DJ LAND DEVELOPMENT

STORMWATER MANAGEMENT REPORT

PROPOSED DEVELOPMENT

SADDLER STREET EAST, DURHAM

MUNICIPALITY OF WEST GREY

JANUARY 2024

COBIDE Engineering Inc
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COBIDE ENGINEERING INC

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1. INTRODUCTION

Cobide Engineering Inc. was retained by DJ Land Development to complete a preliminary stormwater management report in support of a Draft Plan Approval Application. The application will be to subdivide the property into a residential subdivision development.

A copy of the proposed Draft Plan has been included in **Appendix A** as Drawing 01855-DP1.

1.1 LOCATION

The proposed subdivision development, herein referred to as the Site, is located on Part of Park Lots 13, 14 and 15 on the North Side of Saddler Street, Registered Plan 500, within the Town of Durham, Municipality of West Grey, County of Grey. The Site is located on the north side of Saddler Street East between Rock Street and Concession 1. A Site Location Map is included as **Figure 1**.

1.2 DEVELOPMENT PROPOSAL

The overall property area is approximately 2.66 hectares (6.57 acres) in size. The owner is proposing to subdivide the property into 26 residential lots with a mix of semi-detached, four-plex and six-plex style units and condominium townhouse block consisting of 30 units. The subdivision will have two access points, one from Lambton Street East and one from Saddler Street East.

The development will consist of the following:

- Municipal Right-of-Way (Street A) providing access to Saddler Street East and Lambton Street East
- Lots 1 to 26 Semi-detached and Townhouse Units
- Block 28 Stormwater Management Facility
- Block 27 Condominium Townhouse Development
- Portion of land to be retained by owner to be sold to the adjacent landowner to the east due to existing encroachments

The Draft Plan showing the proposed development configuration has been included in **Appendix A** as Drawing 01855-DP1.

The Site is located on the southeast side of Durham and is currently zoned R1B and Future Development within the Municipality of West Grey's zoning. The property is within the primary settlement area in the current Grey County Official Plan.

1.3 SCOPE OF WORK

The stormwater management report addresses the design and implementation of drainage and stormwater management facilities for the development.

The report includes:

- Details of erosion protection and sedimentation control for short-term, construction phase and the long-term;
- Rehabilitation/protection measures;
- Quantity Control;
- Quality Control;

- Established lot grading requirements for the proposed site based on existing topographic constraints, neighbouring properties, groundwater elevations and overall proposed drainage patterns;
- Provisions for the major and minor flows through the development;
- Summary of Peak Flows, Stormwater Management Facility Geometry and Performance;
- Impact of stormwater drainage on County owned ditch along the south side of Lambton Street East;
- Summary of how all County, Municipal and Watershed SWM criteria has been satisfied.

1.4 BACKGROUND INFORMATION

In support of the Draft Plan Approval Application, pre-consultation with the Municipality of West Grey, County of Grey, and Saugeen Valley Conservation Authority (SVCA) has occurred. A copy of the pre-consultation meeting minutes has been included within **Appendix C** of this report.

MAP SOURCE - MTO ROAD MAP

COBIDE ENGINEERING INC
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Client/Project
PROPOSED RESIDENTIAL DEVELOPMENT
SADDLER STREET EAST, DURHAM
MUNICIPALITY OF WEST GREY
COUNTY OF GREY
STORMWATER MANAGEMENT REPORT

Figure No.
1

Title
REGIONAL LOCATION MAP

ORIGINAL SHEET – 8 x 11
H:\Tremble\01855 Tremble Sadler St Townhouses\Drawings\Working Drawings\Regional Location.dwg Dec 18, 2023 – 10:38am

Figure 1 - Site Location Map

2. DRAINAGE CHARACTERISTICS

2.1 REGIONAL

The subject property is located within a large catchment area of approximately 34,640 hectares. The surface water drainage from this catchment occurs primarily overland from all directions, with the majority of the lands being upstream of the site towards the north and east flowing into the Saugeen River north and west of the property.

2.2 LOCAL

The majority of the surface runoff from the site currently flows from east to west towards the Saddler Street East Road allowance. The existing storm sewers along Saddler Street East convey the stormwater from the road allowance and residences with eventual outlet to the Saugeen River west of the site at the end of South Street West. A small portion of the north side of the site drains north into the existing roadside ditch along Lambton Street East which flows west into Durham Creek approximately 267m west of the proposed site access off Lambton Street East. Durham Creek meanders southwest towards the South Street West outlet into the Saugeen River.

There are no natural drainage courses that flow through the subject property. The topographical high point for the property is located at the upper southeast corner of the site, along the upper east boundary with an elevation of approximately 354.00 AMSL while the elevation at the southwest boundary of the site along Saddler Street East is approximately 349.50 metres AMSL. The average existing slope on the site is approximately 2.0%.

2.3 SOILS

The soil survey of Grey County (Report No. 17) identifies the native soils on the site as Sargent Loam which consists of a well sorted gravelly outwash. Sargent Loam is represented by Hydraulic Soil Group A. The surrounding properties consist of similar soil types including Donnybrook Loam which consists of sandy loam underlain by gravelly materials.

3. STORMWATER CONTROL

The design guidelines and constraints utilized in the stormwater management review for the development are as follows:

3.1 DESIGN GUIDELINES

The main design guideline utilized in this review is the Ministry of the Environment, Conservation and Park's (MECP) *"Stormwater Management Planning and Design (SWMP&D) Manual,"* dated March 2003. Grey County's Stormwater Management Development Application Guidelines were also referenced when preparing this report.

The SWMP&D Manual details the methodologies for the preparation and evaluation of urban/suburban stormwater management measures. The document provides direction on the design of drainage/ stormwater management facilities required to meet the goals and objectives of the various Municipal/ Provincial Review Agencies.

The SWMP&D Manual provides information on the long-term operation and maintenance techniques for stormwater management facilities that may be implemented in the development of the subdivision.

The storm sewer design criteria to be used are as follows:

- Runoff from the 5 year storm is to be conveyed to a sufficient outlet via a combination of storm sewers and grass swales/ditches;
- Major storm runoff (i.e. >5 years) is to be contained within specified drainage corridors and not adversely impact any of the proposed units within the development or off-site properties.

3.2 METHODOLOGY FOR COMPUTING STORMWATER RUNOFF

As noted previously, the objectives of the Stormwater Management (SWM) Plan for development are to ensure that there is an adequate outlet to convey the runoff from the minor and major storm systems.

The objectives are to be achieved by completing the following tasks:

i. Determining the existing drainage conditions;

ii. Determining the post-development drainage conditions;

iii. Design stormwater management measures that meet the criteria of the Municipality of West Grey, Ministry of Environment, Conservation and Parks (MECP), and Saugeen Valley Conservation Authority (SVCA).

iv. Summarize the analysis by identifying conclusions and recommendations.

4. EXISTING CONDITIONS

The property is split into two main areas by the presence of the existing grassed, former rail trail that runs east to west across the top portion of the property. The north portion of the property consists of dense trees and a small portion of both maintained lawn and natural, unmaintained grassed areas. The south portion is a mixture of natural, unmaintained lawns and an area of maintained lawns along with a combination of trees and low-lying shrubs. The existing roadside ditch that is present along the north property boundary, (Lambton Street East), conveys the runoff from the north portion of the site. The south portion of the site is generally conveyed to the existing road allowance of Saddler Street East.

The pre-development catchment area boundaries are delineated on Drawing 01855-SWM1 attached in **Appendix A**.

Summarized below is a description of each catchment area.

4.1 PRE-DEVELOPMENT CATCHMENT AREAS

CATCHMENT AREA 101

- Includes all lands north of the former rail trail within the site boundary;
- Drainage is typically overland, sheet flow from the south to north towards the existing roadside ditch along the south side of Lambton Street East;
- Catchment Area 101 is considered to discharge to Discharge Point #1 for the purposes of this report;
- Approximately 1.10 ha in area.

CATCHMENT AREA 102

- Includes all lands south of the former rail trail within the site boundary as well as a portion of lands to the east of the site boundary;
- Lands to the east of the site boundary include rear lots of existing residential dwellings on Saddler Street East;
- Drainage is typically overland, sheet flow from east to west towards the southwest corner of the site boundary towards the Saddler Street East Road allowance;
- Catchment Area 102 is considered to discharge to Discharge Point #2 for the purposes of this report;
- Approximately 2.78 ha in area.

5. PROPOSED CONDITIONS

The proposed post development catchment area boundaries are delineated on Drawing 01855-SWM2 attached in **Appendix A**.

Summarized below is a description of each catchment area.

5.1 POST DEVELOPMENT CATCHMENT AREAS

CATCHMENT AREA 201

- This catchment area includes a portion of the proposed Street 'A' road allowance, a small portion of the rooftops for Unit 1 and 13, and the rear yards of proposed dwellings on the north side in Block 27;
- Minor flows from the Street 'A' road allowance will be captured by the storm sewer which will discharge into the proposed stormwater management facility;
- Major flows will flow overland, discharging into the existing roadside ditch along the south side of Lambton Street East;
- Catchment Area 201 is considered to discharge to Discharge Point #1 for the purposes of this report;
- Approximately 0.47 ha in area.

CATCHMENT AREA 202

- This catchment area includes all the lands within Catchment 102 and the majority of the land from Catchment 101;
- Minor flows will be captured by the storm sewer and major flows will flow overland, both discharging into the proposed stormwater management facility;
- Catchment Area 202 is considered to discharge to Discharge Point #2 for the purposes of this report;
- Approximately 3.41 ha in area.

6. QUANTITY CONTROL

The hydrologic modelling software PCSWMM Version 5.6.1803 Professional 2D was used to determine the pre and post-development peak flows for the 2 yr., 5 yr., 25 yr., 50 yr., and 100 yr. storm events. The most current Environment Canada Data has been used for the modelling as it reflects more up to date data (2022 versus 2010) for the MTO parameters and provides a higher runoff rate thus providing a more conservative model. A copy of the rainfall data has been included with **Appendix B**.

The stormwater management design criteria for the subject site as recommended by the Municipality of West Grey, MECP and SVCA are to attenuate post-development peak flow rates to the pre-development levels for all storm events.

The pre-development and post development parameters and model outputs for all Catchments are contained in **Appendix B**.

6.1 DESIGN REQUIREMENTS

The intent of stormwater quantity control is to limit the flows under proposed conditions to existing levels or less to protect the downstream watercourses, infrastructure, and properties.

Minor flows from much of the development will be conveyed to the proposed stormwater management facility via a new storm sewer collection system that will be constructed throughout the development. This storm sewer collection system will be designed to accommodate all flows up to and including the 5 year storm event.

Major flows (>5 year), will be conveyed overland within the road allowance of the street.

Due to the increase in impervious area, stormwater quantity control will be required for the site. The design of the stormwater management facility has assumed a free outlet from the pond.

6.2 SWM FACILITY CHARACTERISTICS

The stormwater management facility and outlet structure have been designed to control peak runoff rates as well as conform to MECP best practices.

In order to provide the above required volumes and discharges, the following SWM facility geometry is being proposed:

Table 7.1 – SWM Facility Geometry

SWM FACILITY	DETAILED DESIGN
Side Slope	3:1
SWM Facility Bottom	346.75 m
Top Elevation	349.50 m
High Water Elevation	348.77 m

The outlet configuration for the SWM Facility will be as follows:

- A 150 mm diameter orifice located at the pond bottom elevation of 346.75m.
- An emergency overflow spillway located on the south side of the pond will allow stormwater to drain from the pond during storm events larger than the 100 year storm if the primary outlet becomes blocked.

6.3 SWM FACILITY PERFORMANCE

Below is a summary of the hydraulic performance of the SWM facility during the various storm events:

Table 7.2 – SWM Facility Performance

RETURN PERIOD	PEAK FLOW (l/s)	ELEVATION (m)	VOLUME (m^3)
2 Year	42.4	347.52	288
5 Year	51.7	347.86	469
25 Year	63.1	348.36	805
50 Year	67.2	348.57	961
100 Year	70.9	348.77	1,127

6.4 MODELLING RESULTS

Based on the above outlet structure, the following summarizes the pre-development and post development peak flows to the two (2) discharge points:

Table 7.3 – SWM Peak Flow Summary

RETURN PERIOD	DISCHARGE POINT #1 (l/s)		DISCHARGE POINT #2 (l/s)	
	CATCHMENT 101 PRE	CATCHMENT 201 POST	CATCHMENT 102 PRE	CATCHMENT 202 POST
2 Year	6.0	18.6	34.9	42.4
5 Year	14.2	32.1	56.0	51.7
25 Year	35.8	59.7	114.4	63.1
50 Year	48.1	72.7	146.4	67.2
100 Year	62.5	86.4	183.1	70.9

6.4.1 DISCHARGE POINT #1

As shown in the chart above, the pre-development flows are greater than the post development flows for Discharge Point #1. This is primarily due to the inability to grade the site in a manner that allows all the runoff to be directed towards the proposed SWM pond. Therefore, the post development flows to Lambton Street East are greater than the pre-development flows. The increase in flow is very minor and not expected to adversely impact any downstream infrastructure and properties between the site and Durham Creek.

6.4.2 DISCHARGE POINT #2

The post development flows for Discharge Point #2 are less than the pre-development flows for the majority of the storm events. The only storm event that is above the pre-development conditions is the 2-year storm event. This increase is not expected to cause any adverse impacts or issues as the storm sewers are designed to accommodate the 5-year storm event. Therefore, no additional quantity control beyond the construction of the proposed stormwater management facility is being considered.

6.4.3 MODELLING SUMMARY

Ultimately, both discharge points outlet to Durham Creek at Kincardine Street with eventual outlet to the Saugeen River. The combined post development flows are below the pre-development flows during all major storm events.

It is presumed that the downstream infrastructure from Rock Street West is adequate to service this proposed development as the current construction being completed by Grey County on Rock Street South of Saddler Street has been designed without stormwater controls. Based on the minor increases in flow as outlined above, it is not anticipated that this proposed development will negatively impact the existing downstream infrastructure.

7. QUALITY CONTROL

To meet the requirements of the Municipality of West Grey, MECP, and SVCA, stormwater quality control will be provided for the proposed development.

The MECP's SWMP&D Guidelines recommend that the required level of protection be associated with the habitat sensitivity of the receiving watercourse. The ultimate receiving watercourse for this development is the Saugeen River. For the purposes of this report, a 'Enhanced' water quality protection level will be implemented in accordance with the MECP 2003 Guidelines and SVCA requirements.

In keeping with the approach suggested in the SWMP&D manual, a 'treatment train' approach to stormwater quality management has been proposed for this development. This approach consists of three (3) levels of treatment which are described as follows:

- Lot level control measures
- Conveyance control measures
- End-of-Pipe control measures

A review of each measure and its suitability for use in the development is discussed below:

7.1 LOT LEVEL CONTROL MEASURES

The Municipality of West Grey design standards require minimum grades of 2.0% for lot grading, driveways, and drainage swales. Therefore, reduced lot grading of the front, side, and rear yards to less than 2.0% is not feasible.

The north portion of the site contains karst deposits and therefore the use of drainage pits and infiltration trenches have not been considered. Drainage pits and infiltration trenches also require additional ongoing maintenance which is borne by the homeowner and their long-term function is contingent on the action of the landowner.

It is proposed that all runoff draining from rooftops be directed overland across the grass lawns to encourage infiltration and filtering of pollutants from this runoff. The Lot Grading Plan will note the following "Roof drain troughs shall be directed to grassed areas of the property and not to driveways or private drain connections".

7.2 CONVEYANCE CONTROL MEASURES

The Municipality's standard road cross section only allows for the use of curb and gutter in new urban type subdivisions. Therefore, the use of grass swales as a conveyance control measure for runoff from the subdivision streets cannot be implemented.

Grassed drainage swales may be proposed to be constructed in the rear yards of some of the lots. These swales will provide rear yard drainage for the proposed lots. Swales will have slopes of at least 2.0% where possible. This will assist with removing pollutants and sediment from the runoff prior to draining into the municipal storm sewer system.

All catchbasins and manholes within the subdivision will be provided with minimum 600 mm and 300 mm sumps respectively which will assist in removing a portion of the sediment contained in the runoff from the street.

7.3 END-OF-PIPE CONTROL MEASURES

The proposed stormwater management pond has been designed such that it can be provide a minor level of end of pipe control prior to its discharge into the municipal storm sewer. The proposed pond can provide adequate storage while allowing the stored water to be released back into the storm sewer system at a reduced rate which will prevent downstream flooding.

The use of an Oil Grit Separator (OGS) is a viable option for this development to provide "Enhanced" treatment for the stormwater. The OGS will be installed at the downstream end of the new storm sewer

system prior to discharging into the stormwater management pond. Runoff from the impervious road surface will be collected by the storm sewers and directed through the OGS which will remove pollutants and sediment prior to discharging into the drainage ditch. Design details for the OGS are attached in **Appendix D**.

8. EROSION & SEDIMENTATION CONTROL

8.1 CONSTRUCTION STAGE

The following are details regarding the erosion and sediment control measures to be implemented during construction:

- Placement of siltation fences in all areas where surface drainage flows over disturbed areas. Siltation fence shall remain erect until construction is completed and the upstream area is fully re-vegetated.
- The stormwater management pond should be constructed first to act as a sedimentation pond during construction;
- Placement of temporary rock check dams within swales and any other locations where a concentrated flow of runoff may occur. All proposed drainage swales are to be seeded during construction;
- Installation of filter cloth under all new and existing catchbasin grates until paving of the subdivision streets is completed;
- Mud mats will be placed at construction accesses to keep public roadways free from debris during the construction period.

Once the ground surface of the site has been stabilized, the rock check dams and siltation fences can then be removed.

During the construction phase, it is important to ensure that erosion/sediment control is in place to ensure against transport of sediment into the existing downstream drainage ditches.

8.2 LOT DEVELOPMENT

During individual construction of homes within the subdivision, siltation barriers are to be constructed, as appropriate, to prevent the erosion of materials into the proposed roadside ditches and storm sewer system. The siltation barriers can be the form of siltation fences or shallow excavated sediment traps in the direction of flow from the construction site to the proposed drainage system.

The proposed grading will not alter the existing grading along the perimeter of the property. Individual lot grading will be determined based on the development of each lot; therefore, the sediment control of each individual lot is up to the landowner constructing the dwelling.

8.3 RESTORATION AND PROTECTION MEASURES

Every effort will be made to restore all disturbed areas as soon as possible after the completion of construction and lot development. A synergistic approach during construction, lot development and post-construction will be used to ensure adequate restoration to the disturbed areas has been completed to provide appropriate protection measures. This will be achieved by allowing disturbed areas to revegetate before removing sediment and erosion control measures as to avoid their migration from the subject property to any to adjacent properties, infrastructure and/or the municipal right-of-way. When and where beneficial, interim and rough grading of the property shall be completed such that the drainage and runoff is contained on site or controlled to a positive outlet. Special care shall be taken to ensure that silt and sediment laden surface water does not enter any watercourses or environmentally sensitive areas, either overland or through the storm drainage system.

9. CONCLUSIONS & RECOMMENDATIONS

The above report presents the Preliminary Stormwater Management Plan in support of Draft Plan Approval Application for a residential subdivision development located in Durham. Based on the findings of this report, the following conclusions are made:

1. Stormwater quantity control will be provided by a dry pond SWM Facility with an outlet configuration as described previously.
2. Stormwater quantity control for the development will maintain or lower pre-development flows during storm events for the flows captured in Catchment 202 (Discharge Point #2).
3. Stormwater quality control for the development will be higher than pre-development flows during storm events for the flows captured in Catchment 201 (Discharge Point #1) with proposed discharge to Lambton Street East. This increase however, is not expected to cause downstream concerns;
4. Stormwater quality will be provided by a treatment train approach which will include lot level control, conveyance control and 'end-of-pipe' control measures.

   Lot level control will be provided by directing most impervious areas not directly connected to the municipal storm sewer system, over vegetated areas and directing all rear yard drainage to grass swales prior to discharging into the proposed storm sewer system.

   Conveyance control will be provided by and providing a minimum 600 mm sumps in all catchbasins and a minimum 300 mm sumps in all catchbasin manholes.

   End-of-pipe control will be provided by the proposed stormwater management pond (SWM facility).

   All three levels of the treatment train approach will be used for the development to provide an "Enhanced" Level of protection for the development.

Based on the above conclusions of this report, it is recommended that the above Stormwater Management Report for the proposed subdivision be submitted to the SVCA, Municipality of West Grey and Grey County as part of the Draft Plan Approval Application.

Sincerely,

COBIDE Engineering Inc.

Amy R.M. Hoffarth, E.I.T.

Travis Burnside, P.Eng.
Director

LICENSED PROFESSIONAL ENGINEER
1/24/2024
T. L. BURNSIDE
100199868
PROVINCE OF ONTARIO

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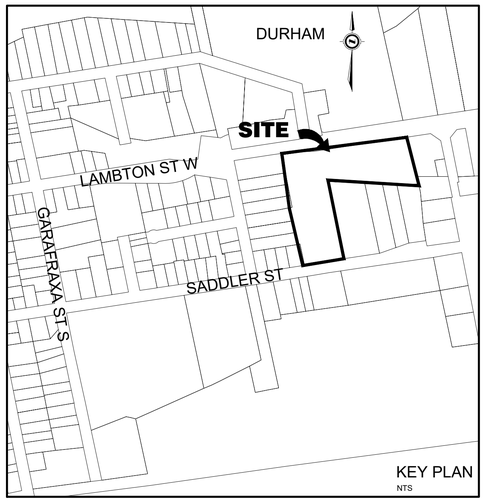
Appendix A

DRAWINGS

01855 – DP1 – DRAFT PLAN OF SUBDVISION
01855 – SWM1 – PRE-DEVELOPMENT CATCHMENT AREAS
01855 – SWM2 – POST DEVELOPMENT CATCHMENT AREAS



RESIDENTIAL 'R2' ZONE PROVISIONS			RESIDENTIAL 'R3 ZONE PROVISIONS
	SEMI-DETACHED	STREET TOWNHOUSE	CLUSTER TOWNHOUSE
LOT AREA (MIN.)	275 sq.m.	280 sq.m.	(SEE NOTE 2 BELOW)
LOT FRONTAGE (MIN.)	9.0m	6.5m	20.1m
FRONT YARD (MIN.)	7.6m	7.5m	7.6m
REAR YARD (MIN.)	7.6m	7.5m	7.6m
EXT. SIDE YARD (MIN.)	7.6m	7.5m	7.6m
INT. SIDE YARD (MIN.)	1.2m & 1.8m & 3.7m (SEE NOTE 1 BELOW)	3.0m	6.0m
MAX. LOT COVERAGE	45.0%	-	-

NOTE:
1) INTERIOR SIDE YARD REQUIREMENTS FOR A ONE STOREY UNIT IS 1.2m. MORE THAN ONE STORY IS 1.8m. NO ATTACHED GARAGE IS 3.7m. EXCEPTING HOWEVER THAT THE SIDE YARD ALONG THE COMMON WALL DIVIDING THE ATTACHED UNITS SHALL BE 0m.
2) LOT AREA MINIMUM:
a) 1393.5 sq. m FOR THE FIRST FOUR UNITS.
b) 264.8 sq. m FOR EACH ADDITIONAL UNIT THEREAFTER

SOURCE: MUNICIPALITY OF WEST GREY,
ZONING BYLAW No. 37-2006 (INCLUDES AMENDMENTS IN FORCE AND EFFECT AS OF APRIL 1, 2017)

Lot Information			
Lot Number	Frontage (m) *(AS DEFINED IN ZONING BY-LAW)*	Area (sq.m)	Lot Coverage
1	17.8	659.1	24.2%
2	12.7	414.4	38.6%
3	12.7	387.4	41.2%
4	9.1	277	49.3%
5	9.1	277	49.3%
6	12.7	384	41.6%
7	12.7	384	41.6%
8	9.1	277	49.3%
9	9.1	301.7	45.4%
10	12.7	419.2	38.1%
11	19.8	656.3	38.4%
12	19.8	656.9	38.3%
13	18.5	570.9	28.0%
14	16.7	470.6	34.0%
15	16.7	512.2	31.2%
16	9.1	280.5	48.8%
17	9.1	280.2	48.8%
18	12.7	388	41.2%
19	12.7	387.5	41.2%
20	9.1	279.2	48.8%
21	9.1	278.9	48.8%
22	12.7	386.2	41.2%
23	12.7	385.7	41.2%
24	9.1	277.9	48.8%
25	9.1	277.7	48.8%
26	18.4	569.1	28.1%
BLOCK 27	-	11163.3	
BLOCK 28	-	1233.6	

DRAFT PLAN OF SUBDIVISION

SADDLER ST. TOWNHOUSES
PART OF PARK LOTS 13, 14 & 15
NORTH SIDE OF SADDLER STREET
REGISTERED PLAN 500
TOWN OF DURHAM
MUNICIPALITY OF WEST GREY
COUNTY OF GREY

RELEVANT SITE INFORMATION

SEMI-DETACHED RESIDENTIAL LOTS (6) (LOTS 1 TO 2, LOTS 11 TO 14)	0.331 ha.
STREET TOWNHOUSE RESIDENTIAL LOTS (20) (LOTS 3 TO 10, LOTS 15 TO 26)	0.696 ha.
MUNICIPAL STREET (STREET A)	0.393 ha.
BLOCK 27 (MULTI-FAMILY UNIT DWELLING)	1.018ha.
BLOCK 28 (STORM WATER MANAGEMENT)	0.123 ha.
TOTAL PROPOSED SUBDIVISION	2.563 ha.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

a. AS SHOWN
b. AS SHOWN
c. AS SHOWN
d. MULTI-FAMILY RESIDENTIAL
e. AS SHOWN
f. AS SHOWN
g. AS SHOWN
h. MUNICIPAL WATER SUPPLY
i. SANDY SILT & GRAVEL
j. AS SHOWN
k. WATER, STORM SEWERS, SANITARY SEWERS, HYDRO, TELEPHONE
l. AS SHOWN

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:
THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

JAMES LAWS O.L.S.
VAN HARTEN SURVEYING INC.

DATE

OWNER'S CERTIFICATE

I, THE REGISTERED OWNER OF THESE LANDS, HEREBY AUTHORIZE COBIDE ENGINEERING INC. TO SUBMIT THIS DRAFT PLAN FOR APPROVAL.

DATE

OWNER

DRAFT APPROVAL SIGNATURE BLOCK

APPROVED IN ACCORDANCE WITH SECTION 51(31) OF THE PLANNING ACT, RSO, 1990, CHAPTER P.13, AS AMENDED,

THIS _____ DAY OF _____, 20___

SECRETARY-TREASURER OF THE LAND DIVISION COMMITTEE
COUNTY OF GREY

SCALE 1:500
5 0 2.5 5 10 15 25 METRES
30 20 10 0 25 50 100 FEET

No.	DATE	DESCRIPTION	BY	APPD
1	DEC 07/23	FIRST SUBMISSION	JHL	TLB

REVISION / ISSUE

COBIDE ENGINEERING INC
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Title:
PROPOSED SUBDIVISION
REGISTERED PLAN 500
TOWN OF DURHAM
MUNICIPALITY OF WEST GREY

Client: TREMBLE

Design:	TLB	Scale:	1:500
Drawn:	JHL	Approved:	
Checked:	TLB		
Date:	DEC 2023		Design Engineer

DRAWING No. 01855-DP1

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LEGEND

EXISTING STREET/PROPERTY LINES	EXISTING CATCH BASIN
PROPOSED STREET/PROPERTY LINES	EXISTING HYDRO GUY WIRE
EDGE OF EXISTING PAVEMENT	EXISTING HYDRO POLE
EDGE OF EXISTING GRAVEL	EXISTING TELEPHONE PEDESTAL
EXISTING STORM SEWER	STANDARD IRON BAR
EXISTING FENCE	IRON BAR
EXISTING TREE LINE	EXISTING DECIDUOUS TREE AND DIAMETER
EXISTING UNDERGROUND TELEPHONE CABLE	EXISTING CONIFEROUS TREE AND DIAMETER
EXISTING UNDERGROUND GAS LINE	BENCHMARK
EXISTING UNDERGROUND HYDRO CABLE	EXISTING CONTOUR
EXISTING DITCH	
EXISTING MANHOLE	

CAUTION:
THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE DRAWINGS, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

Notes

SCALE 1:500

5 0 2.5 5 10 15 25 METRES
30 20 10 0 25 50 100 FEET

Benchmark Information

BM1
SIB LOCATED AT NORTHEASTERN CORNER OF SUBJECT PROPERTY.
ELEVATION 353.06m

No.	DATE	DESCRIPTION	BY	APPD

REVISION / ISSUE

Seal not valid unless signed and dated

COBIDE ENGINEERING INC
517 10th Street, Hanover, Ontario N4N 1R4
Telephone: (519) 506-5959
www.cobideeng.com

Title:
PROPOSED TOWNHOUSE DEVELOPMENT
MUNICIPALITY OF WEST GREY
COUNTY OF GREY
PRE-DEVELOPMENT CATCHMENT AREAS

Client: TREMBLE

Design:	TLB	Scale:	1:500
Drawn:	ARMH	Approved:	
Checked:	TLB		
Date:	NOV 2023		Design Engineer

DRAWING No. 01855-SWM1

H:\Tremble\01855 Tremble Sadler St Townhouses\Drawings\Submissions\2023-11-30 SWM\01855 Sadler St Townhouses Concept 2023-10-18.dwg

CAUTION:
THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE DRAWINGS, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

Notes

SCALE 1:500

LEGEND

EXISTING STREET/PROPERTY LINES
PROPOSED STREET/PROPERTY LINES
EDGE OF EXISTING PAVEMENT
EDGE OF EXISTING GRAVEL
EXISTING STORM SEWER
EXISTING FENCE
EXISTING TREE LINE
EXISTING UNDERGROUND TELEPHONE CABLE
EXISTING UNDERGROUND GAS LINE
EXISTING UNDERGROUND HYDRO CABLE
EXISTING DITCH
SANMH EXISTING MANHOLE
CB EXISTING CATCH BASIN
EXISTING HYDRO GUY WIRE
HP EXISTING HYDRO POLE
BPED EXISTING TELEPHONE PEDESTAL
SIB STANDARD IRON BAR
IB IRON BAR
DEC .25 EXISTING DECIDUOUS TREE AND DIAMETER
FIR .25 EXISTING CONIFEROUS TREE AND DIAMETER
BM BENCHMARK
273.5 EXISTING CONTOUR

Benchmark Information

BM1
SIB LOCATED AT NORTHEASTERN CORNER OF SUBJECT PROPERTY. ELEVATION 353.06m

No.	DATE	DESCRIPTION	BY	APPD

REVISION / ISSUE

Seal not valid unless signed and dated

COBIDE ENGINEERING INC
517 10th Street, Hanover, Ontario N4N 1R4
Telephone: (519) 506-5959
www.cobideeng.com

Title:
PROPOSED TOWNHOUSE DEVELOPMENT
MUNICIPALITY OF WEST GREY
COUNTY OF GREY
POST DEVELOPMENT CATCHMENT AREAS

Client:
TREMBLE

Design:	TLB	Scale:	1:500
Drawn:	ARMH	Approved:	
Checked:	TLB		
Date:	NOV 2023		Design Engineer

DRAWING No. 01855-SWM2

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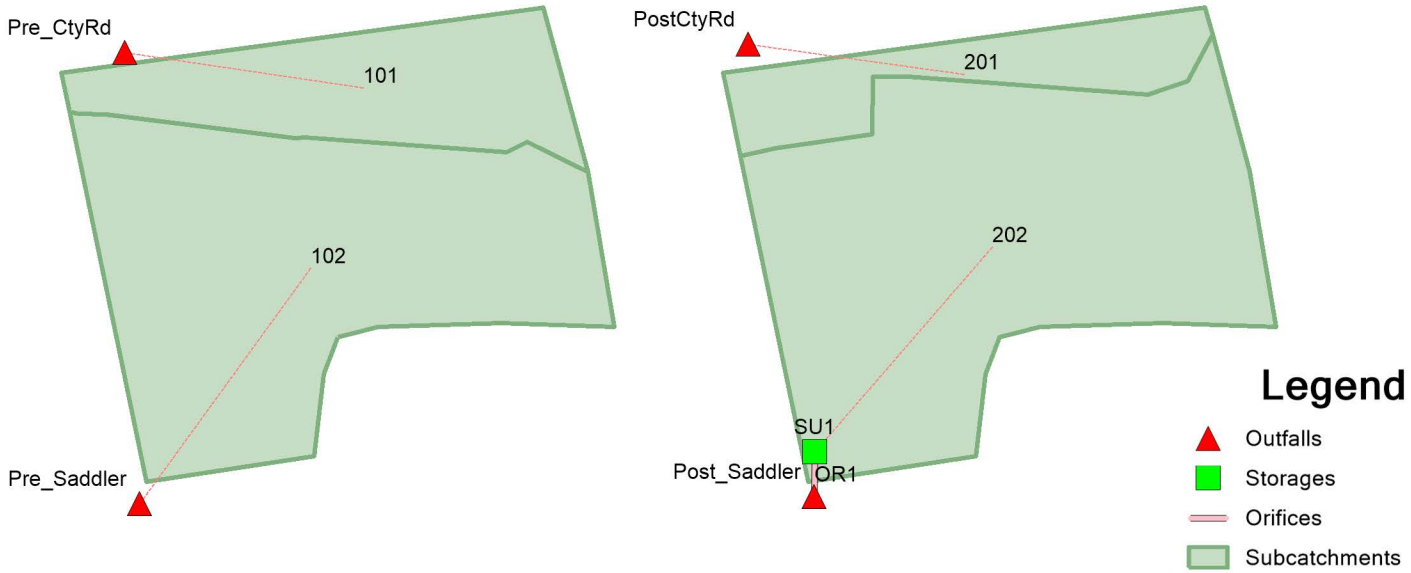
Appendix B

STORMWATER MANAGEMENT MODELLING
SWM MODELLING – PRE AND POST DEVELOPMENT

Saddler Street Development - Model Schematic



COBIDE ENGINEERING INC

SADDLER STREET DEVELOPMENT – SWM MODELLING – MODEL DETAILS

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           12/2/2023
START_TIME           00:00:00
REPORT_START_DATE    12/2/2023
REPORT_START_TIME    00:00:00
END_DATE             12/3/2023
END_TIME             00:00:00
SWEEP_START          1/1
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              8

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
SCS_Type_II_39.8mm_2yr INTENSITY 0:06     1.0      TIMESERIES SCS_Type_II_39.8mm_2yr
SCS_Type_II_55.1mm_5yr INTENSITY 0:06     1.0      TIMESERIES SCS_Type_II_55.1mm_5yr
SCS_Type_II_78.1mm_25yr INTENSITY 0:06     1.0      TIMESERIES SCS_Type_II_78.1mm_25yr
SCS_Type_II_87.6mm_50yr INTENSITY 0:06     1.0      TIMESERIES SCS_Type_II_87.6mm_50yr
SCS_Type_II_97.1mm_100yr INTENSITY 0:06     1.0      TIMESERIES SCS_Type_II_97.1mm_100yr

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------
-
101              SCS_Type_II_97.1mm_100yr Pre_CtyRd 1.1      0.8      212      1.7      0
102              SCS_Type_II_97.1mm_100yr Pre_Saddler 2.78   4.9      330      1.6      0
201              SCS_Type_II_97.1mm_100yr PostCtyRd 0.47     12.5     212      2.8      0
202              SCS_Type_II_97.1mm_100yr SU1      3.41     32.7     1100     2.5      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
101              0.01       0.37       0.05       0.05       25         OUTLET
102              0.01       0.31       0.05       0.05       25         OUTLET
201              0.01       0.25       0.05       0.05       25         OUTLET
202              0.01       0.25       0.05       0.05       25         OUTLET

[INFILTRATION]
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – MODEL DETAILS

```
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
101               52.1       12.7       7          0          0
102               55.4       12.7       7          0          0
201               60         12.7       7          0          0
202               60         12.7       7          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
Post_Saddler      0          FREE                        NO
PostCtyRd         0          FREE                        NO
Pre_CtyRd         0          FREE                        NO
Pre_Saddler       0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            SurDepth Fevap    Psi
Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- -------- ----
---- -------- --------
SU1               346.75   2.75       0          TABULAR    Pond                         0        0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
OR1               SU1              Post_Saddler     SIDE         346.75     0.65       NO       0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
OR1               CIRCULAR     0.15             0          0          0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Pond              Storage    0          260
Pond                         2.75       1075

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;SCS_Type_II_39.8mm design storm, total rainfall = 39.8 mm, rain interval = 6 minutes, rain units = mm/hr.
SCS_Type_II_39.8mm_2yr

;SCS_Type_II_55.1mm design storm, total rainfall = 55.1 mm, rain interval = 6 minutes, rain units = mm/hr.
SCS_Type_II_55.1mm_5yr

;SCS_Type_II_78.1mm design storm, total rainfall = 78.1 mm, rain interval = 6 minutes, rain units = mm/hr.
SCS_Type_II_78.1mm_25yr

;SCS_Type_II_87.6mm design storm, total rainfall = 87.6 mm, rain interval = 6 minutes, rain units = mm/hr.
SCS_Type_II_87.6mm_50yr

;SCS_Type_II_97.1mm design storm, total rainfall = 97.1 mm, rain interval = 6 minutes, rain units = mm/hr.
SCS_Type_II_97.1mm_100yr

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       515119.6099      4891364.6717     515754.9501      4891624.1243
UNITS            Meters
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 2 YEAR DESIGN STORM

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****
Number of rain gages 5
Number of subcatchments ... 4
Number of nodes 5
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
SCS_Type_II_39.8mm_2yr	SCS_Type_II_39.8mm_2yr	INTENSITY	6 min.
SCS_Type_II_55.1mm_5yr	SCS_Type_II_55.1mm_5yr	INTENSITY	6 min.
SCS_Type_II_78.1mm_25yr	SCS_Type_II_78.1mm_25yr	INTENSITY	6 min.
SCS_Type_II_87.6mm_50yr	SCS_Type_II_87.6mm_50yr	INTENSITY	6 min.
SCS_Type_II_97.1mm_100yr	SCS_Type_II_97.1mm_100yr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	1.10	212.00	0.80	1.7000	SCS_Type_II_39.8mm_2yr	Pre_CtyRd
102	2.78	330.00	4.90	1.6000	SCS_Type_II_39.8mm_2yr	Pre_Saddler
201	0.47	212.00	12.50	2.8000	SCS_Type_II_39.8mm_2yr	PostCtyRd
202	3.41	1100.00	32.70	2.5000	SCS_Type_II_39.8mm_2yr	SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Post_Saddler	OUTFALL	0.00	0.00	0.0	
PostCtyRd	OUTFALL	0.00	0.00	0.0	
Pre_CtyRd	OUTFALL	0.00	0.00	0.0	
Pre_Saddler	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	346.75	2.75	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	Post_Saddler	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
Analysis Options
****
Flow Units ..... LPS
Process Models:

SADDLER STREET DEVELOPMENT – SWM MODELLING – 2 YEAR DESIGN STORM

```
  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 ............ 12/02/2023 00:00:00
Ending Date .............. 12/03/2023 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 ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.309        39.800
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.216        27.809
Surface Runoff ...........         0.092        11.859
Final Storage ............         0.001         0.137
Continuity Error (%) .....        -0.014


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.092         0.921
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.092         0.920
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         0.001
Continuity Error (%) .....         0.000


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


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


*********************************
Most Frequent Nonconverging Nodes
*********************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     4.50 sec
Average Time Step           :     5.00 sec
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 2 YEAR DESIGN STORM

```
  Maximum Time Step           :     5.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.00
  % of Steps Not Converging   :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :   100.00 %
      3.155 -  1.991 sec      :     0.00 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
LPS
  ---------------------------------------------------------------------------------------------------------------
  101                       39.80       0.00       0.00      34.37       0.32       4.93       5.25        0.06
6.01   0.132
  102                       39.80       0.00       0.00      32.66       1.95       4.96       6.91        0.19
34.92   0.174
  201                       39.80       0.00       0.00      28.20       4.98       6.57      11.55        0.05
18.59   0.290
  202                       39.80       0.00       0.00      21.69      13.02       5.05      18.07        0.62
269.58   0.454


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type      Meters   Meters   Meters  days hr:min      Meters
  ------------------------------------------------------------------------------
  Post_Saddler         OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  PostCtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_CtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_Saddler          OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  SU1                  STORAGE     0.11     0.77   347.52     0  03:31        0.77


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                               Maximum  Maximum                  Lateral       Total        Flow
                               Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type       LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Saddler         OUTFALL   0.00    42.39     0  03:31           0       0.616       0.000
  PostCtyRd            OUTFALL  18.59    18.59     0  03:00      0.0543      0.0543       0.000
  Pre_CtyRd            OUTFALL   6.01     6.01     0  03:06      0.0578      0.0578       0.000
  Pre_Saddler          OUTFALL  34.92    34.92     0  03:00       0.192       0.192       0.000
  SU1                  STORAGE 269.58   269.58     0  03:00       0.617       0.617       0.000


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 2 YEAR DESIGN STORM

****
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 LPS
SU1	0.038	2.1	0.0	0.0	0.288	15.7	0 03:31	42.39

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Post_Saddler	93.87	7.59	42.39	0.616
PostCtyRd	42.68	1.46	18.59	0.054
Pre_CtyRd	96.78	0.69	6.01	0.058
Pre_Saddler	99.97	2.23	34.92	0.192
System	83.33	11.97	93.72	0.920

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OR1	ORIFICE	42.39	0 03:31			1.00

****
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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Dec 8 16:42:24 2023
Analysis ended on: Fri Dec 8 16:42:24 2023
Total elapsed time: < 1 sec

SADDLER STREET DEVELOPMENT – SWM MODELLING – 5 YEAR DESIGN STORM

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****
Number of rain gages 5
Number of subcatchments ... 4
Number of nodes 5
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
SCS_Type_II_39.8mm_2yr	SCS_Type_II_39.8mm_2yr	INTENSITY	6 min.
SCS_Type_II_55.1mm_5yr	SCS_Type_II_55.1mm_5yr	INTENSITY	6 min.
SCS_Type_II_78.1mm_25yr	SCS_Type_II_78.1mm_25yr	INTENSITY	6 min.
SCS_Type_II_87.6mm_50yr	SCS_Type_II_87.6mm_50yr	INTENSITY	6 min.
SCS_Type_II_97.1mm_100yr	SCS_Type_II_97.1mm_100yr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	1.10	212.00	0.80	1.7000	SCS_Type_II_55.1mm_5yr	Pre_CtyRd
102	2.78	330.00	4.90	1.6000	SCS_Type_II_55.1mm_5yr	Pre_Saddler
201	0.47	212.00	12.50	2.8000	SCS_Type_II_55.1mm_5yr	PostCtyRd
202	3.41	1100.00	32.70	2.5000	SCS_Type_II_55.1mm_5yr	SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Post_Saddler	OUTFALL	0.00	0.00	0.0	
PostCtyRd	OUTFALL	0.00	0.00	0.0	
Pre_CtyRd	OUTFALL	0.00	0.00	0.0	
Pre_Saddler	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	346.75	2.75	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	Post_Saddler	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
Analysis Options
****
Flow Units ..... LPS
Process Models:

SADDLER STREET DEVELOPMENT – SWM MODELLING – 5 YEAR DESIGN STORM

```
  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 ............ 12/02/2023 00:00:00
Ending Date .............. 12/03/2023 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 ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.428        55.100
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.281        36.259
Surface Runoff ...........         0.145        18.709
Final Storage ............         0.001         0.139
Continuity Error (%) .....        -0.012


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.145         1.453
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.145         1.453
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         0.001
Continuity Error (%) .....         0.000


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


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


*********************************
Most Frequent Nonconverging Nodes
*********************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     4.50 sec
Average Time Step           :     5.00 sec
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 5 YEAR DESIGN STORM

```
  Maximum Time Step           :     5.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.00
  % of Steps Not Converging   :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :   100.00 %
      3.155 -  1.991 sec      :     0.00 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
LPS
  ---------------------------------------------------------------------------------------------------------------
  101                       55.10       0.00       0.00      45.27       0.44       9.19       9.63        0.11
14.21   0.175
  102                       55.10       0.00       0.00      42.83       2.70       9.34      12.04        0.33
56.04   0.218
  201                       55.10       0.00       0.00      36.38       6.89      11.78      18.67        0.09
32.14   0.339
  202                       55.10       0.00       0.00      27.98      18.02       9.06      27.08        0.92
404.55   0.491


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Reported
                                  Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type      Meters   Meters   Meters  days hr:min      Meters
  ------------------------------------------------------------------------------
  Post_Saddler         OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  PostCtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_CtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_Saddler          OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  SU1                  STORAGE     0.19     1.11   347.86     0  03:40        1.11


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                                Maximum  Maximum                  Lateral       Total        Flow
                                Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                 Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type       LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Saddler         OUTFALL     0.00    51.70     0  03:40           0       0.924       0.000
  PostCtyRd            OUTFALL    32.14    32.14     0  03:06      0.0879      0.0879       0.000
  Pre_CtyRd            OUTFALL    14.21    14.21     0  03:06       0.106       0.106       0.000
  Pre_Saddler          OUTFALL    56.04    56.04     0  03:00       0.335       0.335       0.000
  SU1                  STORAGE   404.55   404.55     0  03:00       0.924       0.924       0.000


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 5 YEAR DESIGN STORM

****
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 LPS
SU1	0.071	3.9	0.0	0.0	0.469	25.6	0 03:40	51.70

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Post_Saddler	96.23	11.11	51.70	0.924
PostCtyRd	43.85	2.31	32.14	0.088
Pre_CtyRd	98.56	1.25	14.21	0.106
Pre_Saddler	99.98	3.88	56.04	0.335
System	84.66	18.54	148.64	1.453

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OR1	ORIFICE	51.70	0 03:40			1.00

****
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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Jan 17 20:46:34 2024
Analysis ended on: Wed Jan 17 20:46:34 2024
Total elapsed time: < 1 sec

SADDLER STREET DEVELOPMENT – SWM MODELLING – 25 YEAR DESIGN STORM

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****
Number of rain gages 5
Number of subcatchments ... 4
Number of nodes 5
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
SCS_Type_II_39.8mm_2yr	SCS_Type_II_39.8mm_2yr	INTENSITY	6 min.
SCS_Type_II_55.1mm_5yr	SCS_Type_II_55.1mm_5yr	INTENSITY	6 min.
SCS_Type_II_78.1mm_25yr	SCS_Type_II_78.1mm_25yr	INTENSITY	6 min.
SCS_Type_II_87.6mm_50yr	SCS_Type_II_87.6mm_50yr	INTENSITY	6 min.
SCS_Type_II_97.1mm_100yr	SCS_Type_II_97.1mm_100yr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	1.10	212.00	0.80	1.7000	SCS_Type_II_78.1mm_25yr	Pre_CtyRd
102	2.78	330.00	4.90	1.6000	SCS_Type_II_78.1mm_25yr	Pre_Saddler
201	0.47	212.00	12.50	2.8000	SCS_Type_II_78.1mm_25yr	PostCtyRd
202	3.41	1100.00	32.70	2.5000	SCS_Type_II_78.1mm_25yr	SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Post_Saddler	OUTFALL	0.00	0.00	0.0	
PostCtyRd	OUTFALL	0.00	0.00	0.0	
Pre_CtyRd	OUTFALL	0.00	0.00	0.0	
Pre_Saddler	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	346.75	2.75	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	Post_Saddler	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
Analysis Options
****
Flow Units ..... LPS
Process Models:

SADDLER STREET DEVELOPMENT – SWM MODELLING – 25 YEAR DESIGN STORM

```
  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 ............ 12/02/2023 00:00:00
Ending Date .............. 12/03/2023 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 ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.606        78.100
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.366        47.163
Surface Runoff ...........         0.239        30.807
Final Storage ............         0.001         0.142
Continuity Error (%) .....        -0.014


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.239         2.394
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.239         2.393
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         0.001
Continuity Error (%) .....         0.000


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


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


*********************************
Most Frequent Nonconverging Nodes
*********************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     4.50 sec
Average Time Step           :     5.00 sec
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 25 YEAR DESIGN STORM

```
  Maximum Time Step           :     5.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.00
  % of Steps Not Converging   :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :   100.00 %
      3.155 -  1.991 sec      :     0.00 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  **************************
  Subcatchment Runoff Summary
  **************************

  ------------------------------------------------------------------------------------------------------------
----------------
                           Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
LPS
  ------------------------------------------------------------------------------------------------------------
----------------
  101                      78.10       0.00       0.00      59.65       0.62      17.63      18.25        0.20
35.77   0.234
  102                      78.10       0.00       0.00      55.89       3.83      18.14      21.97        0.61
114.36   0.281
  201                      78.10       0.00       0.00      46.88       9.76      21.41      31.17        0.15
59.66   0.399
  202                      78.10       0.00       0.00      36.06      25.55      16.46      42.01        1.43
644.76   0.538


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type      Meters   Meters   Meters  days hr:min      Meters
  ------------------------------------------------------------------------------
  Post_Saddler         OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  PostCtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_CtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_Saddler          OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  SU1                  STORAGE     0.35     1.61   348.36     0  03:51        1.61


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                               Maximum  Maximum                  Lateral       Total        Flow
                               Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type       LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Saddler         OUTFALL   0.00    63.10     0  03:51           0        1.43       0.000
  PostCtyRd            OUTFALL  59.66    59.66     0  03:06       0.147       0.147       0.000
  Pre_CtyRd            OUTFALL  35.77    35.77     0  03:06       0.201       0.201       0.000
  Pre_Saddler          OUTFALL 114.36   114.36     0  03:06       0.612       0.612       0.000
  SU1                  STORAGE 644.76   644.76     0  03:00        1.43        1.43       0.000


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 25 YEAR DESIGN STORM

****
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 LPS
SU1	0.149	8.1	0.0	0.0	0.805	43.8	0 03:51	63.10

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Post_Saddler	99.74	16.64	63.10	1.434
PostCtyRd	44.51	3.81	59.66	0.147
Pre_CtyRd	99.62	2.34	35.77	0.201
Pre_Saddler	99.98	7.08	114.36	0.612
System	85.96	29.86	265.63	2.393

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OR1	ORIFICE	63.10	0 03:51			1.00

****
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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Jan 17 20:47:25 2024
Analysis ended on: Wed Jan 17 20:47:25 2024
Total elapsed time: < 1 sec

SADDLER STREET DEVELOPMENT – SWM MODELLING – 50 YEAR DESIGN STORM

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****
Number of rain gages 5
Number of subcatchments ... 4
Number of nodes 5
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
SCS_Type_II_39.8mm_2yr	SCS_Type_II_39.8mm_2yr	INTENSITY	6 min.
SCS_Type_II_55.1mm_5yr	SCS_Type_II_55.1mm_5yr	INTENSITY	6 min.
SCS_Type_II_78.1mm_25yr	SCS_Type_II_78.1mm_25yr	INTENSITY	6 min.
SCS_Type_II_87.6mm_50yr	SCS_Type_II_87.6mm_50yr	INTENSITY	6 min.
SCS_Type_II_97.1mm_100yr	SCS_Type_II_97.1mm_100yr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	1.10	212.00	0.80	1.7000	SCS_Type_II_87.6mm_50yr	Pre_CtyRd
102	2.78	330.00	4.90	1.6000	SCS_Type_II_87.6mm_50yr	Pre_Saddler
201	0.47	212.00	12.50	2.8000	SCS_Type_II_87.6mm_50yr	PostCtyRd
202	3.41	1100.00	32.70	2.5000	SCS_Type_II_87.6mm_50yr	SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Post_Saddler	OUTFALL	0.00	0.00	0.0	
PostCtyRd	OUTFALL	0.00	0.00	0.0	
Pre_CtyRd	OUTFALL	0.00	0.00	0.0	
Pre_Saddler	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	346.75	2.75	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	Post_Saddler	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
Analysis Options
****
Flow Units ..... LPS
Process Models:

SADDLER STREET DEVELOPMENT – SWM MODELLING – 50 YEAR DESIGN STORM

```
  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 ............ 12/02/2023 00:00:00
Ending Date .............. 12/03/2023 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 ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.680        87.600
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.397        51.197
Surface Runoff ...........         0.282        36.277
Final Storage ............         0.001         0.141
Continuity Error (%) .....        -0.017


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.282         2.819
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.282         2.818
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         0.001
Continuity Error (%) .....         0.000


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


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


*********************************
Most Frequent Nonconverging Nodes
*********************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     4.50 sec
Average Time Step           :     5.00 sec
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 50 YEAR DESIGN STORM

```
  Maximum Time Step           :     5.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.00
  % of Steps Not Converging   :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :   100.00 %
      3.155 -  1.991 sec      :     0.00 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
LPS
  ---------------------------------------------------------------------------------------------------------------
  101                       87.60       0.00       0.00      65.05       0.70      21.66      22.36        0.25
48.13   0.255
  102                       87.60       0.00       0.00      60.72       4.29      22.34      26.64        0.74
146.41   0.304
  201                       87.60       0.00       0.00      50.64      10.95      25.97      36.93        0.17
72.65   0.422
  202                       87.60       0.00       0.00      39.04      28.66      19.88      48.54        1.66
756.00   0.554


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type      Meters   Meters   Meters  days hr:min      Meters
  ------------------------------------------------------------------------------
  Post_Saddler         OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  PostCtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_CtyRd            OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  Pre_Saddler          OUTFALL     0.00     0.00     0.00     0  00:00        0.00
  SU1                  STORAGE     0.42     1.82   348.57     0  03:56        1.82


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                               Maximum  Maximum                  Lateral       Total        Flow
                               Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type       LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Saddler         OUTFALL     0.00    67.15     0  03:56           0        1.66       0.000
  PostCtyRd            OUTFALL    72.65    72.65     0  03:06       0.174       0.174       0.000
  Pre_CtyRd            OUTFALL    48.13    48.13     0  03:06       0.246       0.246       0.000
  Pre_Saddler          OUTFALL   146.41   146.41     0  03:06       0.741       0.741       0.000
  SU1                  STORAGE   756.00   756.00     0  03:00        1.66        1.66       0.000


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 50 YEAR DESIGN STORM

****
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 LPS
SU1	0.192	10.5	0.0	0.0	0.961	52.4	0 03:56	67.15

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Post_Saddler	99.76	19.22	67.15	1.657
PostCtyRd	44.82	4.48	72.65	0.174
Pre_CtyRd	99.05	2.88	48.13	0.246
Pre_Saddler	99.98	8.58	146.41	0.741
System	85.90	35.17	326.44	2.818

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OR1	ORIFICE	67.15	0 03:56			1.00

****
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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Jan 17 20:48:08 2024
Analysis ended on: Wed Jan 17 20:48:08 2024
Total elapsed time: < 1 sec

SADDLER STREET DEVELOPMENT – SWM MODELLING – 100 YEAR DESIGN STORM

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

****
Element Count
****
Number of rain gages 5
Number of subcatchments ... 4
Number of nodes 5
Number of links 1
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
SCS_Type_II_39.8mm_2yr	SCS_Type_II_39.8mm_2yr	INTENSITY	6 min.
SCS_Type_II_55.1mm_5yr	SCS_Type_II_55.1mm_5yr	INTENSITY	6 min.
SCS_Type_II_78.1mm_25yr	SCS_Type_II_78.1mm_25yr	INTENSITY	6 min.
SCS_Type_II_87.6mm_50yr	SCS_Type_II_87.6mm_50yr	INTENSITY	6 min.
SCS_Type_II_97.1mm_100yr	SCS_Type_II_97.1mm_100yr	INTENSITY	6 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	1.10	212.00	0.80	1.7000	SCS_Type_II_97.1mm_100yr	Pre_CtyRd
102	2.78	330.00	4.90	1.6000	SCS_Type_II_97.1mm_100yr	Pre_Saddler
201	0.47	212.00	12.50	2.8000	SCS_Type_II_97.1mm_100yr	PostCtyRd
202	3.41	1100.00	32.70	2.5000	SCS_Type_II_97.1mm_100yr	SU1

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Post_Saddler	OUTFALL	0.00	0.00	0.0	
PostCtyRd	OUTFALL	0.00	0.00	0.0	
Pre_CtyRd	OUTFALL	0.00	0.00	0.0	
Pre_Saddler	OUTFALL	0.00	0.00	0.0	
SU1	STORAGE	346.75	2.75	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
OR1	SU1	Post_Saddler	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

****
Analysis Options
****
Flow Units ..... LPS
Process Models:

SADDLER STREET DEVELOPMENT – SWM MODELLING – 100 YEAR DESIGN STORM

```
  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 ............ 12/02/2023 00:00:00
Ending Date .............. 12/03/2023 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 ........... 0.001524 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.753        97.100
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.426        54.944
Surface Runoff ...........         0.326        42.034
Final Storage ............         0.001         0.140
Continuity Error (%) .....        -0.019


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.327         3.267
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.327         3.266
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         0.001
Continuity Error (%) .....         0.000


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


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


*********************************
Most Frequent Nonconverging Nodes
*********************************
Convergence obtained at all time steps.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     4.50 sec
Average Time Step           :     5.00 sec
```

SADDLER STREET DEVELOPMENT – SWM MODELLING – 100 YEAR DESIGN STORM

```
  Maximum Time Step           :     5.00 sec
  % of Time in Steady State   :     0.00
  Average Iterations per Step :     2.00
  % of Steps Not Converging   :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :   100.00 %
      3.155 -  1.991 sec      :     0.00 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  **************************
  Subcatchment Runoff Summary
  **************************

  ---------------------------------------------------------------------------------------------------------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
LPS
  ---------------------------------------------------------------------------------------------------------------
  101                       97.10       0.00       0.00      70.15       0.78      25.98      26.76        0.29
62.51   0.276
  102                       97.10       0.00       0.00      65.26       4.76      26.84      31.60        0.88
183.12   0.325
  201                       97.10       0.00       0.00      54.25      12.14      30.68      42.82        0.20
86.37   0.441
  202                       97.10       0.00       0.00      41.73      31.76      23.60      55.36        1.89
873.54   0.570


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type     Meters   Meters   Meters  days hr:min      Meters
  ------------------------------------------------------------------------------
  Post_Saddler         OUTFALL    0.00     0.00     0.00     0  00:00        0.00
  PostCtyRd            OUTFALL    0.00     0.00     0.00     0  00:00        0.00
  Pre_CtyRd            OUTFALL    0.00     0.00     0.00     0  00:00        0.00
  Pre_Saddler          OUTFALL    0.00     0.00     0.00     0  00:00        0.00
  SU1                  STORAGE    0.50     2.02   348.77     0  04:01        2.02


  ******************
  Node Inflow Summary
  ******************

  -------------------------------------------------------------------------------------------------
                               Maximum  Maximum                  Lateral       Total        Flow
                               Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                Inflow   Inflow   Occurrence      Volume      Volume       Error
  Node                 Type       LPS      LPS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  Post_Saddler         OUTFALL    0.00    70.91     0  04:01           0        1.89       0.000
  PostCtyRd            OUTFALL   86.37    86.37     0  03:06       0.202       0.202       0.000
  Pre_CtyRd            OUTFALL   62.51    62.51     0  03:06       0.295       0.295       0.000
  Pre_Saddler          OUTFALL  183.12   183.12     0  03:06        0.88        0.88       0.000
  SU1                  STORAGE  873.54   873.54     0  03:00        1.89        1.89       0.000


  **********************
  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 LPS
SU1	0.241	13.1	0.0	0.0	1.127	61.4	0 04:01	70.91

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Post_Saddler	99.77	21.92	70.91	1.890
PostCtyRd	44.68	5.22	86.37	0.202
Pre_CtyRd	98.04	3.48	62.51	0.295
Pre_Saddler	99.98	10.18	183.12	0.880
System	85.62	40.80	394.48	3.266

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OR1	ORIFICE	70.91	0 04:01			1.00

****
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

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Jan 17 20:49:17 2024
Analysis ended on: Wed Jan 17 20:49:18 2024
Total elapsed time: 00:00:01

Appendix C

BACKGROUND INFORMATION
PRE-CONSULTATION MEETING NOTES

TREMBLE PROPERTIES

PRE-CONSULTATION MEETING MINUTES

Project Nos. 6001, 1855, 6006

Date:	Wednesday, August 17, 2022	
Time:	10:00 a.m.	
Place:	Durham Arena	
Attendees:	Ms. Lorelie Spencer	Municipality of West Grey
	Mr. Scott Taylor	County of Grey
	Mr. Michael Cook	SVCA
	Mr. Jason Tremble	Proponent
	Mr. Donald Tremble	Proponent
	Mr. Travis Burnside	Cobide Engineering
	Ms. Dana Kieffer	Cobide Engineering

Item

1. **221/ 229 Bruce St. S. Re-Development**

Proposal:

A consent to create one residential lot, fronting onto Saddler St., 1 fourplex, fronting onto Bruce St. and 4 Consents to make the units freehold. A 40-unit apartment on the retained.

Applications needed:

- Consent for Saddler St. lot
- Rezone to R1
  - Minimum size reduction
- 4 consents for Bruce St. fourplex
- Rezone property to R3 to permit townhouses and apartment
  - Several site-specific permissions for the townhouses including: minimum lot size, maximum coverage, interior side yard
  - Potential site-specific amendment for height of the apartment building

Deliverables:

Required Information	*Details*	*Action*
Feasibility Study	Need elevation study, a maximum permitted depth	Cobide, to be included in

	of 0.8 m for regional storm on Bruce St. to ensure safe access	submission
Record of Site Condition	Former contractors' yard, a phase 1 & 2 ESA has been completed, the consultant will register a RSC	Proponent/ Cobide, details to be included in submission
Functional Servicing Report	Municipality would like to see projected flows for sewage to ensure capacity	West Grey/ Cobide, discussion prior to submission
Stormwater Management	Cobide requesting clearance from SVCA that the property not have quantity control due to the direct outlet to the Saugeen River, but still propose to control quality	Cobide to follow up with E. Downing, SVCA
Planning Justification Report	Required	Cobide, to be included in submission
Holding Removal	Property has a H-Holding for a feasibility study for residential development	West Grey/ Cobide

Other Notes:

- S. Taylor confirmed a condo exemption following a zoning by-law amendment would be acceptable.
- S. Taylor recommended engaging Saugeen Ojibway Nation
- L. Spencer mentioned that a turning radius for emergency services should be shown on the drawings at the time of Site Plan Approval.

2. Part Park Lot 5, Plan 505, Park St. Development

Proposal:

TREMBLE PROPERTIES

PRE-CONSULTATION MEETING MINUTES

Project Nos. 6001, 1855, 6006

Local Official Plan Amendment and Zoning By-law Amendment to permit a 59 unit apartment, 1 fourplex and 1 fiveplex (to be freehold)

419 Park: fiveplex, freehold

Applications needed:

- Local Official Plan Amendment from FD to Residential.
- Zoning By-law Amendment from FD to R3
  - Reductions for lot size and interior side yards, increase in coverage for proposed townhouses
- 5 Consents for 419 Park St.
- 9 Consents to create freehold townhouses located on adjacent parcel
- Rezone retained property to R3-H
  - Apartment building is conceptual at this time as more land in the area may be acquired.
  - Sewage allocation will need to be confirmed based on unit counts

Deliverables:

Required Information	*Details*	*Action*
Dry-Flood Proofing	Units 1-5 may need to be dry-flood proofed at time of construction depending on design.	Proponent, to decide on building design at time of construction and obtain SVCA permit as needed
Landfill	The property is 393 m from the landfill.	West Grey to provide details on landfill study Cobide to potentially confirm suitability of site for residential development based on information
Functional Servicing Report	Municipality would like to see projected flows for sewage to ensure capacity	West Grey/ Cobide, discussion prior to submission
Stormwater Management	Required	Cobide, to be included in

		submission
Planning Justification	Include notes on compatibility between the townhouses and the retained. Potential fencing required. Address servicing	Cobide, to be included in submission

Other Notes:

- M. Cook confirmed an EIS was not required
- M. Cook confirmed safe access
- L. Spencer confirmed two fees will be required since they're two different properties.

3. Lambton/ Saddler St. Development

Proposal:

Plan of Subdivision to create 28 freehold townhouse units. Plan will include a Condominium block with 30 smaller home units on a private road.

Applications needed:

- Draft Plan of Subdivision
- Rezone to R3
  - Minimum size lot reduction
  - Minimum building size reduction for condo block
  - Potential lot coverage reduction
- Plan of Condominium Exemption

Deliverables:

Required Information	*Details*	*Action*
Grey County Highways exemption	Proposed new entrance onto Lambton St. (County Road 4) is within 400m of Rock St.	Grey County, to confirm this acceptable Grey County to confirm if road widening required

Traffic Study	More than 50 units requires	Cobide, to be included in submission
EIS	Completed	Cobide, to be included in submission
Archeological study	Completed	Cobide, to be included in submission
Functional Servicing Report	Municipality would like to see projected flows for sewage to ensure capacity	West Grey/ Cobide, discussion prior to submission
Stormwater Management	Required	Cobide, to be included in submission
Planning Justification Report	To address compatibility between development and adjacent gravel pit	Cobide, to be included in submission
WHPA Clearance	Property is within a WHPA, clearance needed	Cobide, to be included in submission

Other Notes:

Appendix D

DESIGN DETAILS
OIL GRIT SEPARATOR (OGS)

Hydro First Defense® - HC

Hydro International

Rev. 9.6

Project Name:	**Saddler Street**	*Report Date:*	Paste
Street:	**Saddler Street**	*City:*	**Durham**
Province:	**ON**	*Country:*	**Canada**
Designer:	**Travis Burnside**	*email:*	

Teatment Parameters:

Structure ID:	OGS	
TSS Goal:	80	% Removal
TSS Particle Size:	Fine	
Area:	3.4	ha
Percent Impervious:	33%	
Rational C value:	0.66	Calc. Cn
Rainfall Station:	Owen Sound	MAP
Peak Storm Flow:	158	L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	74.2%	88.1%
FD-4HC	78.2%	95.9%
FD-5HC	**81.9%**	**98.3%**
FD-6HC	84.3%	98.9%
FD-8HC	88.4%	98.9%

Model Specification:

Model:	**FD-5HC**	
Diameter:	1500	mm
Peak Flow Capacity:	566.00	L/s
Sediment Storage:	0.84	m^3
Oil Storage:	1136.00	L

Installation Configuration:

Placement:	Online		
Outlet Pipe Size:	375	mm	*OK*
Inlet Pipe 1 Size:	375	mm	*OK*
Inlet Pipe 2 Size:		mm	*OK*
Inlet Pipe 3 Size:		mm	*OK*
Rim Level:	350.420	m	Calc Invs.
Outlet Pipe Invert:	348.220	m	*OK*
Invert Pipe 1:	348.260	m	*OK*
Invert Pipe 2:		m	
Invert Pipe 3:		m	

Net Annual Removal Model: FD-5HC

Intensity[1]	Fraction of Rainfall[1]	FD-5HC Removal Efficiency[2]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	10.1%	98.0%	9.9%
1.00	10.7%	91.9%	9.8%
1.50	10.0%	88.5%	8.8%
2.00	8.4%	86.1%	7.2%
2.50	6.6%	84.3%	5.6%
3.00	6.2%	82.9%	5.1%
3.60	4.1%	81.5%	3.3%
4.10	4.2%	80.6%	3.4%
4.60	3.7%	79.7%	2.9%
5.10	3.8%	78.9%	3.0%
6.40	6.4%	77.3%	4.9%
7.60	4.6%	76.1%	3.5%
8.90	3.3%	75.0%	2.5%
10.20	2.4%	74.0%	1.8%
11.40	2.6%	73.2%	1.9%
12.70	1.5%	72.5%	1.1%
15.20	2.1%	71.3%	1.5%
19.10	2.3%	69.8%	1.6%
25.40	3.9%	68.0%	2.7%
38.10	1.4%	65.5%	0.9%
50.80	0.6%	63.7%	0.4%
Total Net Annual Removal Efficiency:			**81.9%**
Total Annual Runoff Volume Treated:			**98.3%**

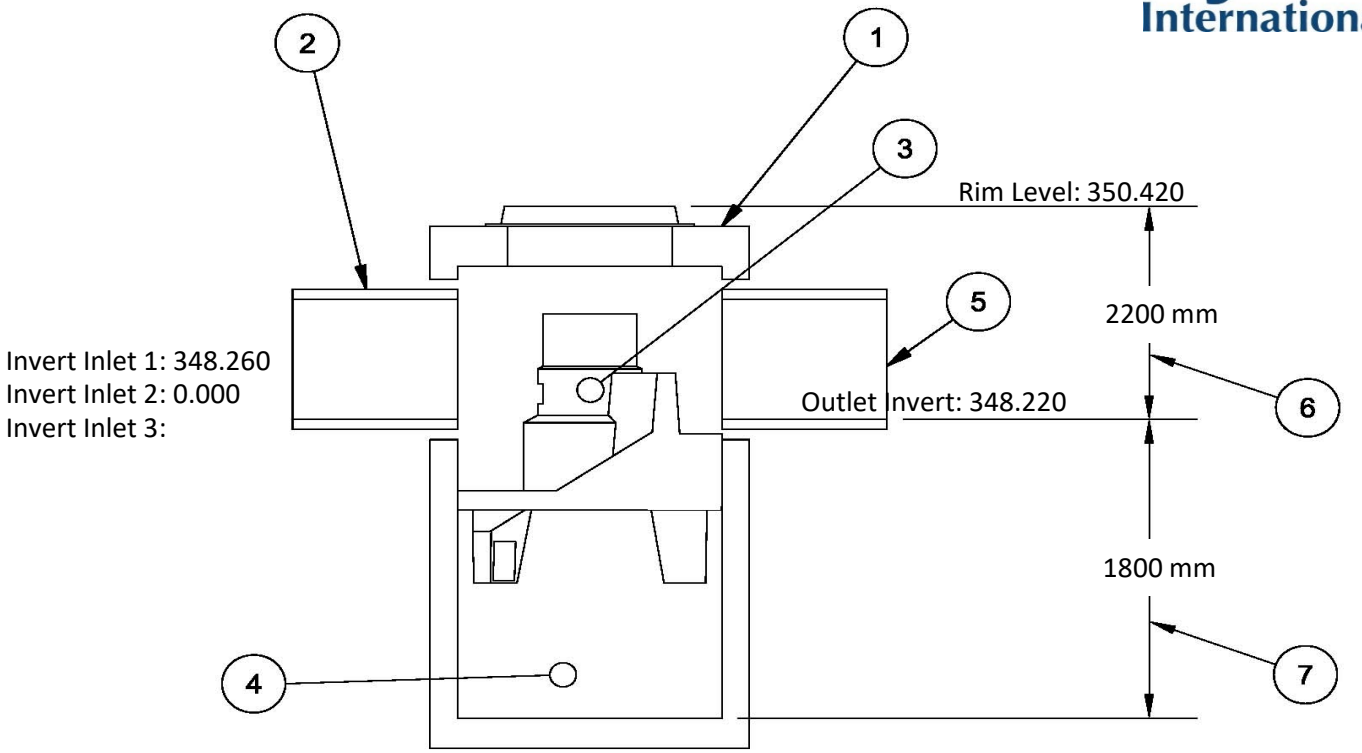
1. Rainfall data based on 37 years of rainfall data for Canada Station Owen Sound, Owen Sound, Ontario, Canada.

2. Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Designer Notes:

Hydro First Defense® - HC



All drawing elevations are metres.

FD-5HC Specification

1	Vortex Chamber Diameter	1500	mm
2	Inlet Pipe Diameter	375	mm
3	Oil Storage Capacity	1136.00	L
4	Min. Provided Sediment Storage Capacity	0.84	m^3
5	Outlet Pipe Diameter	375	mm
6	Height(Final Grade to Outlet Invert)	2200	mm
7	Sump Depth(Outlet Invert to Sump)	1800	mm
	Total Depth	**4000**	**mm**

Notes: