0.8730
            0.8967     0.9177     0.9347     0.9490     0.9615
            0.9731     0.9843     0.9953     1.0047     0.9884
            0.9781     0.7089     0.7583     0.8070     0.8552
            0.9028     0.9498     0.9963     1.0423     1.0000
Width:
            0.0126     0.0267     0.0306     0.0346     0.0385
            0.0425     0.0464     0.0549     0.0659     0.0769
            0.0880     0.0921     0.0956     0.1000     0.1070
            0.1140     0.1210     0.1280     0.1350     0.1421
            0.1497     0.1573     0.1670     0.1767     0.1870
            0.1978     0.2085     0.2192     0.2300     0.2407
            0.2578     0.2839     0.3143     0.3448     0.3753
            0.4058     0.4380     0.4755     0.5782     0.7261
            0.7741     0.8199     0.8372     0.8545     0.8718
            0.8891     0.9063     0.9236     0.9409     1.0000

Transect Transect3
Area:
            0.0015     0.0033     0.0052     0.0072     0.0094
            0.0116     0.0139     0.0165     0.0197     0.0235
            0.0278     0.0325     0.0376     0.0432     0.0492
            0.0555     0.0621     0.0691     0.0764     0.0839
            0.0918     0.0999     0.1083     0.1173     0.1267
            0.1367     0.1473     0.1583     0.1699     0.1820
            0.1946     0.2080     0.2227     0.2391     0.2636
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            0.3020     0.3439     0.3872     0.4314     0.4761
            0.5211     0.5665     0.6123     0.6599     0.7099
            0.7630     0.8188     0.8769     0.9372     1.0000
Hrad:
            0.0468     0.0960     0.1399     0.1797     0.2164
            0.2503     0.2780     0.2839     0.2853     0.2939
            0.3158     0.3393     0.3634     0.3879     0.4167
            0.4459     0.4747     0.5042     0.5366     0.5684
            0.5999     0.6308     0.6492     0.6650     0.6819
            0.6999     0.7187     0.7383     0.7586     0.7795
            0.7998     0.8190     0.8358     0.8486     0.8309
            0.7810     0.7544     0.4915     0.5428     0.5937
            0.6442     0.6943     0.7439     0.7911     0.8244
            0.8527     0.8901     0.9288     0.9662     1.0000
Width:
            0.0270     0.0285     0.0300     0.0315     0.0329
            0.0344     0.0368     0.0435     0.0527     0.0619
            0.0686     0.0751     0.0815     0.0880     0.0933
            0.0985     0.1037     0.1087     0.1128     0.1169
            0.1211     0.1252     0.1323     0.1402     0.1482
            0.1562     0.1641     0.1721     0.1801     0.1880
            0.1963     0.2130     0.2325     0.2901     0.4443
            0.6280     0.6479     0.6694     0.6754     0.6814
            0.6874     0.6935     0.7071     0.7402     0.7836
            0.8298     0.8664     0.9004     0.9344     1.0000

Transect Transect4
Area:
            0.0038     0.0095     0.0158     0.0227     0.0302
            0.0383     0.0468     0.0560     0.0657     0.0760
            0.0868     0.0982     0.1101     0.1226     0.1357
            0.1493     0.1635     0.1782     0.1935     0.2093
            0.2257     0.2427     0.2602     0.2783     0.2969
            0.3161     0.3359     0.3562     0.3770     0.3985
            0.4205     0.4431     0.4663     0.4901     0.5145
            0.5395     0.5650     0.5912     0.6179     0.6452
            0.6731     0.7016     0.7306     0.7603     0.7911
            0.8239     0.8586     0.8955     0.9348     1.0000
Hrad:
            0.0398     0.0818     0.1214     0.1576     0.1910
            0.2223     0.2519     0.2801     0.3073     0.3337
            0.3593     0.3843     0.4088     0.4328     0.4565
            0.4799     0.5029     0.5258     0.5484     0.5708
            0.5931     0.6152     0.6371     0.6590     0.6807
            0.7023     0.7238     0.7453     0.7663     0.7870
            0.8077     0.8284     0.8491     0.8698     0.8904
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            0.9111     0.9317     0.9523     0.9730     0.9936
            1.0142     1.0348     1.0554     1.0756     1.0672
            1.0603     1.0525     1.0426     1.0362     1.0000
Width:
            0.0600     0.0703     0.0774     0.0838     0.0903
            0.0968     0.1033     0.1098     0.1163     0.1228
            0.1293     0.1358     0.1423     0.1488     0.1553
            0.1618     0.1683     0.1748     0.1813     0.1878
            0.1943     0.2008     0.2073     0.2138     0.2203
            0.2268     0.2333     0.2398     0.2465     0.2533
            0.2601     0.2669     0.2738     0.2806     0.2874
            0.2942     0.3011     0.3079     0.3147     0.3215
            0.3284     0.3352     0.3420     0.3490     0.3702
            0.3927     0.4170     0.4443     0.4715     1.0000

Transect Transect5
Area:
            0.0017     0.0069     0.0158     0.0266     0.0404
            0.0566     0.0742     0.0921     0.1100     0.1281
            0.1463     0.1646     0.1830     0.2015     0.2202
            0.2389     0.2578     0.2768     0.2959     0.3151
            0.3344     0.3539     0.3734     0.3931     0.4129
            0.4328     0.4528     0.4730     0.4932     0.5136
            0.5340     0.5547     0.5757     0.5969     0.6184
            0.6402     0.6624     0.6851     0.7082     0.7317
            0.7558     0.7805     0.8056     0.8314     0.8579
            0.8850     0.9128     0.9412     0.9703     1.0000
Hrad:
            0.0145     0.0250     0.0466     0.0642     0.0762
            0.0949     0.1196     0.1473     0.1748     0.2021
            0.2292     0.2561     0.2828     0.3094     0.3357
            0.3619     0.3879     0.4137     0.4394     0.4649
            0.4902     0.5153     0.5404     0.5652     0.5899
            0.6145     0.6389     0.6632     0.6873     0.7113
            0.7343     0.7530     0.7715     0.7900     0.8084
            0.8230     0.8347     0.8464     0.8582     0.8710
            0.8881     0.9047     0.9195     0.9308     0.9418
            0.9527     0.9636     0.9743     0.9859     1.0000
Width:
            0.1107     0.2664     0.3245     0.3969     0.5083
            0.5706     0.5936     0.5974     0.6012     0.6050
            0.6089     0.6127     0.6165     0.6203     0.6241
            0.6280     0.6318     0.6356     0.6394     0.6433
            0.6471     0.6509     0.6547     0.6585     0.6624
            0.6662     0.6700     0.6738     0.6776     0.6815
            0.6862     0.6950     0.7039     0.7127     0.7216
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            0.7337     0.7488     0.7638     0.7788     0.7954
            0.8131     0.8307     0.8498     0.8719     0.8940
            0.9161     0.9382     0.9602     0.9814     1.0000

Transect Transect6
Area:
            0.0004     0.0013     0.0029     0.0054     0.0086
            0.0120     0.0156     0.0196     0.0238     0.0283
            0.0331     0.0381     0.0434     0.0490     0.0548
            0.0610     0.0674     0.0742     0.0814     0.0903
            0.1009     0.1135     0.1278     0.1439     0.1619
            0.1814     0.2023     0.2247     0.2486     0.2738
            0.3002     0.3276     0.3560     0.3855     0.4160
            0.4476     0.4803     0.5140     0.5487     0.5845
            0.6213     0.6592     0.6981     0.7381     0.7791
            0.8212     0.8643     0.9085     0.9537     1.0000
Hrad:
            0.0295     0.0527     0.0690     0.0850     0.1228
            0.1583     0.1919     0.2240     0.2549     0.2848
            0.3139     0.3423     0.3702     0.3975     0.4245
            0.4510     0.4727     0.4922     0.4793     0.4315
            0.4071     0.3959     0.3930     0.3957     0.4035
            0.4218     0.4408     0.4543     0.4750     0.4973
            0.5239     0.5501     0.5761     0.6019     0.6275
            0.6530     0.6783     0.7036     0.7287     0.7537
            0.7786     0.8034     0.8281     0.8528     0.8774
            0.9019     0.9264     0.9508     0.9751     1.0000
Width:
            0.0144     0.0254     0.0426     0.0642     0.0700
            0.0758     0.0816     0.0874     0.0931     0.0989
            0.1047     0.1105     0.1163     0.1220     0.1278
            0.1336     0.1409     0.1492     0.1687     0.2087
            0.2480     0.2868     0.3257     0.3645     0.4023
            0.4311     0.4599     0.4960     0.5247     0.5519
            0.5742     0.5967     0.6191     0.6415     0.6639
            0.6863     0.7087     0.7311     0.7535     0.7759
            0.7983     0.8207     0.8431     0.8656     0.8880
            0.9104     0.9328     0.9552     0.9776     1.0000

Transect Transect7
Area:
            0.0043     0.0098     0.0157     0.0220     0.0287
            0.0357     0.0432     0.0511     0.0593     0.0680
            0.0771     0.0865     0.0963     0.1062     0.1161
            0.1261     0.1361     0.1462     0.1563     0.1664
            0.1766     0.1871     0.1981     0.2096     0.2216
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            0.2343     0.2482     0.2632     0.2793     0.2969
            0.3157     0.3360     0.3576     0.3806     0.4049
            0.4307     0.4579     0.4872     0.5186     0.5521
            0.5877     0.6255     0.6653     0.7074     0.7527
            0.7994     0.8475     0.8970     0.9478     1.0000
Hrad:
            0.0436     0.0917     0.1369     0.1798     0.2207
            0.2599     0.2978     0.3346     0.3703     0.4052
            0.4393     0.4728     0.5159     0.5657     0.6153
            0.6646     0.7137     0.7625     0.8110     0.8592
            0.9033     0.9138     0.9256     0.9387     0.9529
            0.9259     0.9040     0.8891     0.8735     0.8586
            0.8495     0.8451     0.8444     0.8468     0.8519
            0.8591     0.8546     0.8465     0.8429     0.8429
            0.8460     0.8514     0.8591     0.8523     0.8633
            0.8907     0.9180     0.9453     0.9727     1.0000
Width:
            0.1000     0.1075     0.1150     0.1226     0.1301
            0.1376     0.1452     0.1527     0.1602     0.1677
            0.1753     0.1828     0.1864     0.1873     0.1882
            0.1891     0.1899     0.1908     0.1917     0.1926
            0.1943     0.2035     0.2127     0.2219     0.2311
            0.2516     0.2730     0.2945     0.3183     0.3442
            0.3702     0.3961     0.4220     0.4480     0.4739
            0.4999     0.5345     0.5743     0.6141     0.6540
            0.6938     0.7338     0.7738     0.8297     0.8717
            0.8975     0.9232     0.9489     0.9745     1.0000


**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
```

```
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 08/20/2020 00:00:00
Ending Date ..... 08/21/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	11.694	123.398
Evaporation Loss	0.000	0.000
Infiltration Loss	7.753	81.819
Surface Runoff	2.509	26.479
Final Storage	1.438	15.175
Continuity Error (%)	-0.060	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	2.505	25.052
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	2.494	24.941
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.011	0.108
Continuity Error (%)	0.016	

Time-Step Critical Elements
****
Link C5 (1.49%)

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 2.58 sec
Average Time Step : 4.98 sec
Maximum Time Step : 5.00 sec
Percent in Steady State : -0.00
Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	123.40	0.00	0.00	77.68	13.35	21.92	35.27	0.32	0.06	0.286
EXT2	123.40	0.00	0.00	81.17	8.51	17.90	26.40	21.44	2.62	0.214
EXT3	123.40	0.00	0.00	82.04	7.28	23.19	30.47	0.74	0.12	0.247
S1	123.40	0.00	0.00	87.28	0.00	24.41	24.41	0.41	0.04	0.198
S2	123.40	0.00	0.00	87.28	0.00	24.72	24.72	1.25	0.14	0.200
S3	123.40	0.00	0.00	87.28	0.00	26.71	26.71	0.95	0.13	0.216

****
Node Depth Summary
****

	Average Depth	Maximum Depth	Maximum HGL	Time of Max Occurrence	Reported Max Depth

Node	Type	Meters	Meters	Meters	days	hr:min	Meters
J2	JUNCTION	0.12	0.40	222.40	0	12:00	0.40
J3	JUNCTION	0.14	0.45	210.45	0	12:00	0.45
J4	JUNCTION	0.12	0.59	206.59	0	12:00	0.59
J5	JUNCTION	0.10	0.41	204.41	0	12:00	0.41
J6	JUNCTION	0.07	0.21	201.21	0	12:00	0.21
J7	JUNCTION	0.17	0.53	194.53	0	11:57	0.53
J8	JUNCTION	0.11	0.55	193.55	0	12:03	0.55
OF1	OUTFALL	0.00	0.00	200.22	0	00:00	0.00
OF2	OUTFALL	0.06	0.26	192.50	0	12:03	0.26
OF3	OUTFALL	0.00	0.00	193.43	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J2	JUNCTION	2.618	2.618	0	12:00	21.4	21.4	0.035
J3	JUNCTION	0.000	2.605	0	12:00	0	21.4	0.118
J4	JUNCTION	0.000	2.584	0	12:00	0	21.4	0.054
J5	JUNCTION	0.000	2.572	0	12:00	0	21.4	0.029
J6	JUNCTION	0.000	2.572	0	12:00	0	21.3	0.046
J7	JUNCTION	0.000	2.571	0	12:00	0	21.3	0.099
J8	JUNCTION	0.000	2.629	0	12:00	0	21.3	0.141
OF1	OUTFALL	0.097	0.097	0	12:00	0.726	0.726	0.000
OF2	OUTFALL	0.138	2.471	0	12:03	1.24	22.5	0.000
OF3	OUTFALL	0.255	0.255	0	12:00	1.68	1.68	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	93.92	0.009	0.097	0.726
OF2	92.00	0.289	2.471	22.533
OF3	94.03	0.021	0.255	1.682
System	93.32	0.320	0.255	24.941

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C2	CHANNEL	2.605	0 12:00	1.75	0.01	0.24
C3	CHANNEL	2.584	0 12:00	1.56	0.02	0.30
C4	CHANNEL	2.572	0 12:00	2.72	0.01	0.16
C5	CHANNEL	2.572	0 12:00	3.72	0.01	0.06
C6	CHANNEL	2.571	0 12:00	4.59	0.00	0.07
C7	CHANNEL	2.629	0 12:00	1.39	0.12	0.55
C8	CHANNEL	2.337	0 12:03	0.73	0.88	0.90

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl

C2	1.00	0.06	0.00	0.00	0.37	0.58	0.00	0.00	0.93	0.00
C3	1.00	0.06	0.00	0.00	0.02	0.92	0.00	0.00	0.01	0.00
C4	1.00	0.07	0.00	0.00	0.02	0.91	0.00	0.00	0.00	0.00
C5	1.00	0.07	0.00	0.00	0.01	0.93	0.00	0.00	0.26	0.00
C6	1.00	0.07	0.01	0.00	0.92	0.01	0.00	0.00	0.92	0.00
C7	1.00	0.07	0.00	0.00	0.93	0.01	0.00	0.00	0.01	0.00
C8	1.00	0.07	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C8	0.01	0.27	0.01	0.01	0.01

Analysis begun on: Thu Nov 26 13:37:02 2020
Analysis ended on: Thu Nov 26 13:37:02 2020
Total elapsed time: < 1 sec

100-Year Chicago 4-Hour

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

WARNING 02: maximum depth increased for Node J4
WARNING 02: maximum depth increased for Node J5
WARNING 02: maximum depth increased for Node J6
WARNING 02: maximum depth increased for Node J7

*************
Element Count
*************
Number of rain gages ...... 12
Number of subcatchments ... 6
Number of nodes ........... 10
Number of links ........... 7
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
100yr_Chicago_4h     100yr_Chicago_4h             INTENSITY    5 min.
10yr_Chicago_4h      10yr_Chicago_4h              INTENSITY    5 min.
25yr_Chicago_4h      25yr_Chicago_4h              INTENSITY    5 min.
2yr_Chicago_4h       2yr_Chicago_4h               INTENSITY    5 min.
50yr_Chicago_4h      50yr_Chicago_4h              INTENSITY    5 min.
5yr_Chicago_4h       5yr_Chicago_4h               INTENSITY    5 min.
B_100yr_SCS_Type_II_123.4mm B_100yr_SCS_Type_II_123.4mm    INTENSITY   15 min.
B_10yr_SCS_Type_II_85.6mm B_10yr_SCS_Type_II_85.6mm      INTENSITY   15 min.
B_25yr_SCS_Type_II_101.0mm B_25yr_SCS_Type_II_101.0mm     INTENSITY   15 min.
B_2yr_SCS_Type_II_55.2mm B_2yr_SCS_Type_II_55.2mm       INTENSITY   15 min.
B_50yr_SCS_Type_II_112.2mm B_50yr_SCS_Type_II_112.2mm     INTENSITY   15 min.
B_5yr_SCS_Type_II_73.7mm B_5yr_SCS_Type_II_73.7mm       INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                         Area     Width    %Imperv    %Slope Rain Gage            Outlet
------------------------------------------------------------------------------------------------
EXT1                         0.90     75.33     11.00    6.5000 100yr_Chicago_4h     OF1
```

EXT2	81.18	2029.61	7.00	2.5000	100yr_Chicago_4h	J2
EXT3	2.43	194.06	6.00	8.5000	100yr_Chicago_4h	OF3
S1	1.67	92.79	0.00	12.4940	100yr_Chicago_4h	OF1
S2	5.04	387.81	0.00	11.6450	100yr_Chicago_4h	OF2
S3	3.54	294.85	0.00	9.8420	100yr_Chicago_4h	OF3

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J2	JUNCTION	222.00	3.00	0.0	
J3	JUNCTION	210.00	3.00	0.0	
J4	JUNCTION	206.00	3.14	0.0	
J5	JUNCTION	204.00	5.45	0.0	
J6	JUNCTION	201.00	5.47	0.0	
J7	JUNCTION	194.00	5.47	0.0	
J8	JUNCTION	193.00	3.00	0.0	
OF1	OUTFALL	200.22	0.00	0.0	
OF2	OUTFALL	192.24	0.32	0.0	
OF3	OUTFALL	193.43	0.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C2	J2	J3	CONDUIT	118.9	10.1468	0.0500
C3	J3	J4	CONDUIT	65.3	6.1415	0.0500
C4	J4	J5	CONDUIT	32.9	6.0864	0.0500
C5	J5	J6	CONDUIT	26.0	11.6170	0.0500
C6	J6	J7	CONDUIT	33.9	21.0953	0.0500
C7	J7	J8	CONDUIT	42.3	2.3643	0.0500
C8	J8	OF2	CONDUIT	47.8	1.5910	0.0500

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C2	Transect1	1.78	47.48	0.79	60.00	1	257.53

C3	Transect2	1.72	32.71	0.54	59.57	1	107.26
C4	Transect3	3.14	57.27	1.09	60.00	1	299.13
C5	Transect4	5.45	46.82	2.00	36.87	1	505.98
C6	Transect5	5.47	219.03	3.79	60.00	1	4892.68
C7	Transect6	0.96	13.63	0.40	33.15	1	22.79
C8	Transect7	0.32	4.28	0.12	35.00	1	2.64

****
Transect Summary
****

Transect Transect1
Area:

0.0004	0.0014	0.0026	0.0042	0.0060
0.0080	0.0104	0.0134	0.0172	0.0216
0.0267	0.0325	0.0390	0.0462	0.0540
0.0624	0.0716	0.0814	0.0918	0.1030
0.1148	0.1273	0.1404	0.1542	0.1687
0.1848	0.2027	0.2224	0.2439	0.2672
0.2923	0.3192	0.3482	0.3797	0.4123
0.4456	0.4798	0.5148	0.5506	0.5873
0.6248	0.6631	0.7023	0.7424	0.7832
0.8250	0.8675	0.9109	0.9552	1.0000

Hrad:

0.0224	0.0552	0.0844	0.1111	0.1366
0.1612	0.1755	0.1785	0.1883	0.2022
0.2191	0.2376	0.2571	0.2772	0.2976
0.3184	0.3394	0.3606	0.3820	0.4035
0.4251	0.4468	0.4686	0.4904	0.4992
0.4892	0.4854	0.4862	0.4905	0.4975
0.5067	0.5175	0.5292	0.5325	0.5638
0.5948	0.6259	0.6558	0.6851	0.7141
0.7428	0.7712	0.7994	0.8274	0.8551
0.8826	0.9100	0.9371	0.9663	1.0000

Width:

0.0178	0.0247	0.0309	0.0370	0.0432
0.0494	0.0588	0.0747	0.0905	0.1062
0.1214	0.1363	0.1511	0.1659	0.1806
0.1954	0.2102	0.2250	0.2398	0.2545
0.2693	0.2841	0.2989	0.3136	0.3372
0.3772	0.4171	0.4571	0.4971	0.5370
0.5770	0.6169	0.6733	0.7134	0.7316
0.7496	0.7671	0.7855	0.8042	0.8229
0.8417	0.8604	0.8791	0.8979	0.9166

```
            0.9353     0.9541     0.9728     0.9890     1.0000

Transect Transect2
Area:
            0.0004     0.0016     0.0034     0.0054     0.0077
            0.0103     0.0130     0.0162     0.0199     0.0244
            0.0296     0.0352     0.0411     0.0472     0.0536
            0.0605     0.0679     0.0757     0.0839     0.0926
            0.1017     0.1113     0.1214     0.1322     0.1435
            0.1556     0.1683     0.1816     0.1957     0.2104
            0.2259     0.2428     0.2615     0.2821     0.3046
            0.3290     0.3553     0.3839     0.4153     0.4580
            0.5049     0.5548     0.6066     0.6595     0.7135
            0.7685     0.8247     0.8819     0.9402     1.0000
Hrad:
            0.0311     0.0599     0.1100     0.1555     0.1977
            0.2377     0.2760     0.2899     0.2986     0.3137
            0.3329     0.3779     0.4240     0.4651     0.4949
            0.5249     0.5550     0.5853     0.6157     0.6455
            0.6738     0.7019     0.7221     0.7436     0.7637
            0.7834     0.8044     0.8264     0.8493     0.8730
            0.8967     0.9177     0.9347     0.9490     0.9615
            0.9731     0.9843     0.9953     1.0047     0.9884
            0.9781     0.7089     0.7583     0.8070     0.8552
            0.9028     0.9498     0.9963     1.0423     1.0000
Width:
            0.0126     0.0267     0.0306     0.0346     0.0385
            0.0425     0.0464     0.0549     0.0659     0.0769
            0.0880     0.0921     0.0956     0.1000     0.1070
            0.1140     0.1210     0.1280     0.1350     0.1421
            0.1497     0.1573     0.1670     0.1767     0.1870
            0.1978     0.2085     0.2192     0.2300     0.2407
            0.2578     0.2839     0.3143     0.3448     0.3753
            0.4058     0.4380     0.4755     0.5782     0.7261
            0.7741     0.8199     0.8372     0.8545     0.8718
            0.8891     0.9063     0.9236     0.9409     1.0000

Transect Transect3
Area:
            0.0015     0.0033     0.0052     0.0072     0.0094
            0.0116     0.0139     0.0165     0.0197     0.0235
            0.0278     0.0325     0.0376     0.0432     0.0492
            0.0555     0.0621     0.0691     0.0764     0.0839
            0.0918     0.0999     0.1083     0.1173     0.1267
            0.1367     0.1473     0.1583     0.1699     0.1820
            0.1946     0.2080     0.2227     0.2391     0.2636
```

```
            0.3020     0.3439     0.3872     0.4314     0.4761
            0.5211     0.5665     0.6123     0.6599     0.7099
            0.7630     0.8188     0.8769     0.9372     1.0000
Hrad:
            0.0468     0.0960     0.1399     0.1797     0.2164
            0.2503     0.2780     0.2839     0.2853     0.2939
            0.3158     0.3393     0.3634     0.3879     0.4167
            0.4459     0.4747     0.5042     0.5366     0.5684
            0.5999     0.6308     0.6492     0.6650     0.6819
            0.6999     0.7187     0.7383     0.7586     0.7795
            0.7998     0.8190     0.8358     0.8486     0.8309
            0.7810     0.7544     0.4915     0.5428     0.5937
            0.6442     0.6943     0.7439     0.7911     0.8244
            0.8527     0.8901     0.9288     0.9662     1.0000
Width:
            0.0270     0.0285     0.0300     0.0315     0.0329
            0.0344     0.0368     0.0435     0.0527     0.0619
            0.0686     0.0751     0.0815     0.0880     0.0933
            0.0985     0.1037     0.1087     0.1128     0.1169
            0.1211     0.1252     0.1323     0.1402     0.1482
            0.1562     0.1641     0.1721     0.1801     0.1880
            0.1963     0.2130     0.2325     0.2901     0.4443
            0.6280     0.6479     0.6694     0.6754     0.6814
            0.6874     0.6935     0.7071     0.7402     0.7836
            0.8298     0.8664     0.9004     0.9344     1.0000

Transect Transect4
Area:
            0.0038     0.0095     0.0158     0.0227     0.0302
            0.0383     0.0468     0.0560     0.0657     0.0760
            0.0868     0.0982     0.1101     0.1226     0.1357
            0.1493     0.1635     0.1782     0.1935     0.2093
            0.2257     0.2427     0.2602     0.2783     0.2969
            0.3161     0.3359     0.3562     0.3770     0.3985
            0.4205     0.4431     0.4663     0.4901     0.5145
            0.5395     0.5650     0.5912     0.6179     0.6452
            0.6731     0.7016     0.7306     0.7603     0.7911
            0.8239     0.8586     0.8955     0.9348     1.0000
Hrad:
            0.0398     0.0818     0.1214     0.1576     0.1910
            0.2223     0.2519     0.2801     0.3073     0.3337
            0.3593     0.3843     0.4088     0.4328     0.4565
            0.4799     0.5029     0.5258     0.5484     0.5708
            0.5931     0.6152     0.6371     0.6590     0.6807
            0.7023     0.7238     0.7453     0.7663     0.7870
            0.8077     0.8284     0.8491     0.8698     0.8904
```

```
            0.9111     0.9317     0.9523     0.9730     0.9936
            1.0142     1.0348     1.0554     1.0756     1.0672
            1.0603     1.0525     1.0426     1.0362     1.0000
Width:
            0.0600     0.0703     0.0774     0.0838     0.0903
            0.0968     0.1033     0.1098     0.1163     0.1228
            0.1293     0.1358     0.1423     0.1488     0.1553
            0.1618     0.1683     0.1748     0.1813     0.1878
            0.1943     0.2008     0.2073     0.2138     0.2203
            0.2268     0.2333     0.2398     0.2465     0.2533
            0.2601     0.2669     0.2738     0.2806     0.2874
            0.2942     0.3011     0.3079     0.3147     0.3215
            0.3284     0.3352     0.3420     0.3490     0.3702
            0.3927     0.4170     0.4443     0.4715     1.0000

Transect Transect5
Area:
            0.0017     0.0069     0.0158     0.0266     0.0404
            0.0566     0.0742     0.0921     0.1100     0.1281
            0.1463     0.1646     0.1830     0.2015     0.2202
            0.2389     0.2578     0.2768     0.2959     0.3151
            0.3344     0.3539     0.3734     0.3931     0.4129
            0.4328     0.4528     0.4730     0.4932     0.5136
            0.5340     0.5547     0.5757     0.5969     0.6184
            0.6402     0.6624     0.6851     0.7082     0.7317
            0.7558     0.7805     0.8056     0.8314     0.8579
            0.8850     0.9128     0.9412     0.9703     1.0000
Hrad:
            0.0145     0.0250     0.0466     0.0642     0.0762
            0.0949     0.1196     0.1473     0.1748     0.2021
            0.2292     0.2561     0.2828     0.3094     0.3357
            0.3619     0.3879     0.4137     0.4394     0.4649
            0.4902     0.5153     0.5404     0.5652     0.5899
            0.6145     0.6389     0.6632     0.6873     0.7113
            0.7343     0.7530     0.7715     0.7900     0.8084
            0.8230     0.8347     0.8464     0.8582     0.8710
            0.8881     0.9047     0.9195     0.9308     0.9418
            0.9527     0.9636     0.9743     0.9859     1.0000
Width:
            0.1107     0.2664     0.3245     0.3969     0.5083
            0.5706     0.5936     0.5974     0.6012     0.6050
            0.6089     0.6127     0.6165     0.6203     0.6241
            0.6280     0.6318     0.6356     0.6394     0.6433
            0.6471     0.6509     0.6547     0.6585     0.6624
            0.6662     0.6700     0.6738     0.6776     0.6815
            0.6862     0.6950     0.7039     0.7127     0.7216
```

```
            0.7337     0.7488     0.7638     0.7788     0.7954
            0.8131     0.8307     0.8498     0.8719     0.8940
            0.9161     0.9382     0.9602     0.9814     1.0000

Transect Transect6
Area:
            0.0004     0.0013     0.0029     0.0054     0.0086
            0.0120     0.0156     0.0196     0.0238     0.0283
            0.0331     0.0381     0.0434     0.0490     0.0548
            0.0610     0.0674     0.0742     0.0814     0.0903
            0.1009     0.1135     0.1278     0.1439     0.1619
            0.1814     0.2023     0.2247     0.2486     0.2738
            0.3002     0.3276     0.3560     0.3855     0.4160
            0.4476     0.4803     0.5140     0.5487     0.5845
            0.6213     0.6592     0.6981     0.7381     0.7791
            0.8212     0.8643     0.9085     0.9537     1.0000
Hrad:
            0.0295     0.0527     0.0690     0.0850     0.1228
            0.1583     0.1919     0.2240     0.2549     0.2848
            0.3139     0.3423     0.3702     0.3975     0.4245
            0.4510     0.4727     0.4922     0.4793     0.4315
            0.4071     0.3959     0.3930     0.3957     0.4035
            0.4218     0.4408     0.4543     0.4750     0.4973
            0.5239     0.5501     0.5761     0.6019     0.6275
            0.6530     0.6783     0.7036     0.7287     0.7537
            0.7786     0.8034     0.8281     0.8528     0.8774
            0.9019     0.9264     0.9508     0.9751     1.0000
Width:
            0.0144     0.0254     0.0426     0.0642     0.0700
            0.0758     0.0816     0.0874     0.0931     0.0989
            0.1047     0.1105     0.1163     0.1220     0.1278
            0.1336     0.1409     0.1492     0.1687     0.2087
            0.2480     0.2868     0.3257     0.3645     0.4023
            0.4311     0.4599     0.4960     0.5247     0.5519
            0.5742     0.5967     0.6191     0.6415     0.6639
            0.6863     0.7087     0.7311     0.7535     0.7759
            0.7983     0.8207     0.8431     0.8656     0.8880
            0.9104     0.9328     0.9552     0.9776     1.0000

Transect Transect7
Area:
            0.0043     0.0098     0.0157     0.0220     0.0287
            0.0357     0.0432     0.0511     0.0593     0.0680
            0.0771     0.0865     0.0963     0.1062     0.1161
            0.1261     0.1361     0.1462     0.1563     0.1664
            0.1766     0.1871     0.1981     0.2096     0.2216
```

```
            0.2343     0.2482     0.2632     0.2793     0.2969
            0.3157     0.3360     0.3576     0.3806     0.4049
            0.4307     0.4579     0.4872     0.5186     0.5521
            0.5877     0.6255     0.6653     0.7074     0.7527
            0.7994     0.8475     0.8970     0.9478     1.0000
Hrad:
            0.0436     0.0917     0.1369     0.1798     0.2207
            0.2599     0.2978     0.3346     0.3703     0.4052
            0.4393     0.4728     0.5159     0.5657     0.6153
            0.6646     0.7137     0.7625     0.8110     0.8592
            0.9033     0.9138     0.9256     0.9387     0.9529
            0.9259     0.9040     0.8891     0.8735     0.8586
            0.8495     0.8451     0.8444     0.8468     0.8519
            0.8591     0.8546     0.8465     0.8429     0.8429
            0.8460     0.8514     0.8591     0.8523     0.8633
            0.8907     0.9180     0.9453     0.9727     1.0000
Width:
            0.1000     0.1075     0.1150     0.1226     0.1301
            0.1376     0.1452     0.1527     0.1602     0.1677
            0.1753     0.1828     0.1864     0.1873     0.1882
            0.1891     0.1899     0.1908     0.1917     0.1926
            0.1943     0.2035     0.2127     0.2219     0.2311
            0.2516     0.2730     0.2945     0.3183     0.3442
            0.3702     0.3961     0.4220     0.4480     0.4739
            0.4999     0.5345     0.5743     0.6141     0.6540
            0.6938     0.7338     0.7738     0.8297     0.8717
            0.8975     0.9232     0.9489     0.9745     1.0000


**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
```

```
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 08/20/2020 00:00:00
Ending Date ..... 08/21/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	6.966	73.509
Evaporation Loss	0.000	0.000
Infiltration Loss	6.344	66.948
Surface Runoff	0.504	5.322
Final Storage	0.120	1.263
Continuity Error (%)	-0.032	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.504	5.038
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.504	5.038
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.004	

Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 3.18 sec
Average Time Step : 4.99 sec
Maximum Time Step : 5.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	73.51	0.00	0.00	62.36	7.88	2.06	9.94	0.09	0.08	0.135
EXT2	73.51	0.00	0.00	66.72	5.03	0.50	5.53	4.49	4.74	0.075
EXT3	73.51	0.00	0.00	65.87	4.30	2.22	6.52	0.16	0.12	0.089
S1	73.51	0.00	0.00	70.35	0.00	2.12	2.12	0.04	0.01	0.029
S2	73.51	0.00	0.00	70.07	0.00	2.41	2.41	0.12	0.02	0.033
S3	73.51	0.00	0.00	68.13	0.00	4.25	4.25	0.15	0.02	0.058

****
Node Depth Summary
****

	Average Depth	Maximum Depth	Maximum HGL	Time of Max Occurrence	Reported Max Depth

Node	Type	Meters	Meters	Meters	days	hr:min	Meters
J2	JUNCTION	0.03	0.48	222.48	0	01:25	0.48
J3	JUNCTION	0.04	0.55	210.55	0	01:26	0.55
J4	JUNCTION	0.03	0.74	206.74	0	01:26	0.74
J5	JUNCTION	0.02	0.54	204.54	0	01:26	0.53
J6	JUNCTION	0.02	0.24	201.24	0	01:26	0.24
J7	JUNCTION	0.04	0.61	194.61	0	01:26	0.61
J8	JUNCTION	0.03	0.68	193.68	0	01:30	0.68
OF1	OUTFALL	0.00	0.00	200.22	0	00:00	0.00
OF2	OUTFALL	0.01	0.27	192.51	0	01:30	0.27
OF3	OUTFALL	0.00	0.00	193.43	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J2	JUNCTION	4.741	4.741	0	01:25	4.48	4.48	-0.217
J3	JUNCTION	0.000	4.563	0	01:25	0	4.49	0.148
J4	JUNCTION	0.000	4.265	0	01:26	0	4.49	0.071
J5	JUNCTION	0.000	4.205	0	01:26	0	4.48	0.004
J6	JUNCTION	0.000	4.203	0	01:26	0	4.48	-0.013
J7	JUNCTION	0.000	4.201	0	01:26	0	4.48	-0.503
J8	JUNCTION	0.000	4.263	0	01:27	0	4.51	0.526
OF1	OUTFALL	0.083	0.083	0	01:25	0.125	0.125	0.000
OF2	OUTFALL	0.025	2.651	0	01:30	0.122	4.6	0.000
OF3	OUTFALL	0.122	0.122	0	01:25	0.308	0.308	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	18.49	0.008	0.083	0.125
OF2	64.95	0.089	2.651	4.604
OF3	18.41	0.020	0.122	0.308
System	33.95	0.118	0.122	5.038

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C2	CHANNEL	4.563	0 01:25	2.00	0.02	0.29
C3	CHANNEL	4.265	0 01:26	1.72	0.04	0.38
C4	CHANNEL	4.205	0 01:26	3.03	0.01	0.20
C5	CHANNEL	4.203	0 01:26	4.53	0.01	0.07
C6	CHANNEL	4.201	0 01:26	5.89	0.00	0.08
C7	CHANNEL	4.263	0 01:27	1.58	0.19	0.63
C8	CHANNEL	2.651	0 01:30	0.78	1.00	0.92

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl

C2	1.00	0.01	0.00	0.00	0.83	0.16	0.00	0.00	0.98	0.00
C3	1.00	0.01	0.00	0.00	0.01	0.98	0.00	0.00	0.01	0.00
C4	1.00	0.02	0.00	0.00	0.80	0.18	0.00	0.00	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.80	0.18	0.00	0.00	0.81	0.00
C6	1.00	0.02	0.00	0.00	0.78	0.20	0.00	0.00	0.95	0.00
C7	1.00	0.02	0.00	0.00	0.98	0.01	0.00	0.00	0.01	0.00
C8	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C8	0.01	0.20	0.01	0.02	0.01

Analysis begun on: Thu Nov 26 13:50:18 2020
Analysis ended on: Thu Nov 26 13:50:18 2020
Total elapsed time: < 1 sec

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

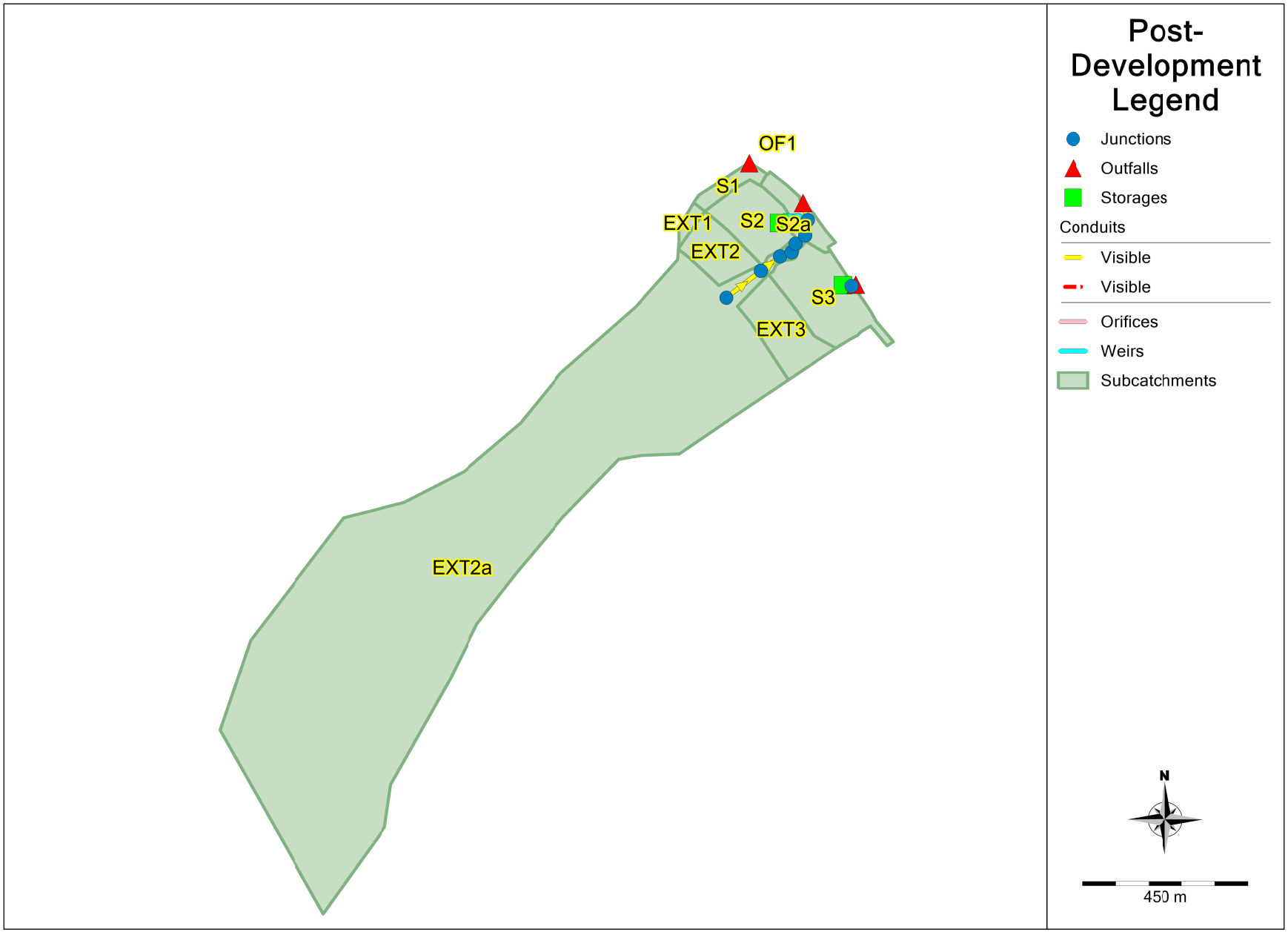
Appendix B

Post-Development Stormwater Management

TITLE: **POST-DEVELOPMENT CATCHMENTS**
Project: BLOCK 18 FESSERTON
RJB# 300050086
Date: 8/14/2020
Author: M. Zettel
Checked By:

CATCHMENT	AREA (m2)	AREA (ha)	Imp Area (ha)	Imp%	Nearby Boreholes	BH Soils	Hydrologic Soil Group	Drain Length	CNII	CNIII	Ia (mm)
S1	8600	0.86	0.13	15	None	Sandy Loam	AB	180.0	53	71.8	7.5
S2	29600	2.96	0.51	17	None	Sandy Loam	AB	70.0	59	76.8	5.0
S2a	18900	1.89	0.14	7	None	Sandy Loam	AB	50.0	53	71.8	7.5
S3	45300	4.53	0.67	15	BH1-5	Silty Sand to Silty Clay	AB	100.0	59	76.8	5.0
EXT1	3400	0.34	0.05	15	None	Sandy Loam	AB	120.0	46	66.2	10.0
EXT2	22300	2.23	0.10	4	None	Sandy Loam	AB	120.0	46	66.2	10.0
EXT2a	787400	78.74	4.55	6	None	Sandy Loam	AB	400.0	46	66.2	10.0
EXT3	32000	3.20	0.20	6	None	Sandy Loam	AB	125.0	46	66.2	10.0
Total	947500	**94.75**	6.35								

Notes
Lots are 15% imperviousness (Township of severn)
Roads are 33% impervious
CNIII=(23CNII)/(10+0.13CNII)


OF1
S1
EXT1
S2
S2a
EXT2
S3
EXT3
EXT2a
Post-Development Legend
Junctions
Outfalls
Storages
Conduits
Visible
Visible
Orifices
Weirs
Subcatchments
N
450 m

Post Development 100-Year 24-Hour SCS

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

WARNING 02: maximum depth increased for Node J4
WARNING 02: maximum depth increased for Node J5
WARNING 02: maximum depth increased for Node J6
WARNING 02: maximum depth increased for Node J7

*************
Element Count
*************
Number of rain gages ...... 13
Number of subcatchments ... 8
Number of nodes ........... 13
Number of links ........... 13
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
100yr_Chicago_4h     100yr_Chicago_4h             INTENSITY    5 min.
10yr_Chicago_4h      10yr_Chicago_4h              INTENSITY    5 min.
25mmStorm            25mmStorm                    INTENSITY    5 min.
25yr_Chicago_4h      25yr_Chicago_4h              INTENSITY    5 min.
2yr_Chicago_4h       2yr_Chicago_4h               INTENSITY    5 min.
50yr_Chicago_4h      50yr_Chicago_4h              INTENSITY    5 min.
5yr_Chicago_4h       5yr_Chicago_4h               INTENSITY    5 min.
B_100yr_SCS_Type_II_123.4mm B_100yr_SCS_Type_II_123.4mm    INTENSITY   15 min.
B_10yr_SCS_Type_II_85.6mm B_10yr_SCS_Type_II_85.6mm      INTENSITY   15 min.
B_25yr_SCS_Type_II_101.0mm B_25yr_SCS_Type_II_101.0mm     INTENSITY   15 min.
B_2yr_SCS_Type_II_55.2mm B_2yr_SCS_Type_II_55.2mm       INTENSITY   15 min.
B_50yr_SCS_Type_II_112.2mm B_50yr_SCS_Type_II_112.2mm     INTENSITY   15 min.
B_5yr_SCS_Type_II_73.7mm B_5yr_SCS_Type_II_73.7mm       INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width    %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
```

EXT1	0.34	28.61	15.00	6.5000	B_100yr_SCS_Type_II_123.4mm OF1
EXT2	2.23	186.10	4.00	6.5000	B_100yr_SCS_Type_II_123.4mm SU2
EXT2a	78.74	1968.50	6.00	2.5000	B_100yr_SCS_Type_II_123.4mm J2
EXT3	3.20	255.81	6.00	8.5000	B_100yr_SCS_Type_II_123.4mm SU1
S1	0.86	47.81	15.00	10.0000	B_100yr_SCS_Type_II_123.4mm OF1
S2	2.96	422.46	17.00	2.0000	B_100yr_SCS_Type_II_123.4mm SU2
S2a	1.89	378.06	7.00	5.0000	B_100yr_SCS_Type_II_123.4mm OF2
S3	4.53	453.31	15.00	4.0000	B_100yr_SCS_Type_II_123.4mm SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	196.50	0.50	0.0	
J2	JUNCTION	222.00	3.00	0.0	
J3	JUNCTION	210.00	3.00	0.0	
J4	JUNCTION	206.00	3.14	0.0	
J5	JUNCTION	204.00	5.45	0.0	
J6	JUNCTION	201.00	5.47	0.0	
J7	JUNCTION	194.00	5.47	0.0	
J8	JUNCTION	193.00	3.00	0.0	
OF1	OUTFALL	200.22	0.00	0.0	
OF2	OUTFALL	192.24	0.32	0.0	
OF4	OUTFALL	196.36	0.50	0.0	
SU1	STORAGE	196.47	2.30	0.0	
SU2	STORAGE	202.10	2.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	OF4	CONDUIT	11.4	1.2335	0.0400
C2	J2	J3	CONDUIT	118.9	10.1468	0.0500
C3	J3	J4	CONDUIT	65.3	6.1415	0.0500
C4	J4	J5	CONDUIT	32.9	6.0864	0.0500
C5	J5	J6	CONDUIT	26.0	11.6170	0.0500
C6	J6	J7	CONDUIT	33.9	21.0953	0.0500
C7	J7	J8	CONDUIT	42.3	2.3643	0.0500
C8	J8	OF2	CONDUIT	47.8	1.5910	0.0500
OR1	SU1	J1	ORIFICE			
OR3	SU2	J8	ORIFICE			

OR4	SU1	J1	ORIFICE
OR2	SU1	J1	WEIR
W1	SU2	J8	WEIR

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.56
C2	Transect1	1.78	47.48	0.79	60.00	1	257.53
C3	Transect2	1.72	32.71	0.54	59.57	1	107.26
C4	Transect3	3.14	57.27	1.09	60.00	1	299.13
C5	Transect4	5.45	46.82	2.00	36.87	1	505.98
C6	Transect5	5.47	219.03	3.79	60.00	1	4892.68
C7	Transect6	0.96	13.63	0.41	33.15	1	23.04
C8	Transect7	0.32	4.28	0.12	34.95	1	2.64

****
Transect Summary
****

Transect Transect1
Area:

0.0004	0.0014	0.0026	0.0042	0.0060
0.0080	0.0104	0.0134	0.0172	0.0216
0.0267	0.0325	0.0390	0.0462	0.0540
0.0624	0.0716	0.0814	0.0918	0.1030
0.1148	0.1273	0.1404	0.1542	0.1687
0.1848	0.2027	0.2224	0.2439	0.2672
0.2923	0.3192	0.3482	0.3797	0.4123
0.4456	0.4798	0.5148	0.5506	0.5873
0.6248	0.6631	0.7023	0.7424	0.7832
0.8250	0.8675	0.9109	0.9552	1.0000

Hrad:

0.0224	0.0552	0.0844	0.1111	0.1366
0.1612	0.1755	0.1785	0.1883	0.2022
0.2191	0.2376	0.2571	0.2772	0.2976
0.3184	0.3394	0.3606	0.3820	0.4035
0.4251	0.4468	0.4686	0.4904	0.4992
0.4892	0.4854	0.4862	0.4905	0.4975
0.5067	0.5175	0.5292	0.5325	0.5638

```
            0.5948     0.6259     0.6558     0.6851     0.7141
            0.7428     0.7712     0.7994     0.8274     0.8551
            0.8826     0.9100     0.9371     0.9663     1.0000
Width:
            0.0178     0.0247     0.0309     0.0370     0.0432
            0.0494     0.0588     0.0747     0.0905     0.1062
            0.1214     0.1363     0.1511     0.1659     0.1806
            0.1954     0.2102     0.2250     0.2398     0.2545
            0.2693     0.2841     0.2989     0.3136     0.3372
            0.3772     0.4171     0.4571     0.4971     0.5370
            0.5770     0.6169     0.6733     0.7134     0.7316
            0.7496     0.7671     0.7855     0.8042     0.8229
            0.8417     0.8604     0.8791     0.8979     0.9166
            0.9353     0.9541     0.9728     0.9890     1.0000

Transect Transect2
Area:
            0.0004     0.0016     0.0034     0.0054     0.0077
            0.0103     0.0130     0.0162     0.0199     0.0244
            0.0296     0.0352     0.0411     0.0472     0.0536
            0.0605     0.0679     0.0757     0.0839     0.0926
            0.1017     0.1113     0.1214     0.1322     0.1435
            0.1556     0.1683     0.1816     0.1957     0.2104
            0.2259     0.2428     0.2615     0.2821     0.3046
            0.3290     0.3553     0.3839     0.4153     0.4580
            0.5049     0.5548     0.6066     0.6595     0.7135
            0.7685     0.8247     0.8819     0.9402     1.0000
Hrad:
            0.0311     0.0599     0.1100     0.1555     0.1977
            0.2377     0.2760     0.2899     0.2986     0.3137
            0.3329     0.3779     0.4240     0.4651     0.4949
            0.5249     0.5550     0.5853     0.6157     0.6455
            0.6738     0.7019     0.7221     0.7436     0.7637
            0.7834     0.8044     0.8264     0.8493     0.8730
            0.8967     0.9177     0.9347     0.9490     0.9615
            0.9731     0.9843     0.9953     1.0047     0.9884
            0.9781     0.7089     0.7583     0.8070     0.8552
            0.9028     0.9498     0.9963     1.0423     1.0000
Width:
            0.0126     0.0267     0.0306     0.0346     0.0385
            0.0425     0.0464     0.0549     0.0659     0.0769
            0.0880     0.0921     0.0956     0.1000     0.1070
            0.1140     0.1210     0.1280     0.1350     0.1421
            0.1497     0.1573     0.1670     0.1767     0.1870
            0.1978     0.2085     0.2192     0.2300     0.2407
            0.2578     0.2839     0.3143     0.3448     0.3753
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            0.4058     0.4380     0.4755     0.5782     0.7261
            0.7741     0.8199     0.8372     0.8545     0.8718
            0.8891     0.9063     0.9236     0.9409     1.0000

Transect Transect3
Area:
            0.0015     0.0033     0.0052     0.0072     0.0094
            0.0116     0.0139     0.0165     0.0197     0.0235
            0.0278     0.0325     0.0376     0.0432     0.0492
            0.0555     0.0621     0.0691     0.0764     0.0839
            0.0918     0.0999     0.1083     0.1173     0.1267
            0.1367     0.1473     0.1583     0.1699     0.1820
            0.1946     0.2080     0.2227     0.2391     0.2636
            0.3020     0.3439     0.3872     0.4314     0.4761
            0.5211     0.5665     0.6123     0.6599     0.7099
            0.7630     0.8188     0.8769     0.9372     1.0000
Hrad:
            0.0468     0.0960     0.1399     0.1797     0.2164
            0.2503     0.2780     0.2839     0.2853     0.2939
            0.3158     0.3393     0.3634     0.3879     0.4167
            0.4459     0.4747     0.5042     0.5366     0.5684
            0.5999     0.6308     0.6492     0.6650     0.6819
            0.6999     0.7187     0.7383     0.7586     0.7795
            0.7998     0.8190     0.8358     0.8486     0.8309
            0.7810     0.7544     0.4915     0.5428     0.5937
            0.6442     0.6943     0.7439     0.7911     0.8244
            0.8527     0.8901     0.9288     0.9662     1.0000
Width:
            0.0270     0.0285     0.0300     0.0315     0.0329
            0.0344     0.0368     0.0435     0.0527     0.0619
            0.0686     0.0751     0.0815     0.0880     0.0933
            0.0985     0.1037     0.1087     0.1128     0.1169
            0.1211     0.1252     0.1323     0.1402     0.1482
            0.1562     0.1641     0.1721     0.1801     0.1880
            0.1963     0.2130     0.2325     0.2901     0.4443
            0.6280     0.6479     0.6694     0.6754     0.6814
            0.6874     0.6935     0.7071     0.7402     0.7836
            0.8298     0.8664     0.9004     0.9344     1.0000

Transect Transect4
Area:
            0.0038     0.0095     0.0158     0.0227     0.0302
            0.0383     0.0468     0.0560     0.0657     0.0760
            0.0868     0.0982     0.1101     0.1226     0.1357
            0.1493     0.1635     0.1782     0.1935     0.2093
            0.2257     0.2427     0.2602     0.2783     0.2969
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            0.3161     0.3359     0.3562     0.3770     0.3985
            0.4205     0.4431     0.4663     0.4901     0.5145
            0.5395     0.5650     0.5912     0.6179     0.6452
            0.6731     0.7016     0.7306     0.7603     0.7911
            0.8239     0.8586     0.8955     0.9348     1.0000
Hrad:
            0.0398     0.0818     0.1214     0.1576     0.1910
            0.2223     0.2519     0.2801     0.3073     0.3337
            0.3593     0.3843     0.4088     0.4328     0.4565
            0.4799     0.5029     0.5258     0.5484     0.5708
            0.5931     0.6152     0.6371     0.6590     0.6807
            0.7023     0.7238     0.7453     0.7663     0.7870
            0.8077     0.8284     0.8491     0.8698     0.8904
            0.9111     0.9317     0.9523     0.9730     0.9936
            1.0142     1.0348     1.0554     1.0756     1.0672
            1.0603     1.0525     1.0426     1.0362     1.0000
Width:
            0.0600     0.0703     0.0774     0.0838     0.0903
            0.0968     0.1033     0.1098     0.1163     0.1228
            0.1293     0.1358     0.1423     0.1488     0.1553
            0.1618     0.1683     0.1748     0.1813     0.1878
            0.1943     0.2008     0.2073     0.2138     0.2203
            0.2268     0.2333     0.2398     0.2465     0.2533
            0.2601     0.2669     0.2738     0.2806     0.2874
            0.2942     0.3011     0.3079     0.3147     0.3215
            0.3284     0.3352     0.3420     0.3490     0.3702
            0.3927     0.4170     0.4443     0.4715     1.0000

Transect Transect5
Area:
            0.0017     0.0069     0.0158     0.0266     0.0404
            0.0566     0.0742     0.0921     0.1100     0.1281
            0.1463     0.1646     0.1830     0.2015     0.2202
            0.2389     0.2578     0.2768     0.2959     0.3151
            0.3344     0.3539     0.3734     0.3931     0.4129
            0.4328     0.4528     0.4730     0.4932     0.5136
            0.5340     0.5547     0.5757     0.5969     0.6184
            0.6402     0.6624     0.6851     0.7082     0.7317
            0.7558     0.7805     0.8056     0.8314     0.8579
            0.8850     0.9128     0.9412     0.9703     1.0000
Hrad:
            0.0145     0.0250     0.0466     0.0642     0.0762
            0.0949     0.1196     0.1473     0.1748     0.2021
            0.2292     0.2561     0.2828     0.3094     0.3357
            0.3619     0.3879     0.4137     0.4394     0.4649
            0.4902     0.5153     0.5404     0.5652     0.5899
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            0.6145     0.6389     0.6632     0.6873     0.7113
            0.7343     0.7530     0.7715     0.7900     0.8084
            0.8230     0.8347     0.8464     0.8582     0.8710
            0.8881     0.9047     0.9195     0.9308     0.9418
            0.9527     0.9636     0.9743     0.9859     1.0000
Width:
            0.1107     0.2664     0.3245     0.3969     0.5083
            0.5706     0.5936     0.5974     0.6012     0.6050
            0.6089     0.6127     0.6165     0.6203     0.6241
            0.6280     0.6318     0.6356     0.6394     0.6433
            0.6471     0.6509     0.6547     0.6585     0.6624
            0.6662     0.6700     0.6738     0.6776     0.6815
            0.6862     0.6950     0.7039     0.7127     0.7216
            0.7337     0.7488     0.7638     0.7788     0.7954
            0.8131     0.8307     0.8498     0.8719     0.8940
            0.9161     0.9382     0.9602     0.9814     1.0000

Transect Transect6
Area:
            0.0004     0.0013     0.0029     0.0054     0.0086
            0.0120     0.0156     0.0196     0.0238     0.0283
            0.0331     0.0381     0.0434     0.0490     0.0548
            0.0610     0.0674     0.0742     0.0814     0.0903
            0.1009     0.1135     0.1278     0.1439     0.1619
            0.1814     0.2023     0.2247     0.2486     0.2738
            0.3002     0.3276     0.3560     0.3855     0.4161
            0.4476     0.4803     0.5140     0.5487     0.5845
            0.6213     0.6592     0.6981     0.7381     0.7791
            0.8212     0.8643     0.9085     0.9537     1.0000
Hrad:
            0.0291     0.0519     0.0679     0.0836     0.1208
            0.1557     0.1887     0.2203     0.2507     0.2802
            0.3088     0.3368     0.3642     0.3911     0.4176
            0.4437     0.4651     0.4842     0.4716     0.4245
            0.4010     0.3908     0.3884     0.3915     0.3995
            0.4181     0.4372     0.4508     0.4717     0.4941
            0.5208     0.5472     0.5734     0.5993     0.6251
            0.6508     0.6763     0.7017     0.7270     0.7522
            0.7773     0.8023     0.8273     0.8521     0.8769
            0.9016     0.9263     0.9509     0.9755     1.0000
Width:
            0.0144     0.0254     0.0426     0.0642     0.0700
            0.0758     0.0816     0.0874     0.0931     0.0989
            0.1047     0.1105     0.1163     0.1221     0.1278
            0.1336     0.1410     0.1492     0.1687     0.2087
            0.2480     0.2868     0.3257     0.3645     0.4023
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            0.4311     0.4599     0.4960     0.5247     0.5520
            0.5743     0.5967     0.6191     0.6415     0.6639
            0.6863     0.7087     0.7311     0.7535     0.7759
            0.7983     0.8207     0.8431     0.8656     0.8880
            0.9104     0.9328     0.9552     0.9776     1.0000

Transect Transect7
Area:
            0.0043     0.0098     0.0157     0.0220     0.0287
            0.0357     0.0432     0.0511     0.0594     0.0680
            0.0771     0.0866     0.0964     0.1063     0.1162
            0.1262     0.1362     0.1462     0.1564     0.1665
            0.1767     0.1872     0.1982     0.2097     0.2217
            0.2344     0.2483     0.2633     0.2795     0.2970
            0.3159     0.3361     0.3578     0.3808     0.4051
            0.4309     0.4581     0.4874     0.5189     0.5524
            0.5880     0.6257     0.6656     0.7077     0.7529
            0.7996     0.8477     0.8971     0.9479     1.0000
Hrad:
            0.0436     0.0917     0.1369     0.1797     0.2206
            0.2599     0.2978     0.3345     0.3702     0.4051
            0.4392     0.4727     0.5157     0.5656     0.6152
            0.6645     0.7135     0.7623     0.8108     0.8590
            0.9031     0.9135     0.9254     0.9385     0.9526
            0.9257     0.9037     0.8888     0.8733     0.8584
            0.8493     0.8448     0.8442     0.8466     0.8517
            0.8589     0.8544     0.8463     0.8427     0.8427
            0.8458     0.8513     0.8591     0.8523     0.8633
            0.8908     0.9182     0.9455     0.9728     1.0000
Width:
            0.1001     0.1077     0.1152     0.1228     0.1303
            0.1378     0.1454     0.1529     0.1605     0.1680
            0.1755     0.1831     0.1867     0.1876     0.1885
            0.1894     0.1902     0.1911     0.1920     0.1929
            0.1946     0.2038     0.2130     0.2222     0.2314
            0.2519     0.2734     0.2949     0.3188     0.3447
            0.3707     0.3967     0.4227     0.4487     0.4747
            0.5006     0.5353     0.5752     0.6151     0.6550
            0.6949     0.7347     0.7746     0.8303     0.8722
            0.8977     0.9233     0.9489     0.9744     1.0000


**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
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************************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 08/20/2020 00:00:00
Ending Date .............. 08/21/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......        11.693       123.398
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         7.591        80.116
Surface Runoff ...........         2.712        28.617
Final Storage ............         1.397        14.741
Continuity Error (%) .....        -0.062


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         2.707        27.075
```

Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	2.631	26.314
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.096	0.962
Final Stored Volume	0.172	1.718
Continuity Error (%)	0.013	

****
Time-Step Critical Elements
****
Link C1 (6.22%)
Link C5 (1.32%)

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	0.53 sec
Average Time Step	:	4.97 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	123.40	0.00	0.00	74.19	18.21	20.97	39.18	0.13	0.03	0.318

EXT2	123.40	0.00	0.00	83.79	4.86	23.56	28.42	0.63	0.09	0.230
EXT2a	123.40	0.00	0.00	82.04	7.29	18.04	25.33	19.95	2.21	0.205
EXT3	123.40	0.00	0.00	82.04	7.28	23.19	30.47	0.97	0.16	0.247
S1	123.40	0.00	0.00	67.76	18.21	29.23	47.44	0.41	0.09	0.384
S2	123.40	0.00	0.00	60.28	20.64	36.78	57.42	1.70	0.49	0.465
S2a	123.40	0.00	0.00	74.14	8.50	41.17	41.17	0.78	0.24	0.334
S3	123.40	0.00	0.00	61.73	18.21	37.88	56.08	2.54	0.79	0.455

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.05	0.20	196.70	0 12:33	0.20
J2	JUNCTION	0.12	0.37	222.37	0 12:00	0.37
J3	JUNCTION	0.14	0.43	210.43	0 12:00	0.43
J4	JUNCTION	0.12	0.53	206.53	0 12:00	0.53
J5	JUNCTION	0.10	0.37	204.37	0 12:00	0.37
J6	JUNCTION	0.07	0.20	201.20	0 12:01	0.20
J7	JUNCTION	0.17	0.50	194.50	0 11:58	0.50
J8	JUNCTION	0.11	0.52	193.52	0 12:03	0.52
OF1	OUTFALL	0.00	0.00	200.22	0 00:00	0.00
OF2	OUTFALL	0.06	0.25	192.49	0 12:03	0.25
OF4	OUTFALL	0.05	0.20	196.56	0 12:33	0.20
SU1	STORAGE	1.38	1.97	198.44	0 12:33	1.97
SU2	STORAGE	1.25	2.00	204.10	0 12:03	2.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.000	0.231	0 12:33	0	2.97	0.015
J2	JUNCTION	2.209	2.209	0 12:00	19.9	19.9	0.039
J3	JUNCTION	0.000	2.195	0 12:00	0	19.9	0.123

J4	JUNCTION	0.000	2.176	0	12:00	0	19.9	0.056
J5	JUNCTION	0.000	2.163	0	12:00	0	19.9	0.031
J6	JUNCTION	0.000	2.163	0	12:00	0	19.9	0.049
J7	JUNCTION	0.000	2.162	0	12:01	0	19.9	0.106
J8	JUNCTION	0.000	2.603	0	12:01	0	22.1	0.136
OF1	OUTFALL	0.124	0.124	0	12:00	0.542	0.542	0.000
OF2	OUTFALL	0.244	2.473	0	12:03	0.778	22.8	0.000
OF4	OUTFALL	0.000	0.231	0	12:33	0	2.97	0.000
SU1	STORAGE	0.952	0.952	0	12:00	3.51	4.41	0.001
SU2	STORAGE	0.582	0.582	0	12:00	2.33	2.4	0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.350	51	0	0	2.142	81	0 12:33	0.231
SU2	0.146	25	0	0	0.407	71	0 12:03	0.377

****
Outfall Loading Summary
****

	Flow Freq	Avg Flow	Max Flow	Total Volume

Outfall Node	Pcnt	CMS	CMS	10^6 ltr
OF1	93.97	0.007	0.124	0.542
OF2	92.19	0.293	2.473	22.805
OF4	91.91	0.038	0.231	2.967
System	92.69	0.338	0.231	26.314

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.231	0 12:33	0.74	0.15	0.39
C2	CHANNEL	2.195	0 12:00	1.68	0.01	0.22
C3	CHANNEL	2.176	0 12:00	1.54	0.02	0.28
C4	CHANNEL	2.163	0 12:00	2.62	0.01	0.14
C5	CHANNEL	2.163	0 12:00	3.46	0.00	0.05
C6	CHANNEL	2.162	0 12:01	27.39	0.00	0.06
C7	CHANNEL	2.242	0 12:01	1.30	0.10	0.52
C8	CHANNEL	2.271	0 12:03	0.72	0.86	0.89
OR1	ORIFICE	0.012	0 12:33			1.00
OR3	ORIFICE	0.013	0 12:03			1.00
OR4	ORIFICE	0.042	0 12:33			1.00
OR2	WEIR	0.176	0 12:33			0.32
W1	WEIR	0.364	0 12:03			0.72

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.07	0.00	0.00	0.93	0.00	0.00	0.00	0.01	0.00
C2	1.00	0.06	0.00	0.00	0.37	0.58	0.00	0.00	0.93	0.00
C3	1.00	0.06	0.00	0.00	0.01	0.92	0.00	0.00	0.01	0.00
C4	1.00	0.07	0.00	0.00	0.10	0.83	0.00	0.00	0.00	0.00

C5	1.00	0.07	0.00	0.00	0.01	0.92	0.00	0.00	0.28	0.00
C6	1.00	0.07	0.01	0.00	0.92	0.01	0.00	0.00	0.92	0.00
C7	1.00	0.06	0.00	0.00	0.93	0.00	0.00	0.00	0.02	0.00
C8	1.00	0.06	0.00	0.00	0.94	0.00	0.00	0.00	0.01	0.00

****
Conduit Surcharge Summary
****

	Hours Full			Hours Above Full	Hours Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
C8	0.01	0.27	0.01	0.01	0.01

Analysis begun on: Thu Nov 26 16:32:57 2020
Analysis ended on: Thu Nov 26 16:32:57 2020
Total elapsed time: < 1 sec

Post Development 100-Year 4-Hour Chicago

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

WARNING 02: maximum depth increased for Node J4
WARNING 02: maximum depth increased for Node J5
WARNING 02: maximum depth increased for Node J6
WARNING 02: maximum depth increased for Node J7

*************
Element Count
*************
Number of rain gages ...... 13
Number of subcatchments ... 8
Number of nodes ........... 13
Number of links ........... 13
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                  Data       Recording
Name                 Data Source                  Type       Interval
------------------------------------------------------------------------
100yr_Chicago_4h     100yr_Chicago_4h             INTENSITY    5 min.
10yr_Chicago_4h      10yr_Chicago_4h              INTENSITY    5 min.
25mmStorm            25mmStorm                    INTENSITY    5 min.
25yr_Chicago_4h      25yr_Chicago_4h              INTENSITY    5 min.
2yr_Chicago_4h       2yr_Chicago_4h               INTENSITY    5 min.
50yr_Chicago_4h      50yr_Chicago_4h              INTENSITY    5 min.
5yr_Chicago_4h       5yr_Chicago_4h               INTENSITY    5 min.
B_100yr_SCS_Type_II_123.4mm B_100yr_SCS_Type_II_123.4mm    INTENSITY   15 min.
B_10yr_SCS_Type_II_85.6mm B_10yr_SCS_Type_II_85.6mm      INTENSITY   15 min.
B_25yr_SCS_Type_II_101.0mm B_25yr_SCS_Type_II_101.0mm     INTENSITY   15 min.
B_2yr_SCS_Type_II_55.2mm B_2yr_SCS_Type_II_55.2mm       INTENSITY   15 min.
B_50yr_SCS_Type_II_112.2mm B_50yr_SCS_Type_II_112.2mm     INTENSITY   15 min.
B_5yr_SCS_Type_II_73.7mm B_5yr_SCS_Type_II_73.7mm       INTENSITY   15 min.


********************
Subcatchment Summary
********************
Name                        Area     Width    %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
```

EXT1	0.34	28.61	15.00	6.5000	100yr_Chicago_4h	OF1
EXT2	2.23	186.10	4.00	6.5000	100yr_Chicago_4h	SU2
EXT2a	78.74	1968.50	6.00	2.5000	100yr_Chicago_4h	J2
EXT3	3.20	255.81	6.00	8.5000	100yr_Chicago_4h	SU1
S1	0.86	47.81	15.00	10.0000	100yr_Chicago_4h	OF1
S2	2.96	422.46	17.00	2.0000	100yr_Chicago_4h	SU2
S2a	1.89	378.06	7.00	5.0000	100yr_Chicago_4h	OF2
S3	4.53	453.31	15.00	4.0000	100yr_Chicago_4h	SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	196.50	0.50	0.0	
J2	JUNCTION	222.00	3.00	0.0	
J3	JUNCTION	210.00	3.00	0.0	
J4	JUNCTION	206.00	3.14	0.0	
J5	JUNCTION	204.00	5.45	0.0	
J6	JUNCTION	201.00	5.47	0.0	
J7	JUNCTION	194.00	5.47	0.0	
J8	JUNCTION	193.00	3.00	0.0	
OF1	OUTFALL	200.22	0.00	0.0	
OF2	OUTFALL	192.24	0.32	0.0	
OF4	OUTFALL	196.36	0.50	0.0	
SU1	STORAGE	196.47	2.30	0.0	
SU2	STORAGE	202.10	2.30	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	OF4	CONDUIT	11.4	1.2335	0.0400
C2	J2	J3	CONDUIT	118.9	10.1468	0.0500
C3	J3	J4	CONDUIT	65.3	6.1415	0.0500
C4	J4	J5	CONDUIT	32.9	6.0864	0.0500
C5	J5	J6	CONDUIT	26.0	11.6170	0.0500
C6	J6	J7	CONDUIT	33.9	21.0953	0.0500
C7	J7	J8	CONDUIT	42.3	2.3643	0.0500
C8	J8	OF2	CONDUIT	47.8	1.5910	0.0500
OR1	SU1	J1	ORIFICE			
OR3	SU2	J8	ORIFICE			

OR4	SU1	J1	ORIFICE
OR2	SU1	J1	WEIR
W1	SU2	J8	WEIR

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.50	1.25	0.30	4.00	1	1.56
C2	Transect1	1.78	47.48	0.79	60.00	1	257.53
C3	Transect2	1.72	32.71	0.54	59.57	1	107.26
C4	Transect3	3.14	57.27	1.09	60.00	1	299.13
C5	Transect4	5.45	46.82	2.00	36.87	1	505.98
C6	Transect5	5.47	219.03	3.79	60.00	1	4892.68
C7	Transect6	0.96	13.63	0.41	33.15	1	23.04
C8	Transect7	0.32	4.28	0.12	34.95	1	2.64

****
Transect Summary
****

Transect Transect1
Area:

0.0004	0.0014	0.0026	0.0042	0.0060
0.0080	0.0104	0.0134	0.0172	0.0216
0.0267	0.0325	0.0390	0.0462	0.0540
0.0624	0.0716	0.0814	0.0918	0.1030
0.1148	0.1273	0.1404	0.1542	0.1687
0.1848	0.2027	0.2224	0.2439	0.2672
0.2923	0.3192	0.3482	0.3797	0.4123
0.4456	0.4798	0.5148	0.5506	0.5873
0.6248	0.6631	0.7023	0.7424	0.7832
0.8250	0.8675	0.9109	0.9552	1.0000

Hrad:

0.0224	0.0552	0.0844	0.1111	0.1366
0.1612	0.1755	0.1785	0.1883	0.2022
0.2191	0.2376	0.2571	0.2772	0.2976
0.3184	0.3394	0.3606	0.3820	0.4035
0.4251	0.4468	0.4686	0.4904	0.4992
0.4892	0.4854	0.4862	0.4905	0.4975
0.5067	0.5175	0.5292	0.5325	0.5638

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            0.5948     0.6259     0.6558     0.6851     0.7141
            0.7428     0.7712     0.7994     0.8274     0.8551
            0.8826     0.9100     0.9371     0.9663     1.0000
Width:
            0.0178     0.0247     0.0309     0.0370     0.0432
            0.0494     0.0588     0.0747     0.0905     0.1062
            0.1214     0.1363     0.1511     0.1659     0.1806
            0.1954     0.2102     0.2250     0.2398     0.2545
            0.2693     0.2841     0.2989     0.3136     0.3372
            0.3772     0.4171     0.4571     0.4971     0.5370
            0.5770     0.6169     0.6733     0.7134     0.7316
            0.7496     0.7671     0.7855     0.8042     0.8229
            0.8417     0.8604     0.8791     0.8979     0.9166
            0.9353     0.9541     0.9728     0.9890     1.0000

Transect Transect2
Area:
            0.0004     0.0016     0.0034     0.0054     0.0077
            0.0103     0.0130     0.0162     0.0199     0.0244
            0.0296     0.0352     0.0411     0.0472     0.0536
            0.0605     0.0679     0.0757     0.0839     0.0926
            0.1017     0.1113     0.1214     0.1322     0.1435
            0.1556     0.1683     0.1816     0.1957     0.2104
            0.2259     0.2428     0.2615     0.2821     0.3046
            0.3290     0.3553     0.3839     0.4153     0.4580
            0.5049     0.5548     0.6066     0.6595     0.7135
            0.7685     0.8247     0.8819     0.9402     1.0000
Hrad:
            0.0311     0.0599     0.1100     0.1555     0.1977
            0.2377     0.2760     0.2899     0.2986     0.3137
            0.3329     0.3779     0.4240     0.4651     0.4949
            0.5249     0.5550     0.5853     0.6157     0.6455
            0.6738     0.7019     0.7221     0.7436     0.7637
            0.7834     0.8044     0.8264     0.8493     0.8730
            0.8967     0.9177     0.9347     0.9490     0.9615
            0.9731     0.9843     0.9953     1.0047     0.9884
            0.9781     0.7089     0.7583     0.8070     0.8552
            0.9028     0.9498     0.9963     1.0423     1.0000
Width:
            0.0126     0.0267     0.0306     0.0346     0.0385
            0.0425     0.0464     0.0549     0.0659     0.0769
            0.0880     0.0921     0.0956     0.1000     0.1070
            0.1140     0.1210     0.1280     0.1350     0.1421
            0.1497     0.1573     0.1670     0.1767     0.1870
            0.1978     0.2085     0.2192     0.2300     0.2407
            0.2578     0.2839     0.3143     0.3448     0.3753
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            0.4058     0.4380     0.4755     0.5782     0.7261
            0.7741     0.8199     0.8372     0.8545     0.8718
            0.8891     0.9063     0.9236     0.9409     1.0000

Transect Transect3
Area:
            0.0015     0.0033     0.0052     0.0072     0.0094
            0.0116     0.0139     0.0165     0.0197     0.0235
            0.0278     0.0325     0.0376     0.0432     0.0492
            0.0555     0.0621     0.0691     0.0764     0.0839
            0.0918     0.0999     0.1083     0.1173     0.1267
            0.1367     0.1473     0.1583     0.1699     0.1820
            0.1946     0.2080     0.2227     0.2391     0.2636
            0.3020     0.3439     0.3872     0.4314     0.4761
            0.5211     0.5665     0.6123     0.6599     0.7099
            0.7630     0.8188     0.8769     0.9372     1.0000
Hrad:
            0.0468     0.0960     0.1399     0.1797     0.2164
            0.2503     0.2780     0.2839     0.2853     0.2939
            0.3158     0.3393     0.3634     0.3879     0.4167
            0.4459     0.4747     0.5042     0.5366     0.5684
            0.5999     0.6308     0.6492     0.6650     0.6819
            0.6999     0.7187     0.7383     0.7586     0.7795
            0.7998     0.8190     0.8358     0.8486     0.8309
            0.7810     0.7544     0.4915     0.5428     0.5937
            0.6442     0.6943     0.7439     0.7911     0.8244
            0.8527     0.8901     0.9288     0.9662     1.0000
Width:
            0.0270     0.0285     0.0300     0.0315     0.0329
            0.0344     0.0368     0.0435     0.0527     0.0619
            0.0686     0.0751     0.0815     0.0880     0.0933
            0.0985     0.1037     0.1087     0.1128     0.1169
            0.1211     0.1252     0.1323     0.1402     0.1482
            0.1562     0.1641     0.1721     0.1801     0.1880
            0.1963     0.2130     0.2325     0.2901     0.4443
            0.6280     0.6479     0.6694     0.6754     0.6814
            0.6874     0.6935     0.7071     0.7402     0.7836
            0.8298     0.8664     0.9004     0.9344     1.0000

Transect Transect4
Area:
            0.0038     0.0095     0.0158     0.0227     0.0302
            0.0383     0.0468     0.0560     0.0657     0.0760
            0.0868     0.0982     0.1101     0.1226     0.1357
            0.1493     0.1635     0.1782     0.1935     0.2093
            0.2257     0.2427     0.2602     0.2783     0.2969
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            0.3161     0.3359     0.3562     0.3770     0.3985
            0.4205     0.4431     0.4663     0.4901     0.5145
            0.5395     0.5650     0.5912     0.6179     0.6452
            0.6731     0.7016     0.7306     0.7603     0.7911
            0.8239     0.8586     0.8955     0.9348     1.0000
Hrad:
            0.0398     0.0818     0.1214     0.1576     0.1910
            0.2223     0.2519     0.2801     0.3073     0.3337
            0.3593     0.3843     0.4088     0.4328     0.4565
            0.4799     0.5029     0.5258     0.5484     0.5708
            0.5931     0.6152     0.6371     0.6590     0.6807
            0.7023     0.7238     0.7453     0.7663     0.7870
            0.8077     0.8284     0.8491     0.8698     0.8904
            0.9111     0.9317     0.9523     0.9730     0.9936
            1.0142     1.0348     1.0554     1.0756     1.0672
            1.0603     1.0525     1.0426     1.0362     1.0000
Width:
            0.0600     0.0703     0.0774     0.0838     0.0903
            0.0968     0.1033     0.1098     0.1163     0.1228
            0.1293     0.1358     0.1423     0.1488     0.1553
            0.1618     0.1683     0.1748     0.1813     0.1878
            0.1943     0.2008     0.2073     0.2138     0.2203
            0.2268     0.2333     0.2398     0.2465     0.2533
            0.2601     0.2669     0.2738     0.2806     0.2874
            0.2942     0.3011     0.3079     0.3147     0.3215
            0.3284     0.3352     0.3420     0.3490     0.3702
            0.3927     0.4170     0.4443     0.4715     1.0000

Transect Transect5
Area:
            0.0017     0.0069     0.0158     0.0266     0.0404
            0.0566     0.0742     0.0921     0.1100     0.1281
            0.1463     0.1646     0.1830     0.2015     0.2202
            0.2389     0.2578     0.2768     0.2959     0.3151
            0.3344     0.3539     0.3734     0.3931     0.4129
            0.4328     0.4528     0.4730     0.4932     0.5136
            0.5340     0.5547     0.5757     0.5969     0.6184
            0.6402     0.6624     0.6851     0.7082     0.7317
            0.7558     0.7805     0.8056     0.8314     0.8579
            0.8850     0.9128     0.9412     0.9703     1.0000
Hrad:
            0.0145     0.0250     0.0466     0.0642     0.0762
            0.0949     0.1196     0.1473     0.1748     0.2021
            0.2292     0.2561     0.2828     0.3094     0.3357
            0.3619     0.3879     0.4137     0.4394     0.4649
            0.4902     0.5153     0.5404     0.5652     0.5899
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            0.6145     0.6389     0.6632     0.6873     0.7113
            0.7343     0.7530     0.7715     0.7900     0.8084
            0.8230     0.8347     0.8464     0.8582     0.8710
            0.8881     0.9047     0.9195     0.9308     0.9418
            0.9527     0.9636     0.9743     0.9859     1.0000
Width:
            0.1107     0.2664     0.3245     0.3969     0.5083
            0.5706     0.5936     0.5974     0.6012     0.6050
            0.6089     0.6127     0.6165     0.6203     0.6241
            0.6280     0.6318     0.6356     0.6394     0.6433
            0.6471     0.6509     0.6547     0.6585     0.6624
            0.6662     0.6700     0.6738     0.6776     0.6815
            0.6862     0.6950     0.7039     0.7127     0.7216
            0.7337     0.7488     0.7638     0.7788     0.7954
            0.8131     0.8307     0.8498     0.8719     0.8940
            0.9161     0.9382     0.9602     0.9814     1.0000

Transect Transect6
Area:
            0.0004     0.0013     0.0029     0.0054     0.0086
            0.0120     0.0156     0.0196     0.0238     0.0283
            0.0331     0.0381     0.0434     0.0490     0.0548
            0.0610     0.0674     0.0742     0.0814     0.0903
            0.1009     0.1135     0.1278     0.1439     0.1619
            0.1814     0.2023     0.2247     0.2486     0.2738
            0.3002     0.3276     0.3560     0.3855     0.4161
            0.4476     0.4803     0.5140     0.5487     0.5845
            0.6213     0.6592     0.6981     0.7381     0.7791
            0.8212     0.8643     0.9085     0.9537     1.0000
Hrad:
            0.0291     0.0519     0.0679     0.0836     0.1208
            0.1557     0.1887     0.2203     0.2507     0.2802
            0.3088     0.3368     0.3642     0.3911     0.4176
            0.4437     0.4651     0.4842     0.4716     0.4245
            0.4010     0.3908     0.3884     0.3915     0.3995
            0.4181     0.4372     0.4508     0.4717     0.4941
            0.5208     0.5472     0.5734     0.5993     0.6251
            0.6508     0.6763     0.7017     0.7270     0.7522
            0.7773     0.8023     0.8273     0.8521     0.8769
            0.9016     0.9263     0.9509     0.9755     1.0000
Width:
            0.0144     0.0254     0.0426     0.0642     0.0700
            0.0758     0.0816     0.0874     0.0931     0.0989
            0.1047     0.1105     0.1163     0.1221     0.1278
            0.1336     0.1410     0.1492     0.1687     0.2087
            0.2480     0.2868     0.3257     0.3645     0.4023
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            0.4311     0.4599     0.4960     0.5247     0.5520
            0.5743     0.5967     0.6191     0.6415     0.6639
            0.6863     0.7087     0.7311     0.7535     0.7759
            0.7983     0.8207     0.8431     0.8656     0.8880
            0.9104     0.9328     0.9552     0.9776     1.0000

Transect Transect7
Area:
            0.0043     0.0098     0.0157     0.0220     0.0287
            0.0357     0.0432     0.0511     0.0594     0.0680
            0.0771     0.0866     0.0964     0.1063     0.1162
            0.1262     0.1362     0.1462     0.1564     0.1665
            0.1767     0.1872     0.1982     0.2097     0.2217
            0.2344     0.2483     0.2633     0.2795     0.2970
            0.3159     0.3361     0.3578     0.3808     0.4051
            0.4309     0.4581     0.4874     0.5189     0.5524
            0.5880     0.6257     0.6656     0.7077     0.7529
            0.7996     0.8477     0.8971     0.9479     1.0000
Hrad:
            0.0436     0.0917     0.1369     0.1797     0.2206
            0.2599     0.2978     0.3345     0.3702     0.4051
            0.4392     0.4727     0.5157     0.5656     0.6152
            0.6645     0.7135     0.7623     0.8108     0.8590
            0.9031     0.9135     0.9254     0.9385     0.9526
            0.9257     0.9037     0.8888     0.8733     0.8584
            0.8493     0.8448     0.8442     0.8466     0.8517
            0.8589     0.8544     0.8463     0.8427     0.8427
            0.8458     0.8513     0.8591     0.8523     0.8633
            0.8908     0.9182     0.9455     0.9728     1.0000
Width:
            0.1001     0.1077     0.1152     0.1228     0.1303
            0.1378     0.1454     0.1529     0.1605     0.1680
            0.1755     0.1831     0.1867     0.1876     0.1885
            0.1894     0.1902     0.1911     0.1920     0.1929
            0.1946     0.2038     0.2130     0.2222     0.2314
            0.2519     0.2734     0.2949     0.3188     0.3447
            0.3707     0.3967     0.4227     0.4487     0.4747
            0.5006     0.5353     0.5752     0.6151     0.6550
            0.6949     0.7347     0.7746     0.8303     0.8722
            0.8977     0.9233     0.9489     0.9744     1.0000


**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
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************************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 08/20/2020 00:00:00
Ending Date .............. 08/21/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         6.965        73.509
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         6.215        65.590
Surface Runoff ...........         0.631         6.660
Final Storage ............         0.122         1.284
Continuity Error (%) .....        -0.034


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.631         6.306
```

Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.623	6.226
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.096	0.962
Final Stored Volume	0.104	1.041
Continuity Error (%)	0.004	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	2.64 sec
Average Time Step	:	4.99 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	-0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
EXT1	73.51	0.00	0.00	59.56	10.75	2.01	12.76	0.04	0.04	0.174
EXT2	73.51	0.00	0.00	67.27	2.87	2.15	5.02	0.11	0.07	0.068

EXT2a	73.51	0.00	0.00	67.43	4.31	0.50	4.81	3.78	3.94	0.065
EXT3	73.51	0.00	0.00	65.87	4.30	2.22	6.52	0.21	0.16	0.089
S1	73.51	0.00	0.00	55.03	10.75	6.54	17.29	0.15	0.11	0.235
S2	73.51	0.00	0.00	48.25	12.18	11.87	24.05	0.71	0.43	0.327
S2a	73.51	0.00	0.00	59.07	5.02	13.21	13.21	0.25	0.04	0.180
S3	73.51	0.00	0.00	49.05	10.75	12.48	23.22	1.05	0.59	0.316

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.03	0.08	196.58	0 04:02	0.08
J2	JUNCTION	0.02	0.45	222.45	0 01:25	0.45
J3	JUNCTION	0.03	0.51	210.51	0 01:26	0.51
J4	JUNCTION	0.02	0.69	206.69	0 01:26	0.68
J5	JUNCTION	0.02	0.48	204.48	0 01:26	0.48
J6	JUNCTION	0.02	0.23	201.23	0 01:26	0.23
J7	JUNCTION	0.04	0.58	194.58	0 01:27	0.58
J8	JUNCTION	0.03	0.59	193.59	0 01:30	0.58
OF1	OUTFALL	0.00	0.00	200.22	0 00:00	0.00
OF2	OUTFALL	0.01	0.26	192.50	0 01:30	0.26
OF4	OUTFALL	0.03	0.08	196.44	0 04:02	0.08
SU1	STORAGE	1.27	1.71	198.18	0 04:02	1.71
SU2	STORAGE	1.04	1.67	203.77	0 01:29	1.67

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.000	0.049	0 04:02	0	1.18	0.007
J2	JUNCTION	3.944	3.944	0 01:25	3.78	3.78	-0.229
J3	JUNCTION	0.000	3.790	0 01:25	0	3.79	0.156
J4	JUNCTION	0.000	3.544	0 01:26	0	3.78	0.077

J5	JUNCTION	0.000	3.482	0	01:26	0	3.78	0.003
J6	JUNCTION	0.000	3.481	0	01:26	0	3.78	-0.015
J7	JUNCTION	0.000	3.480	0	01:26	0	3.78	-0.448
J8	JUNCTION	0.000	3.633	0	01:27	0	4.62	0.392
OF1	OUTFALL	0.151	0.151	0	01:25	0.192	0.192	0.000
OF2	OUTFALL	0.042	2.450	0	01:30	0.25	4.85	0.000
OF4	OUTFALL	0.000	0.049	0	04:02	0	1.18	0.000
SU1	STORAGE	0.752	0.752	0	01:25	1.26	2.15	0.000
SU2	STORAGE	0.506	0.506	0	01:25	0.823	0.891	0.002

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU1	1.205	45	0	0	1.763	66	0 04:02	0.049
SU2	0.099	17	0	0	0.267	47	0 01:29	0.140

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	19.41	0.012	0.151	0.192
OF2	82.65	0.072	2.450	4.852
OF4	97.89	0.014	0.049	1.182
System	66.65	0.098	0.049	6.226

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.049	0 04:02	0.47	0.03	0.17
C2	CHANNEL	3.790	0 01:25	1.94	0.01	0.27
C3	CHANNEL	3.544	0 01:26	1.69	0.03	0.35
C4	CHANNEL	3.482	0 01:26	2.91	0.01	0.19
C5	CHANNEL	3.481	0 01:26	4.20	0.01	0.07
C6	CHANNEL	3.480	0 01:26	20.25	0.00	0.07
C7	CHANNEL	3.517	0 01:27	1.52	0.15	0.57
C8	CHANNEL	2.430	0 01:30	0.75	0.92	0.90
OR1	ORIFICE	0.010	0 04:02			1.00
OR3	ORIFICE	0.011	0 01:30			1.00
OR4	ORIFICE	0.033	0 04:02			1.00
OR2	WEIR	0.005	0 04:02			0.03
W1	WEIR	0.129	0 01:30			0.36

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.01	0.00	0.00	0.83	0.16	0.00	0.00	0.98	0.00
C3	1.00	0.01	0.00	0.00	0.01	0.98	0.00	0.00	0.01	0.00
C4	1.00	0.02	0.00	0.00	0.81	0.18	0.00	0.00	0.00	0.00
C5	1.00	0.02	0.00	0.00	0.80	0.18	0.00	0.00	0.81	0.00

C6	1.00	0.02	0.00	0.00	0.84	0.14	0.00	0.00	0.93	0.00
C7	1.00	0.02	0.00	0.00	0.98	0.01	0.00	0.00	0.29	0.00
C8	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C8	0.01	0.17	0.01	0.01	0.01

Analysis begun on: Thu Nov 26 16:36:58 2020
Analysis ended on: Thu Nov 26 16:36:58 2020
Total elapsed time: < 1 sec

Project:	Block 18 Fesserton - North Pond
Location:	Fesserton
Project No.:	300050086
Date:	November 25, 2020
Updated:	November 25, 2020
Designed by:	M. Zettel
Reviewed by:	

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]
R. J. Burnside & Associates Limited
3 Ronell Crescent, Collingwood, Ontario
telephone (705) 446-0515 **fax** (705) 446-2399
web www.rjburnside.com

PERMANENT POOL AND EXTENDED DETENTION

SUMMARY OF CATCHMENT LAND USES	AREA		IMPERVIOUS RATIO
Composite Area	2.96	ha	17%
TOTAL	2.96	ha	17%

Protection Level	1	Type "1" for Enhanced, "2" for Normal, "3" for Basic		Table 3.2 Code
SWM Facility Type	Wetpond	Choose Infiltration, Wetpond, Wetland, or Hybrid		3
Impervious Ratio	17	%		
MOE 2003 Table 3.2 Volume	103	m^3/ha		
	63	m^3/ha	Less 40 m^3/ha for active storage	

Type of SWM Facility	Protection Level	Permanent Pool Volume (m^3)		Extended Detention Volume[1]		Estimated Peak Release Rate[2] (m^3/s)
				MOE Guideline (40m^3/ha) (m^3)	25mm Storm Volume (m^3)	
Wetpond	1	186		118	120	0.0021
	Ditch Storage	150	m3			
	Remaining Permanent Pool Required	**36**	m3			

NOTE: [1] The greater of the MOE Guideline (40m^3/ha) and the 25mm Storm Runoff Volume is used as the Extended Detention Volume.

[2] The Estimated Peak Release Rate is based on the Extended Detention Volume divided by 24 hr (MOE Drawdown Time) divided by 3600 s multiplied by a constant of 1.5. The constant of 1.5 is used to determine the approx. peak release rate from the average release rate.

Project: Block 18 Fesserton - North Pond
Location: Fesserton
Project No.: 300050086
Date: November 25, 2020
Updated: November 25, 2020
Designed by: M. Zettel
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SWM FACILITY STORAGE CALCULATIONS

FACILITY: North Pond

INPUT AREA

Base of Pond Elevation:	202.10	
Normal Water Level Elevation (NWL):	203.00	masl
Storage Stage Increment:	0.10	m
Permanent Pool Volume Required:	36.03	m^3
Permanent Pool Volume Provided:	74.70	m^3

207% of Required Permanent Pool

Extended Detention Volume Required:	120.00	m^3
Extended Detention Volume Provided:	93.00	m^3

78% of Required Extended Detention
The rock check dams in the ditches will also contribute to ED

ELEVATION / STORAGE INFORMATION

Pond Characteristic	Elevation (m)	Stage (m)	Area 1 (m^2)	Area 2 (m^2)	Total Area (m^2)	Average Area (m^2)	Incremental Storage (m^3)	Cumulative Storage (m^3)	Cumulative Storage above Permanent Pool (m^3)
Bottom	202.10	0.00	12		12.00		0.00	**0.00**	**0.00**
NWL	203.00	0.90	154		154.00	83.00	74.70	**74.70**	**0.00**
Top of Pond	204.40	2.30	601		601.00	377.50	528.50	**603.20**	**528.50**

Project: Block 18 Fesserton - South Pond
Location: Fesserton
Project No.: 300050086
Date: 25-Nov-2020
Updated: 25-Nov-2020
Designed by: M. Zettel
Reviewed by:

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3 Ronell Crescent, Collingwood, Ontario
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web www.rjburnside.com

PERMANENT POOL AND EXTENDED DETENTION

SUMMARY OF CATCHMENT LAND USES	AREA		IMPERVIOUS RATIO
Composite Area	4.53	ha	15%
TOTAL	4.53	ha	15%

Protection Level	1	Type "1" for Enhanced, "2" for Normal, "3" for Basic	Table 3.2 Code
SWM Facility Type	Wetpond	Choose Infiltration, Wetpond, Wetland, or Hybrid	3
Impervious Ratio	15	%	
MOE 2003 Table 3.2 Volume	98	m^3/ha	
	58	m^3/ha	Less 40 m^3/ha for active storage

Type of SWM Facility	Protection Level	Permanent Pool Volume (m^3)	Extended Detention Volume[1]		Estimated Peak Release Rate[2] (m^3/s)
			MOE Guideline (40m^3/ha) (m^3)	25mm Storm Volume (m^3)	
Wetpond	1	265	181	160	0.0031

NOTE: [1] The greater of the MOE Guideline (40m^3/ha) and the 25mm Storm Runoff Volume is used as the Extended Detention Volume.

[2] The Estimated Peak Release Rate is based on the Extended Detention Volume divided by 24 hr (MOE Drawdown Time) divided by 3600 s multiplied by a constant of 1.5. The constant of 1.5 is used to determine the approx. peak release rate from the average release rate.

Project: Block 18 Fesserton - South Pond
Location: Fesserton
Project No.: 300050086
Date: 25-Nov-2020
Updated: 25-Nov-2020
Designed by: M. Zettel
Reviewed by:

R. J. Burnside & Associates Limited
3 Ronell Crescent, Collingwood, Ontario
telephone (705) 446-0515 **fax** (705) 446-2399
web www.rjburnside.com

SWM FACILITY STORAGE CALCULATIONS

FACILITY: **South Pond**

INPUT AREA

Base of Pond Elevation:	196.47		
Nortmal Water Level Elevation (NWL):	197.47	masl	
Storage Stage Increment:	0.10	m	
Permanent Pool Volume Required:	264.56	m^3	
Permanent Pool Volume Provided:	898.00	m^3	**339% of Required Permanent Pool**
Extended Detention Volume Required:	181.20	m^3	
Extended Detention Volume Provided:	225.00	m^3	**124% of Required Extended Detention**

ELEVATION / STORAGE INFORMATION

Pond Characteristic	Elevation (m)	Stage (m)	Area 1 (m^2)	Area 2 (m^2)	Total Area (m^2)	Average Area (m^2)	Incremental Storage (m^3)	Cumulative Storage (m^3)	Cumulative Storage above Permanent Pool (m^3)
Bottom	196.47	0.00	713		713.00		0.00	**0.00**	**0.00**
NWL	197.47	1.00	1083		1083.00	898.00	898.00	**898.00**	**0.00**
Top of Pond	198.77	2.30	1643		1643.00	1363.00	1771.90	**2669.90**	**1771.90**

DITCH STORAGE CALCULATIONS - Sections of Ditch North of Main Watercourse

Project: Fesserton
File: 300050086
Designed by: M. Zettel
Checked by:
Date: 26-Nov-20

BURNSIDE
R.J. Burnside & Associates Limted
170 Steelwell Road, Suite 200, Brampton, Ontario L6T 5T3
telephone (905) 793-9239 fax (905) 793-5018

User Input:		
Ditch Sta. 393 to 438	South Ditch	
Drawing number	2 Sides of the Road	-
Dtich Sta. (m)		393
Ditch Elev. (m)		204.91
Dtich Sta. (m)		438
Ditch Elev. (m)		204.55
Ditch Side Slope (__H:1V)		3
Ditch Slope (%)		0.80
Ditch Depth (m)		0.83
Bottom Width (m)		0.5
Depth of Freeboard Required (m)		0.3
Length of Ditch to apply Check Dams to (m)		45
Ponded depth at toe of Check Dam (m)		0.2 <--- Adjust to achieve desired check dam spacing
Ponded depth immediately upstream of Check Dam (m)		0.53
Check Dam Spacing (m)		41.25 41.25 <---Calculated
Total Number of Check Dams		1 41.25 <---Total ponded length
Total Storage Provided (cu.m)		**25.13775**
Does furthest u/s check dam pond freely until depth=0		n (Y/N)

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. 438
-ditch depth measured to bottom of gran 'B' or spill point, whichever is lower
- 0.3m clearance required over check dams to top of ditch
- drawings used: Profiles and grading sections Feb, 2012

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.8427	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	3.18	(m)	
h1=	0.53	(m)	
Dist1=	66.25	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	18.609625	(cu. m)	Volume of triangular pyramid1
A2=	0.12	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	1.2	(m)	because an u/s check dam encroaches on the "tip
h2=	0.2	(m)	of the pyramid"
Dist2=	25	(m)	
Volume2=	1	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =		0.8 % is:	17.61 cu.m
Subtot. Storage for furthest u/s Check dam =			18.61 cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	17.55625	(m sq.)	profile view ponded area u/s of dam
Volume1=	8.778125	(cu. m)	
A2=	2.5	(m sq.)	
Volume2=	1.25	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =		0.8 % is:	7.5281 cu.m
Subtot. Storage for furthest u/s Check dam =			8.7781 cu.m
Total Storage per Check dam @ ditch slope =			25.138 cu.m
Total Storage for furthest u/s Check dam =			27.388 cu.m

User Input:		
Ditch Sta. 438 to 522		
Drawing number	2 Sides of the Road	-
Dtich Sta. (m)		438
Ditch Elev. (m)		204.55
Dtich Sta. (m)		522
Ditch Elev. (m)		206.28
Ditch Side Slope (__H:1V)		3
Ditch Slope (%)		2.06
Ditch Depth (m)		0.83
Bottom Width (m)		0.5
Depth of Freeboard Required (m)		0.3
Length of Ditch to apply Check Dams to (m)		84
Ponded depth at toe of Check Dam (m)		0.05 <--- Adjust to achieve desired check dam spacing
Ponded depth immediately upstream of Check Dam (m)		0.53
Check Dam Spacing (m)		23.30635838 23.306 <---Calculated
Total Number of Check Dams		3 69.919 <---Total ponded length
Total Storage Provided (cu.m)		**31.80618728**
Does furthest u/s check dam pond freely until depth=0		n (Y/N)

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. 438
-ditch depth measured to bottom of gran 'B' or spill point, whichever is lower
- 0.3m clearance required over check dams to top of ditch
- drawings used: Profiles and grading sections Feb, 2012

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.8427	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	3.18	(m)	
h1=	0.53	(m)	
Dist1=	25.734104	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	7.22870983	(cu. m)	Volume of triangular pyramid1
A2=	0.0075	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	0.3	(m)	because an u/s check dam encroaches on the "tip
h2=	0.05	(m)	of the pyramid"
Dist2=	2.42774566	(m)	
Volume2=	0.00606936	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =		2.059524 % is:	7.2226 cu.m
Subtot. Storage for furthest u/s Check dam =			7.2287 cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	6.81953757	(m sq.)	profile view ponded area u/s of dam
Volume1=	3.40976879	(cu. m)	
A2=	0.06069364	(m sq.)	
Volume2=	0.03034682	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =		2.1 % is:	3.3794 cu.m
Subtot. Storage for furthest u/s Check dam =			3.4098 cu.m
Total Storage per Check dam @ ditch slope =			10.602 cu.m
Total Storage for furthest u/s Check dam =			10.638 cu.m

DITCH STORAGE CALCULATIONS - Sections of Ditch North of Main Watercourse

Project: Fesserton
File: 300050086
Designed by: M. Zettel
Checked by:
Date: 26-Nov-20

BURNSIDE
R.J. Burnside & Associates Limted
170 Steelwell Road, Suite 200, Brampton, Ontario L6T 5T3
telephone (905) 793-9239 fax (905) 793-5018

User Input:			
Ditch Sta. 540 to 560	North Ditch		
Drawing number	4 Sides around Cul-de-Sac	-	
Dtich Sta. (m)		540	
Ditch Elev. (m)		206.37	
Dtich Sta. (m)		560	
Ditch Elev. (m)		206.27	
Ditch Side Slope (__H:1V)		3	
Ditch Slope (%)		0.50	
Ditch Depth (m)		0.83	
Bottom Width (m)		0.5	
Depth of Freeboard Required (m)		0.3	
Length of Ditch to apply Check Dams to (m)		20	
Ponded depth at toe of Check Dam (m)		0.5	<--- Adjust to achieve desired check dam spacing
Ponded depth immediately upstream of Check Dam (m)		0.53	
Check Dam Spacing (m)		6	6 <---Calculated
Total Number of Check Dams		3	18 <---Total ponded length
Total Storage Provided (cu.m)		**18.9612**	
Does furthest u/s check dam pond freely until depth=0		n	(Y/N)

Check - does furthest upstream check dam pond freely upstream, or does ponding get blocked by something or spill somewhere?

Notes:

-Storage volume for a trapezoidal ditch is calculated as the volume of a triangular pyramid (v-ditch) plus the volume of the projection of a triangle (flat bottom section)
-downstream outlet location is Sta. 5590
-ditch depth measured to bottom of gran 'B' or spill point, whichever is lower
- 0.3m clearance required over check dams to top of ditch
- drawings used: Profiles and grading sections Feb, 2012

Total Ditch Storage **190 m^3**

Triangular Pyramid Volume Calculations (V-ditch component)

A1=	0.8427	(m sq.)	triangle area immediately u/s of dam = 0.5*b*h
b1=	3.18	(m)	
h1=	0.53	(m)	
Dist1=	106	(m)	ponded distance u/s of A1 to water depth=0
Volume1=	29.7754	(cu. m)	Volume of triangular pyramid1
A2=	0.75	(m sq.)	*Volume2 represents portion of Volume1 excluded
b2=	3	(m)	because an u/s check dam encroaches on the "tip
h2=	0.5	(m)	of the pyramid"
Dist2=	100	(m)	
Volume2=	25	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =		0.5 % is:	4.7754 cu.m
Subtot. Storage for furthest u/s Check dam =			29.775 cu.m

Volume Calculations for Non-pyramid portion of trapezoid ditch (i.e. projection of a triangle) to add to V-ditch volume

A1=	28.09	(m sq.)	profile view ponded area u/s of dam
Volume1=	14.045	(cu. m)	
A2=	25	(m sq.)	
Volume2=	12.5	(cu. m)	
Subtot. Storage per Check dam @ ditch slope =		0.5 % is:	1.545 cu.m
Subtot. Storage for furthest u/s Check dam =			14.045 cu.m
Total Storage per Check dam @ ditch slope =			6.3204 cu.m
Total Storage for furthest u/s Check dam =			43.82 cu.m

R.J. Burnside & Associates Limited