

SUNVALE HOMES

STORMWATER MANAGEMENT REPORT

MOUNT FOREST SUBDIVISION

TOWNSHIP OF WELLINGTON NORTH

SEPTEMBER 2020

COBIDE Engineering Inc
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1. INTRODUCTION

Cobide Engineering Inc. was retained by Sunvale Homes 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 141 unit subdivision.

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

1.1 LOCATION

The proposed subdivision development is located Part of Park Lots 10,11 &12 south of Princess Street, Plan Town of Mount Forest & Part of Park Lots I, J, K & L MacDonald's Survey & Part 2 of Division 1 of Lot 2 Concession WSOR (Arthur), Town of Mount Forest, Township of Wellington North, County of Wellington (described herein as the "site"). A Site Location Map is included as Figure 1. The subject property is approximately 9.793 hectares in area.

1.2 DEVELOPMENT PROPOSAL

The proposed development consists of 9.793 hectares of land within the Mount Forest settlement area.

The proposed plan is to develop the site into a residential subdivision. The subdivision will involve the creation of a number of new streets. The development will consist of the following:

- 58 Single Family Lots (Lots 1-44 & 111-124)
- 30 Semi-Detached Lots (Lots 45-60 & 97-110)
- 36 Street Townhouse Lots (Lots 61-96)
- One (1) Cluster Townhouse Block (Block 125)
- One (1) Open Space Blocks for stormwater conveyance as well as a Sewage Pumping Station
- One (1) Walkway Block

The road network within the subdivision will include the construction of Streets A-E. Streets C & E will connect to Cork Street.

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 for erosion protection and sedimentation control for short term, construction phase and the long term.
- Quantity Control
- Quality Control
- Establish lot grading requirements for the proposed subdivision
- Provisions for major flows through the development

1.4 BACKGROUND INFORMATION

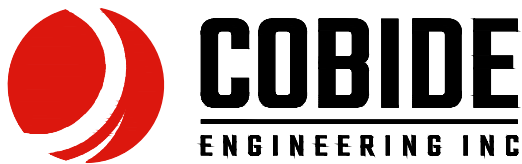
In support of this application, the following information was prepared:

Stormwater Management Report
Sunvale Homes Subdivision

- Pre-consultation with the County of Wellington, Township of Wellington North and Saugeen Valley Conservation Authority (SVCA) which will be discussed later in the report. A copy of the correspondence from the pre consultation meeting has been included in Appendix B.



MAP SOURCE - MTO ROAD MAP



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Client/Project
 SUNVALE HOMES - MOUNT FOREST SUBDIVISION
 FORMER TOWN OF MOUNT FOREST
 Township of Wellington North, Ontario
 STORMWATER MANAGEMENT REPORT

Figure No.

1

Title

REGIONAL LOCATION MAP

2. DRAINAGE CHARACTERISTICS

2.1 REGIONAL

The site is located north of the South Saugeen River; however no part of the subdivision abuts the river.

2.2 LOCAL

On the east side of the property, there is a drainage corridor that conveys runoff from the site and Cork Street and the surrounding streets to the South Saugeen River.

There is also an unnamed watercourse to the west of the site that a portion of the runoff from this site would reach to be conveyed to the South Saugeen River. This unnamed watercourse conveys runoff from a significant area upstream of the development site. Based on aerial photos and site inspections, this watercourse is enclosed for a significant distance downstream of the proposed development before it opens back into an open channel before reaching the South Saugeen River.

2.3 SOILS

According to the Wellington County Soils Survey (1963), the soils on the site are classified as Listowel Silt Loam (LiS). Listowel Silt Loams are a glacial till derived from soft yellowish brown limestones with imperfect drainage. These soils are typically associated with the Hydrologic Soils Group (HSG) BC.

2.4 DISCHARGE POINTS

For the purposes of the report, Discharge Point #1 is any runoff that discharges the South Saugeen River to the south.

Discharge Point #2 is any runoff the discharges to the neighbouring property to the west to the unnamed watercourse.

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 the review is the Ministry of the Environment's "Stormwater Management Planning and Design (SWMP&D) Manual," dated March 2003.

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 also 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 is 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 Township of Wellington North, MECP and Saugeen Valley Conservation Authority (SVCA).
- iv. Summarize the analysis by identifying conclusions and recommendations.

4. EXISTING CONDITIONS

The site was previously used for agricultural purposes.

The existing catchments areas are delineated in Drawing SWM1 in Appendix A.

Summarized below is a description of each of the drainage catchment areas.

4.1 CATCHMENT AREA 101

- This catchment area encompasses the southeast corner of the development.
- Surface water flows by sheet flow to the drainage course on the development site and to the South Saugeen River.
- Catchment Area 101 is considered to discharge at Discharge Point #1 for the purposes of this report.
- Drainage Area = 2.85 ha.

4.2 CATCHMENT AREA 102

- This catchment area encompasses the northerly portion of the development site.
- Surface water flows by sheet flow to the unnamed watercourse to the west side of the site.
- Catchment Area 102 is considered to discharge at Discharge Point #2 for the purposes of this report.
- Drainage Area = 6.92 ha.

5. PROPOSED CONDITIONS

The proposed catchment area boundaries are delineated on Drawing SWM2 in Appendix A.

Summarized below is a description of each of the drainage catchment areas.

5.1 CATCHMENT 201

- This catchment area encompasses the majority of the property.
- Minor flows will be captured by the storm sewers and major flows will flow overland both discharging to the south Saugeen River. Major flows will be collected downstream of the proposed roads and conveyed via a storm sewer sized for the 100 year storm event.
- Catchment Area 201 is considered to discharge at Discharge Point #1 for the purposes of this report.
- Drainage Area = 7.32 ha.

5.2 CATCHMENT 202

- This catchment area encompasses the southeast corner of the development.
- Minor flows within the proposed townhouses will be captured by the storm sewers and major flows from the entire catchment will flow overland both discharging to the South Saugeen River via the existing storm sewers or the existing drainage course.
- Catchment Area 202 is considered to discharge at Discharge Point #1 for the purposes of this report.
- Drainage Area = 1.66 ha.

5.3 CATCHMENT 203

- This catchment area encompasses the rear yards along the west and north sides of the site.
- Minor flows and major flows will flow overland both discharging towards the unnamed water course to the west of the site.
- Catchment Area 203 is considered to discharge at Discharge Point #2 for the purposes of this report.
- Drainage Area = 0.79 ha.

6. QUANTITY CONTROL MODELLING

The hydrologic modelling software PCSWMM Version 5.6.1803 Professional 2D was used to determine the pre and post-development peak flows of the 2 yr., 5 yr., 25 yr., 50 yr., and 100 yr. storm events (6 hour duration, SCS Type II, AMC II storm, Mount Forest IDF Parameters). Based on the pre-consultation meeting minutes, previously discussed, it was indicated that all post development flows must match pre-development levels to the neighbouring property to the west. Based on a proposed direct outlet to the South Saugeen River, post development flows do not have to meet predevelopment levels for this outlet. A copy of this correspondence has been included in Appendix B. The IDF Parameters used have been included as Appendix C.

The pre-development and post development parameters and model outputs are contained in Appendix D and E respectively.

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 the majority of the development will be conveyed 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 each street.

As noted previously, a direct outlet to the South Saugeen River will be provided for this development. To ensure the direct outlet does not cause erosion concerns along the outlet route, the storm sewer from the development to the outlet will be sized to convey the 100 year design storm event.

An inlet pond is proposed to collect the major flow and provide an inlet into the oversized storm sewer. Preliminary grading of this pond is shown on the proposed grading plan included in Appendix A.

6.2 PEAK FLOW MODELLING RESULTS

The following summarizes the pre-development and post development peak flows to the two (2) discharge points.

Table 6.1 - Peak Flow Summary

RETURN PERIOD	DISCHARGE POINT #1 (l/s)		DISCHARGE POINT #2 (l/s)	
	PRE	POST	PRE	POST
	2 Year	21	465	29
5 Year	38	625	50	42
25 Year	73	833	91	63
50 Year	92	995	111	72
100 Year	113	1,107	134	82

The following summarizes the pre-development and post development results at each discharge point:

6.2.1 DISCHARGE POINT #1

All storm events in the post development scenario are above pre-development levels however since a direct outlet is being provided to the South Saugeen River that is fully contained within the storm sewer there is no erosion or flooding risk between the development and the South Saugeen River.

6.2.2 DISCHARGE POINT #2

All storm events in the post development scenario are less than or equal to pre-development levels.

6.3 TOTAL VOLUME MODELLING RESULTS

The following summarizes the pre-development and post development total volume discharged for Discharge Point #2 where it is not a direct outlet to a watercourse.

Table 6.2 – Total Volume Summary

RETURN PERIOD	DISCHARGE POINT #2 (m ³)	
	PRE	POST
2 Year	495	155
5 Year	808	213
25 Year	1,390	307
50 Year	1,660	348
100 Year	1,940	389

As seen in the Table above, the total volume of runoff on the west side is less than pre-development levels for all storm events. This runoff will be spread out along the length of the property on the west side and will not be concentrated in a single location. Based on the above modelling results and the reduction in both peak flow and volume to the western property boundary, we do not foresee any issues at Discharge Point #2.

7. QUALITY CONTROL

To meet the requirements of the SVCA and the MECP, stormwater quality control will be provided for the proposed development. The MOE SWMP&D Manual recommends 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 South Saugeen River. For the purposes of this report, an 'Enhanced' water quality protection level will be implemented in accordance to the MOE 2003 Guidelines and SVCA requirements.

In keeping with the approach suggested in the SWMP&D manual however, 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 it's suitability for use in the development is discussed below:

7.1 LOT LEVEL CONTROL MEASURES

The Township's design standards require minimum grades of 2% from the back of curb to the property line. Therefore, reduced lot grading of the front, side and rear yards to less than 2% is not feasible.

The subdivision property contains native soils that exhibit average drainage characteristics. The use of individual drainage pits and infiltration trenches therefore has not been considered as a feasible option. There are also concerns that based on the ongoing maintenance typically is not being completed that the long term viability of this option is not realistic.

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.

7.2 CONVEYANCE CONTROL MEASURES

The Township'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 use of an Oil Grit Separator (OGS) was selected as an 'end of pipe' control measure. The basic function of an OGS is to remove pollutants from runoff. An OGS was selected to maximize the developable area.

The OGS will be designed during the detailed design stages in conformance with the MOE design guidelines to achieve an "Enhanced" Level of protection.

The OGS will be placed upstream of the major storm inlet basin but close to the proposed road for ease of maintenance.

The OGS has been designed in conformance with the MECP design guidelines to achieve an "Enhanced" Level of protection. The OGS will be a FD-8HC from Hydro International as supplied by Armtec or approved equivalent.

The OGS sizing is included in Appendix E. The OGS area is slightly less than Catchment 201 as the OGS is sized based on what is being conveyed via the storm sewers within the roads and Catchment 201 includes Block 126 that will flow overland to the inlet basin.

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 straw 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 straw bale 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.

A detailed Erosion and Sedimentation Control plan including drawings will be completed during detailed design.

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 storm sewer system or the existing drainage ditches. The siltation barriers can be in 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 responsibility for the individual sediment control is the landowner constructing the dwelling.

9. CONCLUSIONS & RECOMMENDATIONS

The above report presented the Preliminary Stormwater Management Plan in support of the Draft Plan of Subdivision Application. Based on the findings of this report, the following conclusions are made:

1. Stormwater quantity control is not required as the runoff to the South Saugeen River is outletting at the river and therefore poses no risk to lands between the river and the development and post development runoff to the unnamed watercourse to the west is less than or equal to pre development peak flows and total volume.
2. 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 an OGS. The OGS alone is capable of providing an enhanced level of quality control and therefore the Lot Level and Conveyance controls are over and above treatments.

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 subdivision be submitted to the County of Wellington, SVCA, and Township of Wellington North as part of the Draft Plan Approval Application.

Sincerely,

Cobide Engineering Inc.



Travis Burnside, P. Eng.



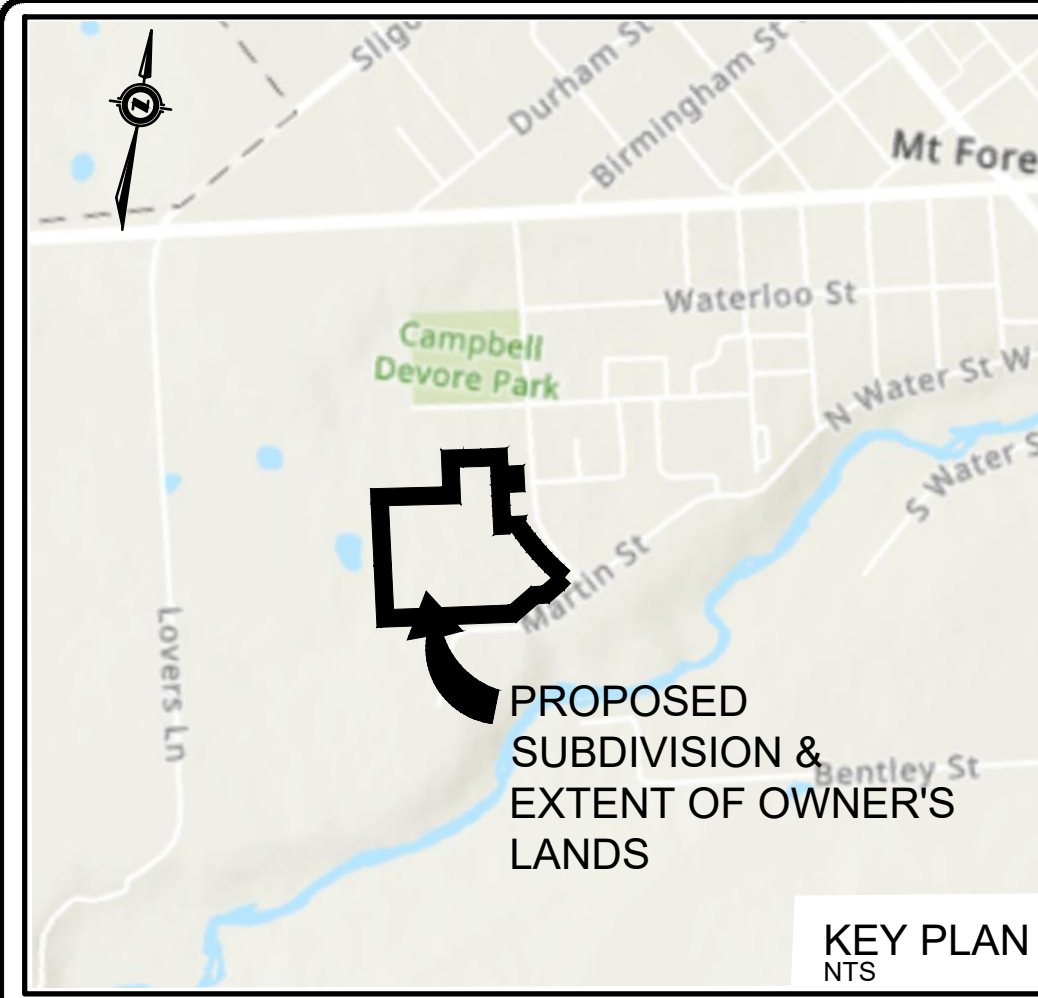
Appendix A

DRAWINGS

STORMWATER MANAGEMENT REPORT

SUNVALE HOMES MOUNT FOREST SUBDIVISION

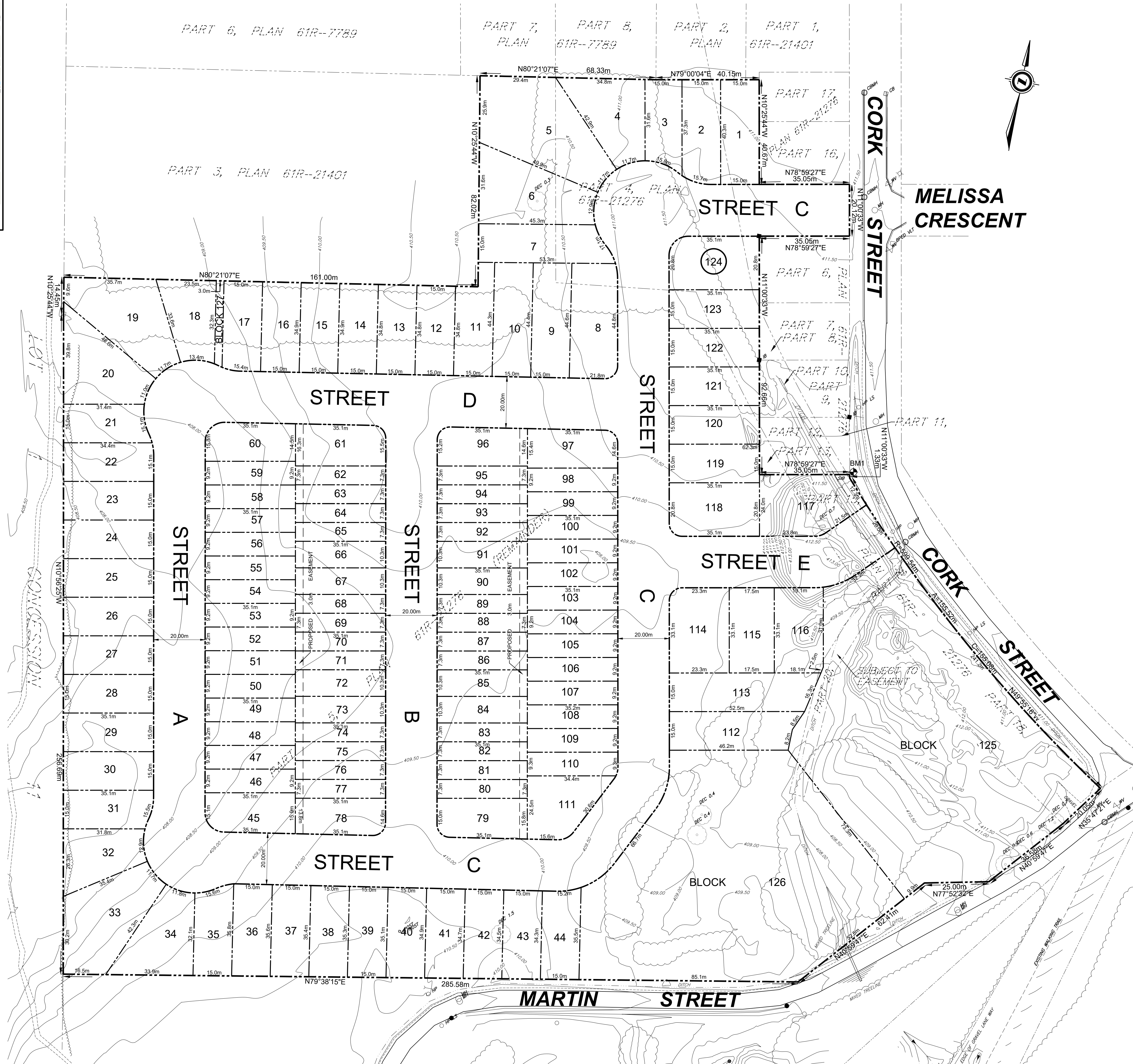
TOWNSHIP OF WELLINGTON NORTH



KEY PLAN
NTS

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 DITCH
	EXISTING MANHOLE
	EXISTING CATCH BASIN
	EXISTING HYDRO GUY WIRE
	EXISTING HYDRO POLE
	EXISTING TELEPHONE PEDESTAL
	STANDARD IRON BAR
	IRON BAR
	EXISTING DECIDUOUS TREE AND DIAMETER
	EXISTING CONIFEROUS TREE AND DIAMETER
	EXISTING CONTOUR



DRAFT PLAN OF SUBDIVISION
 PART OF PARK LOTS 10, 11 & 12
 SOUTH OF PRINCESS STREET
 PART TOWN OF MOUNT FOREST &
 PART OF PARK LOTS 'I', 'K' & 'L'
 MACDONALD'S SURVEY &
 PART OF DIVISION 1 OF
 LOT 2 CON WOSR (ARTHUR)
 (TOWN OF MOUNT FOREST)
 TOWNSHIP OF WELLINGTON NORTH
 COUNTY OF WELLINGTON

RELEVANT SITE INFORMATION

DETACHED RESIDENTIAL LOTS (LOTS 1 TO 44 INCL AND 111-124 INCL.)	3,653 ha.
SEMI-DETACHED RESIDENTIAL LOTS (LOTS 45 TO 60 INCL. & 97 TO 110 INCL.)	1,028 ha.
MULTI-FAMILY RESIDENTIAL LOTS (LOTS 61 TO 96 INCL. & BLOCK 125)	2,011 ha.
MUNICIPAL STREET (STREETS A TO E)	2,286 ha.
OPEN SPACE (BLOCK 126)	0,805 ha.
WALKWAY (BLOCK 127)	0,010 ha.
TOTAL PROPOSED SUBDIVISION	9,793 ha.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51 OF THE PLANNING ACT

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

DATE _____
 XX
 ONTARIO LAND SURVEYOR
 VAN HARTEN SURVEYING INC.
 660 RIDDELL ROAD, UNIT 1
 ORANGEVILLE, ON L9W5G5

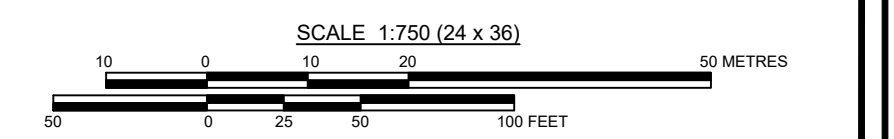
OWNER'S CERTIFICATE
 I, THE REGISTERED OWNER OF THESE LANDS, HEREBY
 AUTHORIZE COBIDE ENGINEERING INC. TO SUBMIT
 THIS DRAFT PLAN FOR APPROVAL.

DATE _____
 OWNER:
 SUNVALE HOMES
 685 RIDDELL ROAD, UNIT 6
 ORANGEVILLE, ON
 L9W 5J7



- Notes**
1. TOPOGRAPHICAL INFORMATION DERIVED FROM TOPOGRAPHICAL SURVEY BY TRITON ENGINEERING LTD. AND FIELD SURVEY BY COBIDE ENGINEERING INC. 2016.
 2. PROPERTY BOUNDARY DERIVED FROM INFORMATION SHOWN ON PLAN 61R-21276 AND 61R-21401.

Benchmark Information
 BM1
 TOP OF SIB LOCATED ON THE WEST SIDE OF CORK STREET AT THE
 SOUTHEAST CORNER OF PART 12 PLAN 61R-21276.
 ELEVATION 410.86m



0	SEP 1/20	PRELIMINARY SUBMISSION	TLB	TLB
No.	DATE	DESCRIPTION	BY	APPD
REVISION / ISSUE				

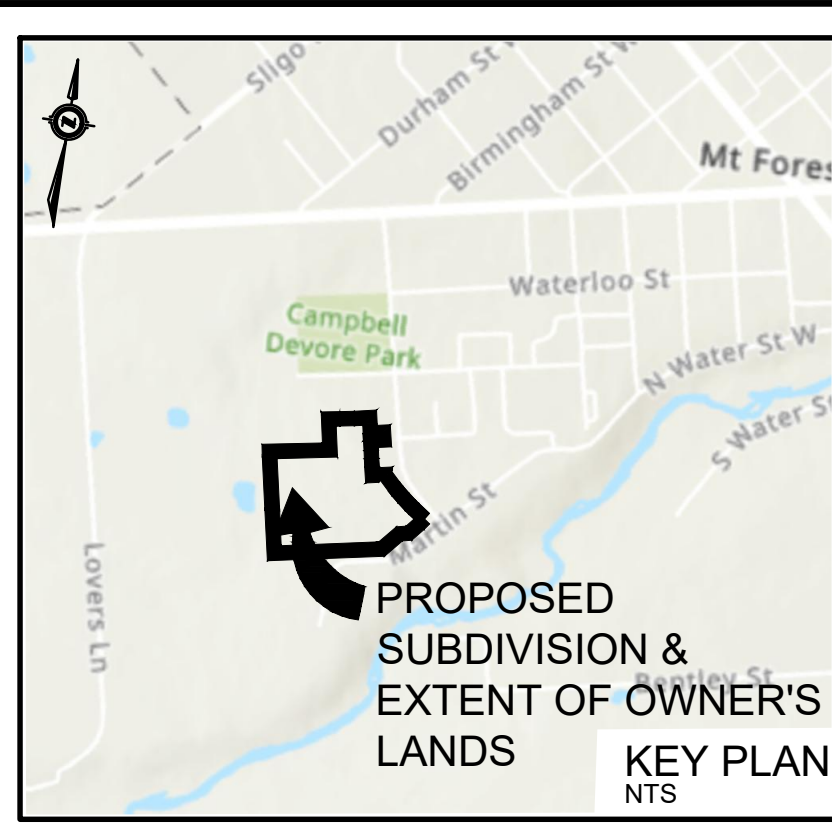
517 10th STREET, UNIT A, Hanover, Ontario N4N 1R4
 Telephone: (519) 506-5959
 www.cobideeng.com

Client: **SUNVALE HOMES INC.**

Design: TLB	Scale: 1:750
Drawn: JAF	Approved:
Checked: SJC	
Date: AUG 2020	Design Engineer

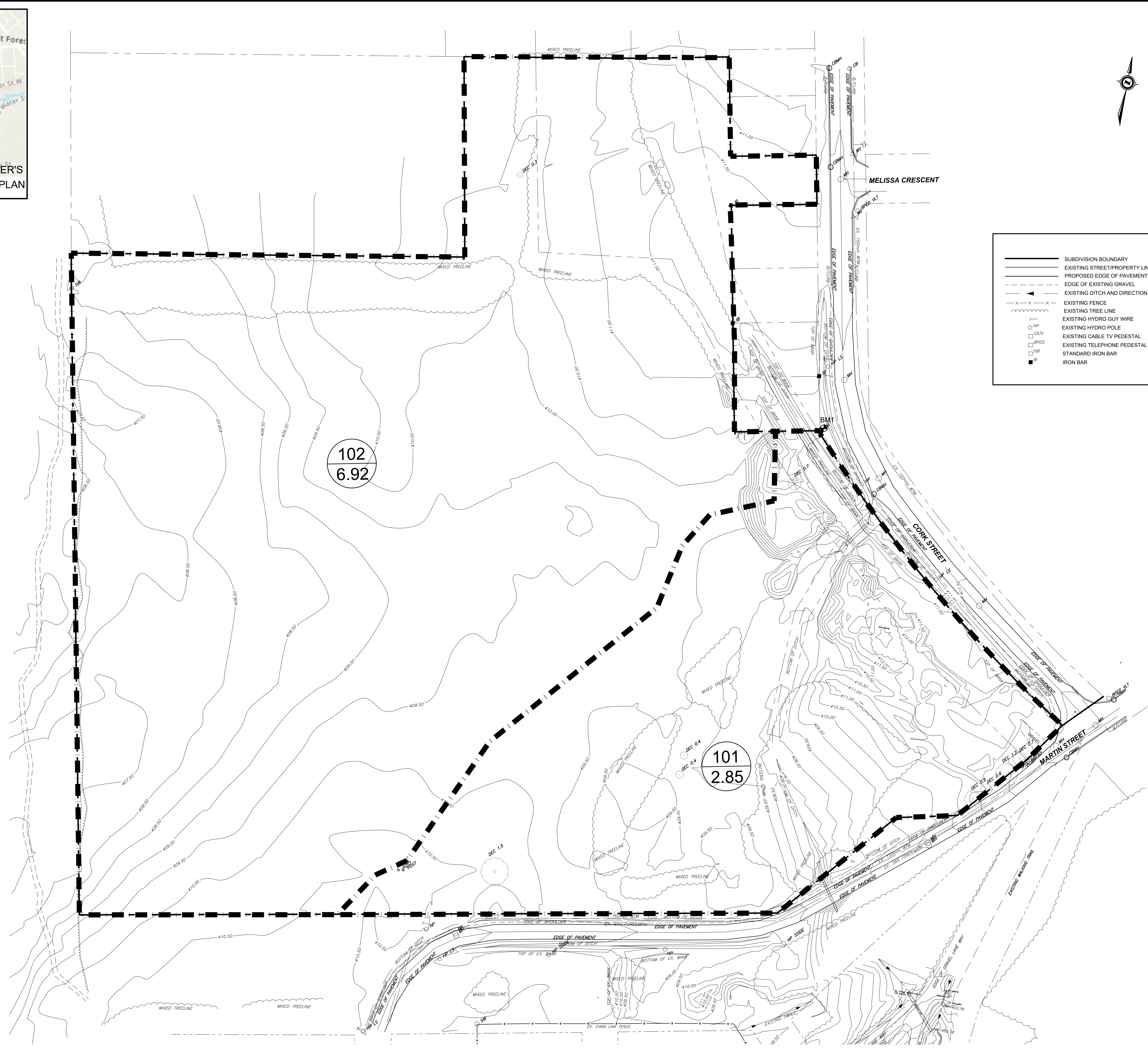
DRAWING No. 00702-DP1

H:\Sunvale Homes\00702 Sunvale Homes Mount Forest Subdivision Drawings\Submissions\Draft Plans\2020-08-10 First Submission\00702 DP Aug 10-20.dwg Sep 01, 2020 - 8:26am



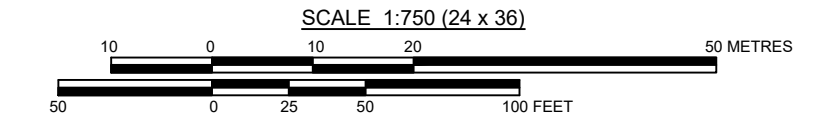
CAUTION:
THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE DRAWINGS, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR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

- Notes**
1. TOPOGRAPHIC INFORMATION DERIVED FROM FIELD SURVEY BY TRITON ENGINEERING COMPLETED IN 2018.
 2. LOT FABRIC DERIVED FROM PLAN 61R-21276 PREPARED BY WILSON FORD SURVEYING ON FEBRUARY 14, 2018.



LEGEND

	SUBDIVISION BOUNDARY		EXISTING DECIDUOUS TREE AND DIAMETER
	EXISTING STREET/PROPERTY LINES		EXISTING CONIFEROUS TREE AND DIAMETER
	PROPOSED EDGE OF PAVEMENT		BENCHMARK
	EDGE OF EXISTING GRAVEL		REMOVAL
	EXISTING DITCH AND DIRECTION OF FLOW		PROPOSED ELEVATION
	EXISTING FENCE		EXISTING ELEVATION
	EXISTING TREE LINE		EXISTING CONTOUR
	EXISTING HYDRO GUY WIRE		CATCHMENT AREA ID
	EXISTING HYDRO POLE		CATCHMENT AREA IN HECTARES
	EXISTING CABLE TV PEDESTAL		STORM DRAINAGE AREA BOUNDARY
	EXISTING TELEPHONE PEDESTAL		
	STANDARD IRON BAR		
	IRON BAR		



Benchmark Information

BM1 TOP OF SIB LOCATED ON THE WEST SIDE OF CORK STREET AT THE SOUTHEAST CORNER OF PART 12 PLAN 61R-21276. ELEVATION 410.86m

No.	DATE	DESCRIPTION	BY	APPD
0	SEPT 16/20	DRAFT PLAN APPROVAL SUBMISSION	TLB	TLB
REVISION / ISSUE				

Seal not valid unless signed and dated

517 10th STREET Hanover, Ontario N4N 1R4
Telephone: (519) 506-9959
www.cobideeng.com

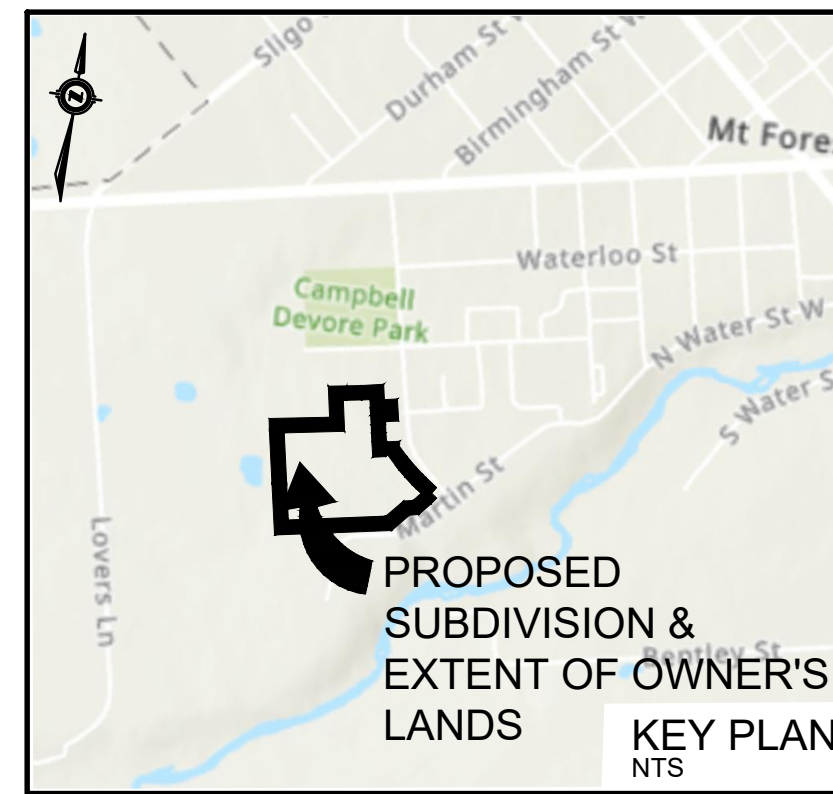
Title: **SUNVALE HOMES**
PROPOSED MOUNT FOREST SUBDIVISION
Township of Wellington North
PRE DEVELOPMENT CATCHMENT AREAS

Client: **SUNVALE HOMES**

Design: TLB	Scale: 1:750
Drawn: TLB	Approved:
Checked: TLB	
Date: JAN 2019	Design Engineer

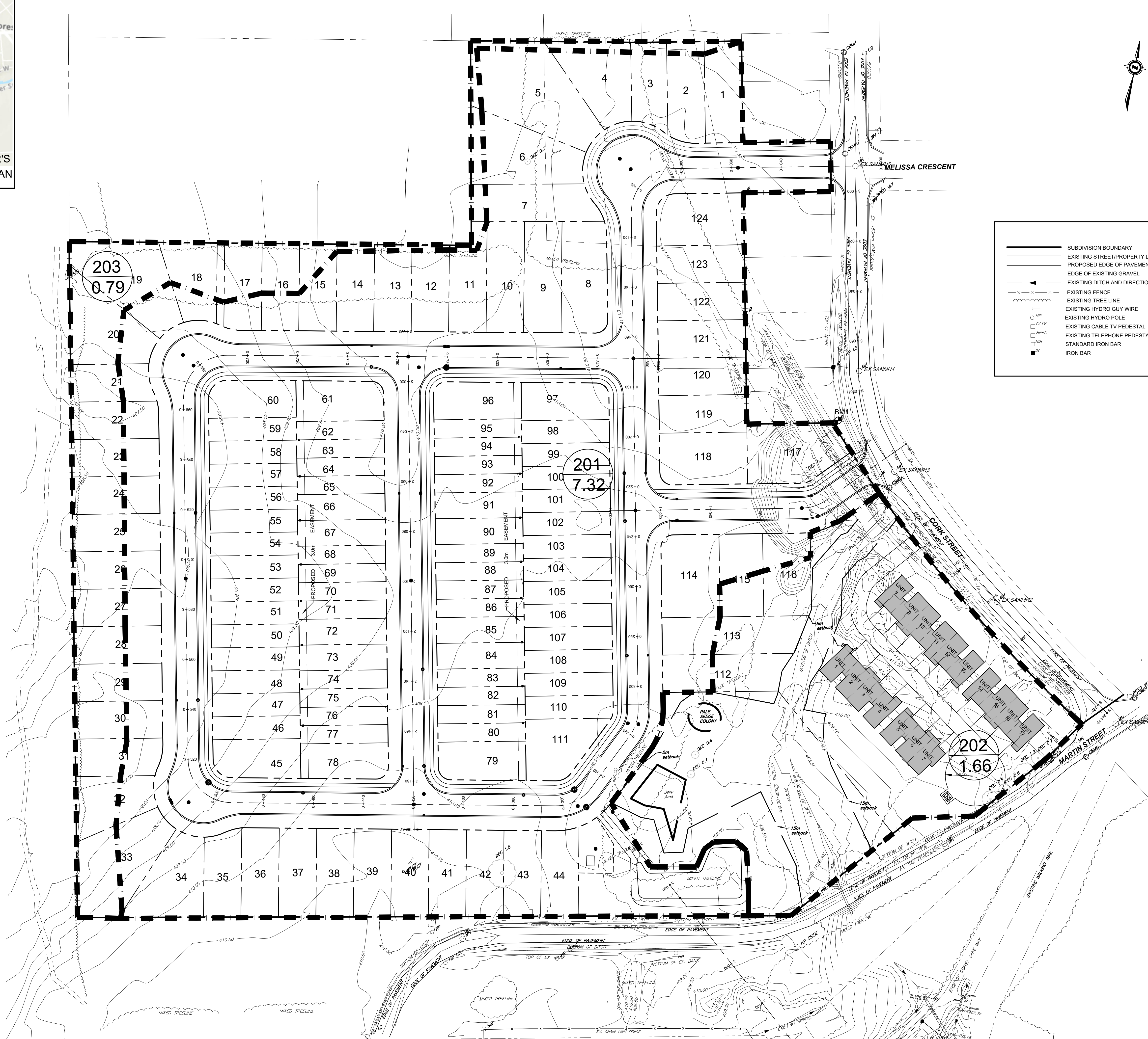
DRAWING No. 00702-SWM1

H:\Sunvale Homes\00702 Sunvale Homes Mount Forest Subdivision\Drawings\Submissions\2019-08-30 First Submission\00702-SWM 2020-09-09.dwg Sep 17, 2020 - 2:42pm



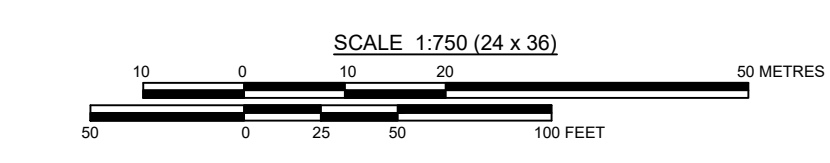
CAUTION:
THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE DRAWINGS, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR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

Notes
1. TOPOGRAPHIC INFORMATION DERIVED FROM FIELD SURVEY BY TRITON ENGINEERING COMPLETED IN 2018.
2. LOT FABRIC OF DERIVED FROM PLAN 61R/21276 PREPARED BY WILSON FORD SURVEYING ON FEBRUARY 14, 2018.



LEGEND

- SUBDIVISION BOUNDARY
- EXISTING STREET/PROPERTY LINES
- PROPOSED EDGE OF PAVEMENT
- EDGE OF EXISTING GRAVEL
- EXISTING DITCH AND DIRECTION OF FLOW
- EXISTING FENCE
- EXISTING TREE LINE
- EXISTING HYDRO GUY WIRE
- EXISTING CABLE TV PEDESTAL
- EXISTING TELEPHONE PEDESTAL
- STANDARD IRON BAR
- IRON BAR
- EXISTING DECIDUOUS TREE AND DIAMETER
- EXISTING CONIFEROUS TREE AND DIAMETER
- BENCHMARK
- REMOVAL
- PROPOSED ELEVATION
- EXISTING ELEVATION
- EXISTING CONTOUR
- CATCHMENT AREA ID
- CATCHMENT AREA IN HECTARES
- STORM DRAINAGE AREA BOUNDARY



Benchmark Information
BM1 TOP OF SIB LOCATED ON THE WEST SIDE OF CORK STREET AT THE SOUTHEAST CORNER OF PART 12 PLAN 61R/21276. ELEVATION 410.86m

No.	DATE	DESCRIPTION	BY	APPD
0	SEPT 16/20	DRAFT PLAN APPROVAL SUBMISSION	TLB	TLB
REVISION / ISSUE				

Seal not valid unless signed and dated

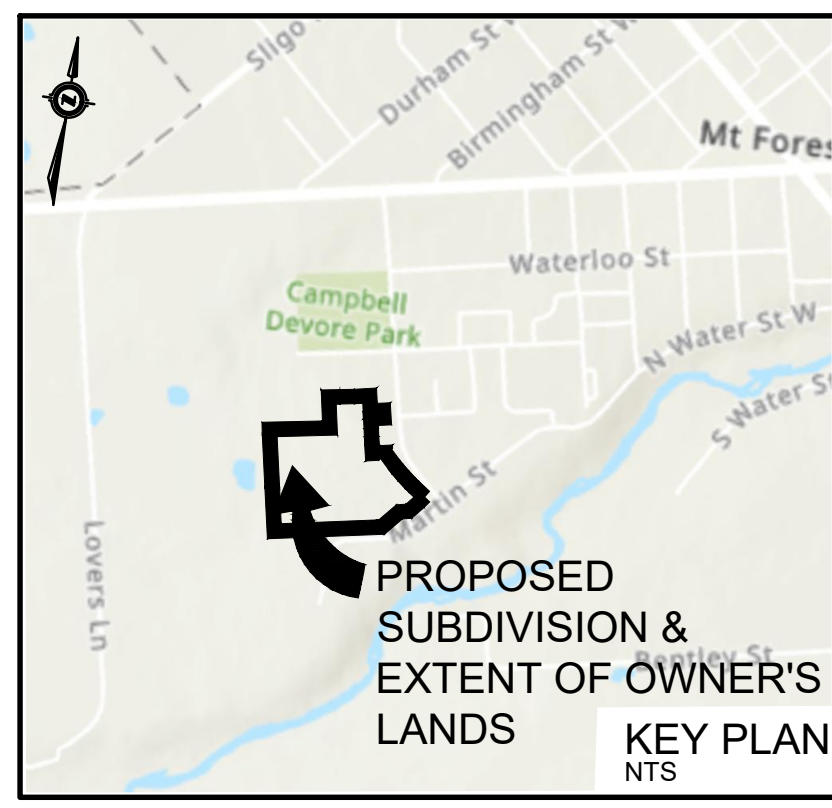
SUNVALE HOMES
PROPOSED MOUNT FOREST SUBDIVISION
Township of Wellington North
POST DEVELOPMENT CATCHMENT AREAS

Client: **SUNVALE HOMES**

Design: TLB	Scale: 1:750
Drawn: TLB	Approved:
Checked: TLB	
Date: JAN 2019	Design Engineer

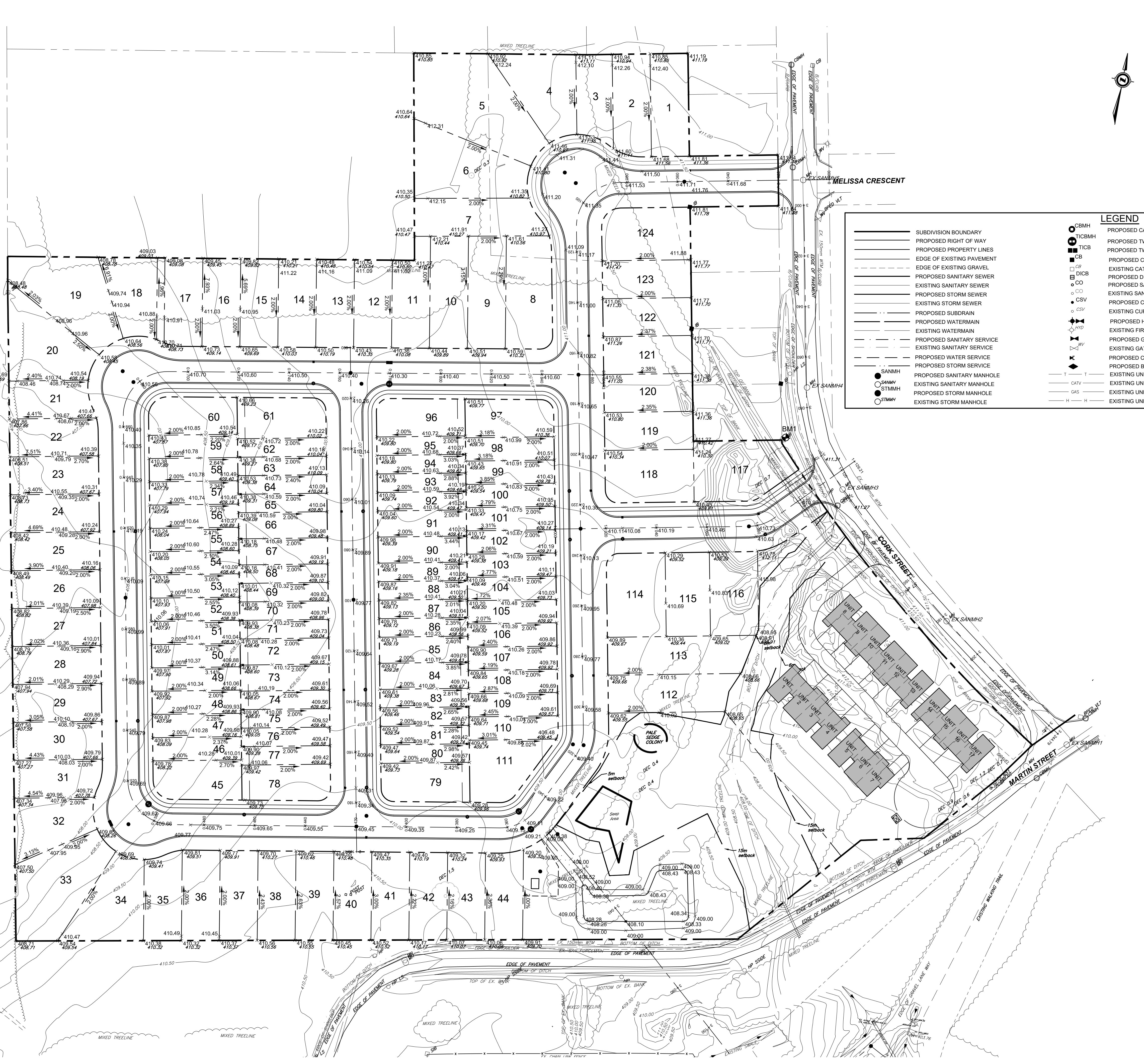
DRAWING No. 00702-SWM2

H:\Sunvale Homes\00702 Sunvale Homes Mount Forest Subdivision\Drawings\Submissions\2019-08-30 First Submission\00702 SWM 2020-09-09.dwg Sep 17, 2020 - 2:23pm



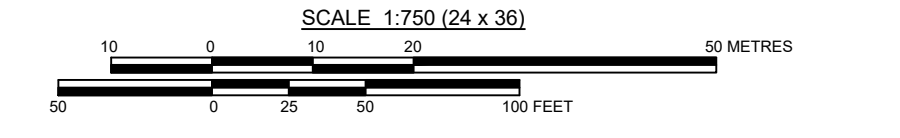
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LEGEND

—	SUBDIVISION BOUNDARY	○ CBMH	PROPOSED CATCHBASIN MANHOLE	○ HP	EXISTING HYDRO GUY WIRE
---	PROPOSED RIGHT OF WAY	○ TICB	PROPOSED TWIN INLET CATCHBASIN MANHOLE	○ CATV	EXISTING HYDRO POLE
---	PROPOSED PROPERTY LINES	□ CB	PROPOSED TWIN INLET CATCHBASIN	□ BPE	EXISTING CABLE TV PEDESTAL
---	EDGE OF EXISTING PAVEMENT	□ CB	PROPOSED CATCH BASIN	□ SIB	EXISTING TELEPHONE PEDESTAL
---	EDGE OF EXISTING GRAVEL	□ DICB	EXISTING CATCH BASIN	○ SIB	STANDARD IRON BAR
---	PROPOSED SANITARY SEWER	○ CO	PROPOSED DITCH INLET CATCHBASIN	○ SIB	IRON BAR
---	EXISTING SANITARY SEWER	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED STORM SEWER	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	EXISTING STORM SEWER	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED SUBDRAIN	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED WATERMAIN	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	EXISTING WATERMAIN	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED SANITARY SERVICE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	EXISTING SANITARY SERVICE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED WATER SERVICE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	EXISTING WATER SERVICE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED STORM SERVICE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	EXISTING STORM SERVICE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	PROPOSED STORM MANHOLE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE
---	EXISTING STORM MANHOLE	○ CO	EXISTING SANITARY SERVICE CLEANOUT	○ SIB	EXISTING DECIDUOUS TREE



Benchmark Information
BM1 TOP OF SIB LOCATED ON THE WEST SIDE OF CORK STREET AT THE SOUTHEAST CORNER OF PART 12 PLAN 61R-21276. ELEVATION 410.86m

No.	DATE	DESCRIPTION	BY	APPD
0	SEPT 16/20	DRAFT PLAN APPROVAL SUBMISSION	TLB	TLB
REVISION / ISSUE				



SUNVALE HOMES
PROPOSED MOUNT FOREST SUBDIVISION
Township of Wellington North
CONCEPTUAL GRADING PLAN

Client: **SUNVALE HOMES**

Design: TLB Scale: 1:750
Drawn: TLB Approved:
Checked: TLB
Date: JAN 2019 Design Engineer

DRAWING No. 00702-GR1

Appendix B

PRE-CONSULTATION

STORMWATER MANAGEMENT REPORT

SUNVALE HOMES MOUNT FOREST SUBDIVISION

TOWNSHIP OF WELLINGTON NORTH

3.0 ZONING BY-LAW

The property is currently zoned 'Future Development' therefore, a Zoning By-Law Amendment will be required to allow for residential development of the property. It was discussed that the Zoning By-Law amendment and Draft Plan be submitted at the same time and therefore only one public meeting will be required.

*Action:
Davidson*

A Planning Justification report will be required as part of the Zoning By-Law Amendment.

The development is 9.79 ha in total area however 0.55 ha has been outlined in the EIS as undevelopable lands. This leaves 9.24 ha available for development.

The plan currently shows 15 units/ha. The County will be looking for a density of 16 units/ha in the final plan however a lower density may be accepted if it can be demonstrated why achieving the requested density is not feasible.

*Action:
Davidson*

Subsequent to the meeting, the Townships current setbacks were discussed. The Zoning By-Law Amendment Application will likely include a request for site specific zoning to allow for reduced setbacks.

4.0 ENVIRONMENTAL IMPACT STUDY (EIS)

An EIS for the property was completed by the previous owner. An amendment to the EIS will be required to review the storm outlet which is discussed in further detail in later sections.

*Action:
Cobide*

The SVCA would welcome the opportunity to review the EIS and provide initial comments ahead of the Draft Plan Application being submitted.

5.0 FUNCTIONAL SERVICING REPORT

A FSR will be required to address the sanitary sewer, storm sewer, watermain capacity and pressure, as well as servicing from various utilities (Wellington North Power, Wightman, Eastlink, Union Gas).

*Action:
Cobide*

The FSR will need to review the viability of using the Cork Street Sanitary Pumping Station including the lowering of sanitary sewers along Cork Street. If this is not feasible, the option of a new sanitary pumping station can be addressed.

6.0 STORMWATER MANAGEMENT

A stormwater management report will be required to address the impacts of the development. Runoff will be required to be treated to an enhanced level of treatment.

*Action:
Cobide*

It is currently proposed to provide a direct outlet from the development to South Saugeen River. The storm sewer would outlet close the existing Martin Street storm sewer outlet. This storm sewer may need to be sized to accommodate the 100 year storm event to reduce erosion concerns on Martin Street and the proposed walking trail.

As per previous correspondence with the SVCA, the proposed outlet must be located above the Hurricane Hazel Flood Elevation.

Any runoff that is directed to the westerly property line must meet pre development peak flow rates as well as pre development peak volumes as this area is not owned by the Township.

7.0 ARCHAEOLOGICAL ASSESSMENT

An archaeological assessment is required to be completed.

*Action:
Cobide*

8.0 TRAFFIC IMPACT STUDY

A traffic impact study is required for this development

*Action:
Cobide*

9.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation will be required as part of the development. The geotechnical report shall include review of the storm sewer outlet.

*Action:
Cobide*

The geotechnical report is not required as part of the Draft Plan Application.

It will be completed after the proposed sanitary servicing and preliminary grading has been worked out.

10.0 SITE SERVICING

The site will be serviced with a storm sewer system that will outlet directly to the South Saugeen River.

The catchment area may be too large for an OGS to service. A settling basin may be proposed to provide quality control to an enhanced level.

The existing sanitary sewer on Cork Street is not deep enough to service the proposed development. Therefore, the sewer either has to be lowered and a sanitary pumping station installed. The Township preference is for all lots to have a gravity connection that outlet to either a new pumping station or the existing Cork Street station.

If a new Sanitary Pumping Station is proposed, further discussions will need to be had regarding the forcemain connection to the existing system. The new forcemain could either connect to existing sanitary sewer on Cork Street or directly to the WWTP.

The watermain will connect to the existing system at both connections to Cork Street. BM Ross confirmed there are no capacity issues in this part of Mount Forest.

The Town will require the internal road to be built to an urban cross section with 8.5m of asphalt, curb and gutter and 1.5m sidewalk on one side of the road.

The plan will need to be revised to have 13.25m edge of pavement radii on bends not at intersections.

A sidewalk may be required to be installed on Cork Street as part of this project. The Township has already collected money from other developments to pay for this work.

As part of the development, Cork Street may need to be reconstructed to an urban standard. This includes a 900mm diameter storm sewer from the current crossing to Martin Street. If required, the development would be able to use this storm sewer for a portion of its runoff such as from the cluster Townhouse development.

As per The Townships servicing standards, all water services shall be copper.

As per The Townships servicing standards, all storm sewers 450mm diameter and larger shall be concrete.

11.0 PARKLAND

The Parkland requirements were not discussed at the meeting however should be confirmed prior to submission of the application. The current proposal does not include any parkland. If the Township wishes for Parkland to be included we would request that we be notified as soon as possible.

12.0 OTHER BUSINESS

The Draft Plan Approval Application will trigger a review by Wellington County of the previously completed Methane Gas Monitoring Report regarding the decommissioned landfill located between the development and the WWTP.

The meeting adjourned at 3:00 pm.

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

COBIDE ENGINEERING INC.



Travis Burnside
Director

Appendix C

IDF PARAMETERS

STORMWATER MANAGEMENT REPORT

SUNVALE HOMES MOUNT FOREST SUBDIVISION

TOWNSHIP OF WELLINGTON NORTH

Environment and Climate Change Canada
 Environnement et Changement climatique Canada

Short Duration Rainfall Intensity-Duration-Frequency Data
 Données sur l'intensité, la durée et la fréquence des chutes
 de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2019/02/27

```
=====
MOUNT FOREST (AUT)                                ON          6145504
Latitude:  43 59'N   Longitude: 80 45'W   Elevation/Altitude: 414      m
Years/Années : 1962 - 2016           # Years/Années :    38
=====
```

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

Year Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
1962	10.4	14.7	18.0	18.0	19.6	23.9	33.0	38.9	45.0
1963	14.0	15.2	21.1	31.7	43.7	49.3	51.3	54.9	61.0
1964	10.4	12.2	14.7	25.7	28.4	29.5	35.3	37.6	61.2
1965	10.2	14.5	17.0	22.6	31.5	32.3	33.0	33.5	33.5
1966	9.9	15.2	19.3	21.1	24.6	27.2	28.2	38.1	56.1
1967	11.2	12.7	13.7	17.3	22.9	24.6	36.3	49.8	50.0
1968	8.4	13.5	17.8	28.7	43.4	52.1	74.4	74.7	83.8
1969	6.1	10.4	12.4	18.0	20.1	20.1	35.1	37.6	39.6
1970	8.6	13.2	13.5	15.7	19.0	20.1	36.8	53.6	56.9
1971	12.7	15.0	15.7	16.0	17.8	20.3	26.2	27.2	34.0
1972	6.9	10.2	13.0	18.0	22.4	33.3	45.2	47.5	50.3
1973	5.6	9.4	11.2	13.2	15.2	18.0	23.1	24.4	32.5
1974	5.3	7.1	9.7	19.0	35.6	40.6	42.7	42.7	42.7
1975	6.3	8.4	9.7	18.0	21.1	28.4	36.1	47.5	51.1
1976	9.1	13.5	16.5	19.0	27.7	33.8	35.8	35.8	43.4
1977	11.7	17.0	18.8	20.1	27.7	41.1	69.1	81.3	81.3
1978	14.8	15.4	18.0	21.2	21.6	25.6	40.3	43.7	52.5
1979	10.5	11.1	11.1	14.4	16.6	32.4	40.5	53.4	64.5
1980	8.9	16.3	19.3	25.4	34.3	43.5	48.3	49.4	49.4
1981	7.7	8.8	10.8	12.7	13.4	17.2	31.0	35.8	41.4
1982	6.9	10.9	13.9	18.6	24.6	29.6	30.4	30.6	32.6

1983	7.9	13.7	15.8	31.4	37.2	38.2	38.2	42.0	43.3
1984	6.8	9.2	11.2	14.6	14.6	20.2	25.2	32.8	33.0
1985	8.8	16.4	22.0	38.6	49.2	53.9	56.2	56.2	64.4
1986	8.2	12.7	15.7	22.7	27.2	39.8	46.8	64.4	93.3
2003	9.2	15.8	18.0	23.6	29.2	34.6	37.0	37.0	40.2
2004	8.4	13.0	16.0	20.0	22.4	25.0	39.0	39.4	39.4
2005	5.6	9.2	12.0	20.0	26.8	32.2	32.2	32.4	40.0
2006	8.6	15.2	20.0	21.0	23.2	34.0	48.8	55.2	55.4
2007	11.4	19.0	22.6	30.0	33.8	35.8	35.8	43.4	55.4
2008	9.8	12.8	14.0	19.0	23.2	33.4	47.0	53.0	78.4
2009	12.4	17.6	18.8	24.6	25.2	28.0	38.6	44.4	56.6
2010	8.0	11.6	12.2	17.6	22.8	31.4	59.2	64.8	65.4
2012	6.8	7.8	8.2	12.4	17.0	20.8	34.8	45.4	53.8
2013	8.2	11.2	15.0	26.0	28.4	42.4	65.2	67.2	67.8
2014	9.8	15.4	18.0	25.4	28.0	29.2	33.2	40.2	40.6
2015	8.2	10.2	10.8	12.6	17.6	20.0	29.0	30.6	31.4
2016	9.0	12.0	15.8	24.4	44.4	51.2	52.2	53.8	54.2

# Yrs. Années	38	38	38	38	38	38	38	38	38
Mean Moyenne	9.0	12.8	15.3	21.0	26.4	31.9	40.8	45.8	52.0
Std. Dev. Écart-type	2.3	2.9	3.7	5.9	8.8	9.9	12.0	12.9	15.3
Skew. Dissymétrie	0.58	-0.05	0.05	0.85	0.91	0.56	1.12	0.81	0.83
Kurtosis	3.38	2.46	2.39	4.02	3.57	2.89	4.15	3.69	3.59

*-99.9 Indicates Missing Data/Données manquantes

Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

Duration/Durée	2	5	10	25	50	100	#Years Années
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	
5 min	8.6	10.6	12.0	13.6	14.9	16.1	38
10 min	12.3	14.9	16.7	18.8	20.4	22.0	38
15 min	14.7	17.9	20.1	22.8	24.8	26.8	38
30 min	20.0	25.3	28.7	33.1	36.3	39.5	38
1 h	24.9	32.7	37.8	44.3	49.1	53.9	38
2 h	30.3	39.0	44.8	52.1	57.5	62.9	38
6 h	38.8	49.4	56.4	65.3	71.9	78.4	38
12 h	43.7	55.1	62.7	72.3	79.4	86.4	38
24 h	49.5	63.0	71.9	83.2	91.5	99.9	38

Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
 Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

Duration/Durée	2	5	10	25	50	100	#Years Années
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	
5 min	103.8	127.8	143.6	163.7	178.6	193.4	38
	+/- 7.9	+/- 13.3	+/- 18.0	+/- 24.3	+/- 29.1	+/- 33.9	38
10 min	74.1	89.6	99.9	113.0	122.6	132.2	38
	+/- 5.1	+/- 8.7	+/- 11.7	+/- 15.8	+/- 18.9	+/- 22.0	38
15 min	58.8	71.8	80.4	91.3	99.3	107.3	38
	+/- 4.3	+/- 7.2	+/- 9.8	+/- 13.2	+/- 15.8	+/- 18.4	38
30 min	40.1	50.5	57.4	66.1	72.6	79.0	38
	+/- 3.4	+/- 5.8	+/- 7.8	+/- 10.6	+/- 12.6	+/- 14.7	38
1 h	24.9	32.7	37.8	44.3	49.1	53.9	38
	+/- 2.6	+/- 4.3	+/- 5.8	+/- 7.9	+/- 9.4	+/- 10.9	38
2 h	15.1	19.5	22.4	26.0	28.8	31.4	38
	+/- 1.4	+/- 2.4	+/- 3.3	+/- 4.4	+/- 5.3	+/- 6.2	38
6 h	6.5	8.2	9.4	10.9	12.0	13.1	38
	+/- 0.6	+/- 1.0	+/- 1.3	+/- 1.8	+/- 2.1	+/- 2.5	38
12 h	3.6	4.6	5.2	6.0	6.6	7.2	38
	+/- 0.3	+/- 0.5	+/- 0.7	+/- 1.0	+/- 1.2	+/- 1.3	38
24 h	2.1	2.6	3.0	3.5	3.8	4.2	38
	+/- 0.2	+/- 0.3	+/- 0.4	+/- 0.6	+/- 0.7	+/- 0.8	38

Table 3 : Interpolation Equation / Équation d'interpolation: $R = A \cdot T^B$

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)

RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)

T = Rainfall duration (h) / Durée de la pluie (h)

Statistics/Statistiques	2	5	10	25	50	100
	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans	yr/ans
Mean of RR/Moyenne de RR	36.5	45.3	51.0	58.3	63.7	69.1
Std. Dev. /Écart-type (RR)	35.7	43.5	48.7	55.3	60.2	65.0
Std. Error/Erreur-type	8.4	10.6	12.1	14.1	15.5	17.0
Coefficient (A)	21.9	27.5	31.2	35.9	39.4	42.9
Exponent/Exposant (B)	-0.701	-0.693	-0.689	-0.686	-0.683	-0.682
Mean % Error/% erreur moyenne	9.3	10.4	11.1	11.8	12.2	12.5

Appendix D

PRE DEVELOPMENT MODEL PARAMETERS AND OUTPUT

STORMWATER MANAGEMENT REPORT

SUNVALE HOMES MOUNT FOREST SUBDIVISION

TOWNSHIP OF WELLINGTON NORTH

Table A.1 Parameter Summary Table

Existing Conditions										
Outlet Location	Model Catchment ID	Description	Area (ha)	Drainage Channel (m)	Flow Length (m)	Gradient (%)	Total Imperv. Connected (%)	Not Connected Imperv. (%)	Manning's 'n' (Perv.)	CN (Perv.)
South Saugeen	101	Southeast Portion of Property	2.85	320	89	3.0	0.0	100%	0.28	72.3
Unnamed Watercourse	102	Off Site to east of Subdivision	6.92	275	252	3.0	0.0	100%	0.21	70.1

Table A.2 Site Soils: (as per Ontario Soil Survey Report No. 35 for Wellington County)

Soil Type
Listowel Silt Loam

Hydrologic Soil Group
BC

TABLE OF CURVE NUMBERS (CN's)									
Land Use	Hydrologic Soil Type							Manning's 'n'	
	A	AB	B	BC	C	CD	D		
Meadow	50	54	58	64.5	71	74.5	78	0.4	continuous grass
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.4	forests
Long Grass	55	60	65	72	79	81.5	84	0.3	natural, not maintained
Lawns	60	65.5	71	77	83	86	89	0.25	maintained
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17	farm pasture
Crop	66	70	74	78	82	84	86	0.13	farm land
Fallow (bare)	77	82	86	89	91	93	94	0.05	idle farm land (bare)
Built-up	60	65.5	71	77	83	89	89	0.25	Lawns Existing
Streets, paved	98	98	98	98	98	98	98	0.01	

HYDROLOGIC SOIL TYPE (%) - Existing Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
101	0	0	0	100	0	0	0	100
102	0	0	0	100	0	0	0	100

LAND USE (%) - Existing Conditions										
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Imperv. Not Connected (Rooftops)	Imperv. Connected	Total
101	0	20	59	0	0.0	21.0	0	0.0	0.0	100
102	0	14	5	0	81	0	0	0.0	0.0	100

CURVE NUMBER (CN) - Existing Conditions											
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Built-up	Imperv. Not Connected (Rooftops)	Weighted CN - Pervious	Manning's 'n'
101	65	67	72	77	70.5	78	89	77	90	72.3	0.28
102	65	67.0	72	77	71	78	89	77	90	70.1	0.21

Table A.3: Impervious Area Determination for Subcatchment 101 - 102

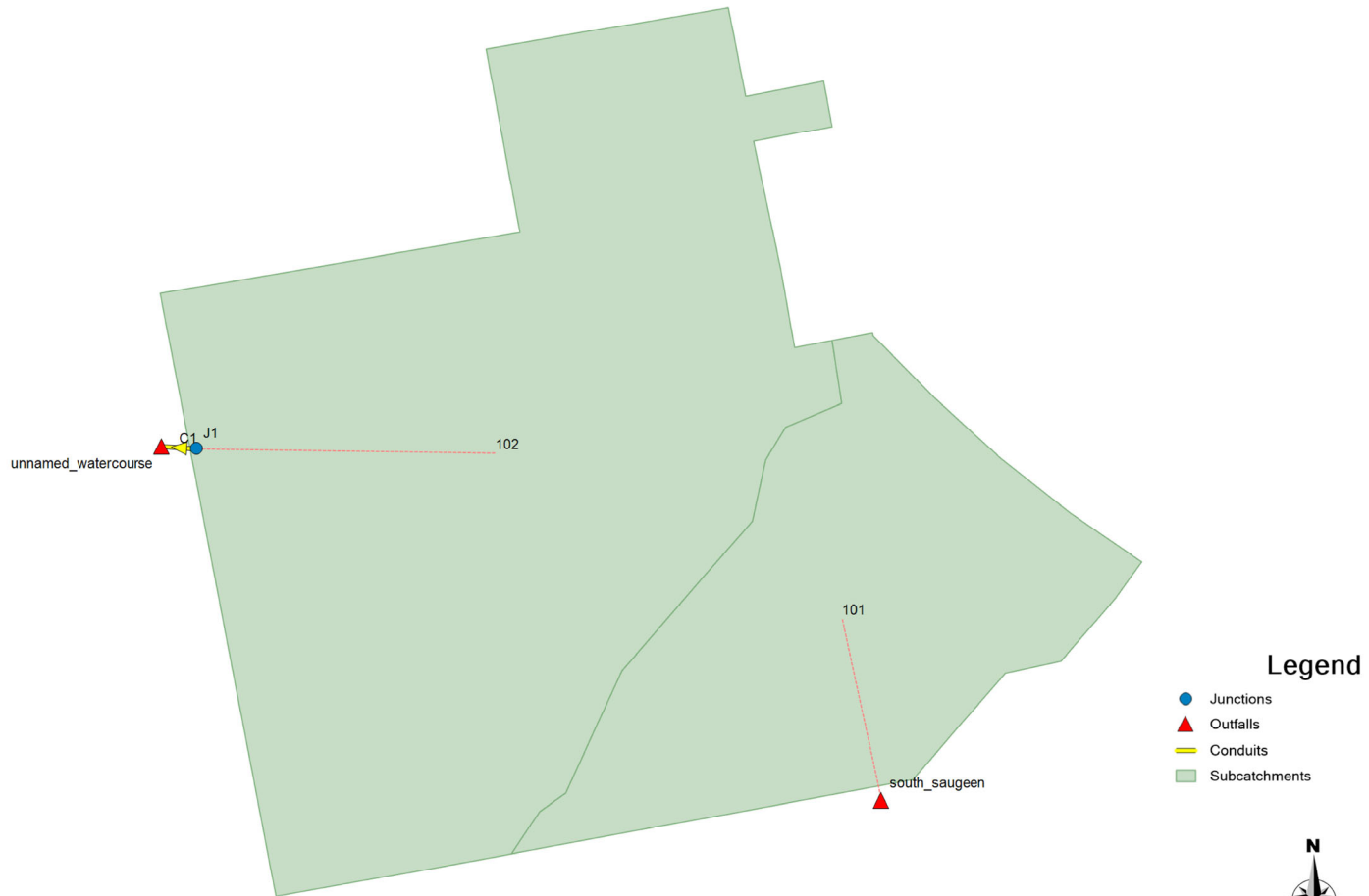
Existing Conditions

Area of Concern	Total Area (ha)	Impervious Area Connected		Impervious Area Not Connected (Rooftops)		Total (%)
		(ha)	(%)	(ha)	(%)	
101	2.85	0.00	0.0	0.00	0.0	0.0
102	6.92	0.00	0.0	0.00	0.0	0.0

Table A.3 - Impervious Area Determination for Existing Catchments 101-102

Catchment					Imperv. Area	Imperv %
101	0	m of	20	m wide ROW @ 45% imperv.	0.00 ha	0.0 %
	0	Impervious Area	814	m ² @ 100% imperv.	0.00 ha	0.0 %
	0	Roof Area	220	m ² @ 100% imperv.	0.00 ha	0.0 %
					0.00 ha	
102	0	m of	10	m wide ROW @ 50% imperv.	0.00 ha	0.0 %
	0	Impervious Area	3490	m ² @ 100% imperv.	0.00 ha	0.0 %
	0	Roof Area	220	m ² @ 100% imperv.	0.00 ha	0.0 %
					0.00 ha	

Sunvale Homes - Mount Forest Subdivision - Pre Development Model Schematic



Sunvale Homes – Mount Forest Subdivision – Pre Development Model Details

[TITLE]

[OPTIONS]

```

;;Options      Value
;;-----
FLOW_UNITS     LPS
INFILTRATION   CURVE_NUMBER
FLOW_ROUTING   DYNWAVE
START_DATE     9/10/2020
START_TIME     00:00
REPORT_START_DATE 9/10/2020
REPORT_START_TIME 00:00
END_DATE       9/11/2020
END_TIME       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
ALLOW_PONDING NO
INERTIAL_DAMPING PARTIAL
VARIABLE_STEP  0.75
LENGTHENING_STEP 0
MIN_SURFAREA   0
NORMAL_FLOW_LIMITED BOTH
SKIP_STEADY_STATE NO
FORCE_MAIN_EQUATION H-W
LINK_OFFSETS   ELEVATION
MIN_SLOPE      0
MAX_TRIALS     8
HEAD_TOLERANCE 0
SYS_FLOW_TOL   5
LAT_FLOW_TOL   5
MINIMUM_STEP   0.5
THREADS        2
    
```

[EVAPORATION]

```

;;Type      Parameters
;;-----
CONSTANT    0.0
DRY_ONLY    NO
    
```

[RAINGAGES]

```

;;          Rain      Time      Snow      Data
;;Name      Type      Intrvl  Catch    Source
;;-----
SCS_6h_38.8mm_2yr INTENSITY 0:05    1.0    TIMESERIES SCS_6h_38.8mm_2yr
SCS_6h_49.4mm_5yr INTENSITY 0:05    1.0    TIMESERIES SCS_6h_49.4mm_5yr
SCS_6h_65.3mm_25yr INTENSITY 0:05    1.0    TIMESERIES SCS_6h_65.3mm_25yr
SCS_6h_71.9mm_50yr INTENSITY 0:05    1.0    TIMESERIES SCS_6h_71.9mm_50yr
SCS_6h_78.4mm_100yr INTENSITY 0:05    1.0    TIMESERIES SCS_6h_78.4mm_100yr
    
```

[SUBCATCHMENTS]

```

;;          Total      Pcnt.      Pcnt.      Curb      Snow
;;Name      Raingage      Outlet      Area      Imperv      Width      Slope      Length      Pack
;;-----
101          SCS_6h_78.4mm_100yr south_saugeen 2.8547    0          320        3          0
102          SCS_6h_78.4mm_100yr J1          6.93      0          275        3          0
    
```

[SUBAREAS]

```

;;Subcatchment N-Imperv N-Perv S-Imperv S-Perv PctZero RouteTo PctRouted
;;-----
101            0.01    0.28    0.05    0.05    25      OUTLET
102            0.01    0.3     0.05    0.05    25      OUTLET
    
```

[INFILTRATION]

```

;;Subcatchment CurveNum HydCon DryTime
;;-----
101            72.3     0.5     7
102            70.1     0.5     7
    
```

Sunvale Homes – Mount Forest Subdivision – Pre Development Model Details

[JUNCTIONS]

```

;;
;;Name          Invert      Max.      Init.      Surcharge  Ponded
;;              Elev.       Depth    Depth     Depth     Area
;;-----
J1              407.5     0.5      0          0          0
    
```

[OUTFALLS]

```

;;
;;Name          Invert      Outfall    Stage/Table  Tide
;;              Elev.       Type       Time Series  Gate Route To
;;-----
south_saugeen  0          FREE
unnamed_watercourse 407     FREE
    
```

[CONDUITS]

```

;;
;;Name          Inlet      Outlet      Length      Manning  Inlet      Outlet      Init.      Max.
;;              Node       Node                N           Offset     Offset     Flow       Flow
;;-----
C1              J1          unnamed_watercourse 15.46      0.013    407.5     407         0          0
    
```

[XSECTIONS]

```

;;Link          Shape      Geom1      Geom2      Geom3      Geom4      Barrels
;;-----
C1              TRIANGULAR 0.5        275        0          0          1
    
```

[LOSSES]

```

;;Link          Inlet      Outlet      Average      Flap Gate  SeepageRate
;;-----
    
```

[TIMESERIES]

```

;;Name          Date      Time      Value
;;-----
;SCS_6h_38.8mm design storm, total rainfall = 38.8 mm, rain units = mm/hr.
SCS_6h_38.8mm_2yr

;SCS_6h_49.4mm design storm, total rainfall = 49.4 mm, rain units = mm/hr.
SCS_6h_49.4mm_5yr

;SCS_6h_65.3mm design storm, total rainfall = 65.3 mm, rain units = mm/hr.
SCS_6h_65.3mm_25yr

;SCS_6h_71.9mm design storm, total rainfall = 71.9 mm, rain units = mm/hr.
SCS_6h_71.9mm_50yr

;SCS_6h_78.4mm design storm, total rainfall = 78.4 mm, rain units = mm/hr.
SCS_6h_78.4mm_100yr
    
```

[REPORT]

```

INPUT          YES
CONTROLS       NO
SUBCATCHMENTS ALL
NODES          ALL
LINKS          ALL
    
```

[TAGS]

[MAP]

```

DIMENSIONS      520227.013871465 4868510.37599868 520703.638701389 4868941.98999018
UNITS           Meters
    
```

Sunvale Homes – Mount Forest Subdivision – Pre Development – 2 Yr Storm Event

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

Element Count

Number of rain gages 5
 Number of subcatchments ... 2
 Number of nodes 3
 Number of links 1
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
SCS_6h_38.8mm_2yr	SCS_6h_38.8mm_2yr	INTENSITY	5 min.
SCS_6h_49.4mm_5yr	SCS_6h_49.4mm_5yr	INTENSITY	5 min.
SCS_6h_65.3mm_25yr	SCS_6h_65.3mm_25yr	INTENSITY	5 min.
SCS_6h_71.9mm_50yr	SCS_6h_71.9mm_50yr	INTENSITY	5 min.
SCS_6h_78.4mm_100yr	SCS_6h_78.4mm_100yr	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	2.85	320.00	0.00	3.0000	SCS_6h_38.8mm_2yr	south_saugeen
102	6.93	275.00	0.00	3.0000	SCS_6h_38.8mm_2yr	J1

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	407.50	0.50	0.0	
south_saugeen	OUTFALL	0.00	0.00	0.0	
unnamed_watercourse	OUTFALL	407.00	0.50	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	unnamed_watercourse	CONDUIT	15.5	3.2358	0.0130

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRIANGULAR	0.50	68.75	0.25	275.00	1	377549.71

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

Sunvale Homes – Mount Forest Subdivision – Pre Development – 2 Yr Storm Event

Analysis Options

```

*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 09/10/2020 00:00:00
Ending Date ..... 09/11/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
  
```

```

*****
                                Volume      Depth
Runoff Quantity Continuity      hectare-m      mm
*****
Total Precipitation .....      0.380      38.807
Evaporation Loss .....          0.000          0.000
Infiltration Loss .....          0.298      30.443
Surface Runoff .....            0.078       7.971
Final Storage .....             0.004       0.396
Continuity Error (%) .....      -0.006
  
```

```

*****
                                Volume      Volume
Flow Routing Continuity          hectare-m      10^6 ltr
*****
Dry Weather Inflow .....          0.000          0.000
Wet Weather Inflow .....          0.078          0.780
Groundwater Inflow .....          0.000          0.000
RDII Inflow .....                0.000          0.000
External Inflow .....             0.000          0.000
External Outflow .....            0.078          0.780
Flooding Loss .....               0.000          0.000
Evaporation Loss .....            0.000          0.000
Exfiltration Loss .....           0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume .....         0.000          0.000
Continuity Error (%) .....         0.000
  
```

```

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

```

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

```

*****
Routing Time Step Summary
*****
Minimum Time Step      :      4.50 sec
Average Time Step      :      5.00 sec
Maximum Time Step      :      5.00 sec
Percent in Steady State :      0.00
Average Iterations per Step :      2.00
  
```

Sunvale Homes – Mount Forest Subdivision – Pre Development – 2 Yr Storm Event

Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
101	38.81	0.00	0.00	28.64	9.98	0.28	21.16	0.257
102	38.81	0.00	0.00	31.19	7.14	0.49	29.16	0.184

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.01	407.51	0 04:30	0.01
south_saugeen	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
unnamed_watercourse	OUTFALL	0.01	0.01	407.01	0 04:30	0.01

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	29.16	29.16	0 04:30	0.495	0.495	0.004
south_saugeen	OUTFALL	21.16	21.16	0 02:45	0.285	0.285	0.000
unnamed_watercourse	OUTFALL	0.00	29.15	0 04:30	0	0.495	0.000

 Node Surcharge Summary

No nodes were surcharged.

 Node Flooding Summary

No nodes were flooded.

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10 ⁶ ltr
south_saugeen	95.39	3.46	21.16	0.285
unnamed_watercourse	94.95	6.03	29.15	0.495
System	95.17	9.49	47.84	0.780

Sunvale Homes – Mount Forest Subdivision – Pre Development – 2 Yr Storm Event

 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
C1	CONDUIT	29.15	0 04:30	0.51	0.00	0.03

 Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl	
C1	1.00	0.03	0.00	0.00	0.00	0.96	0.00	0.00	0.74	0.00

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Wed Sep 16 08:46:56 2020
 Analysis ended on: Wed Sep 16 08:46:56 2020
 Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Pre Development – 5 Yr Storm Event

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

Element Count

Number of rain gages 5
 Number of subcatchments ... 2
 Number of nodes 3
 Number of links 1
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
SCS_6h_38.8mm_2yr	SCS_6h_38.8mm_2yr	INTENSITY	5 min.
SCS_6h_49.4mm_5yr	SCS_6h_49.4mm_5yr	INTENSITY	5 min.
SCS_6h_65.3mm_25yr	SCS_6h_65.3mm_25yr	INTENSITY	5 min.
SCS_6h_71.9mm_50yr	SCS_6h_71.9mm_50yr	INTENSITY	5 min.
SCS_6h_78.4mm_100yr	SCS_6h_78.4mm_100yr	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	2.85	320.00	0.00	3.0000	SCS_6h_49.4mm_5yr	south_saugeen
102	6.93	275.00	0.00	3.0000	SCS_6h_49.4mm_5yr	J1

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	407.50	0.50	0.0	
south_saugeen	OUTFALL	0.00	0.00	0.0	
unnamed_watercourse	OUTFALL	407.00	0.50	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	unnamed_watercourse	CONDUIT	15.5	3.2358	0.0130

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRIANGULAR	0.50	68.75	0.25	275.00	1	377549.71

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

Sunvale Homes – Mount Forest Subdivision – Pre Development – 5 Yr Storm Event

Analysis Options

```

*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 09/10/2020 00:00:00
Ending Date ..... 09/11/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
  
```

```

*****
                                Volume      Depth
Runoff Quantity Continuity      hectare-m      mm
*****
Total Precipitation .....      0.483      49.408
Evaporation Loss .....          0.000          0.000
Infiltration Loss .....          0.355      36.289
Surface Runoff .....            0.124      12.723
Final Storage .....             0.004          0.400
Continuity Error (%) .....      -0.008
  
```

```

*****
                                Volume      Volume
Flow Routing Continuity          hectare-m      10^6 ltr
*****
Dry Weather Inflow .....          0.000          0.000
Wet Weather Inflow .....          0.124          1.245
Groundwater Inflow .....          0.000          0.000
RDII Inflow .....                0.000          0.000
External Inflow .....            0.000          0.000
External Outflow .....           0.124          1.245
Flooding Loss .....              0.000          0.000
Evaporation Loss .....            0.000          0.000
Exfiltration Loss .....           0.000          0.000
Initial Stored Volume .....       0.000          0.000
Final Stored Volume .....         0.000          0.000
Continuity Error (%) .....      -0.002
  
```

```

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

```

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

```

*****
Routing Time Step Summary
*****
Minimum Time Step      :      4.50 sec
Average Time Step      :      5.00 sec
Maximum Time Step      :      5.00 sec
Percent in Steady State :      0.00
Average Iterations per Step :      2.00
  
```

Sunvale Homes – Mount Forest Subdivision – Pre Development – 5 Yr Storm Event

Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
101	49.41	0.00	0.00	33.92	15.31	0.44	38.15	0.310
102	49.41	0.00	0.00	37.27	11.66	0.81	50.05	0.236

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.02	407.52	0 03:55	0.02
south_saugeen	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
unnamed_watercourse	OUTFALL	0.01	0.02	407.02	0 03:55	0.02

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	50.05	50.05	0 03:55	0.808	0.808	0.002
south_saugeen	OUTFALL	38.15	38.15	0 02:45	0.437	0.437	0.000
unnamed_watercourse	OUTFALL	0.00	50.04	0 03:55	0	0.808	0.000

 Node Surcharge Summary

No nodes were surcharged.

 Node Flooding Summary

No nodes were flooded.

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10 ⁶ ltr
south_saugeen	96.20	5.26	38.15	0.437
unnamed_watercourse	95.81	9.76	50.04	0.808
System	96.00	15.02	80.54	1.245

Sunvale Homes – Mount Forest Subdivision – Pre Development – 5 Yr Storm Event

 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
C1	CONDUIT	50.04	0 03:55	0.59	0.00	0.04

 Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Up Dry	Down Dry	Sub Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.03	0.00	0.00	0.00	0.97	0.00	0.00	0.72	0.00

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Wed Sep 16 08:45:42 2020
 Analysis ended on: Wed Sep 16 08:45:42 2020
 Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Pre Development – 25 Yr Storm Event

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

Element Count

Number of rain gages 5
 Number of subcatchments ... 2
 Number of nodes 3
 Number of links 1
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
SCS_6h_38.8mm_2yr	SCS_6h_38.8mm_2yr	INTENSITY	5 min.
SCS_6h_49.4mm_5yr	SCS_6h_49.4mm_5yr	INTENSITY	5 min.
SCS_6h_65.3mm_25yr	SCS_6h_65.3mm_25yr	INTENSITY	5 min.
SCS_6h_71.9mm_50yr	SCS_6h_71.9mm_50yr	INTENSITY	5 min.
SCS_6h_78.4mm_100yr	SCS_6h_78.4mm_100yr	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	2.85	320.00	0.00	3.0000	SCS_6h_65.3mm_25yr	south_saugeen
102	6.93	275.00	0.00	3.0000	SCS_6h_65.3mm_25yr	J1

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	407.50	0.50	0.0	
south_saugeen	OUTFALL	0.00	0.00	0.0	
unnamed_watercourse	OUTFALL	407.00	0.50	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	unnamed_watercourse	CONDUIT	15.5	3.2358	0.0130

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRIANGULAR	0.50	68.75	0.25	275.00	1	377549.71

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

Sunvale Homes – Mount Forest Subdivision – Pre Development – 25 Yr Storm Event

Analysis Options

```

*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 09/10/2020 00:00:00
Ending Date ..... 09/11/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
  
```

```

*****
                                Volume      Depth
Runoff Quantity Continuity    hectare-m      mm
*****
Total Precipitation .....      0.639      65.310
Evaporation Loss .....      0.000      0.000
Infiltration Loss .....      0.426      43.544
Surface Runoff .....      0.209      21.356
Final Storage .....      0.004      0.417
Continuity Error (%) .....      -0.011
  
```

```

*****
                                Volume      Volume
Flow Routing Continuity      hectare-m      10^6 ltr
*****
Dry Weather Inflow .....      0.000      0.000
Wet Weather Inflow .....      0.209      2.090
Groundwater Inflow .....      0.000      0.000
RDII Inflow .....      0.000      0.000
External Inflow .....      0.000      0.000
External Outflow .....      0.209      2.090
Flooding Loss .....      0.000      0.000
Evaporation Loss .....      0.000      0.000
Exfiltration Loss .....      0.000      0.000
Initial Stored Volume ....      0.000      0.000
Final Stored Volume .....      0.000      0.000
Continuity Error (%) .....      -0.001
  
```

```

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

```

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

```

*****
Routing Time Step Summary
*****
Minimum Time Step      :      4.50 sec
Average Time Step      :      5.00 sec
Maximum Time Step      :      5.00 sec
Percent in Steady State :      0.00
Average Iterations per Step :      2.00
  
```

Sunvale Homes – Mount Forest Subdivision – Pre Development – 25 Yr Storm Event

Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101	65.31	0.00	0.00	40.58	24.55	0.70	73.46	0.376
102	65.31	0.00	0.00	44.77	20.04	1.39	90.89	0.307

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.02	407.52	0 03:55	0.02
south_saugeen	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
unnamed_watercourse	OUTFALL	0.01	0.02	407.02	0 03:55	0.02

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	90.89	90.89	0 03:55	1.39	1.39	0.002
south_saugeen	OUTFALL	73.46	73.46	0 02:30	0.701	0.701	0.000
unnamed_watercourse	OUTFALL	0.00	90.89	0 03:55	0	1.39	0.000

 Node Surcharge Summary

No nodes were surcharged.

 Node Flooding Summary

No nodes were flooded.

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
south_saugeen	96.94	8.37	73.46	0.701
unnamed_watercourse	96.62	16.63	90.89	1.389
System	96.78	25.00	151.48	2.090

Sunvale Homes – Mount Forest Subdivision – Pre Development – 25 Yr Storm Event

 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
C1	CONDUIT	90.89	0 03:55	0.68	0.00	0.04

 Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl	
C1	1.00	0.02	0.00	0.00	0.00	0.97	0.00	0.00	0.70	0.00

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Wed Sep 16 08:42:56 2020
 Analysis ended on: Wed Sep 16 08:42:56 2020
 Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Pre Development – 50 Yr Storm Event

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

 Element Count

Number of rain gages 5
 Number of subcatchments ... 2
 Number of nodes 3
 Number of links 1
 Number of pollutants 0
 Number of land uses 0

 Raingage Summary

Name	Data Source	Data Type	Recording Interval
SCS_6h_38.8mm_2yr	SCS_6h_38.8mm_2yr	INTENSITY	5 min.
SCS_6h_49.4mm_5yr	SCS_6h_49.4mm_5yr	INTENSITY	5 min.
SCS_6h_65.3mm_25yr	SCS_6h_65.3mm_25yr	INTENSITY	5 min.
SCS_6h_71.9mm_50yr	SCS_6h_71.9mm_50yr	INTENSITY	5 min.
SCS_6h_78.4mm_100yr	SCS_6h_78.4mm_100yr	INTENSITY	5 min.

 Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	2.85	320.00	0.00	3.0000	SCS_6h_71.9mm_50yr	south_saugeen
102	6.93	275.00	0.00	3.0000	SCS_6h_71.9mm_50yr	J1

 Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	407.50	0.50	0.0	
south_saugeen	OUTFALL	0.00	0.00	0.0	
unnamed_watercourse	OUTFALL	407.00	0.50	0.0	

 Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	unnamed_watercourse	CONDUIT	15.5	3.2358	0.0130

 Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRIANGULAR	0.50	68.75	0.25	275.00	1	377549.71

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

Sunvale Homes – Mount Forest Subdivision – Pre Development – 50 Yr Storm Event

Analysis Options

```
*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 09/10/2020 00:00:00
Ending Date ..... 09/11/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
```

```
*****
Volume      Depth
Runoff Quantity Continuity  hectare-m      mm
*****
Total Precipitation .....      0.704      71.911
Evaporation Loss .....      0.000      0.000
Infiltration Loss .....      0.452      46.169
Surface Runoff .....      0.248      25.337
Final Storage .....      0.004      0.413
Continuity Error (%) .....      -0.012
```

```
*****
Volume      Volume
Flow Routing Continuity  hectare-m      10^6 ltr
*****
Dry Weather Inflow .....      0.000      0.000
Wet Weather Inflow .....      0.248      2.479
Groundwater Inflow .....      0.000      0.000
RDII Inflow .....      0.000      0.000
External Inflow .....      0.000      0.000
External Outflow .....      0.248      2.479
Flooding Loss .....      0.000      0.000
Evaporation Loss .....      0.000      0.000
Exfiltration Loss .....      0.000      0.000
Initial Stored Volume ....      0.000      0.000
Final Stored Volume .....      0.000      0.000
Continuity Error (%) .....      -0.001
```

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

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

```
*****
Routing Time Step Summary
*****
Minimum Time Step      :      4.50 sec
Average Time Step      :      5.00 sec
Maximum Time Step      :      5.00 sec
Percent in Steady State :      0.00
Average Iterations per Step :      2.00
```

Sunvale Homes – Mount Forest Subdivision – Pre Development – 50 Yr Storm Event

Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
101	71.91	0.00	0.00	42.88	28.86	0.82	92.42	0.401
102	71.91	0.00	0.00	47.53	23.89	1.66	111.17	0.332

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.02	407.52	0 03:20	0.02
south_saugeen	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
unnamed_watercourse	OUTFALL	0.01	0.02	407.02	0 03:20	0.02

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	111.17	111.17	0 03:20	1.66	1.66	0.001
south_saugeen	OUTFALL	92.42	92.42	0 02:30	0.824	0.824	0.000
unnamed_watercourse	OUTFALL	0.00	111.16	0 03:20	0	1.66	0.000

 Node Surcharge Summary

No nodes were surcharged.

 Node Flooding Summary

No nodes were flooded.

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10 ⁶ ltr
south_saugeen	97.15	9.81	92.42	0.824
unnamed_watercourse	96.84	19.78	111.16	1.655
System	96.99	29.60	189.46	2.479

Sunvale Homes – Mount Forest Subdivision – Pre Development – 50 Yr Storm Event

 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
C1	CONDUIT	111.16	0 03:20	0.72	0.00	0.05

 Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl	
C1	1.00	0.02	0.00	0.00	0.00	0.98	0.00	0.00	0.69	0.00

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Wed Sep 16 08:35:17 2020
 Analysis ended on: Wed Sep 16 08:35:17 2020
 Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Pre Development – 100 Yr Storm Event

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.011)

Element Count

Number of rain gages 5
 Number of subcatchments ... 2
 Number of nodes 3
 Number of links 1
 Number of pollutants 0
 Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
SCS_6h_38.8mm_2yr	SCS_6h_38.8mm_2yr	INTENSITY	5 min.
SCS_6h_49.4mm_5yr	SCS_6h_49.4mm_5yr	INTENSITY	5 min.
SCS_6h_65.3mm_25yr	SCS_6h_65.3mm_25yr	INTENSITY	5 min.
SCS_6h_71.9mm_50yr	SCS_6h_71.9mm_50yr	INTENSITY	5 min.
SCS_6h_78.4mm_100yr	SCS_6h_78.4mm_100yr	INTENSITY	5 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101	2.85	320.00	0.00	3.0000	SCS_6h_78.4mm_100yr	south_saugeen
102	6.93	275.00	0.00	3.0000	SCS_6h_78.4mm_100yr	J1

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	407.50	0.50	0.0	
south_saugeen	OUTFALL	0.00	0.00	0.0	
unnamed_watercourse	OUTFALL	407.00	0.50	0.0	

Link Summary

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	unnamed_watercourse	CONDUIT	15.5	3.2358	0.0130

Cross Section Summary

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRIANGULAR	0.50	68.75	0.25	275.00	1	377549.71

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

Sunvale Homes – Mount Forest Subdivision – Pre Development – 100 Yr Storm Event

Analysis Options

```

*****
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Flow Routing Method ..... DYNWAVE
Starting Date ..... 09/10/2020 00:00:00
Ending Date ..... 09/11/2020 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 5.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 1
Head Tolerance ..... 0.001524 m
  
```

```

*****
                                Volume      Depth
Runoff Quantity Continuity      hectare-m      mm
*****
Total Precipitation .....      0.767      78.413
Evaporation Loss .....          0.000          0.000
Infiltration Loss .....          0.475      48.529
Surface Runoff .....            0.288      29.475
Final Storage .....             0.004          0.420
Continuity Error (%) .....      -0.013
  
```

```

*****
                                Volume      Volume
Flow Routing Continuity          hectare-m      10^6 ltr
*****
Dry Weather Inflow .....          0.000          0.000
Wet Weather Inflow .....          0.288          2.884
Groundwater Inflow .....          0.000          0.000
RDII Inflow .....                0.000          0.000
External Inflow .....            0.000          0.000
External Outflow .....           0.288          2.884
Flooding Loss .....              0.000          0.000
Evaporation Loss .....           0.000          0.000
Exfiltration Loss .....           0.000          0.000
Initial Stored Volume ....        0.000          0.000
Final Stored Volume .....         0.000          0.000
Continuity Error (%) .....       -0.001
  
```

```

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

```

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

```

*****
Routing Time Step Summary
*****
Minimum Time Step      :      4.50 sec
Average Time Step      :      5.00 sec
Maximum Time Step      :      5.00 sec
Percent in Steady State :      0.00
Average Iterations per Step :      2.00
  
```

Sunvale Homes – Mount Forest Subdivision – Pre Development – 100 Yr Storm Event

Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
101	78.41	0.00	0.00	45.05	33.18	0.95	112.95	0.423
102	78.41	0.00	0.00	49.96	27.95	1.94	133.83	0.356

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.03	407.53	0 03:20	0.03
south_saugeen	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
unnamed_watercourse	OUTFALL	0.01	0.03	407.03	0 03:20	0.03

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	133.83	133.83	0 03:20	1.94	1.94	0.001
south_saugeen	OUTFALL	112.95	112.95	0 02:30	0.947	0.947	0.000
unnamed_watercourse	OUTFALL	0.00	133.82	0 03:20	0	1.94	0.000

 Node Surcharge Summary

No nodes were surcharged.

 Node Flooding Summary

No nodes were flooded.

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10 ⁶ ltr
south_saugeen	97.32	11.26	112.95	0.947
unnamed_watercourse	97.04	23.10	133.82	1.937
System	97.18	34.36	230.41	2.884

Sunvale Homes – Mount Forest Subdivision – Pre Development – 100 Yr Storm Event

 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
C1	CONDUIT	133.82	0 03:20	0.75	0.00	0.05

 Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl	
C1	1.00	0.02	0.00	0.00	0.00	0.98	0.00	0.00	0.69	0.00

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Sep 10 08:39:05 2020
 Analysis ended on: Thu Sep 10 08:39:05 2020
 Total elapsed time: < 1 sec

Appendix E

POST DEVELOPMENT MODEL PARAMETERS AND OUTPUT

STORMWATER MANAGEMENT REPORT

SUNVALE HOMES MOUNT FOREST SUBDIVISION

TOWNSHIP OF WELLINGTON NORTH

Table B.1 Parameter Summary Table

Proposed Conditions										
Outlet Location	Model Catchment ID	Description	Area (ha)	Drainage Channel (m)	Flow Length (m)	Gradient (%)	Total Imperv. (%)	Not Connected Imperv. (%)	Manning's 'n' (Perv.)	CN (Perv.)
South Saugeen	201	Majority of Development	7.32	2525	29	2.0	57.7	47.3	0.25	77.0
South Saugeen	202	Southeast corner of Development	1.66	600	28	3.0	25.0	60.5	0.31	73.0
Unnamed Watercourse	203	Rear Yards on North and West Side of Development	0.79	375	21	3.0	27.3	100.0	0.27	75.6

Table B.2 Site Soils: (as per Ontario Soil Survey Report No. 35 for Wellington County)

Soil Type
Listowel Silt Loam

Hydrologic Soil Group
BC

TABLE OF CURVE NUMBERS (CN's)								
Land Use	Hydrologic Soil Type							Manning's 'n'
	A	AB	B	BC	C	CD	D	
Meadow	50	54	58	64.5	71	74.5	78	0.4
Woodlot	50	55.3	60.5	67	73.5	76.8	80	0.4
Long Grass	55	60	65	72	79	81.5	84	0.3
Lawns	60	65.5	71	77	83	86	89	0.25
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17
Crop	66	70	74	78	82	84	86	0.13
Fallow (bare)	77	82	86	89	91	93	94	0.05
Built-up	60	65.5	71	77	83	89	89	0.25
Streets, paved	98	98	98	98	98	98	98	0.01

continuous grass
forests
natural, not maintained
maintained
farm pasture
farm land
idle farm land (bare)
Lawns Proposed

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
201	0	0	0	100	0	0	0	100
202	0	0	0	100	0	0	0	100
203	0	0	0	100	0	0	0	100

LAND USE (%) - Proposed Conditions										
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Imperv. Not Connected (Rooftops)	Imperv. Connected	Total
201	0	0	0	42	0	0	0	27.3	30.4	100
202	0	30	0	45	0	0	0	15.1	9.9	100
203	0	10	0	62.7	0	0	0	27.3	0.0	100

CURVE NUMBER (CN) - Proposed Conditions											
Catchment	Meadow	Woodlot	Long Grass	Lawns	Pasture Range	Crop	Fallow (Bare)	Built-up	Imperv. Not Connected (Rooftops)	Weighted CN - Pervious	Manning's 'n'
201	65	67	72	77	70.5	78	89	77	90	77.0	0.25
202	65	67.0	72	77	70.5	78	89	77.0	90	73.0	0.31
203	65	67	72	77	70.5	78	89	77	90	75.6	0.27

Table B.3: Impervious Area Determination for Subcatchments 201 - 203

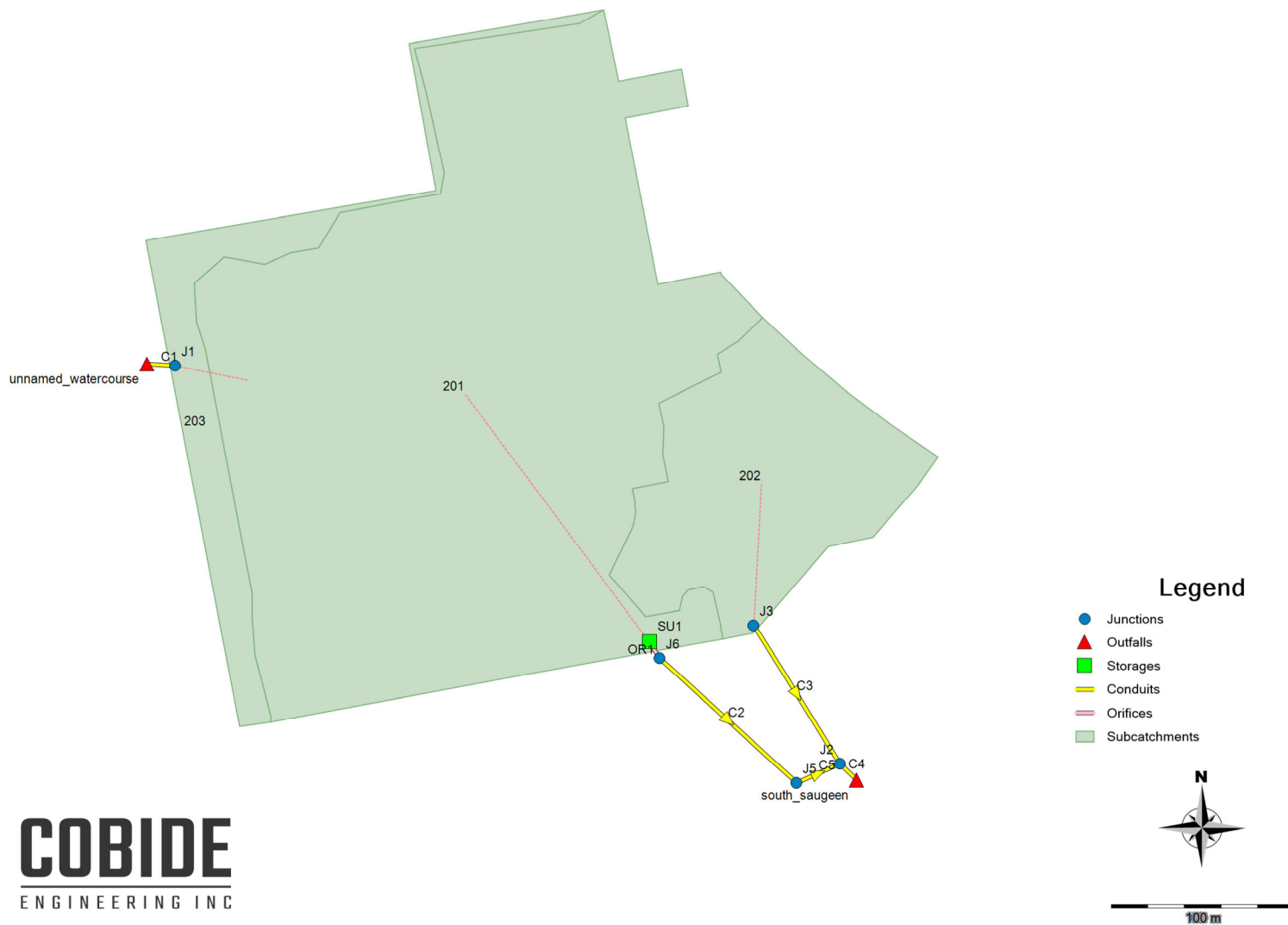
Proposed Conditions

Area of Concern	Total Area (ha)	Impervious Area Connected		Impervious Area Not Connected (Rooftops)		Total (%)
		(ha)	(%)	(ha)	(%)	
201	7.32	2.23	30.4	2.00	27.3	57.7
202	1.66	0.16	9.9	0.25	15.1	25.0
203	0.79	0.00	0.0	0.22	27.3	27.3

Table B.3 - Impervious Area Determination for Proposed Catchments 201 - 203

Catchment				Imperv. Area	Imperv %
201	1100	m of	20 m wide ROW @ 55% imperv.	1.21 ha	16.5 %
	58	driveways @	90 m ² @ 100% imperv.	0.52 ha	7.1 %
	66	driveways @	75 m ² @ 100% imperv.	0.50 ha	6.8 %
	47	single res. homes with roof area of	240 m ²	1.13 ha	15.4 %
	30	Duplex unit with roof area of	145 m ²	0.44 ha	5.9 %
	36	Multi-family units with roof area of	120 m ²	0.43 ha	5.9 %
				4.22 ha	
202	200	m of	6.1 m wide ROW @ 100% imperv.	0.12 ha	7.3 %
	17	driveways @	25 m ² @ 100% imperv.	0.04 ha	2.6
	2	single res. homes with roof area of	240 m ²	0.05 ha	2.9
		Duplex unit with roof area of	145 m ²	0.00 ha	0.0
	17	Multi-family units with roof area of	120 m ²	0.20 ha	12.3
				0.12 ha	
203		m of	20 m wide ROW @ 55% imperv.	0.00 ha	0.0 %
		driveways @	1826 m ² @ 100% imperv.	0.00 ha	0.0 %
	9	single res. homes with roof area of	240 m ²	0.22 ha	27.3 %
		Duplex unit with roof area of	145 m ²	0.00 ha	0.0 %
		Multi-family units with roof area of	120 m ²	0.00 ha	0.0 %
			0.22 ha		

Sunvale Homes - Mount Forest Subdivision - Post Development Model Schematic



Sunvale Homes – Mount Forest Subdivision – Post Development – Model Details

[TITLE]

[OPTIONS]

```

;;Options      Value
;;-----
FLOW_UNITS      LPS
INFILTRATION    CURVE_NUMBER
FLOW_ROUTING    DYNWAVE
START_DATE      9/10/2020
START_TIME      00:00
REPORT_START_DATE 9/10/2020
REPORT_START_TIME 00:00
END_DATE        9/11/2020
END_TIME        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
ALLOW_PONDING  NO
INERTIAL_DAMPING PARTIAL
VARIABLE_STEP   0.75
LENGTHENING_STEP 0
MIN_SURFAREA    0
NORMAL_FLOW_LIMITED BOTH
SKIP_STEADY_STATE NO
FORCE_MAIN_EQUATION H-W
LINK_OFFSETS    ELEVATION
MIN_SLOPE       0
MAX_TRIALS      8
HEAD_TOLERANCE  0
SYS_FLOW_TOL    5
LAT_FLOW_TOL    5
MINIMUM_STEP    0.5
THREADS         2

```

[EVAPORATION]

```

;;Type      Parameters
;;-----
CONSTANT    0.0
DRY_ONLY    NO

```

[RAINGAGES]

```

;;          Rain      Time      Snow      Data
;;Name      Type      Intrvl  Catch    Source
;;-----
SCS_6h_38.8mm_2yr INTENSITY 0:05  1.0  TIMESERIES SCS_6h_38.8mm_2yr
SCS_6h_49.4mm_5yr INTENSITY 0:05  1.0  TIMESERIES SCS_6h_49.4mm_5yr
SCS_6h_65.3mm_25yr INTENSITY 0:05  1.0  TIMESERIES SCS_6h_65.3mm_25yr
SCS_6h_71.9mm_50yr INTENSITY 0:05  1.0  TIMESERIES SCS_6h_71.9mm_50yr
SCS_6h_78.4mm_100yr INTENSITY 0:05  1.0  TIMESERIES SCS_6h_78.4mm_100yr

```

[SUBCATCHMENTS]

```

;;          Total      Pcnt.      Pcnt.      Curb      Snow
;;Name      Raingage      Outlet      Area      Imperv      Width      Slope      Length      Pack
;;-----
201          SCS_6h_78.4mm_100yr SU1          7.3246  57.7      2525      2          0
202          SCS_6h_78.4mm_100yr J3          1.6637  25        600       3          0
203          SCS_6h_78.4mm_100yr J1          0.7912  27.3     375       3          0

```

[SUBAREAS]

```

;;Subcatchment  N-Imperv  N-Perv      S-Imperv  S-Perv      PctZero  RouteTo  PctRouted
;;-----
201             0.01      0.25      0.05      0.05        25      OUTLET
202             0.01      0.31      0.05      0.05        25      OUTLET
203             0.01      0.27      0.05      0.05        25      OUTLET

```

[INFILTRATION]

```

;;Subcatchment  CurveNum  HydCon      DryTime
;;-----
201             77        0.5         7

```

Sunvale Homes – Mount Forest Subdivision – Post Development – Model Details

```
202          73          0.5          7
203          75.6        0.5          7
```

[JUNCTIONS]

```
;;
;;Name      Invert      Max.      Init.      Surcharge      Poned
            Elev.       Depth     Depth     Depth          Area
;;-----
J1          407.5      0.5      0          0              0
J2          402.2      1.8      0          0              0
J3          406.63    0        0          0              0
J5          404.8      2.12    0          0              0
J6          405.97    2.13    0          0              0
```

[OUTFALLS]

```
;;
;;Name      Invert      Outfall      Stage/Table      Tide
            Elev.       Type         Time Series     Gate Route To
;;-----
south_saugeen 401.5      FREE        FREE            NO
unnamed_watercourse 407      FREE        FREE            NO
```

[STORAGE]

```
;;
;;Name      Invert      Max.      Init.      Storage      Curve      Poned      Evap.
            Elev.       Depth     Depth     Curve        Params     Area      Frac.
Infiltration parameters
;;-----
SU1          408.1      0.9       0          TABULAR      Inlet_basin      0          0
```

[CONDUITS]

```
;;
;;Name      Inlet      Outlet      Length      Manning      Inlet      Outlet      Init.      Max.
            Node      Node         Length      N            Offset     Offset     Flow      Flow
;;-----
C1          J1          unnamed_watercourse 15.46    0.013      407.5     407        0          0
C2          J6          J5          101.4      0.013      405.97    404.95    0          0
C3          J3          J2          89.25     0.02       406.63    402.2     0          0
C4          J2          south_saugeen 12.96    0.013      402.2     401.5     0          0
C5          J5          J2          56        0.013      404.8     402.2     0          0
```

[ORIFICES]

```
;;
;;Name      Inlet      Outlet      Orifice      Crest      Disch.      Flap Open/Close
            Node      Node         Type         Height     Coeff.     Gate Time
;;-----
OR1         SU1        J6          BOTTOM        408.1     0.65      NO 0
```

[XSECTIONS]

```
;;Link      Shape      Geom1      Geom2      Geom3      Geom4      Barrels
;;-----
C1          TRIANGULAR 0.5        275        0          0          1
C2          CIRCULAR   0.9        0          0          0          1
C3          CIRCULAR   0.75       0          0          0          1
C4          TRIANGULAR 0.8        4          0          0          1
C5          CIRCULAR   1          0          0          0          1
OR1         RECT_CLOSED 1.2        0.9        0          0          0
```

[LOSSES]

```
;;Link      Inlet      Outlet      Average      Flap Gate      SeepageRate
;;-----
```

[CURVES]

```
;;Name      Type      X-Value      Y-Value
;;-----
Inlet_basin Storage 0             0
Inlet_basin .3         575
Inlet_basin .9         1000
```

[TIMESERIES]

```
;;Name      Date      Time      Value
;;-----
;SCS_6h_38.8mm design storm, total rainfall = 38.8 mm, rain units = mm/hr.
SCS_6h_38.8mm_2yr

;SCS_6h_49.4mm design storm, total rainfall = 49.4 mm, rain units = mm/hr.
SCS_6h_49.4mm_5yr
```

Sunvale Homes – Mount Forest Subdivision – Post Development – Model Details

```
;SCS_6h_65.3mm design storm, total rainfall = 65.3 mm, rain units = mm/hr.  
SCS_6h_65.3mm_25yr
```

```
;SCS_6h_71.9mm design storm, total rainfall = 71.9 mm, rain units = mm/hr.  
SCS_6h_71.9mm_50yr
```

```
;SCS_6h_78.4mm design storm, total rainfall = 78.4 mm, rain units = mm/hr.  
SCS_6h_78.4mm_100yr
```

[REPORT]

```
INPUT      YES  
CONTROLS   NO  
SUBCATCHMENTS ALL  
NODES ALL  
LINKS ALL
```

[TAGS]

[MAP]

```
DIMENSIONS 520227.093448804 4868478.23441462 520703.634912082 4868943.56059042  
UNITS      Meters
```


Sunvale Homes – Mount Forest Subdivision – Post Development – 2 Yr Storm Event

C1	TRIANGULAR	0.50	68.75	0.25	275.00	1 377549.71
C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1815.81
C3	CIRCULAR	0.75	0.44	0.19	0.75	1 1613.27
C4	TRIANGULAR	0.80	1.60	0.37	4.00	1 14790.65
C5	CIRCULAR	1.00	0.79	0.25	1.00	1 5169.24

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

 Analysis Options

 Flow Units LPS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Starting Date 09/10/2020 00:00:00
 Ending Date 09/11/2020 00:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001524 m

	Volume hectare-m	Depth mm
Runoff Quantity Continuity	-----	-----
Total Precipitation	0.380	38.807
Evaporation Loss	0.000	0.000
Infiltration Loss	0.129	13.187
Surface Runoff	0.250	25.592
Final Storage	0.000	0.051
Continuity Error (%)	-0.059	

	Volume hectare-m	Volume 10^6 ltr
Flow Routing Continuity	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.250	2.503
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.250	2.503
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

 Time-Step Critical Elements

 None

Sunvale Homes – Mount Forest Subdivision – Post Development – 2 Yr Storm Event

 Highest Flow Instability Indexes

 All links are stable.

 Routing Time Step Summary

 Minimum Time Step : 4.50 sec
 Average Time Step : 5.00 sec
 Maximum Time Step : 5.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 2.00
 Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
201	38.81	0.00	0.00	10.86	27.93	2.05	416.30	0.720
202	38.81	0.00	0.00	20.60	18.16	0.30	52.03	0.468
203	38.81	0.00	0.00	19.15	19.61	0.16	29.29	0.505

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.01	407.51	0 02:25	0.01
J2	JUNCTION	0.04	0.22	402.42	0 02:25	0.22
J3	JUNCTION	0.01	0.09	406.72	0 02:25	0.09
J5	JUNCTION	0.02	0.19	404.99	0 02:25	0.19
J6	JUNCTION	0.04	0.29	406.26	0 02:25	0.29
south_saugeen	OUTFALL	0.04	0.22	401.72	0 02:26	0.22
unnamed_watercourse	OUTFALL	0.00	0.01	407.01	0 02:25	0.01
SU1	STORAGE	0.01	0.14	408.24	0 02:25	0.14

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	29.29	29.29	0 02:25	0.155	0.155	-0.000
J2	JUNCTION	0.00	464.93	0 02:25	0	2.35	0.007
J3	JUNCTION	52.03	52.03	0 02:25	0.302	0.302	-0.004
J5	JUNCTION	0.00	413.36	0 02:25	0	2.05	-0.002
J6	JUNCTION	0.00	413.77	0 02:25	0	2.05	-0.001
south_saugeen	OUTFALL	0.00	464.92	0 02:26	0	2.35	0.000
unnamed_watercourse	OUTFALL	0.00	29.24	0 02:25	0	0.155	0.000
SU1	STORAGE	416.30	416.30	0 02:25	2.05	2.05	-0.000

 Node Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 2 Yr Storm Event

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	0.001	0	0	0	0.019	3	0 02:25	413.77

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
south_saugeen	79.42	34.21	464.92	2.348
unnamed_watercourse	44.85	4.00	29.24	0.155
System	62.13	38.21	493.79	2.503

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
C1	CONDUIT	29.24	0 02:25	0.52	0.00	0.03
C2	CONDUIT	413.36	0 02:25	2.31	0.23	0.32
C3	CONDUIT	51.85	0 02:25	0.78	0.03	0.21
C4	CONDUIT	464.92	0 02:26	3.89	0.03	0.27
C5	CONDUIT	413.37	0 02:25	3.57	0.08	0.20
OR1	ORIFICE	413.77	0 02:25			

Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.93	0.00
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.58	0.00
C5	1.00	0.00	0.00	0.00	0.71	0.29	0.00	0.00	1.00	0.00

Conduit Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 2 Yr Storm Event

No conduits were surcharged.

Analysis begun on: Wed Sep 16 08:56:00 2020
Analysis ended on: Wed Sep 16 08:56:00 2020
Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Post Development – 5 Yr Storm Event

C1	TRIANGULAR	0.50	68.75	0.25	275.00	1 377549.71
C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1815.81
C3	CIRCULAR	0.75	0.44	0.19	0.75	1 1613.27
C4	TRIANGULAR	0.80	1.60	0.37	4.00	1 14790.65
C5	CIRCULAR	1.00	0.79	0.25	1.00	1 5169.24

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

 Analysis Options

 Flow Units LPS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Starting Date 09/10/2020 00:00:00
 Ending Date 09/11/2020 00:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001524 m

	Volume	Depth
	hectare-m	mm
*****	-----	-----
Runoff Quantity Continuity		
Total Precipitation	0.483	49.408
Evaporation Loss	0.000	0.000
Infiltration Loss	0.151	15.434
Surface Runoff	0.332	33.950
Final Storage	0.000	0.051
Continuity Error (%)	-0.056	

	Volume	Volume
	hectare-m	10^6 ltr
*****	-----	-----
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.332	3.321
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.332	3.321
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

 Time-Step Critical Elements

 None

Sunvale Homes – Mount Forest Subdivision – Post Development – 5 Yr Storm Event

 Highest Flow Instability Indexes

 All links are stable.

 Routing Time Step Summary

 Minimum Time Step : 4.50 sec
 Average Time Step : 5.00 sec
 Maximum Time Step : 5.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 2.00
 Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
201	49.41	0.00	0.00	12.66	36.74	2.69	555.51	0.744
202	49.41	0.00	0.00	24.34	25.01	0.42	74.96	0.506
203	49.41	0.00	0.00	22.41	26.96	0.21	41.85	0.546

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.02	407.52	0 02:25	0.02
J2	JUNCTION	0.04	0.24	402.44	0 02:25	0.24
J3	JUNCTION	0.02	0.11	406.74	0 02:25	0.11
J5	JUNCTION	0.03	0.22	405.02	0 02:25	0.22
J6	JUNCTION	0.04	0.34	406.31	0 02:25	0.34
south_saugeen	OUTFALL	0.04	0.24	401.74	0 02:26	0.24
unnamed_watercourse	OUTFALL	0.00	0.02	407.02	0 02:25	0.02
SU1	STORAGE	0.02	0.17	408.27	0 02:25	0.17

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	41.85	41.85	0 02:25	0.213	0.213	-0.000
J2	JUNCTION	0.00	625.41	0 02:25	0	3.11	0.007
J3	JUNCTION	74.96	74.96	0 02:25	0.416	0.416	-0.003
J5	JUNCTION	0.00	551.13	0 02:25	0	2.69	-0.002
J6	JUNCTION	0.00	551.54	0 02:25	0	2.69	-0.001
south_saugeen	OUTFALL	0.00	625.43	0 02:26	0	3.11	0.000
unnamed_watercourse	OUTFALL	0.00	41.79	0 02:25	0	0.213	0.000
SU1	STORAGE	555.51	555.51	0 02:25	2.69	2.69	-0.000

 Node Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 5 Yr Storm Event

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	0.001	0	0	0	0.028	5	0 02:25	551.54

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
south_saugeen	79.97	44.97	625.43	3.108
unnamed_watercourse	45.44	5.42	41.79	0.213
System	62.71	50.39	666.68	3.321

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
C1	CONDUIT	41.79	0 02:25	0.56	0.00	0.03
C2	CONDUIT	551.13	0 02:25	2.50	0.30	0.38
C3	CONDUIT	74.71	0 02:25	0.94	0.05	0.24
C4	CONDUIT	625.43	0 02:26	4.19	0.04	0.31
C5	CONDUIT	551.14	0 02:25	3.98	0.11	0.23
OR1	ORIFICE	551.54	0 02:25			

Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.90	0.00
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.58	0.00
C5	1.00	0.00	0.00	0.00	0.70	0.30	0.00	0.00	1.00	0.00

Conduit Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 5 Yr Storm Event

No conduits were surcharged.

Analysis begun on: Wed Sep 16 09:04:43 2020
Analysis ended on: Wed Sep 16 09:04:43 2020
Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Post Development – 25 Yr Storm Event

C1	TRIANGULAR	0.50	68.75	0.25	275.00	1 377549.71
C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1815.81
C3	CIRCULAR	0.75	0.44	0.19	0.75	1 1613.27
C4	TRIANGULAR	0.80	1.60	0.37	4.00	1 14790.65
C5	CIRCULAR	1.00	0.79	0.25	1.00	1 5169.24

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

 Analysis Options

 Flow Units LPS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Starting Date 09/10/2020 00:00:00
 Ending Date 09/11/2020 00:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001524 m

	Volume hectare-m	Depth mm

Runoff Quantity Continuity	-----	-----
Total Precipitation	0.639	65.310
Evaporation Loss	0.000	0.000
Infiltration Loss	0.178	18.199
Surface Runoff	0.461	47.094
Final Storage	0.000	0.051
Continuity Error (%)	-0.052	

	Volume hectare-m	Volume 10^6 ltr

Flow Routing Continuity	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.461	4.607
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.461	4.606
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

 Time-Step Critical Elements

 Link C4 (3.65%)

Sunvale Homes – Mount Forest Subdivision – Post Development – 25 Yr Storm Event

 Highest Flow Instability Indexes

 All links are stable.

 Routing Time Step Summary

 Minimum Time Step : 0.90 sec
 Average Time Step : 4.88 sec
 Maximum Time Step : 5.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 2.00
 Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
201	65.31	0.00	0.00	14.85	50.46	3.70	776.35	0.773
202	65.31	0.00	0.00	29.02	36.24	0.60	114.85	0.555
203	65.31	0.00	0.00	26.48	38.79	0.31	63.01	0.594

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.02	407.52	0 02:25	0.02
J2	JUNCTION	0.05	0.28	402.48	0 02:25	0.28
J3	JUNCTION	0.02	0.14	406.77	0 02:25	0.14
J5	JUNCTION	0.04	0.26	405.06	0 02:25	0.26
J6	JUNCTION	0.06	0.41	406.38	0 02:25	0.41
south_saugeen	OUTFALL	0.05	0.28	401.78	0 02:25	0.28
unnamed_watercourse	OUTFALL	0.00	0.02	407.02	0 02:25	0.02
SU1	STORAGE	0.02	0.22	408.32	0 02:25	0.22

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	63.01	63.01	0 02:25	0.307	0.307	0.000
J2	JUNCTION	0.00	883.23	0 02:25	0	4.3	0.007
J3	JUNCTION	114.85	114.85	0 02:25	0.603	0.603	-0.001
J5	JUNCTION	0.00	769.43	0 02:25	0	3.7	-0.002
J6	JUNCTION	0.00	769.82	0 02:25	0	3.7	-0.001
south_saugeen	OUTFALL	0.00	883.26	0 02:25	0	4.3	0.000
unnamed_watercourse	OUTFALL	0.00	62.91	0 02:25	0	0.307	0.000
SU1	STORAGE	776.35	776.35	0 02:25	3.7	3.7	-0.001

 Node Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 25 Yr Storm Event

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	0.003	0	0	0	0.044	8	0 02:25	769.82

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
south_saugeen	80.99	84.24	883.26	4.299
unnamed_watercourse	47.16	10.23	62.91	0.307
System	64.08	94.47	945.40	4.606

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
C1	CONDUIT	62.91	0 02:25	0.62	0.00	0.04
C2	CONDUIT	769.43	0 02:25	2.74	0.42	0.45
C3	CONDUIT	114.47	0 02:25	1.16	0.07	0.28
C4	CONDUIT	883.26	0 02:25	4.57	0.06	0.35
C5	CONDUIT	769.41	0 02:25	4.51	0.15	0.27
OR1	ORIFICE	769.82	0 02:25			

Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.87	0.00
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.58	0.00
C5	1.00	0.00	0.00	0.00	0.68	0.32	0.00	0.00	1.00	0.00

Conduit Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 25 Yr Storm Event

No conduits were surcharged.

Analysis begun on: Wed Sep 16 09:10:27 2020
Analysis ended on: Wed Sep 16 09:10:27 2020
Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Post Development – 50 Yr Storm Event

C1	TRIANGULAR	0.50	68.75	0.25	275.00	1 377549.71
C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1815.81
C3	CIRCULAR	0.75	0.44	0.19	0.75	1 1613.27
C4	TRIANGULAR	0.80	1.60	0.37	4.00	1 14790.65
C5	CIRCULAR	1.00	0.79	0.25	1.00	1 5169.24

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

 Analysis Options

 Flow Units LPS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Starting Date 09/10/2020 00:00:00
 Ending Date 09/11/2020 00:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001524 m

	Volume	Depth
	hectare-m	mm
*****	-----	-----
Runoff Quantity Continuity		
Total Precipitation	0.703	71.911
Evaporation Loss	0.000	0.000
Infiltration Loss	0.188	19.207
Surface Runoff	0.515	52.690
Final Storage	0.000	0.051
Continuity Error (%)	-0.051	

	Volume	Volume
	hectare-m	10^6 ltr
*****	-----	-----
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.515	5.154
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.515	5.154
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

 Time-Step Critical Elements

 Link C4 (4.48%)

Sunvale Homes – Mount Forest Subdivision – Post Development – 50 Yr Storm Event

 Highest Flow Instability Indexes

 All links are stable.

 Routing Time Step Summary

 Minimum Time Step : 0.42 sec
 Average Time Step : 4.85 sec
 Maximum Time Step : 5.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 2.00
 Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
201	71.91	0.00	0.00	15.65	56.26	4.12	871.15	0.782
202	71.91	0.00	0.00	30.74	41.12	0.68	132.97	0.572
203	71.91	0.00	0.00	27.91	43.98	0.35	72.42	0.612

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.02	407.52	0 02:25	0.02
J2	JUNCTION	0.05	0.29	402.49	0 02:25	0.29
J3	JUNCTION	0.02	0.15	406.78	0 02:25	0.15
J5	JUNCTION	0.04	0.28	405.08	0 02:25	0.28
J6	JUNCTION	0.06	0.44	406.41	0 02:25	0.44
south_saugeen	OUTFALL	0.06	0.29	401.79	0 02:25	0.29
unnamed_watercourse	OUTFALL	0.00	0.02	407.02	0 02:25	0.02
SU1	STORAGE	0.03	0.23	408.33	0 02:25	0.23

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	72.42	72.42	0 02:25	0.348	0.348	0.000
J2	JUNCTION	0.00	994.94	0 02:25	0	4.81	0.007
J3	JUNCTION	132.97	132.97	0 02:25	0.684	0.684	-0.001
J5	JUNCTION	0.00	863.21	0 02:25	0	4.12	-0.002
J6	JUNCTION	0.00	863.58	0 02:25	0	4.12	-0.000
south_saugeen	OUTFALL	0.00	994.99	0 02:25	0	4.81	0.000
unnamed_watercourse	OUTFALL	0.00	72.31	0 02:25	0	0.348	0.000
SU1	STORAGE	871.15	871.15	0 02:25	4.12	4.12	-0.001

 Node Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 50 Yr Storm Event

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	0.003	1	0	0	0.052	9	0 02:25	863.58

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
south_saugeen	81.12	99.60	994.99	4.806
unnamed_watercourse	47.65	12.14	72.31	0.348
System	64.39	111.74	1066.38	5.154

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
C1	CONDUIT	72.31	0 02:25	0.65	0.00	0.04
C2	CONDUIT	863.21	0 02:25	2.82	0.48	0.49
C3	CONDUIT	132.55	0 02:25	1.24	0.08	0.29
C4	CONDUIT	994.99	0 02:25	4.71	0.07	0.36
C5	CONDUIT	863.19	0 02:25	4.71	0.17	0.28
OR1	ORIFICE	863.58	0 02:25			

Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.84	0.00
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.58	0.00
C5	1.00	0.00	0.00	0.00	0.68	0.32	0.00	0.00	1.00	0.00

Conduit Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 50 Yr Storm Event

No conduits were surcharged.

Analysis begun on: Wed Sep 16 09:12:43 2020
Analysis ended on: Wed Sep 16 09:12:43 2020
Total elapsed time: < 1 sec

Sunvale Homes – Mount Forest Subdivision – Post Development – 100 Yr Storm Event

C1	TRIANGULAR	0.50	68.75	0.25	275.00	1 377549.71
C2	CIRCULAR	0.90	0.64	0.23	0.90	1 1815.81
C3	CIRCULAR	0.75	0.44	0.19	0.75	1 1613.27
C4	TRIANGULAR	0.80	1.60	0.37	4.00	1 14790.65
C5	CIRCULAR	1.00	0.79	0.25	1.00	1 5169.24

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

 Analysis Options

 Flow Units LPS
 Process Models:
 Rainfall/Runoff YES
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Infiltration Method CURVE_NUMBER
 Flow Routing Method DYNWAVE
 Starting Date 09/10/2020 00:00:00
 Ending Date 09/11/2020 00:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:01:00
 Wet Time Step 00:05:00
 Dry Time Step 00:05:00
 Routing Time Step 5.00 sec
 Variable Time Step YES
 Maximum Trials 8
 Number of Threads 1
 Head Tolerance 0.001524 m

	Volume	Depth
	hectare-m	mm
*****	-----	-----
Runoff Quantity Continuity		
Total Precipitation	0.767	78.413
Evaporation Loss	0.000	0.000
Infiltration Loss	0.196	20.088
Surface Runoff	0.570	58.314
Final Storage	0.000	0.051
Continuity Error (%)	-0.051	

	Volume	Volume
	hectare-m	10^6 ltr
*****	-----	-----
Flow Routing Continuity		
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.570	5.704
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.570	5.704
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.002	

 Time-Step Critical Elements

 Link C4 (4.96%)

Sunvale Homes – Mount Forest Subdivision – Post Development – 100 Yr Storm Event

 Highest Flow Instability Indexes

 All links are stable.

 Routing Time Step Summary

 Minimum Time Step : 1.61 sec
 Average Time Step : 4.83 sec
 Maximum Time Step : 5.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 2.00
 Percent Not Converging : 0.00

 Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff LPS	Runoff Coeff
201	78.41	0.00	0.00	16.34	62.07	4.55	965.92	0.792
202	78.41	0.00	0.00	32.25	46.12	0.77	151.55	0.588
203	78.41	0.00	0.00	29.19	49.19	0.39	81.95	0.627

 Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.00	0.02	407.52	0 02:25	0.02
J2	JUNCTION	0.06	0.30	402.50	0 02:25	0.30
J3	JUNCTION	0.02	0.16	406.79	0 02:25	0.15
J5	JUNCTION	0.04	0.29	405.09	0 02:25	0.29
J6	JUNCTION	0.07	0.46	406.43	0 02:25	0.46
south_saugeen	OUTFALL	0.06	0.30	401.80	0 02:25	0.30
unnamed_watercourse	OUTFALL	0.00	0.02	407.02	0 02:25	0.02
SU1	STORAGE	0.03	0.25	408.35	0 02:25	0.25

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
J1	JUNCTION	81.95	81.95	0 02:25	0.389	0.389	-0.000
J2	JUNCTION	0.00	1107.06	0 02:25	0	5.31	0.006
J3	JUNCTION	151.55	151.55	0 02:25	0.768	0.768	-0.001
J5	JUNCTION	0.00	956.95	0 02:25	0	4.55	-0.002
J6	JUNCTION	0.00	957.32	0 02:25	0	4.55	-0.000
south_saugeen	OUTFALL	0.00	1107.11	0 02:25	0	5.31	0.000
unnamed_watercourse	OUTFALL	0.00	81.84	0 02:25	0	0.389	0.000
SU1	STORAGE	965.92	965.92	0 02:25	4.55	4.55	-0.001

 Node Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 100 Yr Storm Event

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	0.004	1	0	0	0.059	11	0 02:25	957.32

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
south_saugeen	81.38	113.45	1107.11	5.314
unnamed_watercourse	48.01	13.94	81.84	0.389
System	64.69	127.39	1187.91	5.704

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
C1	CONDUIT	81.84	0 02:25	0.67	0.00	0.04
C2	CONDUIT	956.95	0 02:25	2.89	0.53	0.52
C3	CONDUIT	151.09	0 02:25	1.32	0.09	0.31
C4	CONDUIT	1107.11	0 02:25	4.83	0.07	0.38
C5	CONDUIT	956.93	0 02:25	4.89	0.19	0.30
OR1	ORIFICE	957.32	0 02:25			

Flow Classification Summary

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class								
		Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.83	0.00
C2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
C3	1.00	0.00	0.00	0.00	0.00	0.97	0.03	0.00	1.00	0.00
C4	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.58	0.00
C5	1.00	0.00	0.00	0.00	0.68	0.32	0.00	0.00	1.00	0.00

Conduit Surcharge Summary

Sunvale Homes – Mount Forest Subdivision – Post Development – 100 Yr Storm Event

No conduits were surcharged.

Analysis begun on: Wed Sep 16 09:13:59 2020
Analysis ended on: Wed Sep 16 09:13:59 2020
Total elapsed time: < 1 sec

Appendix F

OGS SIZING

STORMWATER MANAGEMENT REPORT

SUNVALE HOMES MOUNT FOREST SUBDIVISION

TOWNSHIP OF WELLINGTON NORTH

ADS OGS Sizing Summary

Project Name:	Sunvale Subdivision	
Consulting Engineer:	Cobide Engineering	
Location:	Mount Forest, ON	
Sizing Completed By:	C. Neath	Email: cody.neath@ads-pipe.com

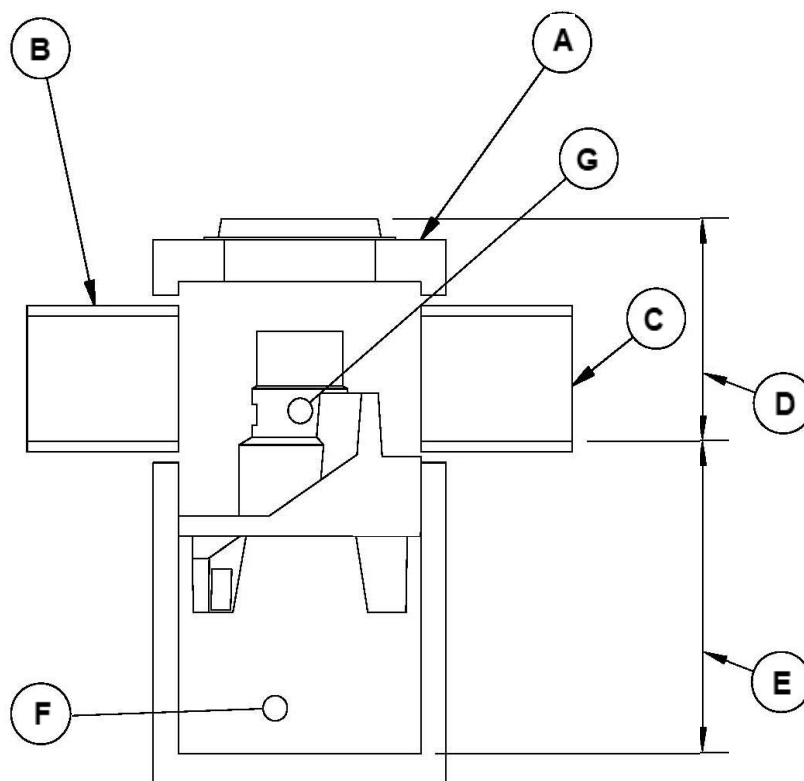
Treatment Requirements		
Treatment Goal:	Enhanced (MOE)	
Selected Parameters:	80% TSS	90% Volume
Selected Unit:	ADS FD-8HC	

Summary of Results		
Model	TSS Removal	Volume Treated
ADS FD-4HC	72.0%	87.5%
ADS FD-5HC	75.4%	94.2%
ADS FD-6HC	77.7%	97.2%
ADS FD-8HC	81.9%	98.9%

ADS FD-8HC Specification	
Unit Diameter (A):	2,400 mm
Inlet Pipe Diameter (B):	900 mm
Outlet Pipe Diameter (C):	900 mm
Height, T/G to Outlet Invert (D):	1600 mm
Height, Outlet Invert to Sump (E):	2,200 mm
Sediment Storage Capacity (F):	2.1 m ³
Oil Storage Capacity (G):	4,239 L
Max. Pipe Diameter:	1,200 mm
Peak Flow Capacity:	1,415 L/s

Site Elevations:	
Rim Elevation:	100.00
Inlet Pipe Elevation:	98.40
Outlet Pipe Elevation:	98.40

Site Details	
Site Area:	6.97 ha
% Impervious:	59%
Rational C:	0.79
Rainfall Station:	Owen Sound
Particle Size Distribution:	Fine
Peak Flowrate:	931 L/s



Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.



Project Name: Sunvale Subdivision
 Consulting Engineer: Cobide Engineering
 Location: Mount Forest, ON

Net Annual Removal Efficiency Summary: ADS FD-8HC

Rainfall Intensity ⁽¹⁾	Fraction of Rainfall ⁽¹⁾	ADS FD-8HC Removal Efficiency ⁽²⁾	Weighted Net-Annual Removal 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 Runoff Volume Treated:			98.9%

Notes:

- (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 approximating the removal of a PSD similar to the STC Fine distribution
- (3) Rainfall adjusted to 5 min peak intensity based on hourly average.