TATHAM ENGINEERING

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50 Saunders Street

PRELIMINARY STORMWATER MANAGEMENT REPORT

Lotco II Limited

File 119106 | December 11, 2019

Document Control

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Issue	Date	Description
1	December 11, 2019	Draft Plan Submission

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1 Introduction

Tatham Engineering Limited has been retained by Lotco II Limited to prepare a Preliminary Stormwater Management Report in support of Draft Plan Approval for the proposed 50 Saunders Street residential development in the Town of Collingwood. The objective of this report is to address the internal and external servicing requirements related to stormwater management associated with this development.

Several other reports as well as engineering drawings have been prepared in conjunction with this report in support of the proposed residential development and are summarized below:

- *Natural Hazards Background* prepared by Tatham Engineering Limited (October 15, 2019);
- *Pre-Consultation Servicing Assessment* prepared by Tatham Engineering Limited (August 2, 2019);
- *Servicing and Earthworks Assessment* prepared by C.C. Tatham & Associates Ltd. (May 8, 2018);
- *Servicing Assessment* prepared by Tatham Engineering Limited (June 14, 2019);
- *Functional Servicing Report* prepared by Tatham Engineering Limited (November 14, 2019); and
- *Traffic Impact Brief* prepared by Tatham Engineering Limited (November 14, 2019).

2 Site Description

2.1 SITE LOCATION

The subject property consists of approximately 3.89 ha of undeveloped land and is legally described as Lots R1, R2 and part of R3, registered plan 446, geographic Township of Nottawasaga, now in the Town of Collingwood, County of Simcoe. The site is bound on the east by Saunders Street, on the south by Poplar Sideroad, on the west by the Mountaincroft Subdivision and on the north by the St. Mary's Elementary Catholic School. Figure 1, included in the rear of this report, illustrates the location of the property in the Town of Collingwood. The site is currently vacant and mostly tree covered.

2.2 SITE CONDITIONS

The existing grading of the site generally slopes from south to north at an average gradient of 0.9% as detailed by the topographic survey of the site completed by Rudy Mak Surveying Ltd. dated June 28, 2017. The site is vacant with vegetation ranging from trees to brush.

The site is currently designated Low Density Residential in the Official Plan which allows for the proposed development.

2.3 SUBSURFACE CONDITONS

A geotechnical investigation, submitted under separate cover, was completed by Peto MacCallum Ltd. dated July 2017 and summarized the subsurface conditions as follows:

- 150 to 300 mm of sandy topsoil;
- 1.4 to 2.9 m of sand; and
- layered clay and silt from 1.4 to 2.9 m deep to termination of the borehole at 5 m deep.

The above noted geotechnical investigation established groundwater levels at 1.1 to 1.2 m below existing grade with a gradient following the topography sloping from south to north.

3 Proposed Development

The proposed development features a 20 m public right-of-way (ROW) crescent street with two intersections with Saunders Road (the north intersection aligns with Mary Street). The development will feature 64 single family detached lots fronting either the proposed crescent road or Saunders Street with a park block and SWM block in the centre of the development. Most of the lots will have frontages that are 12.2 m and a majority of the lots are 32 m deep. The proposed development is shown on the attached Overall Servicing Plan, Figure 2, which is included at the end of this report. The proposed development also features an approximate 8.76 m block along its south extent to facilitate a possible future road widening of Poplar Sideroad.

4 Existing Drainage Conditions

Existing site topography, ground cover, land use and drainage patterns were established through site visitation, interpretation of available topographic maps, aerial photographs, and a site topographic survey. An Existing Conditions Drainage Plan (Drawing DP-1) illustrating the existing drainage conditions across the site and in the surrounding area is enclosed for reference.

The existing properties along Garbutt Crescent that back onto the subject property were designed to drain rear to front and to Garbutt Crescent and the Mountaincroft Subdivision Stormwater Management Facility (SWMF). However, to match existing grade at the property line shared with the subject property, a slope draining onto the subject property was created on the neighbouring lots. As such, approximately 6 m of the neighbouring lots within the Mountaincroft Subdivision drains overland as sheet flow onto the subject property.

As previously noted, the subject property generally slopes from south to north at an average gradient of 0.9%. Runoff from the subject property drains to Saunders Street and its storm sewer constructed as part of the South Collingwood development. The storm sewer runs north on Saunders Street to Findlay Drive, then east on Findlay Drive to the South Collingwood development stormwater management facility (SWMF). The South Collingwood development SWMF was sized to overcontrol post development peak flows discharged downstream to the Oak Street Canal to levels less than pre-development to prevent potential negative impacts associated with development downstream.

While the SWMF's contributing drainage area includes 50 Saunders Street it was sized to accommodate existing (undeveloped) flows from the site. Similarly, the existing storm sewers on Saunders Street and Findlay Drive draining to the SWMF were sized to convey the existing (undeveloped) runoff generated during the 1:5-year design storm from 50 Saunders Street to the SWMF. During this design storm, the storm sewer was designed to convey 205 L/s from 50 Saunders Street.

5 Stormwater Management Plan

50 Saunders Street is located between the Mountaincroft subdivision and the South Collingwood development. As such, the stormwater management plans for each development were reviewed to assess options that address the stormwater management requirements of the 50 Saunders Street residential development.

As part of our Pre-Consultation Servicing Assessment (August 2019), it was determined that the South Collingwood development SWMF as designed provides sufficient water quantity and quality control to accommodate the additional flows generated from the development of 50 Saunders Street. No improvements are required to the SWMF to accommodate the contemplated development.

Similarly, the existing Saunders Street and Findlay Drive storm sewers were reviewed and it was determined that they do not have sufficient conveyance capacity to accommodate the additional flows generated from the contemplated development. The uncontrolled 1:5-year design flow from the 50 Saunders Street development is 528 L/s. The storm sewers were designed to convey approximately 205 L/s from 50 Saunders Street during the 1:5-year design storm.

Through the Pre-Consultation Servicing Assessment, the preferred SWM strategy for the subject site was identified, which includes constructing an on-site dry pond to control the minor storm (up to and including the 1:5-year design storm) peak flows to the available capacity of the storm sewer along Saunders Street and utilizing the available storage capacity in the South Collingwood development SWMF to provide the requisite water quantity control for the site runoff from the major storm events. Similarly, the available storage in the South Collingwood development SWMF will be utilized to provide the requisite water quality control for the site.

5.1 PROPOSED DRAINAGE CONDITIONS

The proposed drainage conditions for the subject site are illustrated on the Post Development Drainage Plan (Drawing DP-2) enclosed. The proposed drainage conditions are summarized as follows:

- The runoff from the slope draining onto the subject property from the neighbouring lots will be collected and conveyed to the internal road network and an internal storm sewer network in the 50 Saunders Street development;
- Approximately 0.78 ha of the 50 Saunders Street residential development will drain overland directly to Saunders Street and the Saunders Street storm sewer;

- The remainder of the 50 Saunders Street development (3.35 ha including the external drainage area) will be serviced by an internal storm sewer network draining to a dry pond SWMF in the centre of the development;
- The dry pond SWMF will provide the requisite water quantity control to reduce the discharge from the 50 Saunders Street development during minor storm events (up to and including the 1:5-year design storm) below 205 L/s (allowable storm sewer capacity); and
- All runoff generated within the 50 Saunders Street residential development will drain to the South Collingwood development SWMF.

5.2 WATER QUANTITY CONTROL

As mentioned, the South Collingwood development SWMF as designed provides sufficient water quantity control to accommodate the additional flows generated from the site with no improvements to the SWMF. A hydrologic analysis was completed to confirm the existing South Collingwood development SWMF will provide the requisite water quantity control for its contributing drainage area considering the 50 Saunders Street development. Specifically, the hydrologic model prepared in support of the South Collingwood development was revised to include the development of 50 Saunders Street as proposed and the model results were compared against the original design criteria. The results of the revised hydrologic analysis are included in Appendix A for reference and summarized in Table 1.

Table 1: Overall Peak Flow Summary

STORM EVENT	PRE-DEVELOPMENT PEAK FLOW (m^3/s)	EXISTING PEAK FLOW (m^3/s)	PROPOSED PEAK FLOW (m^3/s)
25 mm	0.052	0.048	0.051
1:2-year	0.153	0.087	0.146
1:5-year	0.249	0.163	0.245
1:10-year	0.324	0.229	0.318
1:25-year	0.429	0.319	0.404
1:50-year	0.512	0.380	0.471
1:100-year	0.598	0.444	0.532
Regional	1.164	1.068	1.111

A comparison of the proposed peak flow rates against the target pre-development flow rates demonstrates that the as constructed South Collingwood development SWMF will provide the requisite water quantity control for its contributing drainage area including the 50 Saunders Street development.

As the existing Saunders Street and Findlay Drive storm sewers do not have sufficient conveyance capacity to accommodate the additional flows generated from the site, an on-site dry pond SWMF will be constructed to limit the total discharge from the development to the design capacity of the storm sewer (205 L/s) during minor storm events (up to and including the 1:5-year design storm). Runoff from major storm events exceeding the capacity of the storm sewer will drain overland via the road network.

To control the minor storm event peak flows leaving the site, an on-site dry pond with a storage volume of 627 m^3 and a 200 mm diameter storm sewer outlet is proposed. A hydrologic analysis was completed to confirm the proposed on-site dry pond will provide the requisite water quantity control. Specifically, modified rational method calculations were completed to determine the required storage volume and outlets controls needed to restrict flows leaving the site to the design capacity of the Saunders Street storm sewer. The modified rational method calculations are included in Appendix B and the results of the analysis are summarized in Table 2.

Table 2: 50 Saunders Street Peak Flow Summary

STORM EVENT	UNCONTROLLED PEAK FLOW (m^3/s)	DRY POND DISCHARGE (m^3/s)	TOTAL PEAK FLOW (m^3/s)
1:2-year	0.076	0.067	0.143
1:5-year	0.100	0.080	0.179
1:10-year	0.115	0.087	0.202
1:25-year	0.148	0.129	0.277
1:50-year	0.179	0.189	0.368
1:100-year	0.205	0.244	0.449

As demonstrated in the table above, the proposed on-site dry pond SWMF will restrict the discharge from the 50 Saunders Street development below 205 L/s during minor storm events (up to and including the 1:5-year design storm).

The on-site dry pond stage-storage-discharge tables are provided in Appendix C for reference and the on-site dry pond water levels, storage volumes and discharge rates during the design storms are presented in Table 3.

Table 3: On-site Dry Pond Stage-Storage-Discharge Summary

STORM EVENT	STAGE (m)	STORAGE (m^3)	DISCHARGE (m^3/s)
1:2-year	195.57	237	0.067
1:5-year	195.71	330	0.080

5.3 WATER QUALITY CONTROL

The South Collingwood development SWMF as designed provides sufficient water quality control to accommodate the additional flows generated from the 50 Saunders Street development with no improvements required. As designed, the South Collingwood development SWMF has a permanent pool and extended detention storage volumes of 2,290 m^3 and 1,203 m^3 respectively.

The South Collingwood development SWMF has a drainage area of 16.58 ha at an imperviousness of 40% with the 50 Saunders Street development included. The corresponding water quality storage volume required is 150 m^3/ha which includes 110 m^3/ha for permanent pool storage and 40 m^3/ha for extended detention storage, which equates to 1,824 m^3 and 663 m^3 of permanent pool and extended detention storage respectively. As such, the provided water quality storage volumes exceed those required and the South Collingwood development SWMF has sufficient water quality storage to accommodate the additional flows from the 50 Saunders Street development.

The water quality calculations are included in Appendix D for reference.

5.4 STORMWATER CONVEYANCE

Runoff from major storm events exceeding the capacity of the storm sewer will drain overland via the road network. The runoff from the major storm events will be conveyed to the South Collingwood development SWMF through the Saunders Street and Findlay Drive road allowances. To confirm that the road allowances have sufficient capacity to convey the runoff, conveyance capacity calculations have been completed. Overland flow calculations were completed using the Hydraflow Express Extension of Autodesk AutoCAD Civil 3D for typical cross-sections of Saunders Street and Findlay Drive downstream of 50 Saunders Street. The detailed Hydraflow calculations are included in Appendix E and a summary of the results is provided in Table 4.

Table 4: Overland Flow Summary

LOCATION	PEAK FLOW (m^3/s)	CONVEYANCE CAPACITY (m^3/s)	DEPTH OF FLOW (m)	VELOCITY (m^3/s)
Saunders Street	0.71	1.4	0.11	0.75
Findlay Drive	0.94[1]	1.4	0.12	0.85

1: Overland flow from Findlay Street and Saunders Street

As demonstrated, the maximum depth and velocity of flow on the roadway is 0.12 m and 0.85 m/s respectively. The runoff produced during major storms will be conveyed at depths and velocities satisfying the safe access/egress criteria established by the Nottawasaga Valley Conservation Authority. The conveyance capacity of the roadway (within the road allowance) is sufficient to convey the runoff produced by each major storm event downstream to the South Collingwood development SWMF.

6 Siltation and Erosion Control

Siltation and erosion control will be implemented for all construction activities within the development site, including vegetation clearing, topsoil stripping, road construction and stockpiling of materials. The basic principles considered to minimize erosion and sedimentation and resultant negative environmental impacts include:

- Minimize disturbance activities where possible;
- Expose the smallest possible land area to erosion for the shortest possible time;
- Institute erosion control measures as-required immediately;
- Implement sediment control measures before the outset of construction activities; and
- Carry out regular inspections of erosion/sediment control measures and repair or maintain as necessary.

7 Summary

The proposed SWM plan demonstrates that the development will meet the established criteria and can proceed without negatively impacting the local drainage systems. The water quality and quantity controls for the subject site will be provided via the South Collingwood development SWMF. A small dry pond is proposed within the subject property to attenuate minor peak flows to the capacity of the downstream storm sewers. Major flows will be safely conveyed overland from the subject site to the South Collingwood development SWMF. No further improvement to the South Collingwood development is required to accommodate development of the 50 Saunders Street site for the proposed 64 single family lots.

Siltation and erosion control strategies will be implemented as part of erosion and sediment control best management practices during site servicing and building construction to reduce the transportation of sediment from the site, improve stormwater quality and mitigate any environmental impacts during construction activities.

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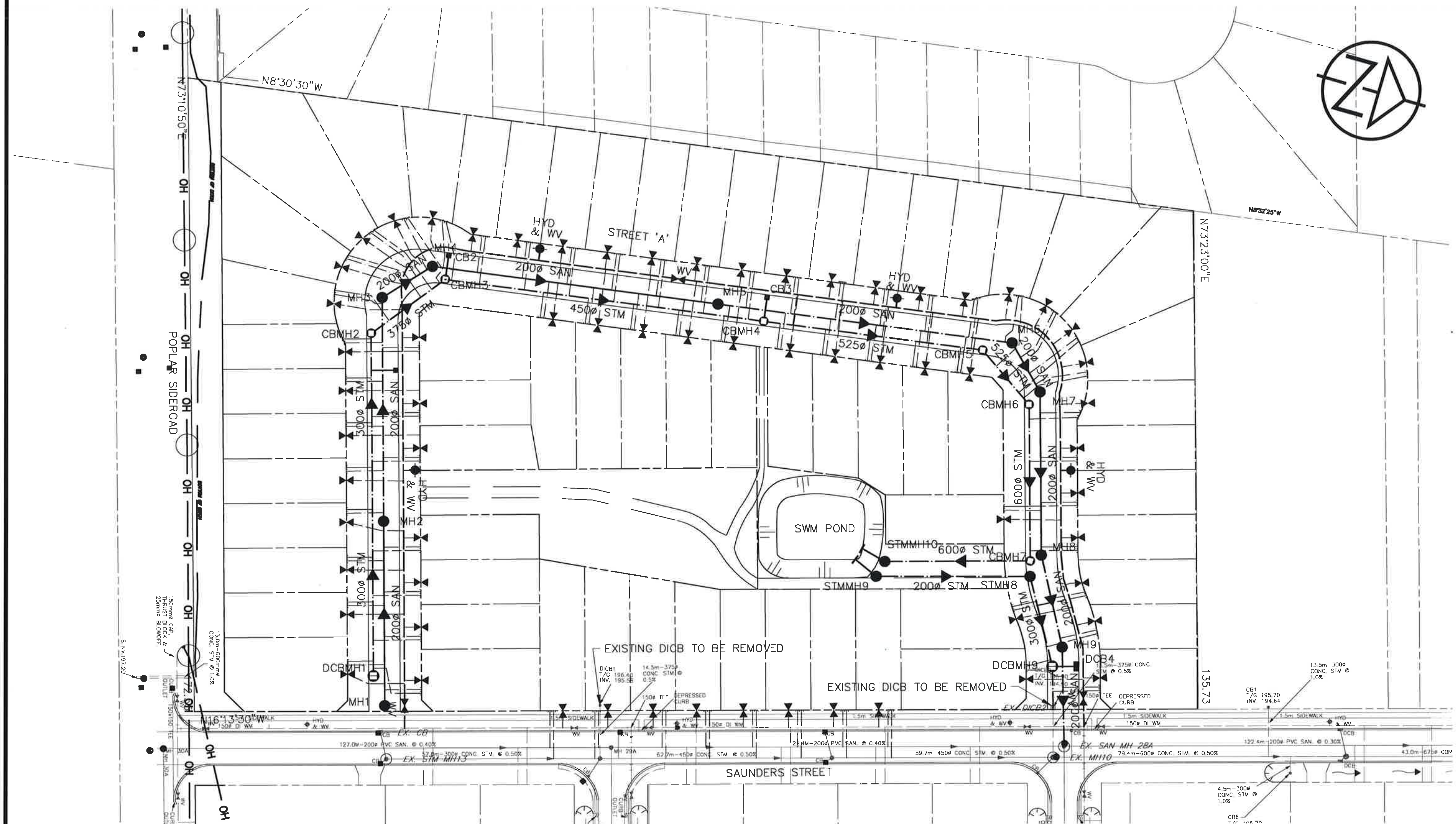
50 SAUNDERS STREET
SITE LOCATION PLAN

SCALE: NTS	DATE: NOV/19	DWG. No. FIG. 1

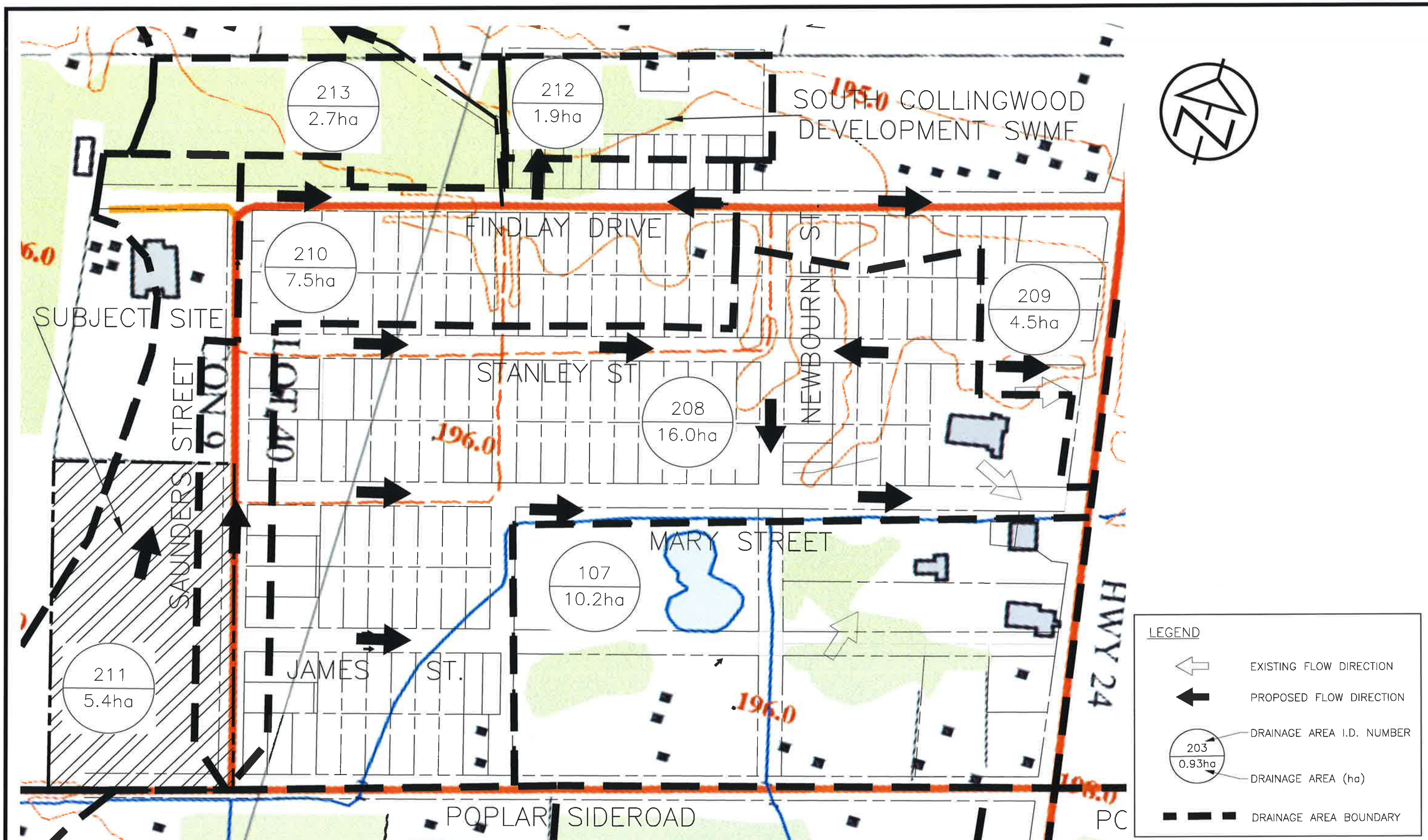
Drawing Name: 119106-KP01.dwg, Plotted: Dec 12, 2019



TATHAM ENGINEERING	**OVERALL SERVICING PLAN** **50 SAUNDERS STREET**	DWG. No. **FIG. 2**
	SCALE: 1:1000 DRAWN: AC DATE: NOV/19	JOB NO. 119106

Drawing Name: 119106-OS01.dwg, Plotted: Dec 13, 2019

Appendix A:
Overall Hydrologic Analysis



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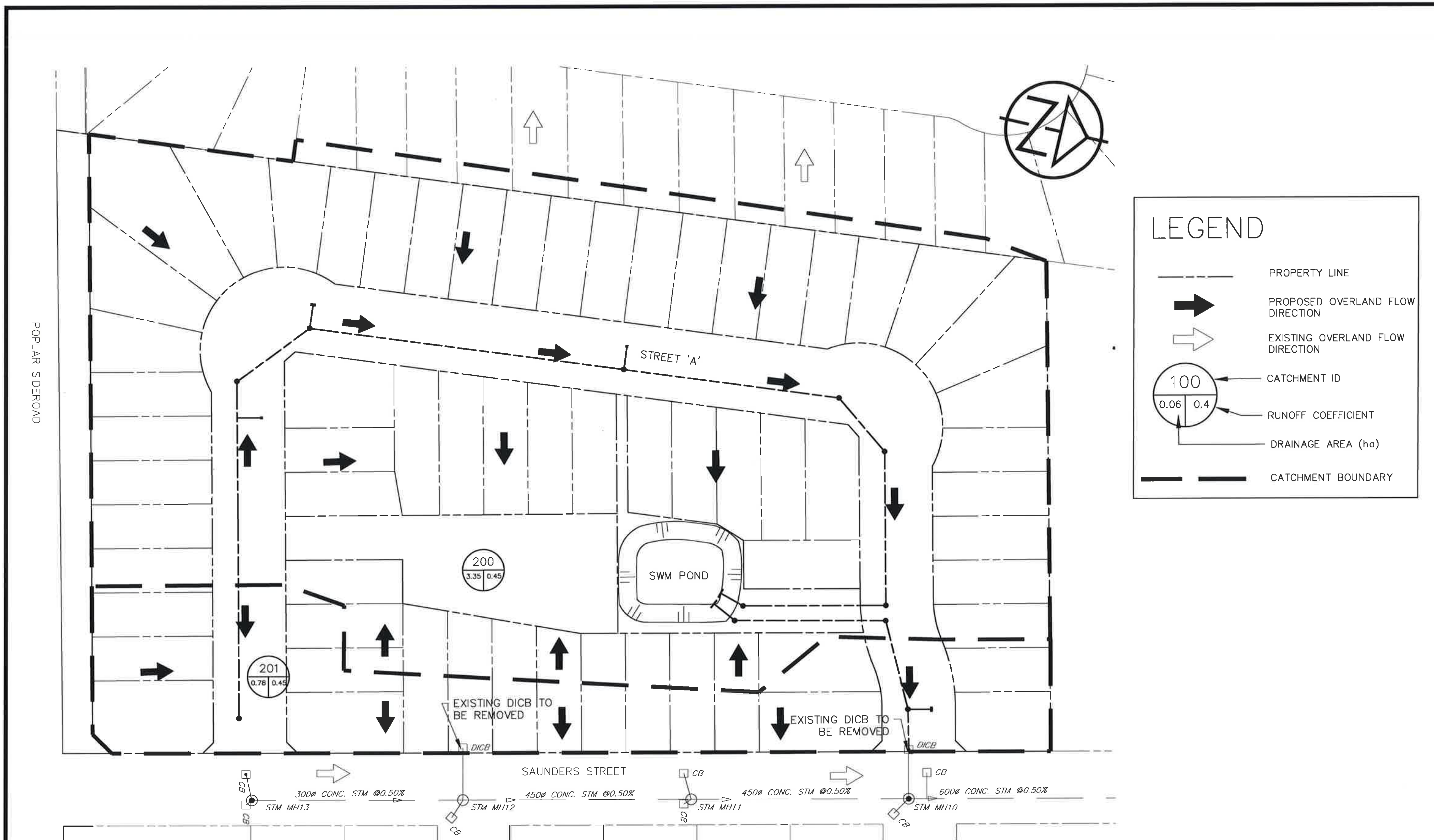
50 SAUNDERS STREET
EXISTING CONDITIONS
DRAINAGE PLAN

DWG. No. **DP-1**

SCALE: 1:3000 | DRAWN: AC | DATE: NOV/19 | JOB NO. 119106

Drawing Name: 119106-DP01.dwg, Plotted: Dec 13, 2019



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50 SAUNDERS STREET
POST-DEVELOPMENT STORM DRAINAGE PLAN

DWG. No. **DP-2**

SCALE: 1:1000 | DRAWN: AC | DATE: NOV/19 | JOB NO. 119106

Drawing Name: 119106-DP02.dwg, Plotted: Dec 13, 2019

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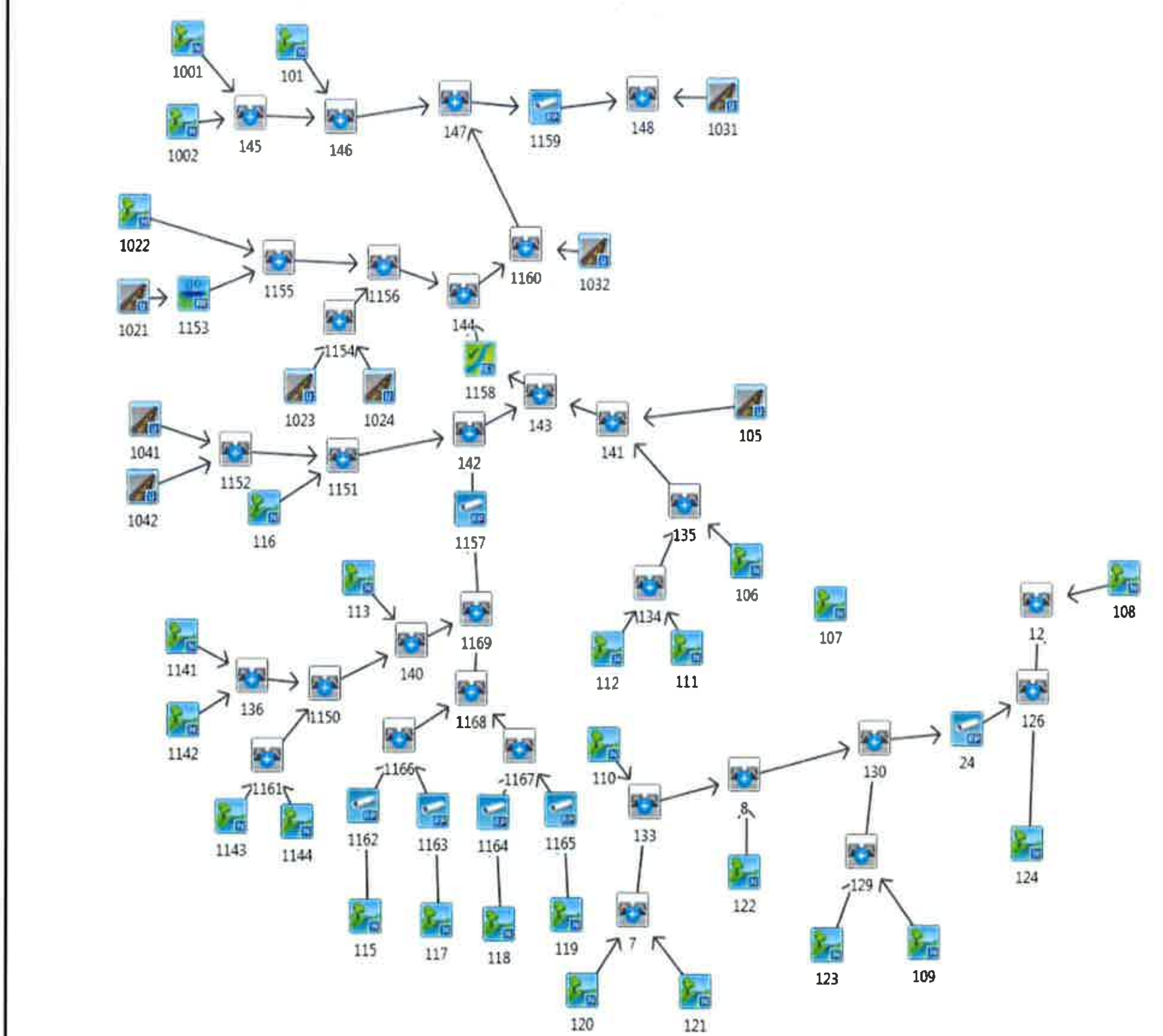
PROJECT	50 Saunders Street	FILE	119106
		DATE	12/13/2019
SUBJECT	VO Schematic	NAME	ASB
		PAGE	1 OF 1

PRE-DEVELOPMENT CONDITIONS

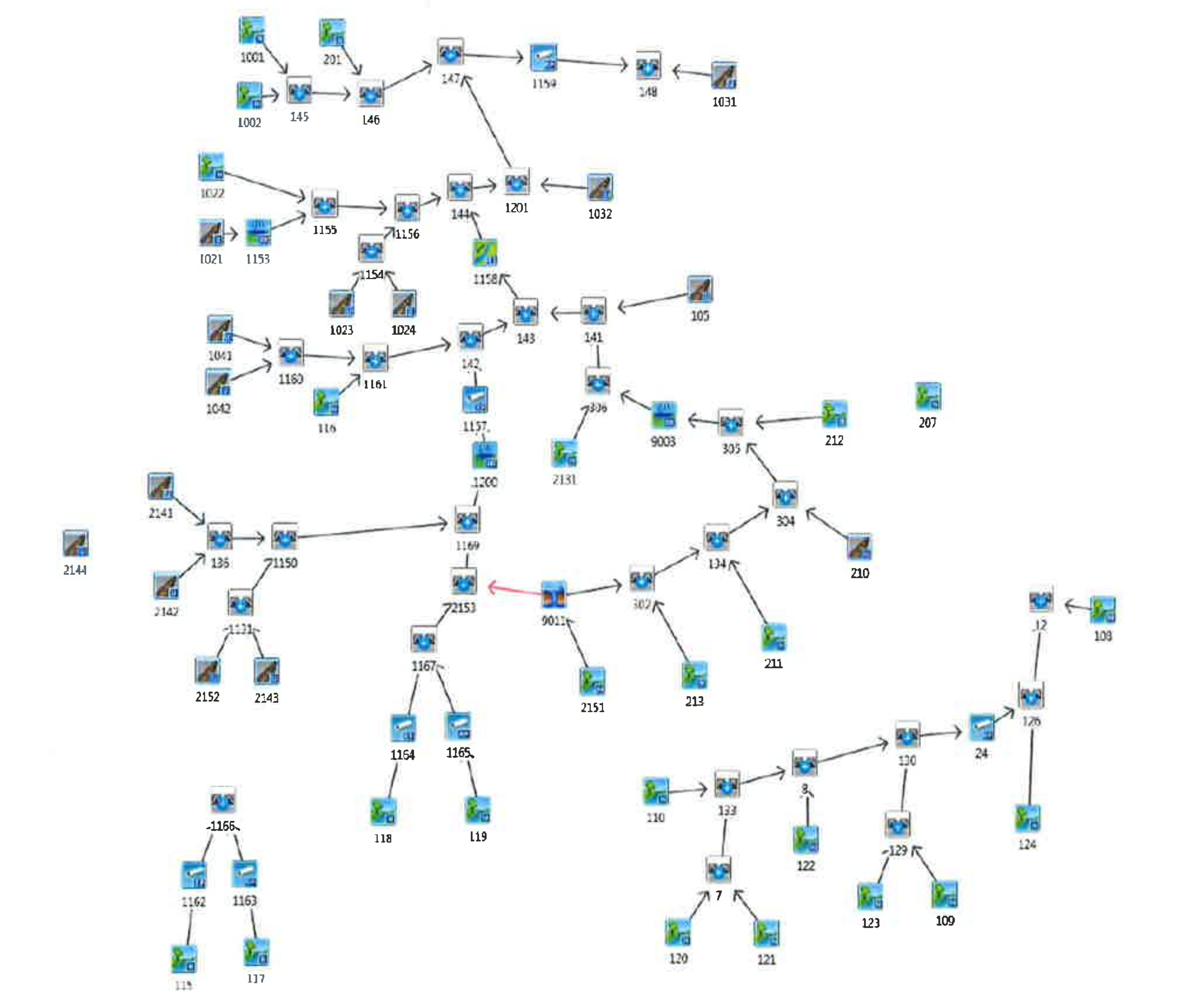


NASHYD	ROUTE PIPE
STANDHYD	ROUTE CHANNEL
ADDHYD	ROUTE RESERVC
DUHYD	DIVERT HYD

TATHAM ENGINEERING

PROJECT	50 Saunders Street	FILE	119106
		DATE	12/13/2019
SUBJECT	VO Schematic	NAME	ASB
		PAGE	1 OF 1

EXISTING CONDITIONS



NASHYD

STANDHYD

ADDHYD

ROUTE PIPE

ROUTE CHANNEL

ROUTE RESERVC

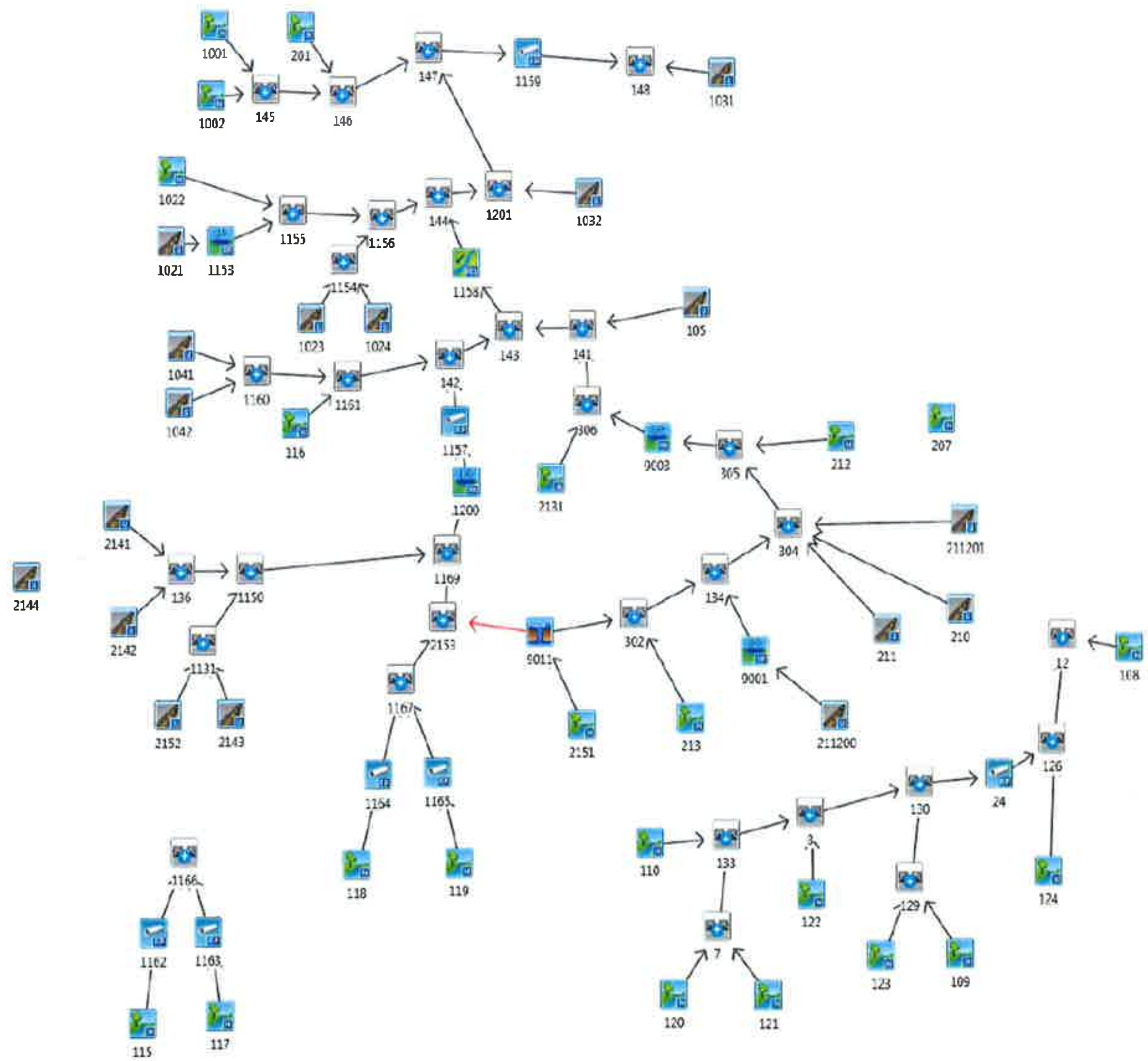
DUHYD

DIVERT HYD

TATHAM ENGINEERING

PROJECT	50 Saunders Street	FILE	119106
		DATE	12/13/2019
SUBJECT	VO Schematic	NAME	ASB
		PAGE	1 OF 1

POST-DEVELOPMENT CONDITIONS



NASHYD

ROUTE PIPE

DUHYD

STANDHYD

ROUTE CHANNEL

DIVERT HYD

ADDHYD

ROUTE RESERVC

Pre-Development Chicago Storms

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**********************************
** SIMULATION:Run 01 (25mm 4-HR Chicago) **
**********************************

 --------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |       AREA    QPEAK    TPEAK     R.V.
 --------------------      (ha)    (cms)    (hrs)     (mm)
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      + ID2= 2 ( 0135):   22.95    0.044    2.83      1.50
        ======================================================
        ID = 3 ( 0141):   24.87    0.056    2.67      1.91

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 02 (2YR 4-HR Chicago) **
**********************************

 --------------------
| ADD HYD  (  0141)|
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 --------------------      (ha)    (cms)    (hrs)     (mm)
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      + ID2= 2 ( 0135):   22.95    0.097    2.75      3.21
        ======================================================
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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 03 (5YR 4-HR Chicago) **
**********************************

 --------------------
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 --------------------      (ha)    (cms)    (hrs)     (mm)
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      + ID2= 2 ( 0135):   22.95    0.183    2.75      5.92
        ======================================================
        ID = 3 ( 0141):   24.87    0.214    2.58      6.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 04 (10YR 4-HR Chicago) **
**********************************

 --------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |       AREA    QPEAK    TPEAK     R.V.
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        ID1= 1 ( 0105):    1.92    0.140    1.92     20.99
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```



```
        ======================================================
        ID = 3 ( 0141):   24.87    0.288    2.58      8.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 05 (25YR 4-HR Chicago) **
**********************************

 --------------------
| ADD HYD  (  0141)|
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 --------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):    1.92    0.178    1.92     26.63
      + ID2= 2 ( 0135):   22.95    0.349    2.67     11.00
        ======================================================
        ID = 3 ( 0141):   24.87    0.395    2.58     12.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 06 (50YR 4-HR Chicago) **
**********************************

 --------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |       AREA    QPEAK    TPEAK     R.V.
 --------------------      (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):    1.92    0.211    2.00     31.22
      + ID2= 2 ( 0135):   22.95    0.436    2.67     13.60
        ======================================================
        ID = 3 ( 0141):   24.87    0.489    2.58     14.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 07 (100YR 4-HR Chicago) **
**********************************

 --------------------
| ADD HYD  (  0141)|
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        ID1= 1 ( 0105):    1.92    0.248    2.08     35.65
      + ID2= 2 ( 0135):   22.95    0.523    2.67     16.19
        ======================================================
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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 08 (Timmins) **
**********************************

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

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

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Pre-Development SCS Storms

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**********************************
** SIMULATION:Run 01 (2YR SCS) **
**********************************

--------------------
| ADD HYD  ( 0141)|
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   ID1= 1 ( 0105):         1.92   0.072    12.25    18.29
 + ID2= 2 ( 0135):        22.95   0.126    12.92     6.59
   ==================================================
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  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 02 (5YR SCS) **
**********************************

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

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 03 (10YR SCS) **
**********************************

--------------------
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   ==================================================
   ID = 3 ( 0141):        24.87   0.324    12.75    15.59
```



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

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 04 (25YR SCS) **
**********************************

--------------------
| ADD HYD  ( 0141)|
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   ==================================================
   ID = 3 ( 0141):        24.87   0.429    12.75    20.46

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 05 (50YR SCS) **
**********************************

--------------------
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--------------------        (ha)    (cms)    (hrs)     (mm)
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 + ID2= 2 ( 0135):        22.95   0.455    12.92    22.53
   ==================================================
   ID = 3 ( 0141):        24.87   0.512    12.75    24.34

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 06 (100YR SCS) **
**********************************

--------------------
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--------------------        (ha)    (cms)    (hrs)     (mm)
   ID1= 1 ( 0105):         1.92   0.255    12.25    51.86
 + ID2= 2 ( 0135):        22.95   0.534    12.92    26.35
   ==================================================
   ID = 3 ( 0141):        24.87   0.598    12.75    28.32

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

Existing Development Chicago Storms

```
**********************************
```

```
** SIMULATION:Run 01 (25mm 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.047    1.92      6.81
       + ID2= 2 (  0306):  19.28    0.014    2.75      4.30
         =====================================================
         ID = 3 (  0141):  21.20    0.048    1.92      4.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 02 (2YR 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.071    1.92     11.09
       + ID2= 2 (  0306):  19.28    0.047    4.08      7.56
         =====================================================
         ID = 3 (  0141):  21.20    0.075    1.92      7.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 03 (5YR 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.112    1.92     16.93
       + ID2= 2 (  0306):  19.30    0.122    3.25     12.19
         =====================================================
         ID = 3 (  0141):  21.22    0.137    2.92     12.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 04 (10YR 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.140    1.92     20.99
       + ID2= 2 (  0306):  19.47    0.176    3.08     15.46
         =====================================================
         ID = 3 (  0141):  21.39    0.198    2.75     15.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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



```
*********************************
** SIMULATION:Run 05 (25YR 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.178    1.92     26.63
       + ID2= 2 (  0306):  19.71    0.256    2.92     20.04
         =====================================================
         ID = 3 (  0141):  21.63    0.288    2.67     20.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 06 (50YR 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.211    2.00     31.22
       + ID2= 2 (  0306):  19.87    0.307    2.75     23.84
         =====================================================
         ID = 3 (  0141):  21.79    0.362    2.50     24.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 07 (100YR 4-HR Chicago) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.248    2.08     35.65
       + ID2= 2 (  0306):  19.99    0.352    2.67     27.54
         =====================================================
         ID = 3 (  0141):  21.91    0.437    2.33     28.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 08 (Timmins) **
*********************************

---------------------
| ADD HYD  (  0141)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
---------------------       (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):   1.92    0.185    7.00    139.08
       + ID2= 2 (  0306):  19.62    0.967    9.08    120.81
         =====================================================
         ID = 3 (  0141):  21.54    1.068    9.08    122.44

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

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

Existing Development SCS Storms


*********************************
** SIMULATION:Run 01 (2YR SCS) **
*********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):     1.92   0.072    12.25    18.29
       + ID2= 2 (  0306):    19.28   0.072    14.00    13.29
         ==================================================
         ID = 3 (  0141):    21.20   0.087    12.25    13.75

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 02 (5YR SCS) **
*********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):     1.92   0.120    12.25    26.42
       + ID2= 2 (  0306):    19.33   0.146    13.42    19.98
         ==================================================
         ID = 3 (  0141):    21.25   0.163    13.17    20.56

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 03 (10YR SCS) **
*********************************
--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):     1.92   0.151    12.25    32.26
       + ID2= 2 (  0306):    19.43   0.203    13.17    24.85
         ==================================================
         ID = 3 (  0141):    21.35   0.229    12.92    25.52

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 04 (25YR SCS) **
*********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
```



```
         ID1= 1 (  0105):     1.92   0.191    12.25    40.00
       + ID2= 2 (  0306):    19.55   0.278    13.00    31.40
         ==================================================
         ID = 3 (  0141):    21.47   0.319    12.83    32.17

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 05 (50YR SCS) **
*********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):     1.92   0.223    12.25    45.93
       + ID2= 2 (  0306):    19.62   0.321    13.00    36.48
         ==================================================
         ID = 3 (  0141):    21.54   0.380    12.67    37.32

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 06 (100YR SCS) **
*********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):     1.92   0.255    12.25    51.86
       + ID2= 2 (  0306):    19.69   0.358    12.83    41.60
         ==================================================
         ID = 3 (  0141):    21.61   0.444    12.42    42.51

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------


Post-Development Chicago Storms


*********************************
** SIMULATION:Run 01 (25mm 4-HR Chicago) **
*********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0105):     1.92   0.047     1.92     6.81
       + ID2= 2 (  0306):    19.28   0.037     4.00     6.83
         ==================================================
         ID = 3 (  0141):    21.20   0.051     1.92     6.83

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

```
**********************************
** SIMULATION:Run 02 (2YR 4-HR Chicago) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.071     1.92      11.09
       + ID2= 2 (  0306):    19.28     0.106     3.25      10.80
         ==================================================
         ID = 3 (  0141):    21.20     0.116     3.08      10.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 03 (5YR 4-HR Chicago) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.112     1.92      16.93
       + ID2= 2 (  0306):    19.30     0.193     3.00      16.12
         ==================================================
         ID = 3 (  0141):    21.22     0.214     2.75      16.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 04 (10YR 4-HR Chicago) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.140     1.92      20.99
       + ID2= 2 (  0306):    19.47     0.255     2.75      19.73
         ==================================================
         ID = 3 (  0141):    21.39     0.286     2.67      19.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 05 (25YR 4-HR Chicago) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.178     1.92      26.63
       + ID2= 2 (  0306):    19.71     0.318     2.67      24.69
         ==================================================
         ID = 3 (  0141):    21.63     0.371     2.33      24.86

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



```
--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 06 (50YR 4-HR Chicago) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.211     2.00      31.22
       + ID2= 2 (  0306):    19.87     0.357     2.67      28.74
         ==================================================
         ID = 3 (  0141):    21.79     0.441     2.33      28.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 07 (100YR 4-HR Chicago) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.248     2.08      35.65
       + ID2= 2 (  0306):    19.99     0.394     2.58      32.66
         ==================================================
         ID = 3 (  0141):    21.91     0.517     2.17      32.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
**********************************
** SIMULATION:Run 08 (Timmins) **
**********************************

--------------------
| ADD HYD  (  0141)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
         ID1= 1 (  0105):     1.92     0.185     7.00     139.08
       + ID2= 2 (  0306):    19.62     1.002     9.00     128.36
         ==================================================
         ID = 3 (  0141):    21.54     1.111     9.00     129.32

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------


Post-Development SCS Storms


**********************************
** SIMULATION:Run 01 (2YR SCS) **
**********************************


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

```
| ADD HYD  (  0141)|
|  1 + 2 = 3       |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):     1.92    0.072    12.25    18.29
      + ID2= 2 ( 0306):    19.28    0.132    13.33    17.36
        ====================================================
        ID = 3 ( 0141):    21.20    0.146    13.08    17.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 02 (5YR SCS) **
*********************************


--------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):     1.92    0.120    12.25    26.42
      + ID2= 2 ( 0306):    19.33    0.220    13.08    24.70
        ====================================================
        ID = 3 ( 0141):    21.25    0.245    12.92    24.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 03 (10YR SCS) **
*********************************


--------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):     1.92    0.151    12.25    32.26
      + ID2= 2 ( 0306):    19.43    0.276    12.92    29.93
        ====================================================
        ID = 3 ( 0141):    21.35    0.318    12.75    30.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 04 (25YR SCS) **
*********************************


--------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):     1.92    0.191    12.25    40.00
      + ID2= 2 ( 0306):    19.55    0.331    12.83    36.85
        ====================================================
        ID = 3 ( 0141):    21.47    0.404    12.42    37.13

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



```
------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 05 (50YR SCS) **
*********************************


--------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):     1.92    0.223    12.25    45.93
      + ID2= 2 ( 0306):    19.62    0.364    12.83    42.18
        ====================================================
        ID = 3 ( 0141):    21.54    0.471    12.42    42.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*********************************
** SIMULATION:Run 06 (100YR SCS) **
*********************************


--------------------
| ADD HYD  (  0141)|
|  1 + 2 = 3       |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 0105):     1.92    0.255    12.25    51.86
      + ID2= 2 ( 0306):    19.69    0.397    12.83    47.51
        ====================================================
        ID = 3 ( 0141):    21.61    0.532    12.42    47.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

Appendix B: Modified Rational Method Calculations

TATHAM ENGINEERING

PROJECT	50 Saunders Street	FILE	119106
		DATE	November 6, 2019
SUBJECT	Modified Rational Method	NAME	ASB
		PAGE	1 OF 3

POST DEVELOPMENT ANALYSIS
CATCHMENT # 201

Runoff Coefficient (Municipal Standard)

2 Year	0.45	
5 Year	0.45	
10 Year	0.45	
25 Year	0.50	=C5*1.10
50 Year	0.54	=C5*1.20
100 Year	0.56	=C5*1.25

Peak Rainfall Intensity Town of Collingwood

	2YR	5YR	10YR	25YR	50YR	100YR
A	807	1135	1387	1676	1973	2193
B	6.75	7.5	7.97	8.3	9	9.04
C	0.83	0.84	0.85	0.86	0.87	0.87

2 Year	78.3	mm/hr	T_C =	10
5 Year	102.3	mm/hr	T_C =	10
10 Year	118.4	mm/hr	T_C =	10
25 Year	138.4	mm/hr	T_C =	10
50 Year	153.2	mm/hr	T_C =	10
100 Year	168.4	mm/hr	T_C =	10

Drainage Area 0.780 ha

Peak Runoff Rate - Rational Method (Q=CiA/360)

	$Q_{UNCONTROLLED}$
2 Year	0.076 m^3/s
5 Year	0.100 m^3/s
10 Year	0.115 m^3/s
25 Year	0.148 m^3/s
50 Year	0.179 m^3/s
100 Year	0.205 m^3/s

TATHAM ENGINEERING

PROJECT	50 Saunders Street	FILE	119106
		DATE	November 6, 2019
SUBJECT	Modified Rational Method	NAME	ASB
		PAGE	2 OF 3

POST DEVELOPMENT ANALYSIS CATCHMENT # 200

Runoff Coefficient (Municipal Standard)

2 Year	$\boxed{0.45}$	
5 Year	0.45	
10 Year	0.45	
25 Year	0.50	=C5*1.10
50 Year	0.54	=C5*1.20
100 Year	0.56	=C5*1.25

Peak Rainfall Intensity Town of Collingwood

	2YR	5YR	10YR	25YR	50YR	100YR
A	807	1135	1387	1676	1973	2193
B	6.75	7.5	7.97	8.3	9	9.04
C	0.83	0.84	0.85	0.86	0.87	0.87

2 Year	78.3	mm/hr	T_C = 10
5 Year	102.3	mm/hr	T_C = 10
10 Year	118.4	mm/hr	T_C = 10
25 Year	138.4	mm/hr	T_C = 10
50 Year	153.2	mm/hr	T_C = 10
100 Year	168.4	mm/hr	T_C = 10

Drainage Area 3.350 ha

Peak Runoff Rate - Rational Method (Q=CiA/360)

	$Q_{UNCONTROLLED}$
2 Year	0.328 m^3/s
5 Year	0.428 m^3/s
10 Year	0.496 m^3/s
25 Year	0.638 m^3/s
50 Year	0.770 m^3/s
100 Year	0.882 m^3/s

POST DEVELOPMENT ANALYSIS CATCHMENT # 200

Runoff Coefficient (Municipal Standard)

2 Year	$\boxed{0.45}$	
5 Year	0.45	
10 Year	0.45	
25 Year	0.50	=C5*1.10
50 Year	0.54	=C5*1.20
100 Year	0.56	=C5*1.25

Peak Rainfall Intensity Town of Collingwood

	2YR	5YR	10YR	25YR	50YR	100YR
A	807	1135	1387	1676	1973	2193
B	6.8	7.5	8.0	8.3	9.0	9.0
C	0.828	0.841	0.852	0.858	0.868	0.871

2 Year	78.3	mm/hr	T_C = 10
5 Year	102.3	mm/hr	T_C = 10
10 Year	118.4	mm/hr	T_C = 10
25 Year	138.4	mm/hr	T_C = 10
50 Year	153.2	mm/hr	T_C = 10
100 Year	168.4	mm/hr	T_C = 10

Drainage Area 3.350 ha

Peak Runoff Rate - Rational Method (Q=CiA/360)

	$Q_{Uncontrolled}$	Q_{DIS}	Reduction	
2 Year	0.328	**0.0670**	0.261	m^3/s
5 Year	0.428	**0.0795**	0.349	m^3/s
10 Year	0.496	**0.0870**	0.409	m^3/s
25 Year	0.638	**0.1290**	0.509	m^3/s
50 Year	0.770	**0.1890**	0.581	m^3/s
100 Year	0.882	**0.2440**	0.638	m^3/s

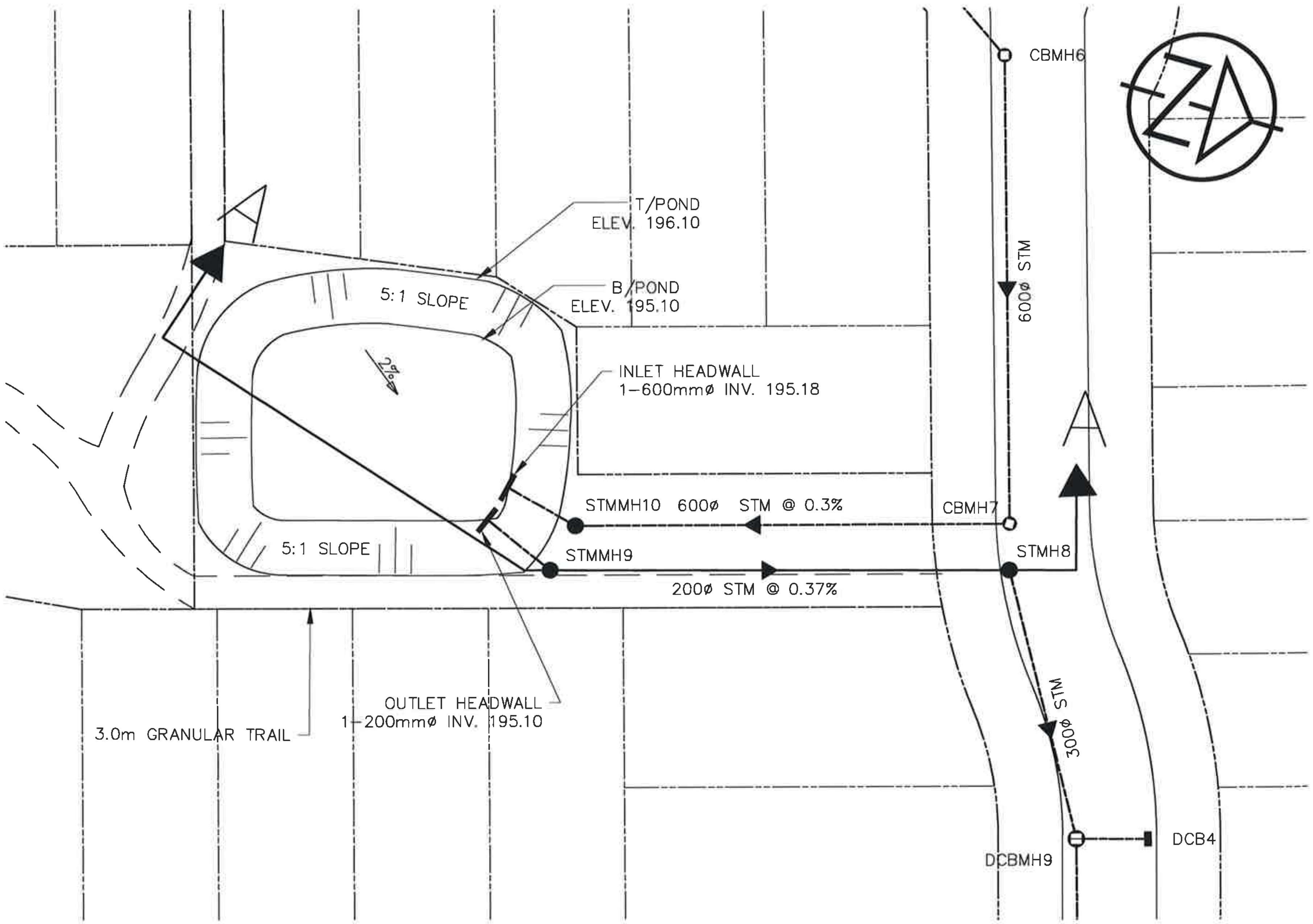
Required Storage Volumes

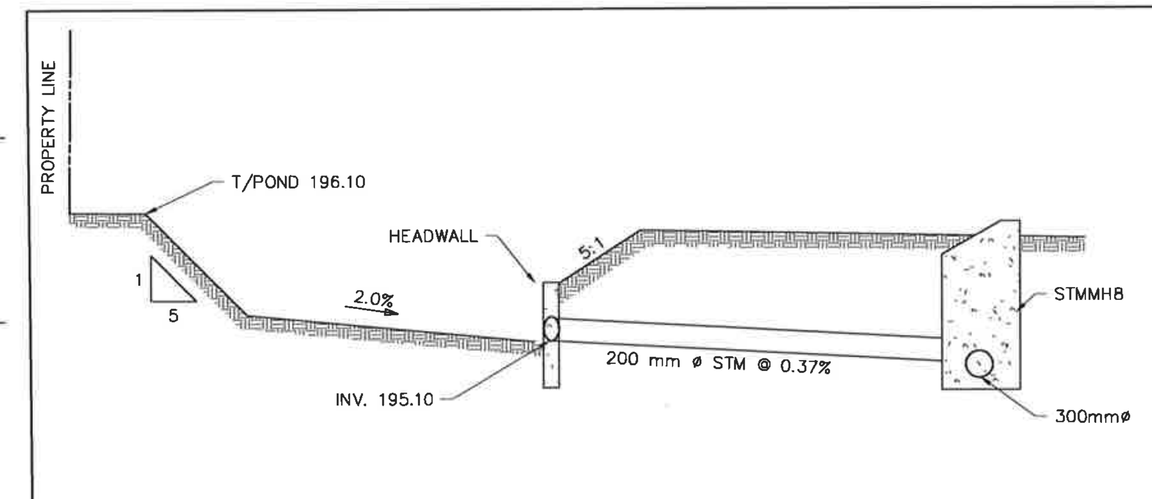
Dur.	2YR	5YR	10YR	25YR	50YR	100YR
10	156.5	209.3	245.2	305.1	348.4	382.6
20	206.6	279.9	329.7	410.2	469.8	512.9
30	227.4	310.7	367.3	454.1	515.4	556.4
40	235.8	324.6	384.8	471.9	**528.2**	**562.3**
50	**237.4**	**329.3**	391.6	**475.5**	523.4	547.9
60	234.9	328.5	**391.7**	470.5	507.7	521.2
70	229.6	323.8	387.4	459.7	484.8	486.3
80	222.2	316.4	379.9	444.7	456.8	445.5

Post Development Peak Flow (m^3/s)

Storm Event	Catchment 200	Catchment 201	Total (Uncontrolled)	Total (Controlled)
2 Year	0.067	0.076	0.404	0.143
5 Year	0.080	0.100	0.528	0.179
10 Year	0.087	0.115	0.611	0.202
25 Year	0.129	0.148	0.786	0.277
50 Year	0.189	0.179	0.949	0.368
100 Year	0.244	0.205	1.087	0.449

Appendix C: On-site Dry Pond Stage-Storage-Discharge Tables





SECTION A–A
SCALE: N.T.S.

TATHAM ENGINEERING

50 SAUNDERS STREET
STORMWATER MANAGEMENT POND

DWG. No. **PND-1**

SCALE: 1:500	DRAWN: AC	DATE: NOV/19	JOB NO. 119106

TATHAM ENGINEERING	Project :	50 Saunders Street
	File No.	119106
	Date:	6-Nov-19
	Designed By:	ASB
	Checked By:	DRT
	Subject:	SWMF Stage-Storage

STAGE-STORAGE TABLE

Side Slope 5 (H:V)
Bottom Elevation 195.10 m
Stage 0.10 m

STAGE-STORAGE TABLE					
Elevation	Pond Depth	Pond Area	Average Pond Area	Volume	
				Active Storage	Accum. Active Storage
(m)	(m)	(sq.m)	(sq.m)	(cu.m)	(cu.m)
195.10	0.00	**400.00**	0.00	0.00	0.00
195.20	0.10	445.50	422.75	42.27	42.27
195.30	0.20	491.00	468.25	46.82	89.10
195.40	0.30	536.50	513.75	51.37	140.47
195.50	0.40	582.00	559.25	55.92	196.40
195.60	0.50	627.50	604.75	60.47	256.87
195.70	0.60	673.00	650.25	65.02	321.90
195.80	0.70	718.50	695.75	69.57	391.47
195.90	0.80	764.00	741.25	74.12	465.60
196.00	0.90	809.50	786.75	78.67	544.27
196.10	1.00	**855.00**	832.25	83.22	627.50

TATHAM ENGINEERING		
	Project:	50 Saunders Street
	File No:	119106
	Date:	6-Nov-18
	Designed By:	ASB
	Checked By:	DRT
	Subject:	SWMF Stage-Discharge

STAGE-DISCHARGE TABLE

Outlet

Type	Pipe	Type	Weir
Diameter (mm)	200	Bottom Width (mm)	300
Area (sq.m)	0.031	Side Slope (_H:1V)	3
Coefficient	0.80	Coefficient	1.60
Invert (m)	195.1	Invert (m)	195.8

Pond Water Level	Pipe		Weir		Total
	Head	Discharge	Head	Discharge	Discharge
(m)	(m)	(cms)	(m)	(cms)	(cms)
195.10	0.00	0.0000	0.00	0.0000	0.0000
195.20	0.10	0.0082	0.00	0.0000	0.0082
195.30	0.10	0.0352	0.00	0.0000	0.0352
195.40	0.20	0.0498	0.00	0.0000	0.0498
195.50	0.30	0.0609	0.00	0.0000	0.0609
195.60	0.40	0.0704	0.00	0.0000	0.0704
195.70	0.50	0.0787	0.00	0.0000	0.0787
195.80	0.60	0.0862	0.00	0.0000	0.0862
195.90	0.70	0.0931	0.10	0.0259	0.1190
196.00	0.80	0.0995	0.20	0.1083	0.2078
196.10	0.90	0.1056	0.30	0.2634	0.3690

NVCA Weir Flow Calculation Applied For Weir Flow Below Circular Orifice Centroid

Q_w = 1.65([(pi*(D^2)/4)(2*cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)$^{0.5}$)]/d)d$^{1.5}$

Where:

Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

TATHAM ENGINEERING	Project:	50 Saunders Street
	File No:	119106
	Date:	6-Nov-19
	Designed By:	ASB
	Checked By:	DRT
	Subject:	SWMF SSD Relationship

STAGE-STORAGE-DISCHARGE TABLE

Outlet		
Type	Pipe	Trapezoidal Weir
Diameter (mm)	200.00	0.3 m Bottom Width
Invert(m)	195.10	195.80

	STAGE-STORAGE-DISCHARGE TABLE		
	Pond Water Level	Total Discharge	Active Storage
	(m)	(cms)	(cu.m)
	195.10	0.0000	0
	195.20	0.0082	42
	195.30	0.0352	89
	195.40	0.0498	140
	195.50	0.0609	196
Interpolated to match Modified Rational Method	195.57	0.0673	237
	195.60	0.0704	257
	195.70	0.0787	322
Interpolated to match Modified Rational Method	195.71	0.0796	330
	195.80	0.0862	391
	195.90	0.1190	466
Interpolated to match Modified Rational Method	195.91	0.1285	474
Interpolated to match Modified Rational Method	195.98	0.1894	528
	196.00	0.2078	544
Interpolated to match Modified Rational Method	196.02	0.2441	563
	196.10	0.3690	627

Appendix D:
Water Quality Calculations

TATHAM ENGINEERING	**Project:** 50 Saunders Road	**Date:** 11-Jun-19
	File No.: 119106	**Designed By:** DAM
	Subject: SWMF Water Quality Requirements	**Checked By:** DRT

South Collingwood SWMF

Stormwater Management Facility Water Quality Storage Requirements

TOTAL DRAINAGE AREA	**16.58 ha**	**%Impervious**	**39.60**		

Required Level of Treatment 80 % Enhanced Level
SWM Facility Type 4 (1-Infiltration, 2-Wetlands, 3-Hybrid Wet Pond/Wetland, 4-Wet Pond, 5-Dry Pond)

	Enhanced		Normal		Basic	
Water Quality Storage Requirement	**150.0**		-		-	cu.m/ha
Permanent Pool Volume Required	**110.0**		-		-	cu.m/ha
	1823.8		-		-	cu.m
Extended Detention Volume (40 cu.m)	**40.0**		-		-	cu.m/ha
	663.2		-		-	cu.m
25mm Storm Runoff Volume	**7.36**	mm				
	1220.3	cu.m				
Required Extended Detention Volume	**1220.3**	cu.m				
Permanent Pool Volume Provided	**2290**	**cu.m**	**Provided**	**>**	**Required**	
Extended Detention Volume Provided	**1203**	**cu.m**	**Provided**	**<**	**Required**	

Appendix E:
Conveyance Calculations

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Nov 7 2019

Saunders Street - Channel Analysis

User-defined

Invert Elev (m)	= 0.0300
Slope (%)	= 0.5000
N-Value	= 0.013

Calculations

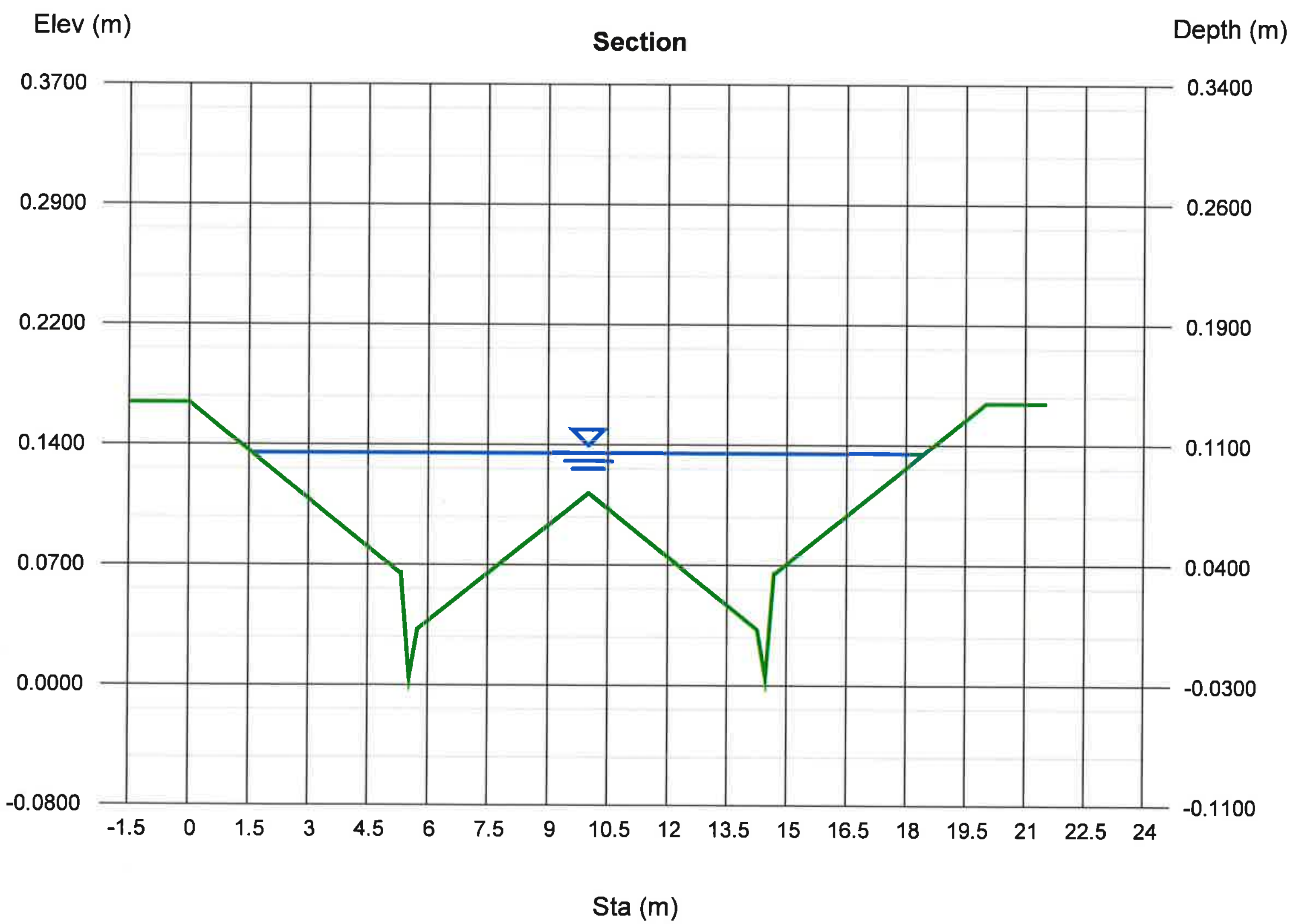
Compute by:	Known Q
Known Q (cms)	= 0.7100

Highlighted

Depth (m)	= 0.1097
Q (cms)	= 0.7100
Area (sqm)	= 0.9507
Velocity (m/s)	= 0.7468
Wetted Perim (m)	= 16.8804
Crit Depth, Yc (m)	= 0.1128
Top Width (m)	= 16.8528
EGL (m)	= 0.1382

(Sta, El, n)-(Sta, El, n)...

(0.0000, 0.1712)-(5.3100, 0.0650, 0.013)-(5.3350, 0.0650, 0.013)-(5.7500, 0.0300, 0.013)-(10.0000, 0.1150, 0.013)-(14.2500, 0.0300, 0.013)-(14.6650, 0.0650, 0.01
-(14.6900, 0.0650, 0.013)-(20.0000, 0.1712, 0.013)



Channel Report

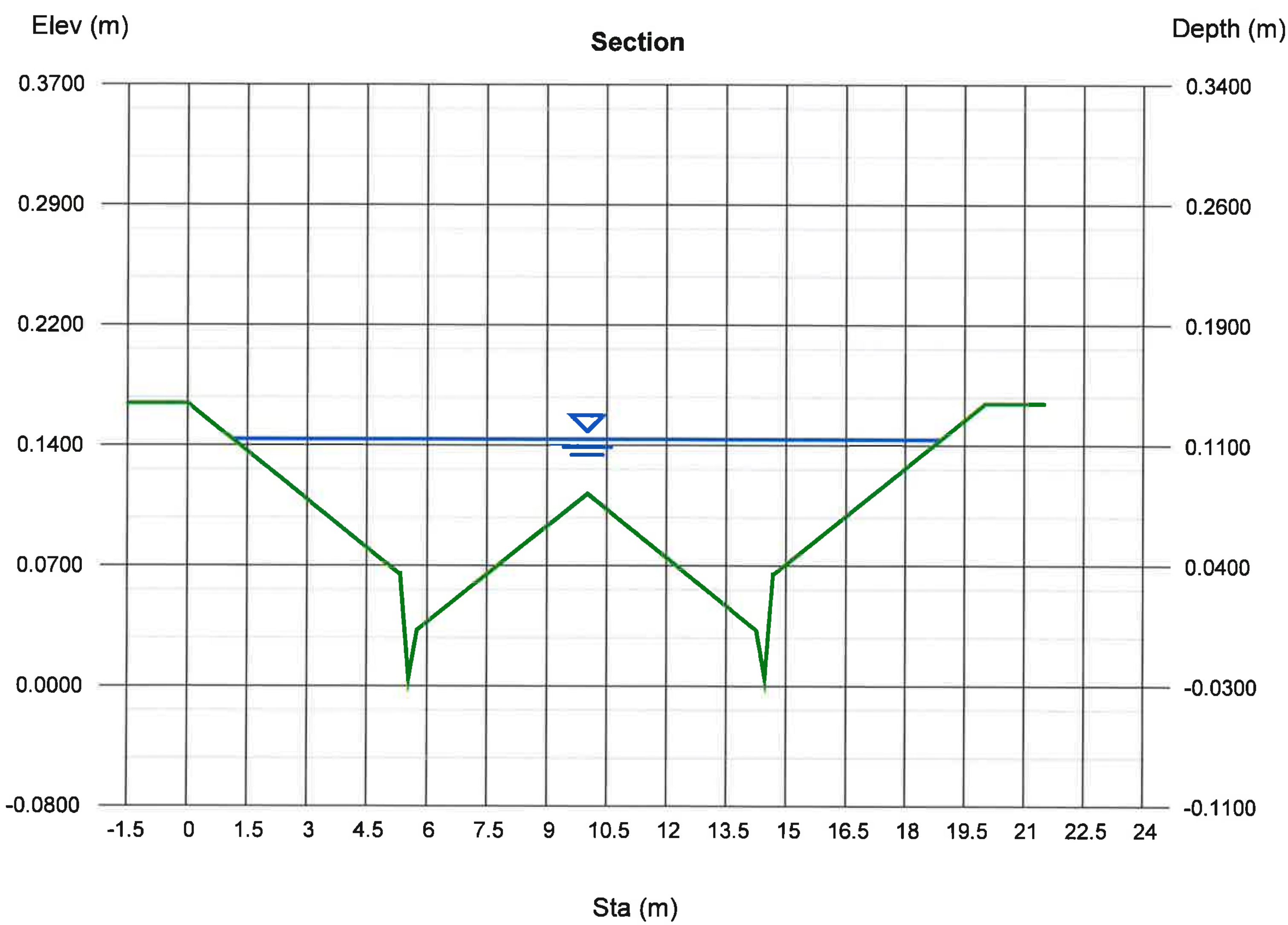
Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 15 2019

Findlay Drive - Channel Analysis

User-defined		**Highlighted**	
Invert Elev (m)	= 0.0300	Depth (m)	= 0.1189
Slope (%)	= 0.5000	Q (cms)	= 0.9400
N-Value	= 0.013	Area (sqm)	= 1.1090
		Velocity (m/s)	= 0.8476
Calculations		Wetted Perim (m)	= 17.7950
Compute by:	Known Q	Crit Depth, Yc (m)	= 0.1250
Known Q (cms)	= 0.9400	Top Width (m)	= 17.7672
		EGL (m)	= 0.1555

(Sta, El, n)-(Sta, El, n)...

(0.0000, 0.1712)-(5.3100, 0.0650, 0.013)-(5.3350, 0.0650, 0.013)-(5.7500, 0.0300, 0.013)-(10.0000, 0.1150, 0.013)-(14.2500, 0.0300, 0.013)-(14.6650, 0.0650, 0.01
-(14.6900, 0.0650, 0.013)-(20.0000, 0.1712, 0.013)



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 15 2019

Findlay Drive - Channel Analysis (Max Flow)

User-defined

Invert Elev (m)	=	0.0300
Slope (%)	=	0.5000
N-Value	=	0.013

Calculations

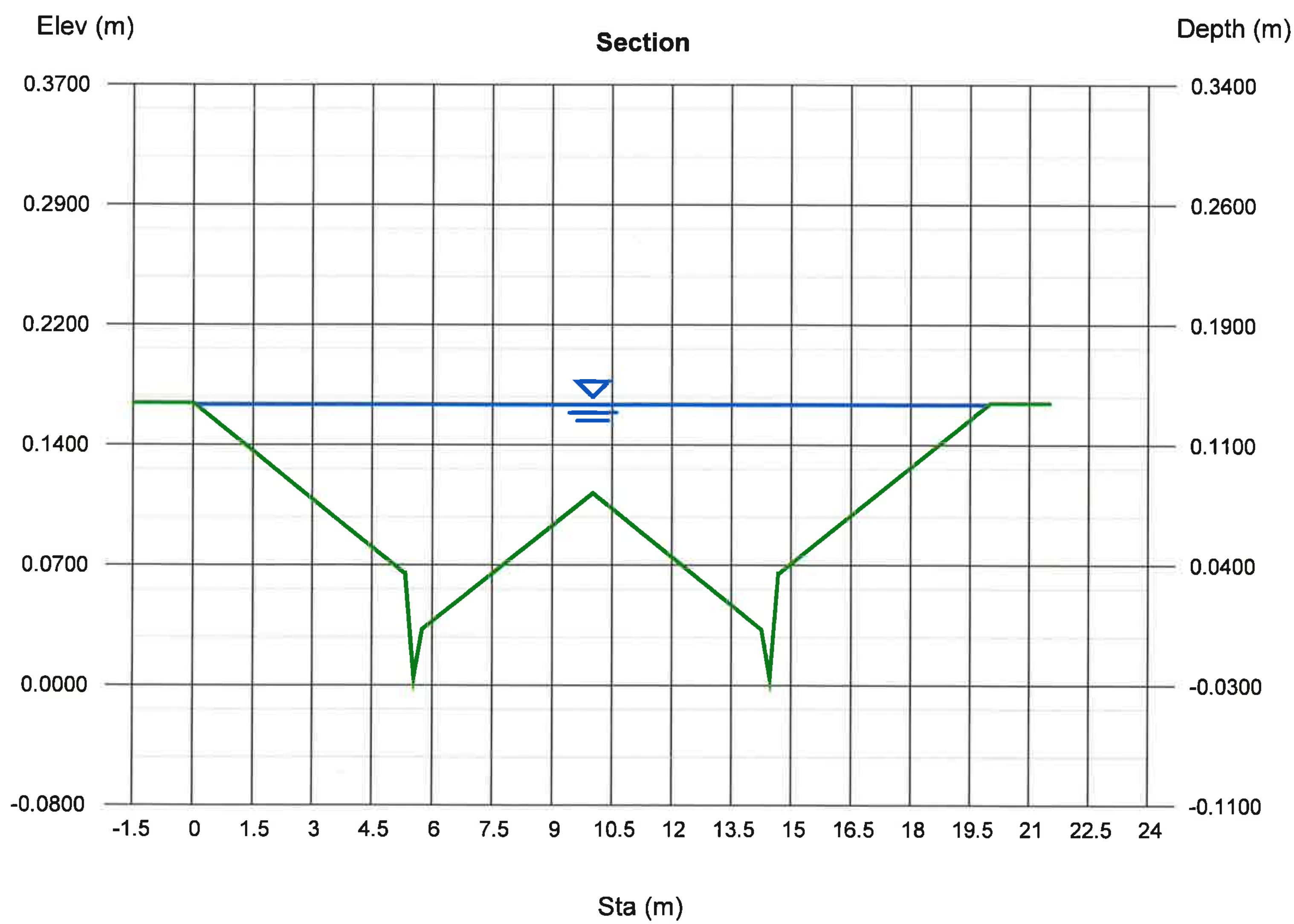
Compute by:		Known Q
Known Q (cms)	=	1.4000

Highlighted

Depth (m)	=	0.1402
Q (cms)	=	1.4000
Area (sqm)	=	1.5109
Velocity (m/s)	=	0.9266
Wetted Perim (m)	=	19.9290
Crit Depth, Yc (m)	=	0.1412
Top Width (m)	=	19.9008
EGL (m)	=	0.1840

(Sta, El, n)-(Sta, El, n)...

(0.0000, 0.1712)-(5.3100, 0.0650, 0.013)-(5.3350, 0.0650, 0.013)-(5.7500, 0.0300, 0.013)-(10.0000, 0.1150, 0.013)-(14.2500, 0.0300, 0.013)-(14.6650, 0.0650, 0.01
-(14.6900, 0.0650, 0.013)-(20.0000, 0.1712, 0.013)



TATHAM ENGINEERING

PROJECT	50 Saunders Street	FILE	119106
		DATE	November 6, 2019
SUBJECT	Post Development Flow Summary	NAME	ASB
		PAGE	1

Sag Spill Over High Point

High Point in Road Acting as Weir Control

Length of Weir	20	m
Weir Sill Elevation	196.07	m
Weir constant K	1.6	
Side Slope (H:V)	50	

Q = K x L x H^1.5

where Q = flow rate (cms)
K = constant
L = length (m)
H = head on the weir (m)

Major Overland Flow 0.71 cms

Water Level	Emergency Spillway	
	Head	Discharge
(m)	(m)	(cms)
196.07	0.00	0.00
196.08	0.01	0.03
196.09	0.02	0.10
196.10	0.03	0.18
196.11	0.04	0.28
196.12	0.05	0.40
196.13	0.06	0.54
196.14	0.07	**0.70**
196.15	0.08	0.87
196.16	0.09	1.06
196.17	0.10	1.26

Saunders Street Sta. 0+420.005