

Prepared By:



## Elora Ridge Developments

# FUNCTIONAL SERVICING REPORT Inverhaugh Pasture Edge Subdivision Township of Centre Wellington (Inverhaugh)

**GMBP File No. 117021  
December 11, 2018**

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**FUNCTIONAL SERVICING REPORT  
INVERHAUGH PASTURE EDGE SUBDIVISION  
TOWNSHIP OF CENTRE WELLINGTON  
(INVERHAUGH)  
DECEMBER 11, 2018  
GMBP FILE NO. 117021**

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## **1. INTRODUCTION**

In support of the Draft Plan of Subdivision, this Functional Servicing Report documents the proposed preliminary site servicing and stormwater management design for the proposed Inverhaugh Pasture Edge Subdivision in the Township of Centre Wellington (Inverhaugh), as shown on Figure No. 1.

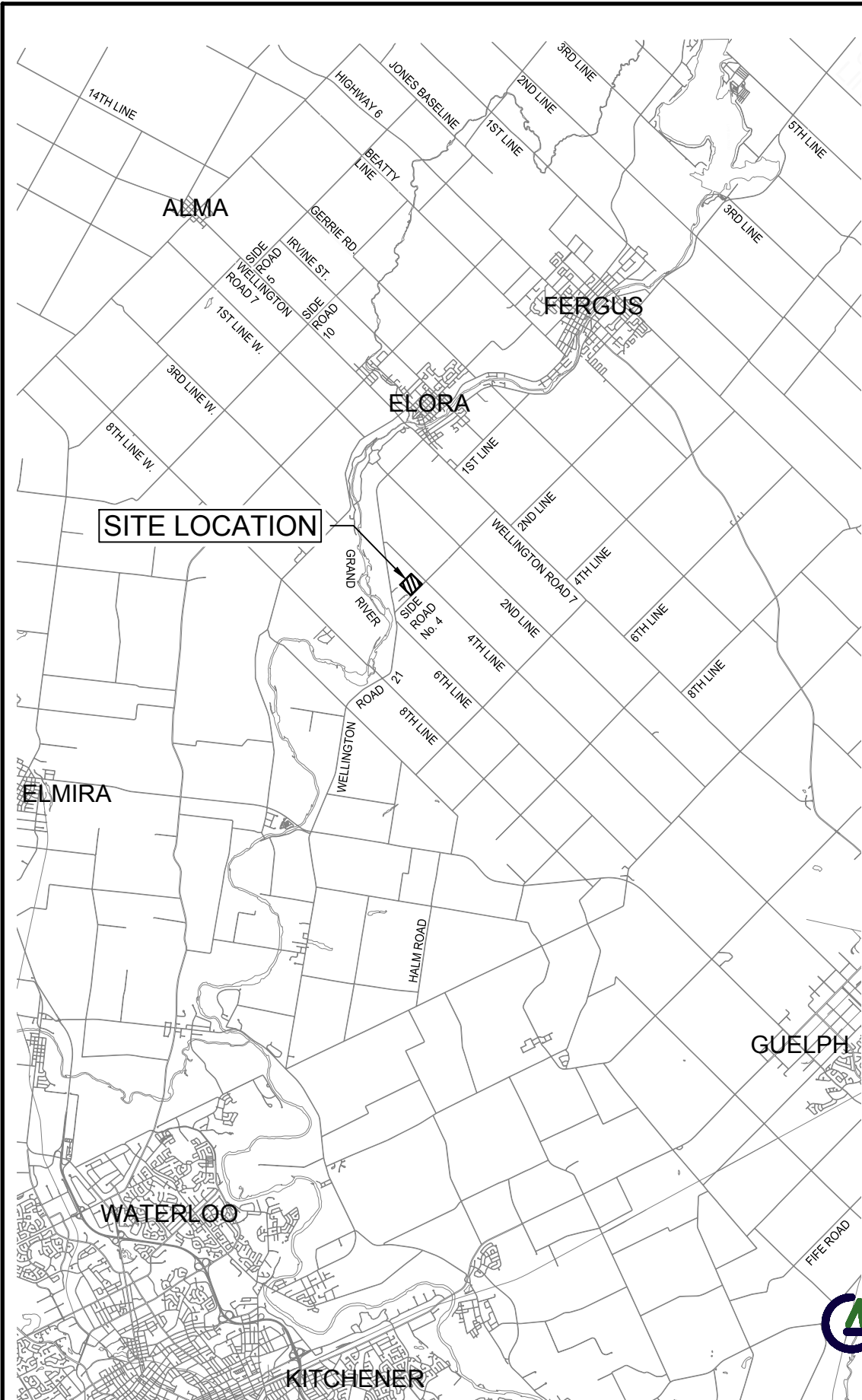
The topographic survey of the site was provided by Van Harten Surveying Inc. (dated December 2017). Van Harten Surveying Inc. also provided additional topographic surveying in March 2018. The lot layout was provided by Astrid J. Clos Planning Consultants (dated August 28, 2018). The existing and proposed site details are shown on the Preliminary Site Grading and Servicing Plan.

## **2. SITE INFORMATION**

The 15.20-hectare site is bound by agricultural lands to the north, 4th Line East to the east, Side Road 4 to the south, and existing residential development and Swan Creek to the west.

A Preliminary Geotechnical Investigation was completed for the site by V.A. Wood (Guelph) Incorporated and is included as Appendix 'A'. A total of eight (8) boreholes were completed on-site which found surficial topsoil which was underlain by sand, silty sand, sandy gravel and/or sandy silt on compact to very dense gravel or sandy silt till. Under existing conditions the subject property generally slopes from northeast to southwest, towards Swan Creek.

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 CENTRE  
 WELLINGTON  
 (INVERHAUGH)



SITE  
 LOCATION  
 MAP

Figure No. 1



117021  
 DECEMBER 2018  
 Scale: N.T.S.

### **3. PROPOSED DEVELOPMENT**

At this time, the intent of the Owner is to develop the 15.20 ha site into 40 single family residential lots. The development layout is shown on the Draft Plan of Subdivision (Figure No. 2).

Following development, runoff generated from the site will be attenuated on-site in two (2) stormwater management facilities prior to discharging to the existing wetland and Swan Creek.

#### **3.1 Water Services**

Water supply for the Inverhaugh Pasture Edge Subdivision will be provided via individual on-site drilled wells (bedrock wells) on each lot. To achieve the minimum separation distance from the on-site septic system, the on-site wells are proposed to be located in the front yards of each lot.

#### **3.2 Septic Systems**

Sanitary services for the Inverhaugh Pasture Edge Subdivision will be provided by individual septic systems (complete with tertiary treatment) on each lot. The detailed design of the individual septic system for each lot will be based on the specific soil conditions on each lot.

The preliminary footprint of the individual septic systems has also been illustrated on the Preliminary Grading Plans.

#### **3.3 Storm System**

Runoff from the upstream lands will continue to be conveyed through the proposed development. Runoff from the upstream lands and the subject property will be captured and conveyed via storm sewers to the proposed stormwater management facility, prior to discharge to the existing wetland and Swan Creek.

INVERHAUGH PASTURE EDGE  
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(INVERHAUGH)

**ASTRID J. CLOS**  
PLANNING CONSULTANTS

423 Woolwich Street, Suite 201  
Guelph, Ontario N1H 3X3  
Email: astrid.clos@ajcplanning.ca  
Phone: (519) 836-7528 (836-PLAN)

**INVERHAUGH PASTURE EDGE  
DRAFT PLAN OF SUBDIVISION**

DATE: AUGUST 28, 2018      SCALE: 1:1,000  
PROJECT No. 1705      DRAWN BY: A.R.N.

**KEY MAP**

**LEGAL DESCRIPTION**  
PARK LOTS 8 AND 11 AND PART OF PARK LOT 7  
PART OF MILL PROPERTY, REGISTERED PLAN 140  
(GEOGRAPHIC TOWNSHIP OF PILKINGTON)  
TOWNSHIP OF CENTRE WELLINGTON  
COUNTY OF WELLINGTON

**NOTES**

1. MINIMUM LOT FRONTAGE 24.4m
2. MINIMUM LOT AREA 1,858m<sup>2</sup>
3. TOPOGRAPHIC INFORMATION PROVIDED BY VAN HARTEN SURVEYING INC.

**ADDITIONAL INFORMATION**  
(UNDER SECTION 61(17) OF THE PLANNING ACT)  
INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g) and I ARE AS SHOWN ON DRAFT PLAN.  
h) private wells  
i) storm fills and deep gravel terraces  
k) tertiary services

**LAND USE SCHEDULE**

DESCRIPTION	BLOCKS	AREA (ha.)
SINGLE DETACHED	1-40	9.329
STORMWATER MANAGEMENT	41, 42	2.900
OPEN SPACE	43	1.570
WALKWAY AND EMERGENCY ACCESS	44	0.077
ROADS	-	1.235
<b>TOTAL</b>	<b>44</b>	<b>15.109</b>

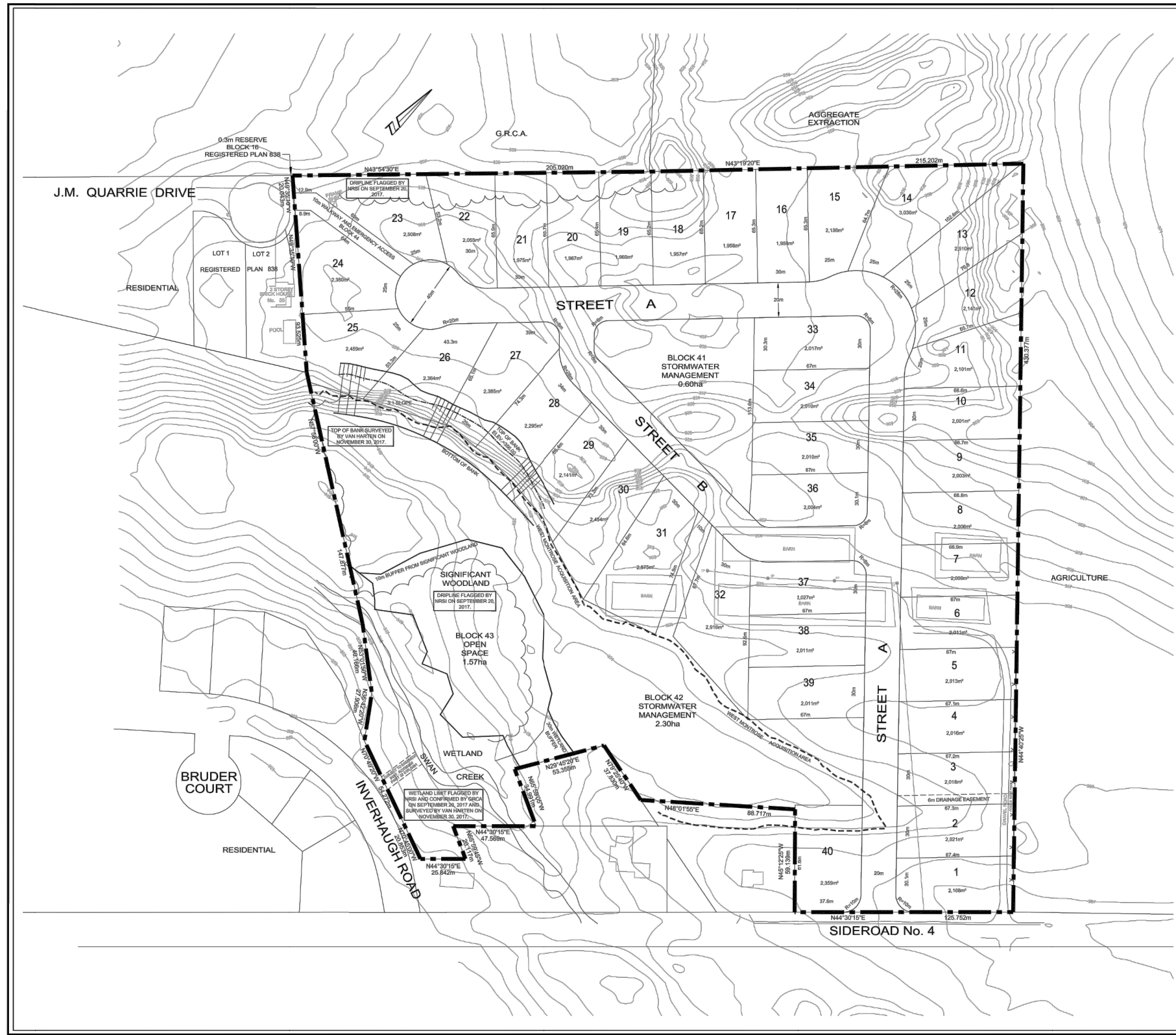
**OWNER'S CERTIFICATE**  
I, AUTHORIZE ASTRID J. CLOS, PLANNING CONSULTANTS TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION.

STEVEN WRIGHT      DATE  
ELORA RIDGE DEVELOPMENTS LIMITED

**SURVEYOR'S CERTIFICATE**  
I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

JAMES M. LAWS, O.L.S.  
VAN HARTEN SURVEYING INC.      AUGUST 28, 2018  
DATE

Aug 28, 2018 - 2:36pm      (24475-17)  
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DRAFT PLAN  
OF SUBDIVISION

Figure No. 2



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## 4. STORMWATER MANAGEMENT

### 4.1 Design Criteria

The stormwater management criteria used for the analysis of the site is as follows:

1. Post-development runoff generated from the site during the full range of design storm events is to be attenuated to the pre-development flow rates.
2. Enhanced water quality control (80% of TSS removal) is required prior to the discharge of runoff from the site.
3. Major storm flows are to be routed overland to an appropriate outlet.
4. Match pre- and post-development infiltration rates.
5. Provide cooling measures for runoff prior to discharge from the site.

The City of Guelph 25mm storm event was used to size the quality control component of the stormwater management facility; the corresponding Chicago Storm parameters are shown below in Table No. 1. The Ministry of Transportation (MTO) curve lookup tool was used to determine the IDF curves for the site for the storms greater than the 25mm storm event, as shown in Appendix 'B'. The MIDUSS IDF Curve Fit tool presented in Appendix 'B' was used to calculate the Chicago Storm parameters for the 2, 5, 10, 25, 50 and 100-year design rainfall events and are summarized in the following Table No. 1.

**Table No. 1: MTO - Chicago Storm Parameters**

Coefficient	25mm	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	367	412.629	541.973	621.728	732.700	813.857	891.458
B	5	0.1038	0.0933	0.0102	0.0464	0.0427	0.0345
C	0.7	0.7010	0.7005	0.6992	0.6997	0.6998	0.6995
R	0.394	0.400	0.400	0.400	0.400	0.400	0.400
Duration (min)	120	180	180	180	180	180	180
Total Depth (mm)	25.00	32.476	42.768	49.410	58.070	64.470	70.730

The Horton infiltration method was used in the MIDUSS model. The following parameters summarized in the following Table No. 2 were used according to the MTO Drainage Management Manual for a Type 'B' Soil Classification.

**Table No. 2: MIDUSS Horton Parameters**

	Impervious Areas	Pervious Areas
Maximum Infiltration (mm/hr)	0.0	60.0
Minimum Infiltration (mm/hr)	0.0	13.0
Lag Constant (hr)	0.00	0.5
Depression Storage (mm)	1.5	5.0

## 4.2 Pre-Development Conditions

For pre-development analysis purposes, the site was modelled as four (4) drainage catchments. The pre-development drainage catchment is shown on Figure No. 3 and described below. The pre-development MIDUSS computer modeling is attached in Appendix 'C'.

**Catchment 10 (14.36 hectares, 5% impervious)** represents the portion of the site draining to Swan Creek. Catchment 10 is comprised of mostly agricultural fields with a few barns.

**Catchment 11 (0.63 hectares, 0% impervious)** represents the north portion of the site draining to adjacent agricultural lands.

**Catchment 21 (0.24 hectares, 25% impervious)** represents the south portion of the off-site area draining to the subject property.

**Catchment 22 (6.95 hectares, 1% impervious)** represents the east portion of the off-site area draining to the subject property. Catchment 22 is comprised of agricultural fields.

**Table No. 3: Pre-Development Condition Flow Rates**

	25mm	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Catchment 10	0.114 m <sup>3</sup> /s	0.197 m <sup>3</sup> /s	0.417 m <sup>3</sup> /s	0.703 m <sup>3</sup> /s	1.020 m <sup>3</sup> /s	1.406 m <sup>3</sup> /s	1.849 m <sup>3</sup> /s
Catchment 11	0.000 m <sup>3</sup> /s	0.015 m <sup>3</sup> /s	0.045 m <sup>3</sup> /s	0.074 m <sup>3</sup> /s	0.129 m <sup>3</sup> /s	0.163 m <sup>3</sup> /s	0.196 m <sup>3</sup> /s
Catchment 21	0.009 m <sup>3</sup> /s	0.016 m <sup>3</sup> /s	0.024 m <sup>3</sup> /s	0.030 m <sup>3</sup> /s	0.042 m <sup>3</sup> /s	0.052 m <sup>3</sup> /s	0.063 m <sup>3</sup> /s
Catchment 22	0.010 m <sup>3</sup> /s	0.106 m <sup>3</sup> /s	0.373 m <sup>3</sup> /s	0.618 m <sup>3</sup> /s	0.896 m <sup>3</sup> /s	1.128 m <sup>3</sup> /s	1.351 m <sup>3</sup> /s
Total	0.132 m <sup>3</sup> /s	0.278 m <sup>3</sup> /s	0.739 m <sup>3</sup> /s	1.184 m <sup>3</sup> /s	1.801 m <sup>3</sup> /s	2.355 m <sup>3</sup> /s	2.865 m <sup>3</sup> /s

### 4.2.1 Allowable Release Rates

The allowable release rates from the site have been established by attenuating post-development flow rates to the pre-development flow rates generated from the site during the full range of design storm events. Therefore, the allowable release rates for the range of design storm events are as follows:

**Table No. 4: Allowable Release Rates**




	25mm	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Allowable Release Rate	0.132 m <sup>3</sup> /s	0.278 m <sup>3</sup> /s	0.739 m <sup>3</sup> /s	1.184 m <sup>3</sup> /s	1.801 m <sup>3</sup> /s	2.355 m <sup>3</sup> /s	2.865 m <sup>3</sup> /s

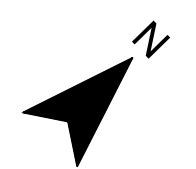


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WELLINGTON  
(INVERHAUGH)



LEGEND

-  CATCHMENT NUMBER
- AREA IN HECTARES
- PERCENT IMPERVIOUS
-  CATCHMENT BOUNDARY
-  PROPERTY LINE



PRE-DEVELOPMENT  
DRAINAGE  
AREAS

Figure No. 3



FILE:W:\Guelph\117-2017\117021 - Inverhaugh Ridge\5 Work in Progress\Drafting\Figures\117021 - Pre-Development Drainage Areas.dwg LAYOUT:FIG 3  
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### 4.3 Post-Development Conditions

For post-development analysis purposes, the area was modelled as seven (7) drainage catchments. The post-development drainage catchments are shown on Figure No. 4 and described below. The post-development MIDUSS computer modeling is attached in Appendix 'D'.

**Catchment 101 (1.57 hectares, 10% impervious)** represents the lots fronting on Street A that are proposed to drain north to adjacent agricultural lands.

**Catchment 102 (5.46 hectares, 50% impervious)** represents the east portion of the subject property. Minor runoff from Catchment 102 will be conveyed through storm sewers to the stormwater management facility in Block 41. Major runoff from Catchment 102 will sheetflow overland to the stormwater management facility in Block 42.

**Catchment 103 (1.85 hectares, 55% impervious)** represents the southeast portion of the subject property that is proposed to drain to an on-site storm sewer system which discharges to the on-site stormwater management facility in Block 42.

**Catchment 104 (2.23 hectares, 20% impervious)** represents the south portion of the site. Runoff from Catchment 104 will sheetflow overland to the stormwater management facility in Block 42.

**Catchment 105 (4.04 hectares, 15% impervious)** represents the west portion of the site. Runoff from Catchment 105 will continue to sheetflow overland to the wetland, ultimately discharging to Swan Creek.

**Catchment 201 (0.08 hectares, 20% impervious)** represents an off-site area south of the site. Runoff from Catchment 201 will sheetflow overland to the stormwater management facility in Block 42.

**Catchment 202 (6.95 hectares, 1% impervious)** represents an off-site area east of the site. Runoff from Catchment 202 will sheetflow overland to Catchment 103, ultimately discharging to the stormwater management facility in Block 42.

### 4.4 Stormwater Management System Details

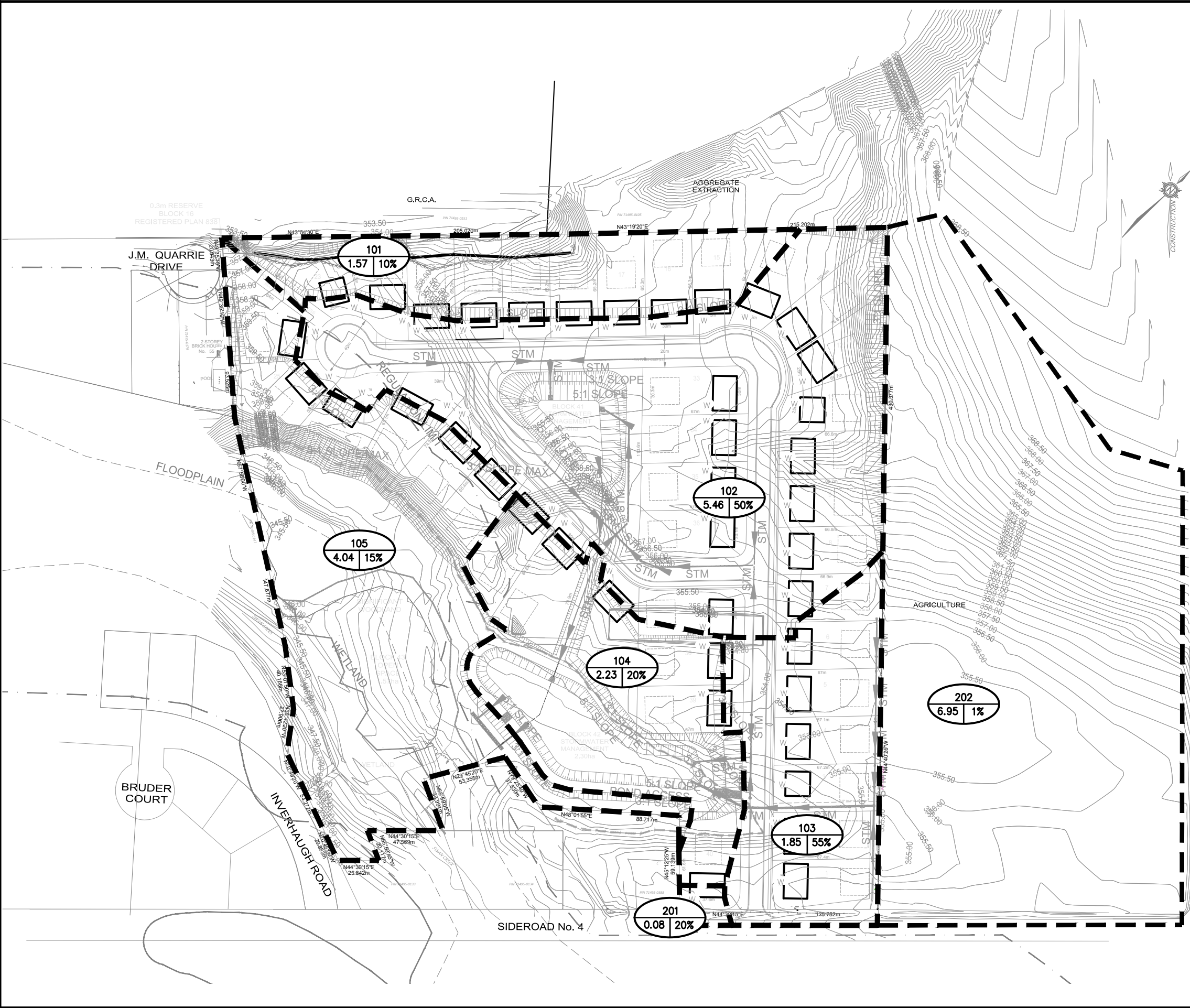
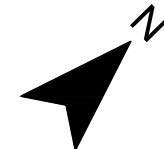
Minor runoff discharging from Catchment 102 will be directed to and attenuated via the Block 41 Stormwater Management Facility, which has been designed as a wetland with 7,250 m<sup>3</sup> of storage. Discharging from this pond will be via a 120 mm orifice plate and a 5 m wide overflow weir.

From Table 3.2 of the Stormwater Management Design Manual (MOE, 2003) a wetland facility with a contributing area that is 50% impervious requires 99 m<sup>3</sup>/ha of storage volume to provide enhanced water quality control treatment (80% TSS removal). 40 m<sup>3</sup>/ha of the required volume is extended detention, the remaining 59 m<sup>3</sup>/ha is required as permanent pool. Based on the contributing drainage area of 5.48ha, approximately 219 m<sup>3</sup> is required in extended detention, and 323 m<sup>3</sup> is required in the permanent pool volume. The proposed facility has been designed to provide approximately 6,779 m<sup>3</sup> of extended detention and 330 m<sup>3</sup> of permanent pool.

Runoff from Catchments 201, 202, 103, and 104, as well as major runoff from Catchment 102 will be attenuated via the Block 42 Stormwater Management Facility, which has been designed as a dry pond with 5,730 m<sup>3</sup> of storage. Discharging from this pond will be via a multi-stage outlet consisting of a 150 mm knockout for minor storms and two (2) 460 mm orifices for major storms, as well as a 5 m wide overflow weir prior to discharge to the cooling trench.

Quality control treatment for runoff generated by Catchment 103 will be provided via an oil/grit separator structure (CDS PMSU30\_20) prior to discharging to Block 42 Stormwater Management Facility. Details of the oil/grit separator structure (CDS PMSU30\_20) have been appended.

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LEGEND

- CATCHMENT NUMBER
- AREA IN HECTARES
- PERCENT IMPERVIOUS
- CATCHMENT BOUNDARY
- PROPERTY LINE

POST-DEVELOPMENT  
DRAINAGE  
AREAS

Figure No. 4



FILE:W:\Guelph\117-2017\117021 Inverhaugh Ridge\5 Work in Progress\Drafting\Figures\117021 - Post-Development Drainage Areas.dwg LAYOUT:FIG 4  
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The cooling trench (30 m long by 2.0 m wide by 1.0 m deep), consisting of 19 mm diameter clear stone, will dissipate the energy from the runoff and disperse the flows over a large area. Runoff will then percolate through the stone, ultimately discharging out the top of the stone. Discharge from the structure will then sheetflow along the entire length of the structure (30 m) overland towards the wetland and Swan Creek. Details of the cooling trench are provided in Appendix 'E'.

#### 4.5 Routing

The hydrologic model MIDUSS was used to create the design storm runoff hydrographs and route the hydrographs. The routing results for the proposed on-site stormwater management facility are summarized in Table No. 5 and Table No. 6 below.

**Table No. 5: Proposed Block 41 Stormwater Management Facility – Stage-Storage-Discharge Capacity**

Storage and Control	Available Capacity			Actual Capacity Used		
	Peak Flow m <sup>3</sup> /s	Storage Volume m <sup>3</sup>	Storage Elevation m	Peak Flow m <sup>3</sup> /s	Storage Volume m <sup>3</sup>	Storage Elevation m
Bottom of Active Storage / Orifice	0.000	0	353.10	---	---	---
25mm	---	---	---	0.022	525	353.49
2 Year	---	---	---	0.024	716	353.61
5 Year	---	---	---	0.028	1,052	353.81
10 Year	---	---	---	0.029	1,238	353.91
25 Year	---	---	---	0.031	1,456	354.03
50 Year	---	---	---	0.032	1,625	354.11
100 Year	---	---	---	0.033	1,795	354.19
Weir	0.053	7,573	356.10	---	---	---
Top of Pond	6.216	11,703	357.00	---	---	---

**Table No. 6: Proposed Block 42 Stormwater Management Facility – Stage-Storage-Discharge Capacity**

Storage and Control	Available Capacity			Actual Capacity Used		
	Peak Flow m <sup>3</sup> /s	Storage Volume m <sup>3</sup>	Storage Elevation m	Peak Flow m <sup>3</sup> /s	Storage Volume m <sup>3</sup>	Storage Elevation m
Bottom of Pond	0.000	0	350.60	---	---	---
25mm	---	---	---	0.015	516	350.78
2 Year	---	---	---	0.056	628	350.81
5 Year	---	---	---	0.278	833	350.87
10 Year	---	---	---	0.483	1,017	350.92
25 Year	---	---	---	0.790	1,292	350.99
50 Year	---	---	---	0.877	1,591	351.06
100 Year	---	---	---	0.916	1,969	351.15
Weir	1.322	4,667	351.70	---	---	---
Top of Pond	2.632	6,578	352.00	---	---	---

In summary, the post-development flows from the site are as follows:

**Table No. 7: Post-Development Condition Flow Rates**

	25mm	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Catchment 101 (uncontrolled)	0.024 m <sup>3</sup> /s	0.041 m <sup>3</sup> /s	0.077 m <sup>3</sup> /s	0.112 m <sup>3</sup> /s	0.188 m <sup>3</sup> /s	0.237 m <sup>3</sup> /s	0.286 m <sup>3</sup> /s
Catchment 102, 103, 104, 201, 202 (controlled)	0.015 m <sup>3</sup> /s	0.056 m <sup>3</sup> /s	0.278 m <sup>3</sup> /s	0.483 m <sup>3</sup> /s	0.790 m <sup>3</sup> /s	0.877 m <sup>3</sup> /s	0.916 m <sup>3</sup> /s
Catchment 105 (uncontrolled)	0.093 m <sup>3</sup> /s	0.149 m <sup>3</sup> /s	0.233 m <sup>3</sup> /s	0.303 m <sup>3</sup> /s	0.409 m <sup>3</sup> /s	0.506 m <sup>3</sup> /s	0.609 m <sup>3</sup> /s
Total	0.121 m <sup>3</sup> /s	0.196 m <sup>3</sup> /s	0.461 m <sup>3</sup> /s	0.795 m <sup>3</sup> /s	1.297 m <sup>3</sup> /s	1.565 m <sup>3</sup> /s	1.771 m <sup>3</sup> /s

The following table compares the post-development condition flow rates to the existing condition release rates for the full range of design storm events.

**Table No. 8: Comparison of Allowable Release Rates and Post-Development Condition Flow Rates**

	<b>Allowable Release Rate</b>	<b>Post-Development Condition</b>
25 mm	0.132 m <sup>3</sup> /s	0.121 m <sup>3</sup> /s
2-Year	0.278 m <sup>3</sup> /s	0.196 m <sup>3</sup> /s
5-Year	0.739 m <sup>3</sup> /s	0.461 m <sup>3</sup> /s
10-Year	1.184 m <sup>3</sup> /s	0.795 m <sup>3</sup> /s
25-Year	1.801 m <sup>3</sup> /s	1.297 m <sup>3</sup> /s
50-Year	2.355 m <sup>3</sup> /s	1.565 m <sup>3</sup> /s
100-Year	2.865 m <sup>3</sup> /s	1.915 m <sup>3</sup> /s

Therefore, the 2, 5, 10, 25, 50, and 100-year post-development flow rates from the site have been attenuated to be less than the allowable release rates.

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## 5. WATER BALANCE

The Stormwater Management Practices and Planning Manual (2003), recommends that infiltration systems be utilized in soils having a hydraulic conductivity greater than or equal to 15 mm/hour ( $4.2 \times 10^{-4}$  cm/s) and where a 1 metre minimum separation from the seasonally high groundwater level can be provided.

From the Geotechnical Investigation completed by V.A. Wood (Guelph) Inc. (dated May 2018), the predominant soils throughout the site are described as sandy silt till, silty sand, and sandy gravel. The coefficient of permeability of the native soils is estimated to be in the range of  $1 \times 10^{-2}$  cm/s to  $1 \times 10^{-5}$  cm/s (approximately 25-75 mm/hour per Credit Valley Conservation Authority's Table C1 on the relationship between permeability and conductivity with a safety factor of 2). The soils have moderate to high permeability and are suitable for infiltration. Groundwater observed on site (V.A. Wood (Guelph) Inc., dated May 2018) ranged from an elevation of 346.4 to 354.1. The depth to groundwater is sufficient for infiltration on most lots.

Infiltration galleries ranging from 10 to 14 metres long by 1 metre wide by 0.6m to 1 metre deep can be constructed on lots 6 to 29 and lots 33 to 38. Infiltration galleries are not feasible on lots 1 to 5 and lots 30 and 31 due to grading and groundwater constraints.

Prior to the issuance of a building permit, it is recommended that infiltration testing be completed on a lot by lot basis to confirm the permeability of the native soils and the design of the lot level infiltration structures.

Per the "Fergus Shand Dam" rainfall station, the average annual precipitation for the area in which the study site is located is estimated to be about 945.7mm. The "Fergus Shand Dam" climate normals were used to estimate an evapotranspiration rate per the Thornthwaite Mather method. It has been estimated that the potential annual evapotranspiration for this area is 571 mm for pervious surfaces. Therefore, 374.7 mm remains available for infiltration and runoff. For impervious surfaces within the development, the annual evapotranspiration is estimated to be 180 mm, resulting in approximately 765.7 mm available for infiltration and runoff.

Under post-development conditions, runoff from a portion of lots 6 to 29 and lots 33 to 38 will be infiltrated through infiltration galleries constructed in the front yard. The infiltration galleries will infiltrate between 2.8mm and 25.9mm of the rainfall depth based on the contributing area. Based on a probability analysis of the "Fergus Shand Dam" rainfall station (2000-2010), the probability of a rainfall event exceeding these depths has been estimated for each infiltrated gallery. These calculations are included in Appendix 'F'.

Under existing conditions, the natural infiltration volume from the site is estimated to be 34,029 m<sup>3</sup>/year, with 52,121 m<sup>3</sup>/year of runoff. Following the development, the natural infiltration volume from the site will be 27,249 m<sup>3</sup>/year; the additional infiltration volume from the infiltration galleries will be 4,283 m<sup>3</sup>/year for a total infiltration volume of 31,532 m<sup>3</sup>/year, with an annual runoff volume of 71,290 m<sup>3</sup>/year. The water budget analysis has been completed for the existing and post-development conditions for the site, as illustrated on Table No. 9.

---

## 6. EROSION AND SEDIMENT CONTROL PLAN

A silt fence will be installed along the property boundary in all locations where runoff will discharge from the site to adjacent lands. The silt fence will serve to minimize the opportunity for waterborne sediments to be washed on to the adjacent properties.

Upon completion of the grading, any area not subject to active construction within 30 days will be topsoiled and hydroseeded as per OPSS 572.

Once manholes, catchbasins or inlet risers have been installed, silt sacks will be installed. This feature will be maintained until all building and landscaping has been completed.

Inspection and maintenance of all silt fencing and silt sacks will start after installation is complete. The fence and silt sacks will be inspected on a weekly basis during active construction or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the facility found to need repair.

Once construction and landscaping has been substantially completed, the silt fence and silt sacks will be removed, any accumulated sediment will be removed and the landscaping will be completed.

After construction of the complete development, erosion will not occur, and sediment transport will be minimal.

## 7. MAINTENANCE PLAN

To ensure that the stormwater management system continues to function as designed and constructed, we recommend that the following inspections and maintenance activities be completed on an annual basis:

1. Is there any noticeable damage to the structures (i.e. outlet structures, overflow weirs)? If yes, complete any necessary repairs and/or installation of replacement structures.
2. Is there any noticeable damage to the asphalt/gravel and grassed swales (i.e. erosion, blockages)? If yes, complete any necessary repairs.
3. Is there any indication of a spill (i.e. frothy water, oily sheen on the water)? If yes, investigate, inform the appropriate agencies and complete the necessary clean-up and restoration.
4. Inspect the oil/grit structure and complete any necessary maintenance/repair activities as identified by the manufacturer.
5. Inspect all catchbasins, and manholes. Remove and dispose of any accumulated sediment, trash/litter, debris (i.e. sediment, garbage, leaves, etc.).
6. Inspect all swales and overflow locations. Remove and dispose of any accumulated sediment, trash/litter, debris (i.e. sediment, garbage, leaves, etc.).

Please note that any structures identified during the annual inspection to be worn, missing or damaged are to be repaired or replaced within 48 hours.



## 8. CONCLUSIONS

In summary, the features of the design for the proposed development are as follows:

1. Each lot will be serviced via private septic system.
2. Each lot will be serviced via a private well.
3. The post development stormwater runoff from the site during the 2, 5, 10, 25, 50, and 100-year design storm events have been attenuated to less than the pre-development level. Runoff from external areas have been conveyed through the site to an appropriate outlet.
4. Quality control treatment (Enhanced – 80% total suspended solids removal) for Catchment 102 will be provided by a permanent pool within Block 41 stormwater management facility.
5. Quality control treatment (Enhanced – 80% total suspended solids removal) for Catchment 103 will be provided via an oil/grit separator structure (CDS PMSU30\_20) prior to discharging to Block 42 Stormwater Management Facility.
6. Prior to construction, a silt fence will be installed along the property boundary in all locations where runoff will discharge from the site to adjacent lands. This will minimize the transport of sediment off-site during the construction period.

All of which is respectfully submitted.

### GM BLUEPLAN ENGINEERING LIMITED

Per:



Angela Kroetsch, P.Eng.

AK/pw



Per:



Brian Fritz, P.Eng.



**Appendix A**  
Preliminary Geotechnical Investigation



**V.A. WOOD (GUELPH) INCORPORATED**  
**CONSULTING GEOTECHNICAL ENGINEERS**

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
TELEPHONE: 519-763-3101

**GEOTECHNICAL INVESTIGATION**  
**PROPOSED RESIDENTIAL DEVELOPMENT**  
**7284 SIDEROAD 4**  
**TOWNSHIP OF CENTRE WELLINGTON (INVERHAUGH), ONTARIO**

*Ref. No. G3965-18-4*  
*May, 2018*

*Prepared for:*

*Elora Ridge Developments*  
*c/o Wriighthaven Homes Ltd.*  
*11 Spencer Drive*  
*Elora, Ontario*  
*N0B 1S0*

*Attn: Mr. Steven Wright, President*



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## APPENDIX

### *APPENDIX 'A' Statement of Limitations*

## ENCLOSURES

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**1.0 INTRODUCTION:**

*V. A. Wood (Guelph) Inc. was retained by Elora Ridge Developments to carry out a geotechnical investigation for the proposed residential subdivision to be located on 7284 Sideroad 4 in Inverhaugh, Ontario.*

*It is noted that the site is presently being operated as a turkey farm.*

*The purpose of the investigation was to reveal the subsurface conditions and to determine the relevant soil properties for recommendations concerning the design and construction of the site services, proposed dwellings, pavement areas and storm water management systems.*

## **2.0 FIELD WORK:**

*The fieldwork was carried out over the period of March 19 to 20, 2018 and consisted of eight (8) boreholes at the locations shown on Enclosure 1. The boreholes were advanced to the sampling depths by means of a track-mounted, power-auger machine equipped for soil sampling. Standard Penetration tests were carried out at frequent intervals of depth and the results are shown on the Borehole Logs as N-values. The subsurface soils were visually inspected, logged and sampled at the borehole locations by a soils technician. Five (5) of the boreholes had monitoring wells installed in them.*

*The boreholes were laid out by personnel from GM BluePlan Engineering Ltd. who also provided the numbering system and ground elevation at each borehole/monitoring well.*

### **3.0 SUBSURFACE CONDITIONS:**

Full details of the soils encountered in each borehole are given on the Borehole/Monitoring Well Logs, Enclosures 2 to 9, inclusive and the following notes are intended to summarize this data.

Boreholes 1, 2, 4 to 8, inclusive encountered a surficial deposit of **topsoil/organic fill** ranging between 150mm and 1.6m thick. Standard Penetration tests in this material gave N-values ranging between 4 and 17 blows/300mm and the natural moisture content was found to be about 24%.

The topsoil at Boreholes TH-04 and TH-06-M was underlain by a deposit of brown sandy silt **fill** to a depth of about 0.8 metres below grade. Standard Penetration tests in this material gave N-values ranging between 4 and 10 blows/300mm and the natural moisture content was found to range from 1 to 36%.

Based on the test results, the deposit of fill is considered to be in a generally very loose to compact condition.

The topsoil at Boreholes TH-01-M, TH-02, TH-08-M and fill at Borehole TH-04 was underlain by deposits of brown **gravel and sand/sandy gravel** to depths ranging between 1.5 and 2.3 metres below grade and the full depth of the investigation (i.e. 11.1 metres below grade). Standard Penetration tests in this deposit gave N-values ranging between 16 and greater than 100 blows/300mm and the natural moisture content was found to range from about 2 to 27%. Typical grain size distribution curves for these materials can be found on Enclosures 10 and 11.

Based on the test results, the deposits of gravel and sand/sandy gravel are considered to have a generally compact to very dense relative density, although it is noted that the presence of gravel, cobbles and boulders in this deposit may have resulted in high N-values and these may not accurately represent the relative density of the soil.

The fill at Borehole TH-06-M and sandy gravel at Borehole TH-08-M was underlain by a deposit of brown **sand** to depths ranging between 0.9 and 6.1 metres below grade. Standard Penetration tests in this deposit gave N-values ranging between 29 and greater than 100 blows/300mm and the natural moisture content was found to be about 5%. A typical grain size distribution curve for the sand can be found on Enclosure 12.

Based on the test results, the deposit of sand is considered to have a generally compact to very dense relative density.

The topsoil at Boreholes TH-05-M and TH-07-M, gravel and sand at Borehole TH-04 and sand at Borehole TH-06-M was underlain by a deposit of brown **sandy silt** to depths ranging between 2.3 and 6.1 metres below grade. It is noted that a deposit of brown **silty sand** was encountered within the sandy silt at Borehole TH-06-M. Standard Penetration tests in these deposits gave N-values ranging between 3 and 27 blows/300mm and the natural moisture content was found to range from 5 to 21%. A typical grain size distribution curve for the silty sand can be found on Enclosure 13.

Based on the test results, the deposits of sandy silt/silty sand are considered to have generally very loose to compact relative densities.

A deposit of brown **sandy silt till** was encountered from the surface at Borehole TH-03, below the gravel and sand at Borehole TH-02, and sandy silt at Boreholes TH-04, TH-05-M and TH-06-M. This deposit extended to the full depth of the investigation (i.e. 6.1 to 8.1 metres below grade). Standard Penetration tests in this deposit gave N-values ranging between 14 and greater than 100 blows/300mm and the natural moisture content was found to range from about 5 to 19%. Pocket penetrometer tests indicated it has an undrained shear strength varying from 150 to 250 kPa. Typical grain size distribution curves for this material can be found on Enclosures 14 to 15, inclusive.

Based on the test results, the deposit of sandy silt till is considered to have a generally compact to very dense relative density.

The sandy silt at Boreholes TH-07-M was underlain by a deposit of brown **gravel and sand** to a depth of about 6.1 metres below grade. Standard Penetration tests in this deposit gave N-values ranging between 30 and greater than 100 blows/300mm and the natural moisture content was found to be about 3%.

Based on the test results, the deposit of gravel and sand is considered to have a generally compact to very dense relative density, although it is noted that the presence of gravel, cobbles and boulders in this deposit may have resulted in high N-values and these may not accurately represent the relative density of the soil.



*The gravel and sand at Borehole TH-07-M and sand at Borehole TH-08-M was underlain by a deposit of brown **silt till** to the full depth of the investigation (i.e. 8.1 metres below grade). Standard Penetration tests in this deposit gave N-values ranging between 41 and greater than 100 blows/300mm and the natural moisture content was found to range from about 8 to 19%. A typical grain size distribution curve for this material can be found on Enclosure 16.*

*Based on the test results, the deposit of silt till is considered to have a generally hard consistency.*

#### 4.0 GROUNDWATER CONDITIONS:

Boreholes TH-02 to TH-04, inclusive were dry and open to the full depth of the investigation on completion of the fieldwork program.

Monitoring wells were installed in Boreholes TH-01-M and TH-05-M to TH-08-M, inclusive and groundwater levels recorded by personnel from GM BluePlan Engineering Ltd. on April 23, 2018 are as noted in the chart below.

<b>Well ID</b>	<b>Water Level Elevations (masl)</b>
TH01-M	DRY
TH05-M	350.735
TH06-M	352.341
TH07-M	354.08
TH08-M	346.417

An examination of the soil samples indicated that they were generally moist to saturated.

It is noted that no sub-artesian water pressures were encountered in any of the boreholes.

A colour change from brown to grey was noted in the samples in Borehole TH-03 at El. 352.8m± (i.e. 2.3± metres below grade).

Based on the foregoing, the groundwater table is considered to be located at elevations ranging between 346.4m± and 354.1m±, although a perched groundwater table can be expected in the upper zones underlain by the less permeable tills.

## 5.0 DISCUSSION AND RECOMMENDATIONS:

### 5.1 General:

*The boreholes generally encountered surficial deposits of topsoil underlain by very loose to compact fill on loose to compact sand, silty sand and/or sandy silt on compact to very dense gravel and sand/sandy gravel on compact to very dense sandy silt till or hard silt till.*

*The groundwater table is considered to be located at elevations ranging between 346.4m± and 354.1m±, although a perched groundwater table can be expected in the upper zones underlain by the less permeable tills.*

### 5.2 Sewers:

*It is assumed that the sewer inverts will be located at depths ranging between 3 and 4 metres below the existing grades.*

*Reference to the Borehole Logs indicates that the subgrade will generally consist of competent deposits of gravel and sand, sand, silty sand, sandy silt, and/or sandy silt till which will generally provide adequate support for the pipes and allow the use of normal Class 'B' bedding using Granular 'A' material. Clear crushed stone should not be used as bedding as fines may migrate into the voids of the stone and cause undesirable settlements. Where the exposed subgrade is less competent than the materials identified in the Borehole Logs, the bedding thickness may have to be increased and it may be necessary to protect the excavation with a skim coat of concrete immediately after it has been exposed.*

*Where sewer trench grades are more than 600mm below the groundwater table, well-points or closed sheeting may be required. The sides of the excavation to a depth of more than 1.2 metres (and above the water table) should either be cut back at a side slope of 1 to 1 or supported using adequately braced closed sheeting.*

*The excavated materials will be generally suitable for use as trench backfill provided that they are free of topsoil and boulders. If the on-site materials become wet, they should be air dried prior to re-use as trench backfill. The trench backfill should be placed in 150 to 200mm thick layers and uniformly compacted to at least 95% of its Standard Proctor maximum dry density.*

The backfill around manholes should consist of well-graded and well-compacted granular material.

To minimize potential problems and wetting of the subgrade material, backfilling operations should follow closely after excavations, so that only a minimal length of trench is exposed at a time. Should construction be carried out in the winter season, particular attention should be given to make sure no frozen material is used for backfill.

### 5.3 Foundations:

The boreholes encountered deposits of topsoil, fill and loose upper soils which are not considered to be a suitable bearing stratum. Therefore, the foundations for the proposed structures should extend to below the surface of underlying native soils. It is anticipated that an adequate stratum for Housing and Small Buildings in accordance with Part 9 of the 2006 Ontario Building Code will be located at the elevations indicated in the following charts:

Borehole No.	Borehole Ground Elev. (m±)	Bearing Stratum	Suitable Bearing Stratum Elev. (m±)	Depth to Suitable Bearing Stratum (m±)	Allowable Bearing Pressure (kPa)
TH-01-M	359.6	Gravel & Sand	359.3	0.3	150
TH-02	355.1	Gravel & Sand	354.8	0.3	150
TH-03	359.4	Sandy Silt Till	359.1	0.3	150
TH-04	359.3	Gravel & Sand	358.5	0.8	150
TH-05-M	354.3	Sandy Silt	352.8	1.5	75
TH-06-M	356.6	Sandy Silt	355.6	1.0	150
TH-07-M	357.9	Sandy Silt	356.3	1.6	75
TH-08-M	351.9	Gravel & Sand	351.6	0.3	150

If basements are constructed, the basement floors should be located at least 0.5 metres above the observed high groundwater levels otherwise sub-floor drainage systems together with continual pumping from the drainage systems will be required.

As well, some consideration should be given to waterproofing the basement walls if located within 0.5m of the groundwater table.

If there are requirements for cut and fill grading, the foundation grade could be raised using "engineered fill", which would be suitable for supporting normal spread footings designed to an allowable bearing pressure of up to 150 kPa.

*The procedure for "engineered fill" construction would consist of the following:*

- 1. The total removal of topsoil and loose material from beneath the proposed development envelopes.*
- 2. Geotechnical personnel from V.A. Wood (Guelph) Inc. prior to placement of "engineered fill" should inspect the exposed subgrade. Any loose or soft zones which are encountered should be removed and replaced with approved on-site or approved imported granular material, compacted to at least 98% Standard Proctor maximum dry density.*
- 3. The areas should then be brought up to the final subgrade level with approved on-site or approved imported granular material placed in maximum 200mm thick lifts and compacted to at least 98% Standard Proctor maximum dry density.*
- 4. The "engineered fill" under all structures to be supported should extend to at least 0.6 metres laterally beyond the edge of their perimeter at the founding level and at least a distance equal to the depths of the fill pad, at the level of the approved subgrade.*

*The "engineered fill" should be in place at least one month prior to loading it to minimize settlement.*

*This "engineered fill" will satisfy the raising of the founding levels to the proposed grades and provide a suitable subgrade for the proposed structures.*

*All exterior house footings or footings in unheated areas should be located at least 1.2 metres below finished grade for adequate frost protection.*

*Elevation differences between adjacent footings should not be more than a half of the horizontal distance between them.*

*It is estimated that the total and differential settlements of the footings designed to the above stated bearing pressures will be less than 25 and 20mm respectively, which are normally considered to be acceptable for the proposed structures.*

*It is recommended that all foundation excavations be inspected by geotechnical personnel from V.A. Wood (Guelph) Inc. to ensure that the founding soils are similar to those identified in the Borehole Logs and that the founding soils are capable of supporting the design loads.*

5.4 Excavation and Groundwater Control:

No major construction problems due to water are anticipated with excavations above El. 346.4m±. However, provision should be made for the control of any surface water run-off and minor seepage from any wet sand seams by pumping from local sumps on an as and where required basis. If, however, excavations are extended below the groundwater table, then provisions may be required to lower the groundwater table through more extensive pumping from local sumps as and where required or through the use of well-points.

Excavations to a depth of more than 1.2 metres below grade should be cut back to a side slope of 1 to 1 or, supported using adequately braced sheeting.

Sub-drains will probably be required for basements less than 0.5m above the water table.

5.5 Floor Slabs:

All topsoil and any deleterious materials encountered should be stripped from the building areas and the proposed subgrade should be re-compacted from the surface to at least 95% of its Standard Proctor maximum dry density. Any loose/wet material encountered should be sub-excavated and replaced with approved fill.

The fill may consist of approved on-site materials free of cobbles/boulders or approved imported fill. All fill materials should be placed in 150 to 200mm thick lifts and compacted to at least 95% of its Standard Proctor maximum dry density. It is recommended the underfloor fill be placed at least one month prior to floor construction in order to minimize settlement.

A layer of well-graded, free-draining material, at least 150mm thick and compacted to 100% of its Standard Proctor maximum dry density, should be placed under the floor slabs to provide a uniform bearing surface and to act as a vapour barrier.

Frequent inspections by geotechnical personnel from V.A. Wood (Guelph) Inc. should be carried out during construction to verify compaction of the subgrade and base courses by in-situ density testing using nuclear gauges.

### 5.6 Storm Water Management:

The grain size distribution curves prepared for the representative soil samples obtained from the boreholes put down in the proposed SWM Pond were compared to the family of curves presented in the Supplementary Standard SB-6 of the 2012 Building Code Compendium. Based on the Unified Soils Classification System, the soils are considered to have the following properties:

<u>Material</u>	<u>Unified Soils Classification Group</u>	<u>Estimated Co-efficient of Permeability (k) (cm/sec)</u>
Sandy Gravel	(GM)	$10^{-2} - 10^{-4}$
Sand	(SP-SM)	$10^{-2} - 10^{-4}$
Silty Sand	(SM)	$10^{-3} - 10^{-5}$

### 5.7 Pavement Designs:

All topsoil and any deleterious materials encountered should be stripped from the paved areas. The proposed subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor maximum dry density prior to the road construction. Any loose areas which are detected should be sub-excavated and backfilled with suitable on-site material or approved imported fill. All fill should be placed in 150 to 200mm thick lifts and compacted to at least 98% of its Standard Proctor maximum dry density.

It is understood that the Township of Centre-Wellington Pavement Design for the roads in this subdivision is as follows

HL-3 Surface Course Asphalt	40mm
HL-8 Base Course Asphalt	50mm
Granular 'A' Base Course	150mm
Granular 'B' Sub-base Course	450mm

The base and sub-base granular materials should be compacted to at least 100% Standard Proctor maximum dry density. The asphalt should be compacted to OPS Specifications.

Frequent inspections by geotechnical personnel from V. A. Wood (Guelph) Inc. should be carried out during construction to verify the compaction of the subgrade, base courses and asphaltic concrete by in-situ density testing using nuclear gauges.

**7.0 STATEMENT OF LIMITATIONS:**

*The Statement of Limitations presented on Appendix 'A' is an integral part of this report.*

**V. A. WOOD (GUELPH) INC.**

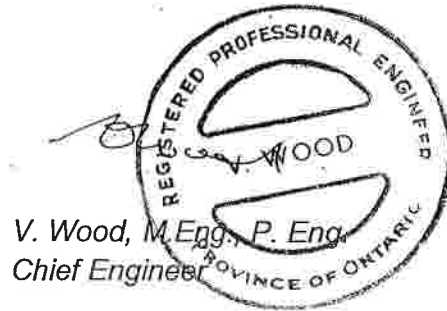


J. Broad, B.A.  
President & General Manager

JB:sm

Encls.

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***APPENDIX***

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**STATEMENT OF LIMITATIONS:**

*The conclusions and recommendations in this report are based on information determined at the borehole locations and on geological data of a general nature, which may be available, for the area investigated. Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations and conditions may become apparent during construction, which would not be detected or anticipated at the time of the soil investigation.*

*We recommend that we be retained to ensure that all necessary stripping, subgrade preparation and compaction requirements are met, and to confirm that the soil conditions do not deviate materially from those encountered in the boreholes. **In cases where this recommendation is not followed the company's responsibility is limited to interpreting accurately the information encountered at the boreholes.***

*This report is applicable only to the project described in the introduction, constructed substantially in accordance with details of alignment and elevations quoted in the text.*

*This report was prepared by V. A. Wood (Guelph) Inc. for Elora Ridge Developments and GM BluePlan Engineering Ltd. The material in it reflects V.A. Wood (Guelph) Inc. judgment in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. V. A. Wood (Guelph) Inc. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.*

***ENCLOSURES***



Project: 117021-1  
 Hydrogeological Study  
 7284 Sideroad 4  
 Township of  
 Centre Wellington

Lot 4 Con 3  
 Geo. Twp. of Pilkington

◆ Borehole Locations

Scale: 1: 4,000  
 May, 2018

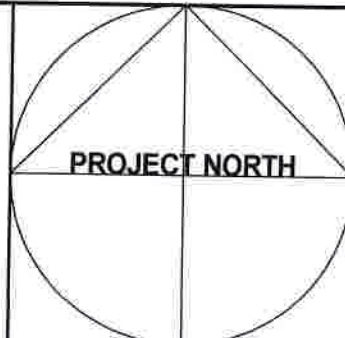
Figure 6:  
 Site Investigation Plan



Borehole #	Ground Elev. (m)
TH-01-M	359.616
TH-02	355.05
TH-03	359.353
TH-04	359.316
TH-05-M	354.29
TH-06-M	356.633
TH-07-M	357.939
TH-08-M	351.885

Borehole Layout & Ground Elevations  
 Supplied by GM BluePlan Engineering Ltd

Note: The stratigraphy referred to in the report is based on the data from the boreholes supplemented by geological data where available. The actual stratigraphy between and beyond the boreholes may vary.



**V.A. WOOD (GUELPH) INC.**  
 Consulting Geotechnical Engineers

405 York Road, Guelph, Ontario N1E 3H3  
 Ph. (519) 763-3101 Fax. (519) 763-5912

Borehole/Monitoring Well Location Plan  
 Proposed Residential Development  
 7284 Sideroad 4  
 Inverhaugh, ON

Scale: As Noted

Ref. No. G3965-18-4

Date: May 3, 2018

Enclosure 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-01-M**

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

CLIENT: Elora Ridge Development

PROJECT: Proposed Residential Development

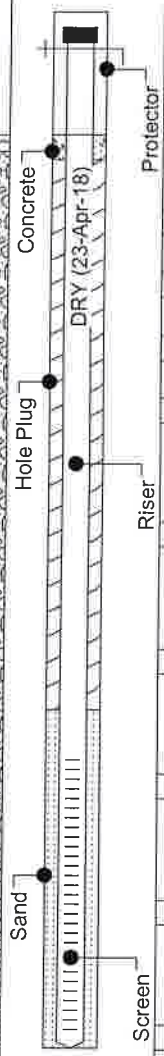
ENCLOSURE No: 2

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: B.R.F.

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING	NUMBER	TYPE	N-VALUE	PENETRATION RESISTANCE				WATER CONTENT %					
								20	40	60	80	5	10	15	20	25	
0.0	Ground Surface	359.6															
	200mm Topsoil				1	SS	16										
	brown, compact to very dense GRAVEL AND SAND trace silt, with cobbles, moist				1	SS	29										
					2	SS	50										
					3	SS	48										
					4	SS	29										
					5	SS	29										
					6	SS	32										
					7	SS	31										
					8	SS	36										
					9	SS	50										
11.1	End of Borehole	348.5			10	SS	50										



25mm

125mm

0mm

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 20, 2018

SHEET: 1 of 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-02**

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

CLIENT: Elora Ridge Development

PROJECT: Proposed Residential Development

ENCLOSURE No: 3

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: N.C.

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE				SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT			
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m												
								20	40	60	80	5	10	15	20		25		
0.0	Ground Surface	355.1																	
0.3	275mm Topsoil	354.8			1	SS	8												
1.5	brown, very dense to compact GRAVEL AND SAND trace silt, moist	353.6		DRY (19-Mar-18)	1	SS	73												
					2	SS	28												
					3	SS	50				125mm								
					4	SS	50				75mm								
					5	SS	36												
6.6	End of Borehole	348.5			6	SS	41												
					7	SS	62												

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 20, 2018

SHEET: 1 of 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-03**

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

CLIENT: Elora Ridge Development

PROJECT: Proposed Residential Development

ENCLOSURE No: 4

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: N.C.

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT			
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m	20	40	60	80	5	10	15	20	25				
0.0	Ground Surface	359.4																		
	brown, compact to very dense SANDY SILT TILL trace gravel, moist  grey @ 2.3m			DRY (19-Mar-18)	1	SS	29													
					1	SS	42													
						2	SS	50				o 125mm								
						3	SS	50				o 100mm								
						4	SS	50				o 50mm								
						5	SS	50				o 75mm								
						6	SS	50				o 75mm								
6.1		353.3																		
6.6	brown, very dense GRAVEL AND SAND trace silt, moist	352.8			7	SS	50		o 50mm											
	End of Borehole																			

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 20, 2018

SHEET: 1 of 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-04**

CLIENT: Elora Ridge Development

PROJECT: Proposed Residential Development

ENCLOSURE No: 5

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: B.R.F.

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m	20	40	60	80	5	10	15	20	25	
0.0	Ground Surface	359.3															
0.3	300mm Topsoil	359.0			1	SS	4										
0.8	brown, very loose Sandy Silt FILL with organics, moist	358.5			1	SS	4										
1.5	brown, compact GRAVEL AND SAND trace organics, trace silt, occasional cobbles.	357.8		DRY (19-Mar-18)	2	SS	20										
	brown, loose to compact SANDY SILT moist				3	SS	10										
					4	SS	20										
					5	SS	11										
4.6	brown, very dense SANDY SILT TILL trace gravel, moist	354.7			6	SS	50				125mm						
6.6		352.7			7	SS	50				125mm						
	End of Borehole																

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 19, 2018

SHEET: 1 of 1



REFERENCE No: G3965-18-4

**BOREHOLE No: TH-05-M**

CLIENT: Elora Ridge Development

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Proposed Residential Development

ENCLOSURE No: 6

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: N.C.

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT		
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING	NUMBER	TYPE	N-VALUE					
0.0	Ground Surface	354.3										
	200mm Topsoil				1	SS	3					
	brown, very loose to loose SANDY SILT moist to wet		Concrete	Protector	1	SS	6					
					2	SS	3					
2.4	brown, compact to very dense SANDY SILT TILL trace gravel, wet	351.9	Hole Plug	W.L. @ El. 350.7m (23-Apr-18)	3	SS	8					
					4	SS	35					
					5	SS	50					
			Riser	Screen	6	SS	33					
					7	SS	14					
8.1		346.2	Sand	Screen	8	SS	18					
	End of Borehole											

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 21, 2018

SHEET: 1 of 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-06-M**

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

CLIENT: Elora Ridge Development

PROJECT: Proposed Residential Development

ENCLOSURE No: 7

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: B.R.F.

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	356.6								
0.3	275mm Topsoil	356.3			1	SS	6			
0.8	brown, loose Silty Sand and Gravel (Possible FILL) moist	355.8			1	SS	10			
	brown, compact SAND moist				2	SS	27			
2.3	brown, compact SANDY SILT moist	354.3			3	SS	26			
	brown, compact SILTY SAND moist				4	SS	18			
	brown, compact SANDY SILT moist				5	SS	21			
4.6	brown, compact SILTY SAND some clay, trace gravel, moist	352.0								
	brown, compact SANDY SILT moist to wet				6	SS	14			
6.1	brown, dense to compact SANDY SILT TILL trace gravel, with wet sand seams	350.5			7	SS	42			
8.1	End of Borehole	348.5			8	SS	30			

DRILLED BY: London Soil Test Limited      HOLE DIAMETER: 140mm  
 DRILL METHOD: Hollow Stem Augers      DATUM: Geodetic  
 DRILL DATE: March 19, 2018      SHEET: 1 of 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-07-M**

CLIENT: Elora Ridge Development

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Proposed Residential Development

ENCLOSURE No: 8

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: N.C.

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	357.9								
1.6	1600mm Topsoil/Organic FILL			Concrete	1	SS	10			
				Protector	1	SS	17			
2.3	brown, loose SANDY SILT trace organics, moist	356.3			2	SS	16			
				W.L. @ El. 354.1m (23-Apr-18)	3	SS	6			
				Hole Plug	4	SS	36			
	brown, compact to very dense GRAVEL AND SAND trace silt, occasional cobbles, moist	355.6			5	SS	50	125mm		
6.1				Riser	6	SS	30			
				Screen	7	SS	55			
8.1	brown, compact to very dense SILT TILL trace clay, trace gravel, with cobbles, moist to saturated	351.8			8	SS	50	125mm		
	End of Borehole	349.8								

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 20, 2018

SHEET: 1 of 1

REFERENCE No: G3965-18-4

**BOREHOLE No: TH-08-M**

**V.A. WOOD (GUELPH) INC.**  
CONSULTING GEOTECHNICAL ENGINEERS

CLIENT: Elora Ridge Development

PROJECT: Proposed Residential Development

ENCLOSURE No: 9

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3  
 PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

SUPERVISOR: N.C.

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT	
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING	NUMBER	TYPE	N-VALUE				
0.0	Ground Surface	351.9									
	150mm Topsoil				1	SS	9				
	brown, compact to very dense SANDY GRAVEL some silt, moist			Concrete	1	SS	15				
					2	SS	16				
2.3					3	SS	50			50mm	
	brown, compact to very dense SAND some gravel, some silt, trace clay, moist			Hole Plug	4	SS	29				
					5	SS	50			50mm	
6.1					6	SS	50			75mm	
	brown, dense to very dense SILT TILL with cobbles, moist			Sand	7	SS	41				
8.1					8	SS	50				
	End of Borehole										

DRILLED BY: London Soil Test Limited

HOLE DIAMETER: 140mm

DRILL METHOD: Hollow Stem Augers

DATUM: Geodetic

DRILL DATE: March 20, 2018

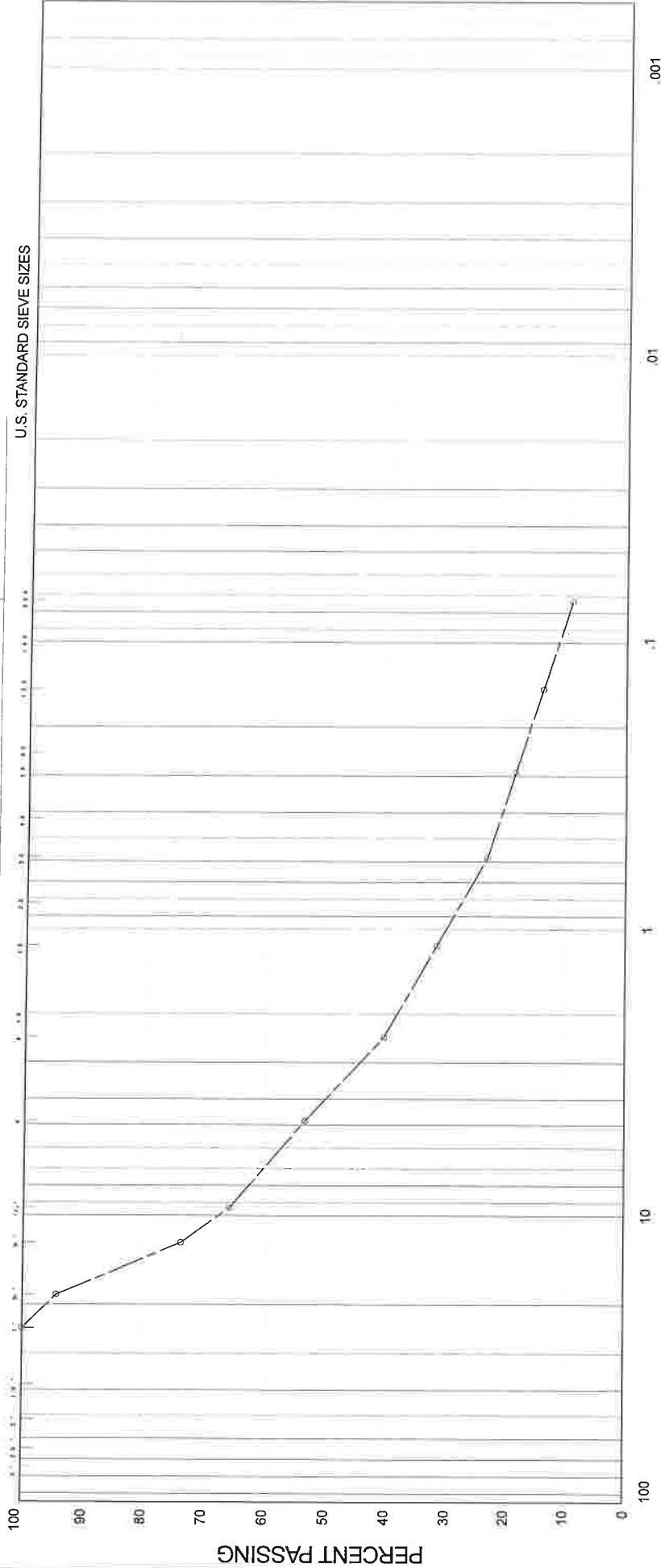
SHEET: 1 of 1

# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G33965-18-4

UNIFIED SOIL CLASSIFICATION SYSTEM

U.S. STANDARD SIEVE SIZES



## Grain Size in Millimeters

PROJECT: Proposed Residential Development  
 LOCATION: 7284, Sideroad 4, Inverhaugh, ON  
 BOREHOLE N°: TH-01-M  
 SAMPLE N°: 3  
 DEPTH: 1.5 - 2.0m±  
 ELEVATION: 358.1 - 357.6m±

COEFFICIENT OF UNIFORMITY: 8.4  
 COEFFICIENT OF CURVATURE: 0.2

PLASTIC PROPERTIES  
 LIQUID LIMIT % =  
 PLASTIC LIMIT % =  
 PLASTICITY INDEX % =  
 MOISTURE CONTENT % = 3.3

### Classification of Sample and Group Symbol:

Gravel and Sand, trace silt (SP-SM)

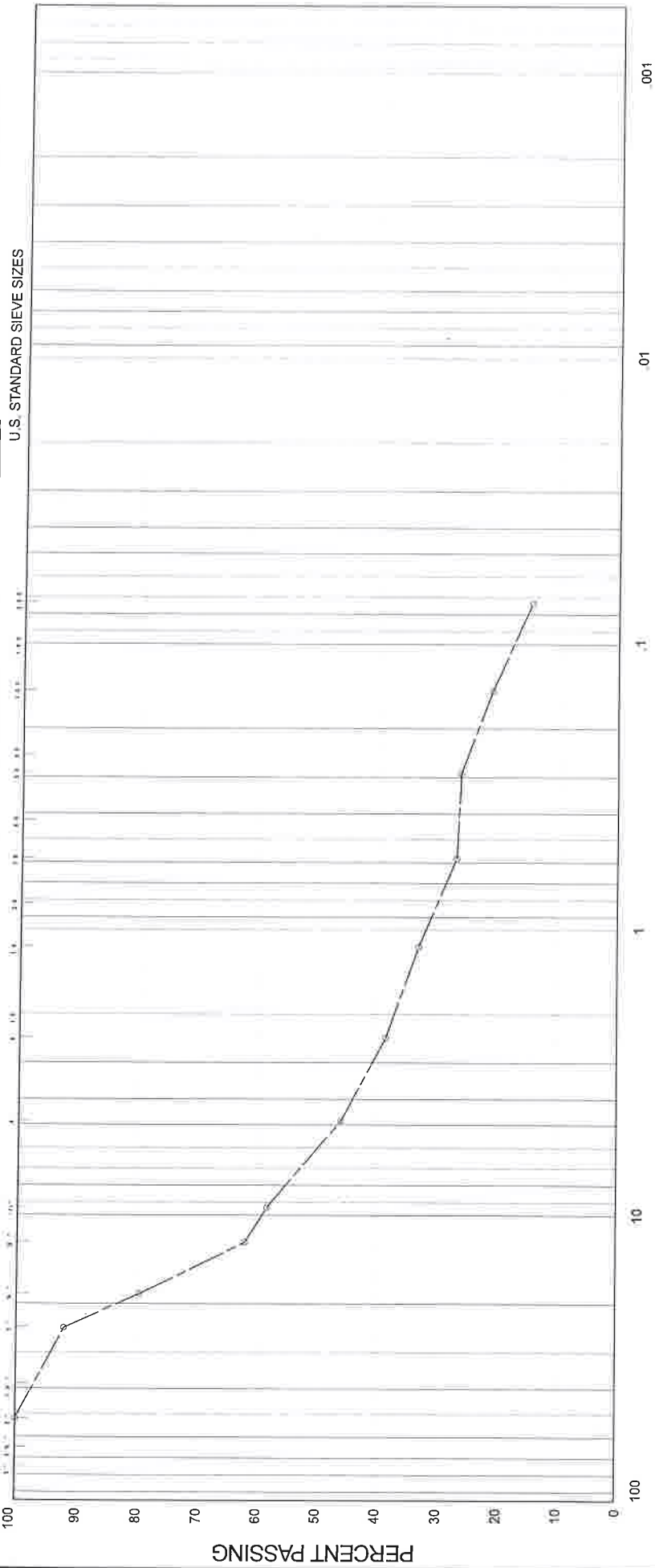
ENCLOSURE N° 10



# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G3965-18-4

UNIFIED SOIL CLASSIFICATION SYSTEM



## Grain Size in Millimeters

ENCLOSURE N° 11

PROJECT: Proposed Residential Development  
 LOCATION: 7284 Sideroad 4, Inverhaugh, ON  
 BOREHOLE N°: TH-08-M

PLASTIC PROPERTIES  
 LIQUID LIMIT % =  
 PLASTIC LIMIT % =  
 PLASTICITY INDEX % =  
 MOISTURE CONTENT % = 3.1

SAMPLE N°: 3

DEPTH: 1.5 - 1.8m±

ELEVATION: 350.4 - 350.1m±

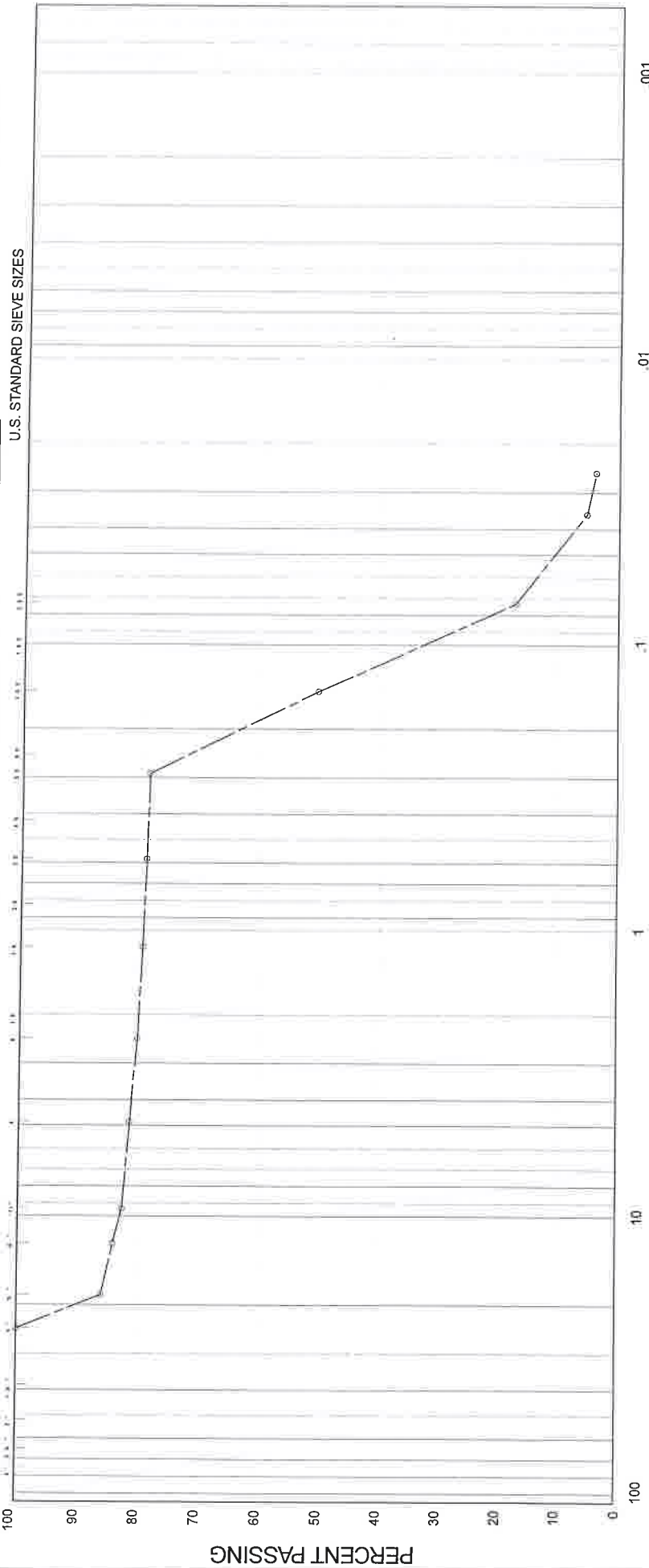
**Classification of Sample and Group Symbol:**  
 SANDY GRAVEL, some silt (GM)



# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G3965-18-4

UNIFIED SOIL CLASSIFICATION SYSTEM



## Grain Size in Millimeters

ENCLOSURE N° 12

PLASTIC PROPERTIES  
 LIQUID LIMIT % =  
 PLASTIC LIMIT % =  
 PLASTICITY INDEX % =  
 MOISTURE CONTENT % = 3.7

PROJECT: Proposed Residential Development  
 LOCATION: 7284 Sideroad 4, Inverhaugh, ON  
 BOREHOLE N°: TH-08-M

COEFFICIENT OF UNIFORMITY:  
 COEFFICIENT OF CURVATURE:

Classification of Sample and Group Symbol:  
 SAND, some gravel, some silt, trace clay (SM)

SAMPLE N°: 4  
 DEPTH: 2.3 - 2.6m±  
 ELEVATION: 349.6 - 349.3m±

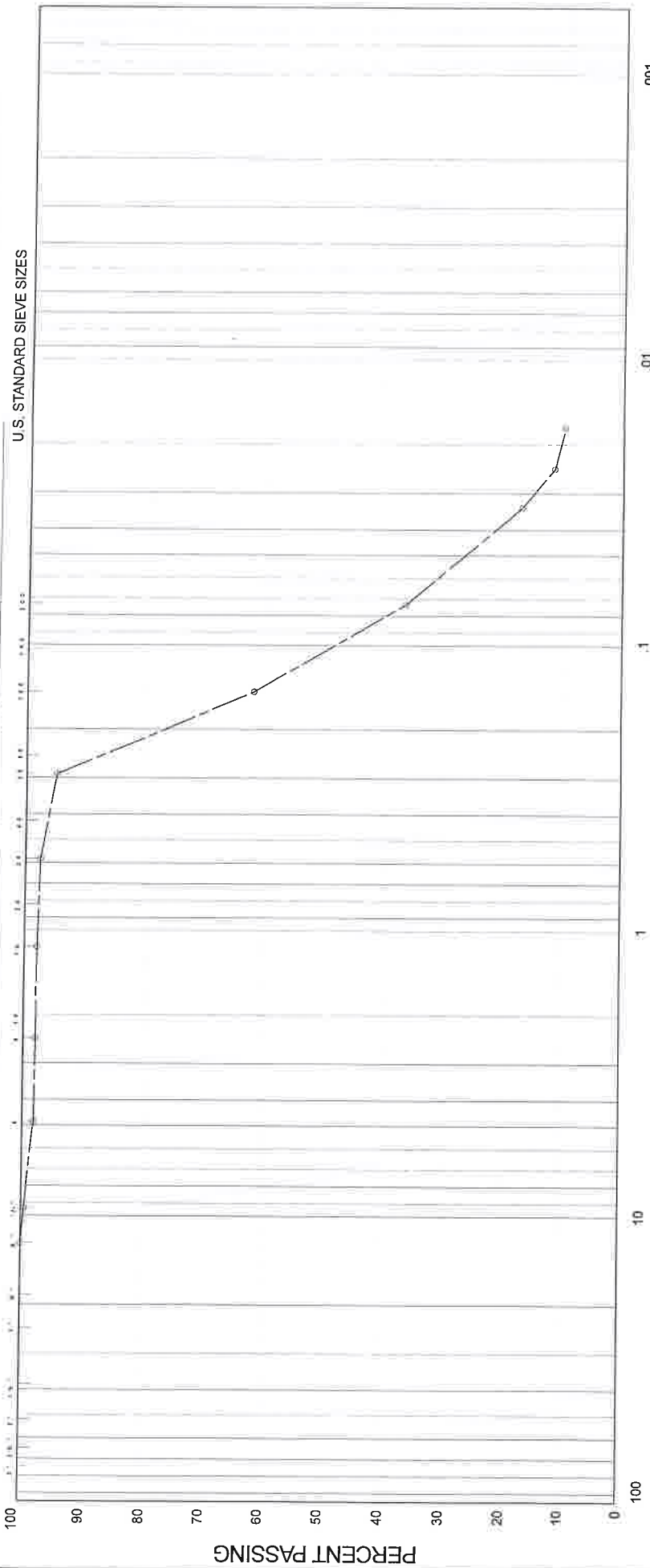


# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G2905-7-5

UNIFIED SOIL CLASSIFICATION SYSTEM

U.S. STANDARD SIEVE SIZES



## Grain Size in Millimeters

PROJECT: Proposed Residential Development  
 LOCATION: 7284 Sideroad 4, Inverhaugh, ON  
 BOREHOLE N°: Th-06-M

SAMPLE N°: 4  
 DEPTH: 2.3 - 2.6m±  
 ELEVATION: 354.3 - 354.0m±

**Classification of Sample and Group Symbol:**  
 SILTY SAND, some clay, trace gravel (SM)

PLASTIC PROPERTIES  
 LIQUID LIMIT % =  
 PLASTIC LIMIT % =  
 PLASTICITY INDEX % =  
 MOISTURE CONTENT % = 9.1

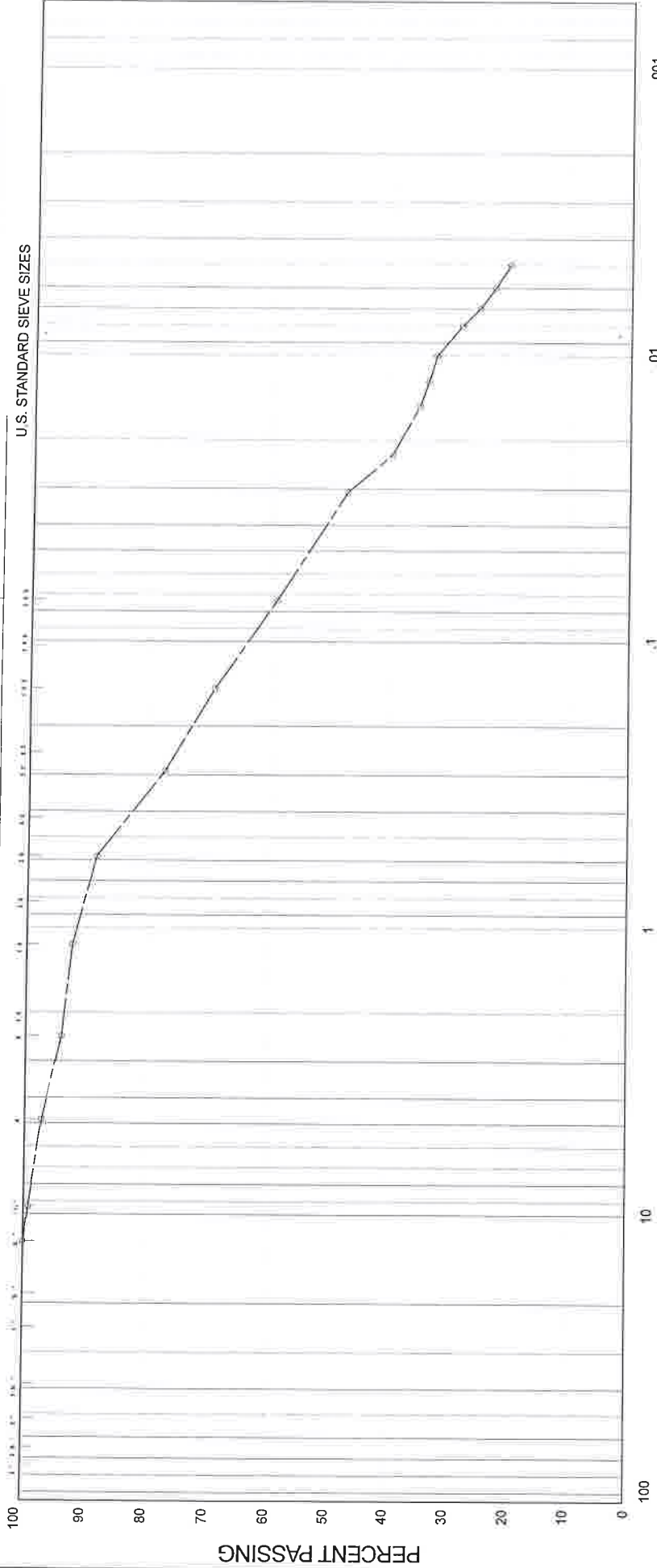
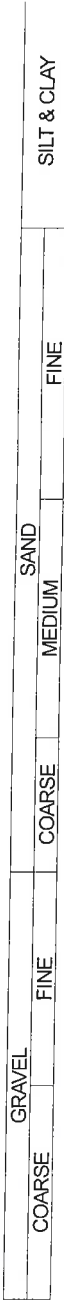




# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G3965-18-4

UNIFIED SOIL CLASSIFICATION SYSTEM



## Grain Size in Millimeters

ENCLOSURE N° 14

PROJECT: Proposed Residential Development  
 LOCATION: 7284 Sideroad 4, Inverhaugh, ON  
 BOREHOLE N°: TH-03-M

PLASTIC PROPERTIES  
 LIQUID LIMIT % = 16.9  
 PLASTIC LIMIT % = 11.6  
 PLASTICITY INDEX % = 5.3  
 MOISTURE CONTENT % = 8.6

SAMPLE N°: 5

DEPTH: 3.0 - 3.3m±

ELEVATION: 356.4 - 356.1m±

**Classification of Sample and Group Symbol:**

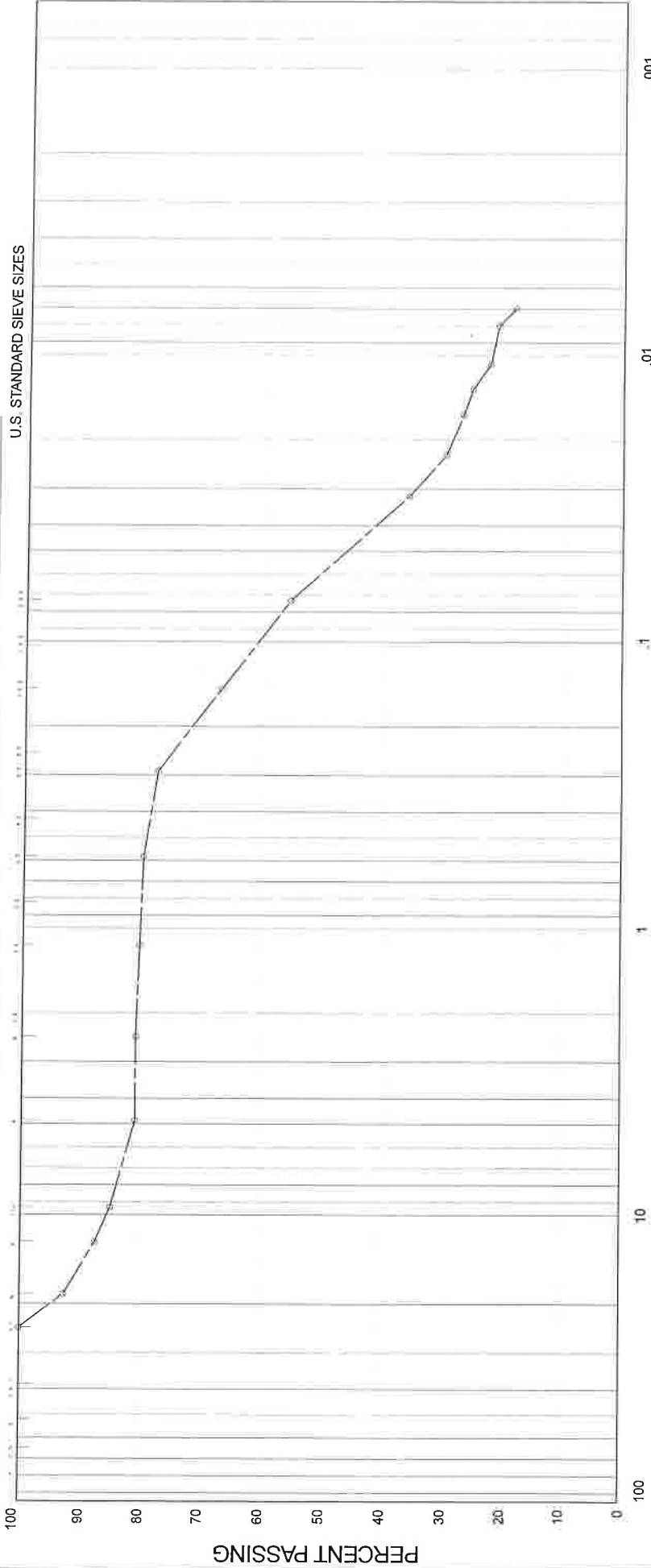
Sandy Silt Till, some clay, trace gravel (ML-CL)



# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G3965-18-4

UNIFIED SOIL CLASSIFICATION SYSTEM



## Grain Size in Millimeters

ENCLOSURE N° 15

PROJECT: Proposed Residential Development

LOCATION: 7284 Sideroad 4, Inverhaugh, ON

BOREHOLE N°: TH-07-M

SAMPLE N°: 7

DEPTH: 3.0 - 3.2m±

ELEVATION: 354.9 - 354.7m±

PLASTIC PROPERTIES

LIQUID LIMIT % =

PLASTIC LIMIT % =

PLASTICITY INDEX % =

MOISTURE CONTENT % = 8.2

**Classification of Sample and Group Symbol:**

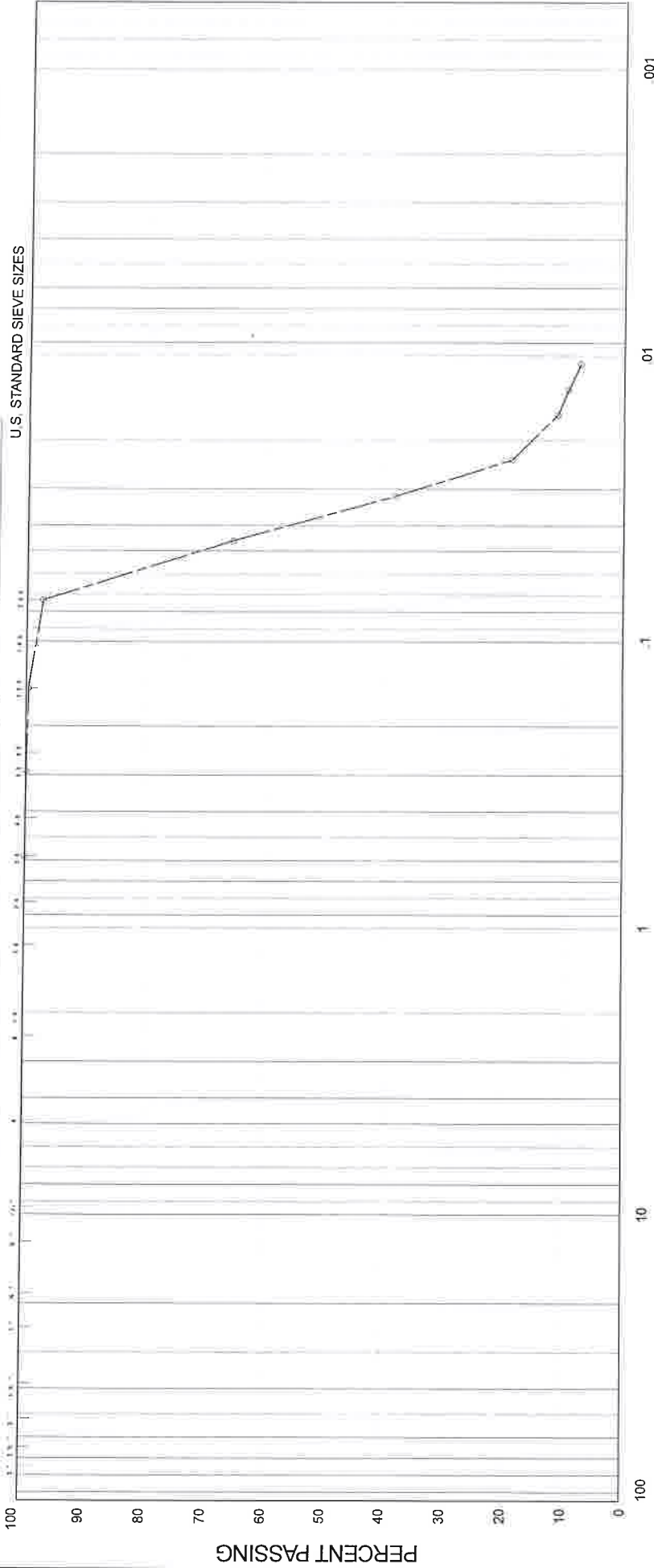
Sandy Silt Till, some gravel, some clay (ML)



# GRAIN SIZE DISTRIBUTION

OUR REFERENCE N° G3965-18-4

UNIFIED SOIL CLASSIFICATION SYSTEM



## Grain Size in Millimeters

ENCLOSURE N° 16

PROJECT: Proposed Residential Development  
 LOCATION: 7284 Sideroad 4, Inverhaugh, ON  
 BOREHOLE N°: TH-08-M

PLASTIC PROPERTIES  
 LIQUID LIMIT % =  
 PLASTIC LIMIT % =  
 PLASTICITY INDEX % =  
 MOISTURE CONTENT % = 21.4

SAMPLE N°: 7

DEPTH: 6.1 - 6.5m±  
 ELEVATION: 345.8 - 345.4m±

Classification of Sample and Group Symbol:

SILT TILL, trace clay, trace sand (ML)

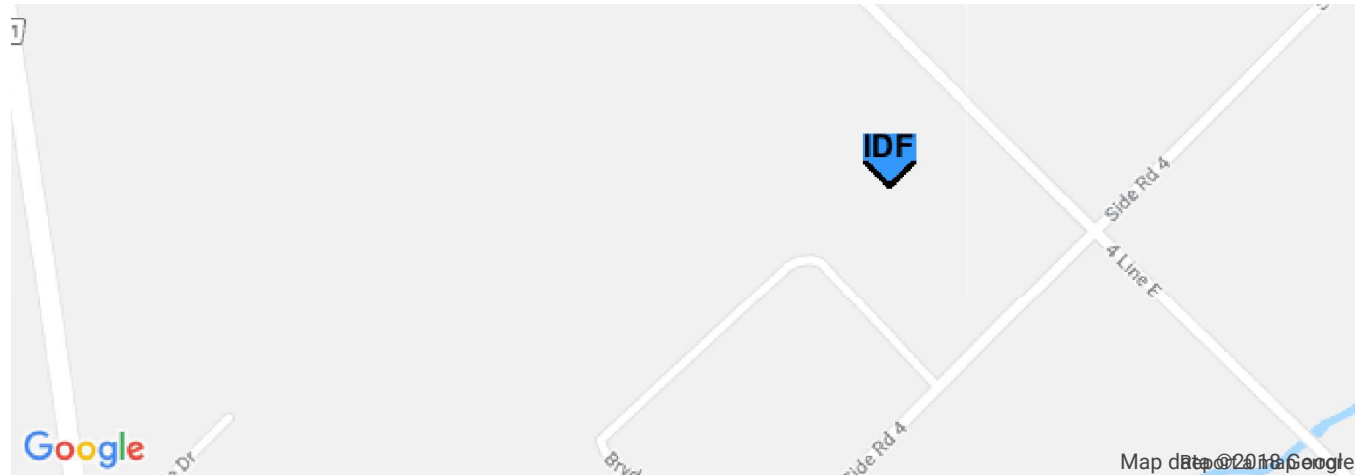


**Appendix B**  
MTO IDF Curve Lookup

### Active coordinate

43° 38' 45" N, 80° 25' 45" W (43.645833,-80.429167)

Retrieved: Wed, 08 Aug 2018 15:33:15 GMT



### Location summary

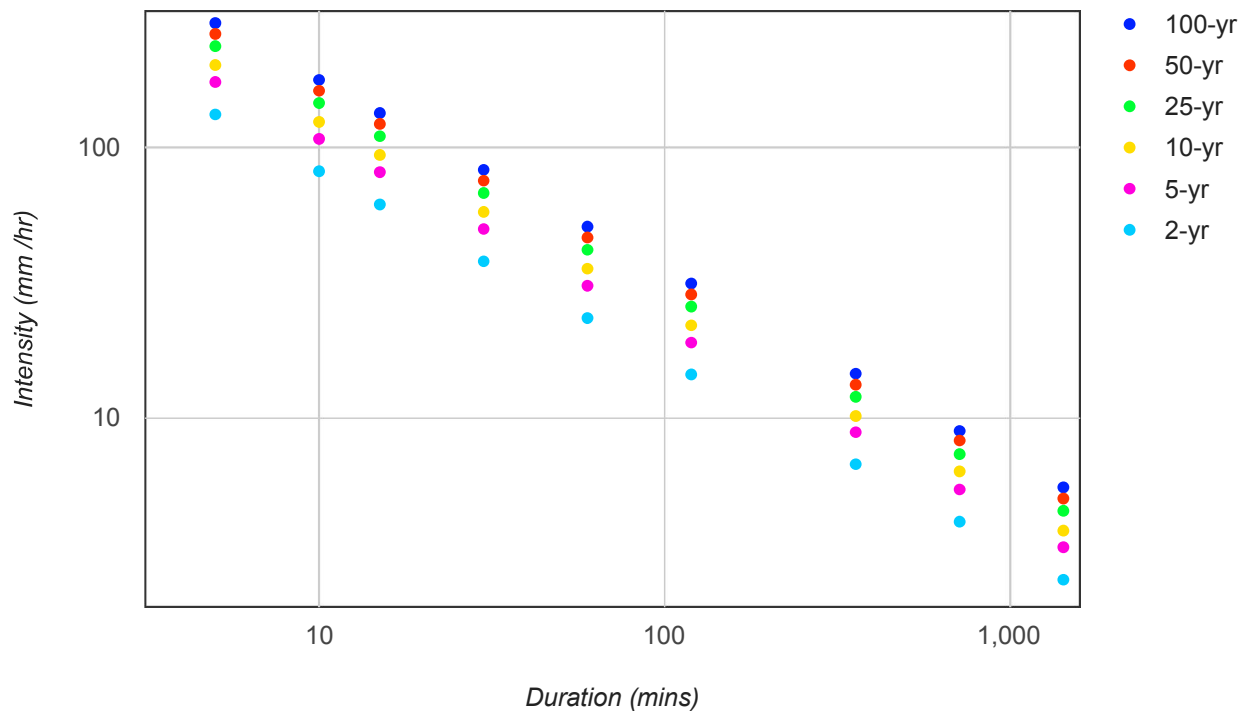
These are the locations in the selection.

**IDF Curve:** 43° 38' 45" N, 80° 25' 45" W (43.645833,-80.429167)

### Results

An IDF curve was found.

Coordinate: 43.645833, -80.429167  
IDF curve year: 2010



**Coefficient summary**

IDF Curve: 43° 38' 45" N, 80° 25' 45" W (43.645833,-80.429167)

Retrieved: Wed, 08 Aug 2018 15:33:15 GMT

Data year: 2010

IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
<b>A</b>	23.3	30.7	35.5	41.7	46.3	50.8
<b>B</b>	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

**Statistics****Rainfall intensity (mm hr<sup>-1</sup>)**

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
<b>2-yr</b>	132.3	81.5	61.4	37.8	23.3	14.4	6.7	4.1	2.5
<b>5-yr</b>	174.4	107.4	80.9	49.8	30.7	18.9	8.8	5.4	3.3
<b>10-yr</b>	201.6	124.2	93.6	57.6	35.5	21.9	10.1	6.3	3.8
<b>25-yr</b>	236.9	145.9	109.9	67.7	41.7	25.7	11.9	7.3	4.5
<b>50-yr</b>	263.0	162.0	122.0	75.2	46.3	28.5	13.2	8.2	5.0
<b>100-yr</b>	288.5	177.7	133.9	82.5	50.8	31.3	14.5	8.9	5.5

**Rainfall depth (mm)**

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
<b>2-yr</b>	11.0	13.6	15.4	18.9	23.3	28.7	40.0	49.2	60.6
<b>5-yr</b>	14.5	17.9	20.2	24.9	30.7	37.8	52.6	64.9	79.9
<b>10-yr</b>	16.8	20.7	23.4	28.8	35.5	43.7	60.9	75.0	92.4
<b>25-yr</b>	19.7	24.3	27.5	33.8	41.7	51.4	71.5	88.1	108.5
<b>50-yr</b>	21.9	27.0	30.5	37.6	46.3	57.0	79.4	97.8	120.5
<b>100-yr</b>	24.0	29.6	33.5	41.2	50.8	62.6	87.1	107.3	132.2

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Last Modified: September 2016

117021 - MTO IDF CURVE LOOKUP\_DEPTH

```

"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\
"      5 work in Progress\Design Calcs\Modelling Files\2018-08-08"
"      Output filename:                    117021 - MTO IDF CURVE LOOKUP_DEPTH.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              8/8/2018 at 11:41:49 AM"
" 85  IDF CURVE FIT"
"      6  Number of Storms"
"      1  Storm no."
"      2  Return interval"
"      12 Data Pairs"
"          5.000   10.000   15.000   30.000   60.000"
"          120.000 180.000 240.000 360.000 720.000"
"      1080.000 1440.000 minutes"
"          11.000   13.600   15.400   18.900   23.300"
"          28.700   0.000   0.000   40.000   49.200"
"          0.000   60.600   mm"
"          132.000  81.600   61.600   37.800   23.300"
"          14.350   0.000   0.000   6.667   4.100"
"          0.000   2.525   mm/hr"
"      412.629 mm/hr 'A' coeff."
"      0.1038  minutes 'B' coeff."
"      0.70101 'C' exponent"
"      0.0295  Std.error of estimate"
"      2  Storm no."
"      5  Return interval"
"      12 Data Pairs"
"          5.000   10.000   15.000   30.000   60.000"
"          120.000 180.000 240.000 360.000 720.000"
"      1080.000 1440.000 minutes"
"          14.500   17.900   20.200   24.900   30.700"
"          37.800   0.000   0.000   52.600   64.900"
"          0.000   79.900   mm"
"          174.000 107.400  80.800   49.800   30.700"
"          18.900   0.000   0.000   8.767   5.408"
"          0.000   3.329   mm/hr"
"      541.973 mm/hr 'A' coeff."
"      0.0933  minutes 'B' coeff."
"      0.70051 'C' exponent"
"      0.0594  Std.error of estimate"
"      3  Storm no."
"      10  Return interval"
"      12 Data Pairs"
"          5.000   10.000   15.000   30.000   60.000"
"          120.000 180.000 240.000 360.000 720.000"
"      1080.000 1440.000 minutes"
"          16.800   20.700   23.400   28.800   35.500"
"          43.700   0.000   0.000   60.900   75.000"
"          0.000   92.400   mm"
"          201.600 124.200  93.600   57.600   35.500"
"          21.850   0.000   0.000   10.150   6.250"
"          0.000   3.850   mm/hr"
"      621.728 mm/hr 'A' coeff."
"      0.0102  minutes 'B' coeff."
"      0.69918 'C' exponent"
"      0.0871  Std.error of estimate"
"      4  Storm no."
"      25  Return interval"
"      12 Data Pairs"

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117021 - MTO IDF CURVE LOOKUP_DEPTH
"      5.000      10.000      15.000      30.000      60.000"
"     120.000     180.000     240.000     360.000     720.000"
"    1080.000   1440.000   minutes"
"      19.700      24.300      27.500      33.800      41.700"
"      51.400       0.000       0.000      71.500      88.100"
"       0.000      108.500   mm"
"     236.400     145.800     110.000     67.600     41.700"
"     25.700       0.000       0.000     11.917      7.342"
"       0.000       4.521   mm/hr"
" 732.700   mm/hr 'A' coeff."
"   0.0464   minutes 'B' coeff."
" 0.69972   'C' exponent"
"   0.0801   Std.error of estimate"
"      5   Storm no."
"     50   Return interval"
"     12   Data Pairs"
"      5.000      10.000      15.000      30.000      60.000"
"     120.000     180.000     240.000     360.000     720.000"
"    1080.000   1440.000   minutes"
"      21.900      27.000      30.500      37.600      46.300"
"      57.000       0.000       0.000      79.400      97.800"
"       0.000      120.500   mm"
"     262.800     162.000     122.000     75.200     46.300"
"     28.500       0.000       0.000     13.233      8.150"
"       0.000       5.021   mm/hr"
" 813.857   mm/hr 'A' coeff."
"   0.0427   minutes 'B' coeff."
" 0.69980   'C' exponent"
"   0.0648   Std.error of estimate"
"      6   Storm no."
"    100   Return interval"
"     12   Data Pairs"
"      5.000      10.000      15.000      30.000      60.000"
"     120.000     180.000     240.000     360.000     720.000"
"    1080.000   1440.000   minutes"
"      24.000      29.600      33.500      41.200      50.800"
"      62.600       0.000       0.000      87.100     107.300"
"       0.000      132.200   mm"
"     288.000     177.600     134.000     82.400     50.800"
"     31.300       0.000       0.000     14.517      8.942"
"       0.000       5.508   mm/hr"
" 891.458   mm/hr 'A' coeff."
"   0.0345   minutes 'B' coeff."
" 0.69951   'C' exponent"
"   0.1282   Std.error of estimate"
" 38  START/RE-START TOTALS "
"      3  Runoff Totals on EXIT"
"      Total Catchment area      0.000  hectare"
"      Total Impervious area      0.000  hectare"
"      Total % impervious      0.000"
" 19  EXIT"

```



**Appendix C**  
Pre-Development MIDUSS Model Output

```

"                                     Pre_25mm
"                                     ----->"
" MIDUSS Output ----->"
" MIDUSS version                      Version 2.25 rev. 473"
" MIDUSS created                      Sunday, February 07, 2010"
" 10  Units used:                      ie METRIC"
" Job folder:                         w:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"   5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
" Output filename:                    Pre_25mm.out"
" Licensee name:                      gmbp"
" Company                             Hewlett-Packard Company"
" Date & Time last used:              11/29/2018 at 8:29:31 AM"
" 31  TIME PARAMETERS"
"      5.000 Time Step"
"     180.000 Max. Storm length"
"    1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1 Chicago storm"
"     367.000 Coefficient A"
"      5.000 Constant B"
"      0.700 Exponent C"
"      0.394 Fraction R"
"     120.000 Duration"
"      1.000 Time step multiplier"
"           Maximum intensity          72.993 mm/hr"
"           Total depth                24.995 mm"
" 33  8 00025hyd Hydrograph extension used in this file"
"     CATCHMENT 10"
"      1 Triangular SCS"
"      1 Equal length"
"      2 Horton equation"
"     10 Catchment 10"
"      5.000 % Impervious"
"     14.360 Total Area"
"     250.000 Flow length"
"      5.000 Overland slope"
"     13.642 Pervious Area"
"     250.000 Pervious length"
"      5.000 Pervious slope"
"      0.718 Impervious Area"
"     250.000 Impervious length"
"      5.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"     60.000 Pervious Max.infiltration"
"     13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"           0.114 0.000 0.000 0.000 c.m/sec"
" Catchment 10 Pervious Impervious Total Area "
" Surface Area 13.642 0.718 14.360 hectare"
" Time of concentration --- 6.821 6.821 minutes"
" Time to Centroid 0.000 68.940 68.940 minutes"
" Rainfall depth 24.995 24.995 24.995 mm"
" Rainfall volume 3409.86 179.47 3589.33 c.m"
" Rainfall losses 24.995 1.782 23.835 mm"
" Runoff depth 0.000 23.213 1.161 mm"
" Runoff volume 0.00 166.67 166.67 c.m"
" Runoff coefficient 0.000 0.929 0.046 "
" Maximum flow 0.000 0.114 0.114 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

```

```

Pre_25mm
"      4  Add Runoff "
"      0.114      0.114      0.000      0.000"
" 33    CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     11  Catchment 11"
"     0.000 % Impervious"
"     0.630 Total Area"
"    30.000 Flow length"
"     5.000 Overland Slope"
"     0.630 Pervious Area"
"    30.000 Pervious length"
"     5.000 Pervious slope"
"     0.000 Impervious Area"
"    30.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"
"     0.000 Impervious Max.infiltration"
"     0.000 Impervious Min.infiltration"
"     0.001 Impervious Lag constant (hours)"
"     1.500 Impervious Depression storage"
"           0.000      0.114      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      ---      1.911      1.911      minutes"
"      Time to Centroid      0.000      62.390      62.390      minutes"
"      Rainfall depth      24.995      24.995      24.995      mm"
"      Rainfall volume      157.47      0.00      157.47      c.m"
"      Rainfall losses      24.995      1.871      24.995      mm"
"      Runoff depth      0.000      23.125      0.000      mm"
"      Runoff volume      0.00      0.00      0.00      c.m"
"      Runoff coefficient      0.000      0.000      0.000      "
"      Maximum flow      0.000      0.000      0.000      c.m/sec"
" 40    HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.000      0.114      0.000      0.000"
" 33    CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     21  Catchment 21"
"    25.000 % Impervious"
"     0.240 Total Area"
"    50.000 Flow length"
"     5.000 Overland Slope"
"     0.180 Pervious Area"
"    50.000 Pervious length"
"     5.000 Pervious slope"
"     0.060 Impervious Area"
"    50.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"

```

```

Pre_25mm
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.009      0.114      0.000      0.000 c.m/sec"
" Catchment 21 Pervious Impervious Total Area "
" Surface Area 0.180 0.060 0.240 hectare"
" Time of concentration --- 2.597 2.597 minutes"
" Time to Centroid 0.000 63.338 63.338 minutes"
" Rainfall depth 24.995 24.995 24.995 mm"
" Rainfall volume 44.99 15.00 59.99 c.m"
" Rainfall losses 24.995 1.943 19.232 mm"
" Runoff depth 0.000 23.052 5.763 mm"
" Runoff volume 0.00 13.83 13.83 c.m"
" Runoff coefficient 0.000 0.922 0.231 "
" Maximum flow 0.000 0.009 0.009 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.009      0.122      0.000      0.000"
" 33 CATCHMENT 22"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 22 Catchment 22"
" 1.000 % Impervious"
" 6.950 Total Area"
" 100.000 Flow length"
" 10.000 Overland Slope"
" 6.880 Pervious Area"
" 100.000 Pervious length"
" 10.000 Pervious slope"
" 0.069 Impervious Area"
" 100.000 Impervious length"
" 10.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.010      0.122      0.000      0.000 c.m/sec"
" Catchment 22 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration --- 3.197 3.197 minutes"
" Time to Centroid 0.000 64.152 64.152 minutes"
" Rainfall depth 24.995 24.995 24.995 mm"
" Rainfall volume 1719.80 17.37 1737.18 c.m"
" Rainfall losses 24.995 1.905 24.764 mm"
" Runoff depth 0.000 23.091 0.231 mm"
" Runoff volume 0.00 16.05 16.05 c.m"
" Runoff coefficient 0.000 0.924 0.009 "
" Maximum flow 0.000 0.010 0.010 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.010      0.132      0.000      0.000"
" 38 START/RE-START TOTALS EXIT"
" 3 Runoff Totals on EXIT"
" Total Catchment area 22.180 hectare"
" Total Impervious area 0.848 hectare"

```

"	Total % impervious	Pre_25mm	3.821"
" 19	EXIT"		

```

"                                     Pre_2yr
"                                     ----->"
" MIDUSS Output ----->"
" MIDUSS version                      Version 2.25 rev. 473"
" MIDUSS created                      Sunday, February 07, 2010"
" 10 Units used:                      ie METRIC"
" Job folder:                        w:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"   5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
" Output filename:                   Pre_2yr.out"
" Licensee name:                     gmbp"
" Company                            Hewlett-Packard Company"
" Date & Time last used:             11/29/2018 at 8:28:22 AM"
" 31 TIME PARAMETERS"
"   5.000 Time Step"
"  180.000 Max. Storm length"
" 1500.000 Max. Hydrograph"
" 32 STORM Chicago storm"
"   1 Chicago storm"
"  412.629 Coefficient A"
"   0.104 Constant B"
"   0.701 Exponent C"
"   0.400 Fraction R"
"  180.000 Duration"
"   1.000 Time step multiplier"
" Maximum intensity                   131.621 mm/hr"
" Total depth                         32.476 mm"
" 6 002hyd Hydrograph extension used in this file"
" 33 CATCHMENT 10"
"   1 Triangular SCS"
"   1 Equal length"
"   2 Horton equation"
"  10 Catchment 10"
"   5.000 % Impervious"
"  14.360 Total Area"
"  250.000 Flow length"
"   5.000 Overland Slope"
"  13.642 Pervious Area"
"  250.000 Pervious length"
"   5.000 Pervious slope"
"   0.718 Impervious Area"
"  250.000 Impervious length"
"   5.000 Impervious slope"
"   0.250 Pervious Manning 'n'"
"  60.000 Pervious Max.infiltration"
"  13.000 Pervious Min.infiltration"
"   0.500 Pervious Lag constant (hours)"
"   5.000 Pervious Depression storage"
"   0.015 Impervious Manning 'n'"
"   0.000 Impervious Max.infiltration"
"   0.000 Impervious Min.infiltration"
"   0.001 Impervious Lag constant (hours)"
"   1.500 Impervious Depression storage"
"           0.197 0.000 0.000 0.000 c.m/sec"
" Catchment 10 Pervious Impervious Total Area "
" Surface Area 13.642 0.718 14.360 hectare"
" Time of concentration 54.674 5.388 34.139 minutes"
" Time to Centroid 115.644 95.634 107.307 minutes"
" Rainfall depth 32.476 32.476 32.476 mm"
" Rainfall volume 4430.35 233.18 4663.52 c.m"
" Rainfall losses 30.201 1.606 28.771 mm"
" Runoff depth 2.275 30.870 3.705 mm"
" Runoff volume 310.33 221.65 531.97 c.m"
" Runoff coefficient 0.070 0.951 0.114 "
" Maximum flow 0.106 0.173 0.197 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

```

```

"          4  Add Runoff "
"          0.197      0.197      0.000      0.000"
" 33  CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     11  Catchment 11"
"     0.000 % Impervious"
"     0.630 Total Area"
"    30.000 Flow length"
"     5.000 Overland Slope"
"     0.630 Pervious Area"
"    30.000 Pervious length"
"     5.000 Pervious slope"
"     0.000 Impervious Area"
"    30.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"
"     0.000 Impervious Max.infiltration"
"     0.000 Impervious Min.infiltration"
"     0.001 Impervious Lag constant (hours)"
"     1.500 Impervious Depression storage"
"          0.015      0.197      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      15.321      1.510      15.321      minutes"
"      Time to Centroid      86.816      89.160      86.816      minutes"
"      Rainfall depth      32.476      32.476      32.476      mm"
"      Rainfall volume      204.60      0.00      204.60      c.m"
"      Rainfall losses      30.206      2.064      30.206      mm"
"      Runoff depth      2.270      30.412      2.270      mm"
"      Runoff volume      14.30      0.00      14.30      c.m"
"      Runoff coefficient      0.070      0.000      0.070      "
"      Maximum flow      0.015      0.000      0.015      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.015      0.206      0.000      0.000"
" 33  CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     21  Catchment 21"
"    25.000 % Impervious"
"     0.240 Total Area"
"    50.000 Flow length"
"     5.000 Overland Slope"
"     0.180 Pervious Area"
"    50.000 Pervious length"
"     5.000 Pervious slope"
"     0.060 Impervious Area"
"    50.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"

```

```

Pre_2yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.016      0.206      0.000      0.000 c.m/sec"
" Catchment 21 Pervious Impervious Total Area "
" Surface Area 0.180 0.060 0.240 hectare"
" Time of concentration 20.816 2.051 5.469 minutes"
" Time to Centroid 90.821 90.133 90.259 minutes"
" Rainfall depth 32.476 32.476 32.476 mm"
" Rainfall volume 58.46 19.49 77.94 c.m"
" Rainfall losses 30.201 1.824 23.107 mm"
" Runoff depth 2.275 30.651 9.369 mm"
" Runoff volume 4.10 18.39 22.49 c.m"
" Runoff coefficient 0.070 0.944 0.288 "
" Maximum flow 0.003 0.016 0.016 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.016      0.218      0.000      0.000"
33 CATCHMENT 22"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 22 Catchment 22"
" 1.000 % Impervious"
" 6.950 Total Area"
100.000 Flow length"
" 10.000 Overland Slope"
" 6.880 Pervious Area"
100.000 Pervious length"
" 10.000 Pervious slope"
" 0.069 Impervious Area"
100.000 Impervious length"
" 10.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.106      0.218      0.000      0.000 c.m/sec"
" Catchment 22 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 25.628 2.525 22.844 minutes"
" Time to Centroid 94.250 90.857 93.841 minutes"
" Rainfall depth 32.476 32.476 32.476 mm"
" Rainfall volume 2234.50 22.57 2257.07 c.m"
" Rainfall losses 30.209 1.742 29.925 mm"
" Runoff depth 2.266 30.734 2.551 mm"
" Runoff volume 155.94 21.36 177.30 c.m"
" Runoff coefficient 0.070 0.946 0.079 "
" Maximum flow 0.103 0.017 0.106 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.106      0.278      0.000      0.000"
38 START/RE-START TOTALS 22"
" 3 Runoff Totals on EXIT"
" Total Catchment area 22.180 hectare"
" Total Impervious area 0.848 hectare"

```



"	Total % impervious	Pre_2yr	3.821"
" 19	EXIT"		

```

"                                     Pre_5yr
"                                     ----->"
" MIDUSS Output ----->"
" MIDUSS version                      Version 2.25 rev. 473"
" MIDUSS created                      Sunday, February 07, 2010"
" 10 Units used:                      ie METRIC"
" Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"   5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
" Output filename:                   Pre_5yr.out"
" Licensee name:                     gmbp"
" Company                            Hewlett-Packard Company"
" Date & Time last used:             11/29/2018 at 8:27:02 AM"
" 31 TIME PARAMETERS"
"   5.000 Time Step"
"  180.000 Max. Storm length"
" 1500.000 Max. Hydrograph"
" 32 STORM Chicago storm"
"   1 Chicago storm"
"  541.973 Coefficient A"
"   0.093 Constant B"
"   0.701 Exponent C"
"   0.400 Fraction R"
"  180.000 Duration"
"   1.000 Time step multiplier"
"   Maximum intensity                173.271 mm/hr"
"   Total depth                      42.768 mm"
"   6 005hyd Hydrograph extension used in this file"
" 33 CATCHMENT 10"
"   1 Triangular SCS"
"   1 Equal length"
"   2 Horton equation"
"   10 Catchment 10"
"   5.000 % Impervious"
"  14.360 Total Area"
" 250.000 Flow length"
"   5.000 Overland Slope"
"  13.642 Pervious Area"
" 250.000 Pervious length"
"   5.000 Pervious slope"
"   0.718 Impervious Area"
" 250.000 Impervious length"
"   5.000 Impervious slope"
"   0.250 Pervious Manning 'n'"
"  60.000 Pervious Max.infiltration"
"  13.000 Pervious Min.infiltration"
"   0.500 Pervious Lag constant (hours)"
"   5.000 Pervious Depression storage"
"   0.015 Impervious Manning 'n'"
"   0.000 Impervious Max.infiltration"
"   0.000 Impervious Min.infiltration"
"   0.001 Impervious Lag constant (hours)"
"   1.500 Impervious Depression storage"
"   0.417 0.000 0.000 0.000 c.m/sec"
" Catchment 10 Pervious Impervious Total Area "
" Surface Area 13.642 0.718 14.360 hectare"
" Time of concentration 36.988 4.827 28.518 minutes"
" Time to Centroid 103.268 94.072 100.846 minutes"
" Rainfall depth 42.768 42.768 42.768 mm"
" Rainfall volume 5834.46 307.08 6141.54 c.m"
" Rainfall losses 36.714 1.644 34.961 mm"
" Runoff depth 6.054 41.124 7.807 mm"
" Runoff volume 825.89 295.27 1121.16 c.m"
" Runoff coefficient 0.142 0.962 0.183 "
" Maximum flow 0.389 0.226 0.417 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

```

```

"          4  Add Runoff "
"          0.417      0.417      0.000      0.000"
" 33  CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     11  Catchment 11"
"     0.000 % Impervious"
"     0.630 Total Area"
"    30.000 Flow length"
"     5.000 Overland Slope"
"     0.630 Pervious Area"
"    30.000 Pervious length"
"     5.000 Pervious slope"
"     0.000 Impervious Area"
"    30.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"
"     0.000 Impervious Max.infiltration"
"     0.000 Impervious Min.infiltration"
"     0.001 Impervious Lag constant (hours)"
"     1.500 Impervious Depression storage"
"          0.045      0.417      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      10.365      1.353      10.365      minutes"
"      Time to Centroid      83.214      88.290      83.214      minutes"
"      Rainfall depth      42.768      42.768      42.768      mm"
"      Rainfall volume      269.44      0.00      269.44      c.m"
"      Rainfall losses      36.768      2.411      36.768      mm"
"      Runoff depth      6.001      40.358      6.001      mm"
"      Runoff volume      37.81      0.00      37.81      c.m"
"      Runoff coefficient      0.140      0.000      0.140      "
"      Maximum flow      0.045      0.000      0.045      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.045      0.419      0.000      0.000"
" 33  CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     21  Catchment 21"
"    25.000 % Impervious"
"     0.240 Total Area"
"    50.000 Flow length"
"     5.000 Overland Slope"
"     0.180 Pervious Area"
"    50.000 Pervious length"
"     5.000 Pervious slope"
"     0.060 Impervious Area"
"    50.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"

```

```

Pre_5yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.024      0.419      0.000      0.000 c.m/sec"
" Catchment 21 Pervious Impervious Total Area "
" Surface Area 0.180 0.060 0.240 hectare"
" Time of concentration 14.082 1.838 5.616 minutes"
" Time to Centroid 86.136 89.067 88.163 minutes"
" Rainfall depth 42.768 42.768 42.768 mm"
" Rainfall volume 76.98 25.66 102.64 c.m"
" Rainfall losses 36.720 2.106 28.067 mm"
" Runoff depth 6.048 40.662 14.702 mm"
" Runoff volume 10.89 24.40 35.28 c.m"
" Runoff coefficient 0.141 0.951 0.344 "
" Maximum flow 0.011 0.021 0.024 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.024      0.426      0.000      0.000"
" 33 CATCHMENT 22"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 22 Catchment 22"
" 1.000 % Impervious"
" 6.950 Total Area"
" 100.000 Flow length"
" 10.000 Overland Slope"
" 6.880 Pervious Area"
" 100.000 Pervious length"
" 10.000 Pervious slope"
" 0.069 Impervious Area"
" 100.000 Impervious length"
" 10.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.373      0.426      0.000      0.000 c.m/sec"
" Catchment 22 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 17.337 2.262 16.373 minutes"
" Time to Centroid 88.547 89.738 88.623 minutes"
" Rainfall depth 42.768 42.768 42.768 mm"
" Rainfall volume 2942.68 29.72 2972.40 c.m"
" Rainfall losses 36.716 1.810 36.367 mm"
" Runoff depth 6.053 40.958 6.402 mm"
" Runoff volume 416.46 28.47 444.92 c.m"
" Runoff coefficient 0.142 0.958 0.150 "
" Maximum flow 0.368 0.023 0.373 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.373      0.739      0.000      0.000"
" 38 START/RE-START TOTALS 22"
" 3 Runoff Totals on EXIT"
" Total Catchment area 22.180 hectare"
" Total Impervious area 0.848 hectare"

```

"	Total % impervious	Pre_5yr	3.821"
" 19	EXIT"		

```

"                                     Pre_10yr
"                                     ----->"
" MIDUSS Output ----->"
" MIDUSS version                      Version 2.25 rev. 473"
" MIDUSS created                      Sunday, February 07, 2010"
" 10 Units used:                      ie METRIC"
" Job folder:                         w:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"   5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
" Output filename:                   Pre_10yr.out"
" Licensee name:                     gmbp"
" Company                            Hewlett-Packard Company"
" Date & Time last used:             11/29/2018 at 8:25:22 AM"
" 31 TIME PARAMETERS"
"   5.000 Time Step"
"  180.000 Max. Storm length"
" 1500.000 Max. Hydrograph"
" 32 STORM Chicago storm"
"   1 Chicago storm"
"  621.728 Coefficient A"
"   0.010 Constant B"
"   0.699 Exponent C"
"   0.400 Fraction R"
"  180.000 Duration"
"   1.000 Time step multiplier"
" Maximum intensity                   201.494 mm/hr"
" Total depth                         49.410 mm"
" 6 010hyd Hydrograph extension used in this file"
" 33 CATCHMENT 10"
"   1 Triangular SCS"
"   1 Equal length"
"   2 Horton equation"
"  10 Catchment 10"
"   5.000 % Impervious"
"  14.360 Total Area"
"  250.000 Flow length"
"   5.000 Overland Slope"
"  13.642 Pervious Area"
"  250.000 Pervious length"
"   5.000 Pervious slope"
"   0.718 Impervious Area"
"  250.000 Impervious length"
"   5.000 Impervious slope"
"   0.250 Pervious Manning 'n'"
"  60.000 Pervious Max.infiltration"
"  13.000 Pervious Min.infiltration"
"   0.500 Pervious Lag constant (hours)"
"   5.000 Pervious Depression storage"
"   0.015 Impervious Manning 'n'"
"   0.000 Impervious Max.infiltration"
"   0.000 Impervious Min.infiltration"
"   0.001 Impervious Lag constant (hours)"
"   1.500 Impervious Depression storage"
"           0.703 0.000 0.000 0.000 c.m/sec"
" Catchment 10 Pervious Impervious Total Area "
" Surface Area 13.642 0.718 14.360 hectare"
" Time of concentration 32.154 4.544 26.212 minutes"
" Time to Centroid 102.325 93.327 100.389 minutes"
" Rainfall depth 49.410 49.410 49.410 mm"
" Rainfall volume 6740.56 354.77 7095.33 c.m"
" Rainfall losses 40.265 1.760 38.340 mm"
" Runoff depth 9.145 47.650 11.071 mm"
" Runoff volume 1247.62 342.13 1589.75 c.m"
" Runoff coefficient 0.185 0.964 0.224 "
" Maximum flow 0.663 0.261 0.703 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

```

```

Pre_10yr
"      4  Add Runoff "
"      0.703      0.703      0.000      0.000"
" 33  CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      11  Catchment 11"
"      0.000  % Impervious"
"      0.630  Total Area"
"      30.000  Flow length"
"      5.000  Overland Slope"
"      0.630  Pervious Area"
"      30.000  Pervious length"
"      5.000  Pervious slope"
"      0.000  Impervious Area"
"      30.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.074      0.703      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      9.010      1.273      9.010      minutes"
"      Time to Centroid      83.231      87.866      83.231      minutes"
"      Rainfall depth      49.410      49.410      49.410      mm"
"      Rainfall volume      311.28      0.00      311.29      c.m"
"      Rainfall losses      40.287      2.714      40.287      mm"
"      Runoff depth      9.123      46.697      9.123      mm"
"      Runoff volume      57.48      0.00      57.48      c.m"
"      Runoff coefficient      0.185      0.000      0.185      "
"      Maximum flow      0.074      0.000      0.074      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.074      0.706      0.000      0.000"
" 33  CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      21  Catchment 21"
"      25.000  % Impervious"
"      0.240  Total Area"
"      50.000  Flow length"
"      5.000  Overland Slope"
"      0.180  Pervious Area"
"      50.000  Pervious length"
"      5.000  Pervious slope"
"      0.060  Impervious Area"
"      50.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

```

```

                                Pre_10yr
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"              0.030      0.706      0.000      0.000 c.m/sec"
"      Catchment 21      Pervious      Impervious      Total Area      "
"      Surface Area      0.180      0.060      0.240      hectare"
"      Time of concentration      12.242      1.730      5.591      minutes"
"      Time to Centroid      85.897      88.532      87.564      minutes"
"      Rainfall depth      49.410      49.410      49.410      mm"
"      Rainfall volume      88.94      29.65      118.58      c.m"
"      Rainfall losses      40.282      2.230      30.769      mm"
"      Runoff depth      9.129      47.180      18.641      mm"
"      Runoff volume      16.43      28.31      44.74      c.m"
"      Runoff coefficient      0.185      0.955      0.377      "
"      Maximum flow      0.017      0.025      0.030      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.030      0.713      0.000      0.000"
" 33      CATCHMENT 22"
"      1      Triangular SCS"
"      1      Equal length"
"      2      Horton equation"
"      22      Catchment 22"
"      1.000      % Impervious"
"      6.950      Total Area"
" 100.000      Flow length"
"      10.000      Overland Slope"
"      6.880      Pervious Area"
" 100.000      Pervious length"
"      10.000      Pervious slope"
"      0.069      Impervious Area"
" 100.000      Impervious length"
"      10.000      Impervious slope"
"      0.250      Pervious Manning 'n'"
"      60.000      Pervious Max.infiltration"
"      13.000      Pervious Min.infiltration"
"      0.500      Pervious Lag constant (hours)"
"      5.000      Pervious Depression storage"
"      0.015      Impervious Manning 'n'"
"      0.000      Impervious Max.infiltration"
"      0.000      Impervious Min.infiltration"
"      0.001      Impervious Lag constant (hours)"
"      1.500      Impervious Depression storage"
"              0.618      0.713      0.000      0.000 c.m/sec"
"      Catchment 22      Pervious      Impervious      Total Area      "
"      Surface Area      6.880      0.069      6.950      hectare"
"      Time of concentration      15.072      2.130      14.427      minutes"
"      Time to Centroid      88.316      89.279      88.364      minutes"
"      Rainfall depth      49.410      49.410      49.410      mm"
"      Rainfall volume      3399.68      34.34      3434.02      c.m"
"      Rainfall losses      40.260      1.903      39.876      mm"
"      Runoff depth      9.150      47.507      9.534      mm"
"      Runoff volume      629.59      33.02      662.61      c.m"
"      Runoff coefficient      0.185      0.961      0.193      "
"      Maximum flow      0.612      0.028      0.618      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.618      1.184      0.000      0.000"
" 38      START/RE-START TOTALS 22"
"      3      Runoff Totals on EXIT"
"              Total Catchment area      22.180      hectare"
"              Total Impervious area      0.848      hectare"

```



"	Total % impervious	Pre_10yr	3.821"
" 19	EXIT"		

```

"                                     Pre_25yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        w:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
"      Output filename:                    Pre_25yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              11/29/2018 at 8:24:37 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      732.700 Coefficient A"
"      0.046  Constant B"
"      0.700  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                236.075  mm/hr"
"      Total depth                      58.070  mm"
"      6  025hyd Hydrograph extension used in this file"
" 33  CATCHMENT 10"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      10  Catchment 10"
"      5.000  % Impervious"
"      14.360 Total Area"
"      250.000 Flow length"
"      5.000  Overland slope"
"      13.642 Pervious Area"
"      250.000 Pervious length"
"      5.000  Pervious slope"
"      0.718  Impervious Area"
"      250.000 Impervious length"
"      5.000  Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      1.020  0.000  0.000  0.000 c.m/sec"
"      Catchment 10  Pervious  Impervious  Total Area  "
"      Surface Area  13.642  0.718  14.360  hectare"
"      Time of concentration  28.151  4.265  23.839  minutes"
"      Time to Centroid  100.275  92.625  98.894  minutes"
"      Rainfall depth  58.070  58.070  58.070  mm"
"      Rainfall volume  7921.97  416.95  8338.91  c.m"
"      Rainfall losses  44.683  2.037  42.551  mm"
"      Runoff depth  13.387  56.034  15.519  mm"
"      Runoff volume  1826.27  402.32  2228.59  c.m"
"      Runoff coefficient  0.231  0.965  0.267  "
"      Maximum flow  0.974  0.297  1.020  c.m/sec"
" 40  HYDROGRAPH Add Runoff "

```

```

Pre_25yr
"      4  Add Runoff "
"      1.020      1.020      0.000      0.000"
" 33  CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     11  Catchment 11"
"     0.000 % Impervious"
"     0.630 Total Area"
"    30.000 Flow length"
"     5.000 Overland Slope"
"     0.630 Pervious Area"
"    30.000 Pervious length"
"     5.000 Pervious slope"
"     0.000 Impervious Area"
"    30.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"
"     0.000 Impervious Max.infiltration"
"     0.000 Impervious Min.infiltration"
"     0.001 Impervious Lag constant (hours)"
"     1.500 Impervious Depression storage"
"           0.129      1.020      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      7.889      1.195      7.889      minutes"
"      Time to Centroid      83.144      87.400      83.144      minutes"
"      Rainfall depth      58.070      58.070      58.070      mm"
"      Rainfall volume      365.84      0.00      365.84      c.m"
"      Rainfall losses      44.691      3.137      44.691      mm"
"      Runoff depth      13.379      54.934      13.379      mm"
"      Runoff volume      84.29      0.00      84.29      c.m"
"      Runoff coefficient      0.230      0.000      0.230      "
"      Maximum flow      0.129      0.000      0.129      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.129      1.046      0.000      0.000"
" 33  CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     21  Catchment 21"
"    25.000 % Impervious"
"     0.240 Total Area"
"    50.000 Flow length"
"     5.000 Overland Slope"
"     0.180 Pervious Area"
"    50.000 Pervious length"
"     5.000 Pervious slope"
"     0.060 Impervious Area"
"    50.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"

```

```

Pre_25yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.042      1.046      0.000      0.000 c.m/sec"
" Catchment 21 Pervious Impervious Total Area "
" Surface Area 0.180 0.060 0.240 hectare"
" Time of concentration 10.718 1.624 5.432 minutes"
" Time to Centroid 85.275 88.013 86.866 minutes"
" Rainfall depth 58.070 58.070 58.070 mm"
" Rainfall volume 104.53 34.84 139.37 c.m"
" Rainfall losses 44.714 2.449 34.148 mm"
" Runoff depth 13.357 55.621 23.923 mm"
" Runoff volume 24.04 33.37 57.41 c.m"
" Runoff coefficient 0.230 0.958 0.412 "
" Maximum flow 0.025 0.030 0.042 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.042      1.064      0.000      0.000"
" 33 CATCHMENT 22"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 22 Catchment 22"
" 1.000 % Impervious"
" 6.950 Total Area"
" 100.000 Flow length"
" 10.000 Overland Slope"
" 6.880 Pervious Area"
" 100.000 Pervious length"
" 10.000 Pervious slope"
" 0.069 Impervious Area"
" 100.000 Impervious length"
" 10.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.896      1.064      0.000      0.000 c.m/sec"
" Catchment 22 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 13.196 1.999 12.739 minutes"
" Time to Centroid 87.354 88.770 87.411 minutes"
" Rainfall depth 58.070 58.070 58.070 mm"
" Rainfall volume 3995.54 40.36 4035.90 c.m"
" Rainfall losses 44.786 2.143 44.359 mm"
" Runoff depth 13.285 55.927 13.711 mm"
" Runoff volume 914.06 38.87 952.93 c.m"
" Runoff coefficient 0.229 0.963 0.236 "
" Maximum flow 0.889 0.033 0.896 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.896      1.801      0.000      0.000"
" 38 START/RE-START TOTALS 22"
" 3 Runoff Totals on EXIT"
" Total Catchment area 22.180 hectare"
" Total Impervious area 0.848 hectare"

```

"	Total % impervious	Pre_25yr	3.821"
" 19	EXIT"		

```

"                                     Pre_50yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
"      Output filename:                   Pre_50yr.out"
"      Licensee name:                     gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:             11/29/2018 at 8:23:51 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      813.857 Coefficient A"
"      0.043  Constant B"
"      0.700  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                262.316  mm/hr"
"      Total depth                      64.470  mm"
"      6  050hyd Hydrograph extension used in this file"
" 33  CATCHMENT 10"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      10  Catchment 10"
"      5.000  % Impervious"
"      14.360 Total Area"
"      250.000 Flow length"
"      5.000  Overland Slope"
"      13.642 Pervious Area"
"      250.000 Pervious length"
"      5.000  Pervious slope"
"      0.718  Impervious Area"
"      250.000 Impervious length"
"      5.000  Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"      1.406 0.000 0.000 0.000 c.m/sec"
"      Catchment 10 Pervious Impervious Total Area "
"      Surface Area 13.642 0.718 14.360 hectare"
"      Time of concentration 25.854 4.089 22.361 minutes"
"      Time to Centroid 99.416 92.195 98.258 minutes"
"      Rainfall depth 64.470 64.470 64.470 mm"
"      Rainfall volume 8794.99 462.89 9257.89 c.m"
"      Rainfall losses 47.360 2.330 45.108 mm"
"      Runoff depth 17.110 62.140 19.362 mm"
"      Runoff volume 2334.20 446.17 2780.37 c.m"
"      Runoff coefficient 0.265 0.964 0.300 "
"      Maximum flow 1.342 0.328 1.406 c.m/sec"
" 40  HYDROGRAPH Add Runoff "

```

```

Pre_50yr
"      4  Add Runoff "
"      1.406      1.406      0.000      0.000"
" 33  CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      11  Catchment 11"
"      0.000  % Impervious"
"      0.630  Total Area"
"      30.000  Flow length"
"      5.000  Overland Slope"
"      0.630  Pervious Area"
"      30.000  Pervious length"
"      5.000  Pervious slope"
"      0.000  Impervious Area"
"      30.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.163      1.406      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      7.245      1.146      7.245      minutes"
"      Time to Centroid      82.945      87.111      82.945      minutes"
"      Rainfall depth      64.470      64.470      64.470      mm"
"      Rainfall volume      406.16      0.00      406.16      c.m"
"      Rainfall losses      47.549      3.484      47.549      mm"
"      Runoff depth      16.920      60.986      16.921      mm"
"      Runoff volume      106.60      0.00      106.60      c.m"
"      Runoff coefficient      0.262      0.000      0.262      "
"      Maximum flow      0.163      0.000      0.163      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.163      1.431      0.000      0.000"
" 33  CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      21  Catchment 21"
"      25.000  % Impervious"
"      0.240  Total Area"
"      50.000  Flow length"
"      5.000  Overland Slope"
"      0.180  Pervious Area"
"      50.000  Pervious length"
"      5.000  Pervious slope"
"      0.060  Impervious Area"
"      50.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

```

```

Pre_50yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      0.052      1.431      0.000      0.000 c.m/sec"
" Catchment 21 Pervious Impervious Total Area "
" Surface Area 0.180 0.060 0.240 hectare"
" Time of concentration 9.843 1.557 5.285 minutes"
" Time to Centroid 84.967 87.731 86.487 minutes"
" Rainfall depth 64.470 64.470 64.470 mm"
" Rainfall volume 116.05 38.68 154.73 c.m"
" Rainfall losses 47.604 2.601 36.353 mm"
" Runoff depth 16.866 61.869 28.117 mm"
" Runoff volume 30.36 37.12 67.48 c.m"
" Runoff coefficient 0.262 0.960 0.436 "
" Maximum flow 0.034 0.033 0.052 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      0.052      1.451      0.000      0.000"
" 33 CATCHMENT 22"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 22 Catchment 22"
" 1.000 % Impervious"
" 6.950 Total Area"
" 100.000 Flow length"
" 10.000 Overland Slope"
" 6.880 Pervious Area"
" 100.000 Pervious length"
" 10.000 Pervious slope"
" 0.069 Impervious Area"
" 100.000 Impervious length"
" 10.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"      1.128      1.451      0.000      0.000 c.m/sec"
" Catchment 22 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 12.119 1.917 11.758 minutes"
" Time to Centroid 87.150 88.445 87.196 minutes"
" Rainfall depth 64.470 64.470 64.470 mm"
" Rainfall volume 4435.86 44.81 4480.66 c.m"
" Rainfall losses 47.359 2.347 46.909 mm"
" Runoff depth 17.111 62.123 17.561 mm"
" Runoff volume 1177.30 43.18 1220.48 c.m"
" Runoff coefficient 0.265 0.964 0.272 "
" Maximum flow 1.120 0.037 1.128 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"      1.128      2.355      0.000      0.000"
" 38 START/RE-START TOTALS 22"
" 3 Runoff Totals on EXIT"
" Total Catchment area 22.180 hectare"
" Total Impervious area 0.848 hectare"

```



"	Total % impervious	Pre_50yr	3.821"
" 19	EXIT"		

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"      MIDUSS created                      Sunday, February 07, 2010"
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"      5 work in Progress\Design Calcs\Modelling Files\2018-11-27"
"      Output filename:                    Pre_100yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
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"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
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"      1  Chicago storm"
"      891.458 Coefficient A"
"      0.034  Constant B"
"      0.700  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                    287.794  mm/hr"
"      Total depth                          70.730  mm"
"      6  100hyd Hydrograph extension used in this file"
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"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      10  Catchment 10"
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"      14.360 Total Area"
"      250.000 Flow length"
"      5.000  Overland Slope"
"      13.642 Pervious Area"
"      250.000 Pervious length"
"      5.000  Pervious slope"
"      0.718  Impervious Area"
"      250.000 Impervious length"
"      5.000  Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"      1.849 0.000 0.000 0.000 c.m/sec"
"      Catchment 10 Pervious Impervious Total Area "
"      Surface Area 13.642 0.718 14.360 hectare"
"      Time of concentration 24.148 3.940 21.202 minutes"
"      Time to Centroid 99.326 91.807 98.229 minutes"
"      Rainfall depth 70.730 70.730 70.730 mm"
"      Rainfall volume 0.9649 0.0508 1.0157 ha-m"
"      Rainfall losses 49.751 2.703 47.399 mm"
"      Runoff depth 20.978 68.026 23.331 mm"
"      Runoff volume 2861.84 488.43 3350.27 c.m"
"      Runoff coefficient 0.297 0.962 0.330 "
"      Maximum flow 1.778 0.358 1.849 c.m/sec"
" 40  HYDROGRAPH Add Runoff "

```

```

Pre_100yr
"      4  Add Runoff "
"      1.849      1.849      0.000      0.000"
" 33  CATCHMENT 11"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      11  Catchment 11"
"      0.000  % Impervious"
"      0.630  Total Area"
"      30.000  Flow length"
"      5.000  Overland Slope"
"      0.630  Pervious Area"
"      30.000  Pervious length"
"      5.000  Pervious slope"
"      0.000  Impervious Area"
"      30.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.196      1.849      0.000      0.000 c.m/sec"
"      Catchment 11      Pervious      Impervious      Total Area "
"      Surface Area      0.630      0.000      0.630      hectare"
"      Time of concentration      6.767      1.104      6.767      minutes"
"      Time to Centroid      82.973      86.863      82.973      minutes"
"      Rainfall depth      70.730      70.730      70.730      mm"
"      Rainfall volume      445.60      0.00      445.60      c.m"
"      Rainfall losses      50.320      3.834      50.320      mm"
"      Runoff depth      20.409      66.895      20.409      mm"
"      Runoff volume      128.58      0.00      128.58      c.m"
"      Runoff coefficient      0.289      0.000      0.289      "
"      Maximum flow      0.196      0.000      0.196      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.196      1.866      0.000      0.000"
" 33  CATCHMENT 21"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      21  Catchment 21"
"      25.000  % Impervious"
"      0.240  Total Area"
"      50.000  Flow length"
"      5.000  Overland Slope"
"      0.180  Pervious Area"
"      50.000  Pervious length"
"      5.000  Pervious slope"
"      0.060  Impervious Area"
"      50.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

```

```

"           Pre_100yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           0.063      1.866      0.000      0.000 c.m/sec"
" Catchment 21 Pervious Impervious Total Area "
" Surface Area 0.180 0.060 0.240 hectare"
" Time of concentration 9.194 1.500 5.188 minutes"
" Time to Centroid 85.198 87.539 86.417 minutes"
" Rainfall depth 70.730 70.730 70.730 mm"
" Rainfall volume 127.31 42.44 169.75 c.m"
" Rainfall losses 49.870 2.763 38.093 mm"
" Runoff depth 20.860 67.967 32.637 mm"
" Runoff volume 37.55 40.78 78.33 c.m"
" Runoff coefficient 0.295 0.961 0.461 "
" Maximum flow 0.043 0.037 0.063 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.063      1.889      0.000      0.000"
" 33 CATCHMENT 22"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 22 Catchment 22"
" 1.000 % Impervious"
" 6.950 Total Area"
" 100.000 Flow length"
" 10.000 Overland Slope"
" 6.880 Pervious Area"
" 100.000 Pervious length"
" 10.000 Pervious slope"
" 0.069 Impervious Area"
" 100.000 Impervious length"
" 10.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           1.351      1.889      0.000      0.000 c.m/sec"
" Catchment 22 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 11.319 1.847 11.018 minutes"
" Time to Centroid 87.257 88.172 87.286 minutes"
" Rainfall depth 70.730 70.730 70.730 mm"
" Rainfall volume 4866.54 49.16 4915.70 c.m"
" Rainfall losses 49.755 2.514 49.282 mm"
" Runoff depth 20.975 68.216 21.447 mm"
" Runoff volume 1443.19 47.41 1490.60 c.m"
" Runoff coefficient 0.297 0.964 0.303 "
" Maximum flow 1.343 0.041 1.351 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           1.351      2.865      0.000      0.000"
" 38 START/RE-START TOTALS 22"
" 3 Runoff Totals on EXIT"
" Total Catchment area 22.180 hectare"
" Total Impervious area 0.848 hectare"

```

"	Total % impervious	Pre_100yr	3.821"
" 19	EXIT"		

**Appendix D**  
Post-Development MIDUSS Model Output  
and Stage-Storage-Discharge Calculation Tables

**Inverhaugh Ridge Development**  
**Township of Centre Wellington**  
**Our File: 117021**  
**December 7, 2018**

**Block 41 Stormwater Management Pond**

Elevation (m)	Depth (m)	Surface Area (m <sup>2</sup> )	Increase	Accum.	Increase	Accum.	
			Perm. Pool Volume (m <sup>3</sup> )	Perm. Pool Storage (m <sup>3</sup> )	Active Volume (m <sup>3</sup> )	Active Storage (m <sup>3</sup> )	
352.80	0.00	991.00	0.00	0.00			Bottom of Permanent Pool
352.95	0.15	1,098.00	156.67	156.67			
353.10	0.30	1,206.00	172.80	329.48	0.00	0.00	Outlet/Top of Permanent Pool
353.30	0.50	1,352.00			255.80	255.80	
353.55	0.75	1,549.50			362.69	618.49	
353.80	1.00	1,761.00			413.81	1,032.30	
354.05	1.25	1,983.00			468.00	1,500.30	
354.30	1.50	2,215.00			524.75	2,025.05	
354.55	1.75	2,457.00			584.00	2,609.05	
354.80	2.00	2,709.00			645.75	3,254.80	
355.05	2.25	2,865.00			696.75	3,951.55	
355.30	2.50	3,214.00			759.88	4,711.42	
355.55	2.75	3,429.00			830.38	5,541.80	
355.80	3.00	3,658.00			885.88	6,427.67	
356.05	3.25	3,923.50			947.69	7,375.36	
356.10	3.30	3,993.00			197.91	7,573.28	Weir
356.40	3.60	4,455.00			1267.20	8,840.47	
356.65	3.85	4,747.50			1150.31	9,990.79	
356.90	4.10	4,956.00			1212.94	11,203.72	
357.00	4.20	5,019.00			498.75	11,702.48	Overflow

**Minor Control**

120 mm Orifice at 352.90

Q = 0.060 cu m/s  
Cd = 0.600  
H = 1.820 m  
2g = 19.620  
A = 0.011 sq m  
D = 0.120 m  
D/2 = 0.060 m

**Overflow Weir**

Q = 6.156 cu m/s  
d1 = 3.900 m  
h = 3.000 m  
H = 0.900 m  
2g = 19.620  
L = 5.000 m

**Stage-Storage-Discharge Table**

<b>Elevation (m)</b>	<b>Stage (m)</b>	<b>Storage (m<sup>3</sup>)</b>	<b>Minor Control (m<sup>3</sup>/s)</b>	<b>Overflow Weir (m<sup>3</sup>/s)</b>	<b>Actual Discharge (m<sup>3</sup>/s)</b>	
353.10	0.00	0.00	0.000	0.000	0.000	Outlet/Top of Permanent Pool
353.30	0.20	255.80	0.018	0.000	0.018	
353.55	0.45	618.49	0.023	0.000	0.023	
353.80	0.70	1,032.30	0.028	0.000	0.028	
354.05	0.95	1,500.30	0.031	0.000	0.031	
354.30	1.20	2,025.05	0.035	0.000	0.035	
354.55	1.45	2,609.05	0.038	0.000	0.038	
354.80	1.70	3,254.80	0.041	0.000	0.041	
355.05	1.95	3,951.55	0.043	0.000	0.043	
355.30	2.20	4,711.42	0.046	0.000	0.046	
355.55	2.45	5,541.80	0.048	0.000	0.048	
355.80	2.70	6,427.67	0.051	0.000	0.051	
356.05	2.95	7,375.36	0.053	0.000	0.053	
356.10	3.00	7,573.28	0.053	0.000	0.053	Weir
356.40	3.30	8,840.47	0.056	1.140	1.196	
356.65	3.55	9,990.79	0.058	2.880	2.937	
356.90	3.80	11,203.72	0.060	5.130	5.189	
357.00	3.90	11,702.48	0.060	6.156	6.216	Overflow



**Inverhaugh Ridge Development  
Township of Centre Wellington  
Our File: 117021  
December 7, 2018**

**Block 42 Stormwater Management Pond**

<b>Elevation (m)</b>	<b>Depth (m)</b>	<b>Surface Area (m<sup>2</sup>)</b>	<b>Increase Active Volume (m<sup>3</sup>)</b>	<b>Accum. Active Storage (m<sup>3</sup>)</b>	
350.60	0.00	2,585.00	0.00	0.00	Bottom of Pond/Minor Outlet
350.70	0.10	2,961.00	277.30	277.30	
350.80	0.20	3,337.00	314.90	592.20	DICB Lip (2)
350.90	0.30	3,712.00	352.45	944.65	DICB Lip (1)
351.00	0.40	4,035.00	387.35	1,332.00	
351.10	0.50	4,228.00	413.15	1,745.15	
351.20	0.60	4,429.00	432.85	2,178.00	
351.30	0.70	4,636.00	453.25	2,631.25	
351.40	0.80	4,852.00	474.40	3,105.65	
351.50	0.90	5,081.00	496.65	3,602.30	
351.60	1.00	5,319.00	520.00	4,122.30	
351.70	1.10	5,570.00	544.45	4,666.75	Weir
351.80	1.20	5,833.00	570.15	5,236.90	
351.90	1.30	6,340.00	608.65	5,845.55	
352.00	1.40	8,314.00	732.70	6,578.25	Top of Bank

**Minor Control**

150 mm Knockout at 350.60

Q = 0.017 cu m/s  
Cd = 0.600  
H = 0.200 m  
2g = 19.620  
A = 0.018 sq m  
D = 0.150 m  
D/2 = 0.075 m

**Major Outlet (1)**

460 mm Orifice at 349.85

Q = 0.612 cu m/s  
Cd = 0.600  
H = 2.250 m  
2g = 19.620  
A = 0.166 sq m  
D = 0.460 m  
D/2 = 0.230 m

**Major Outlet (2)**

460 mm Orifice at 349.85

Q = 0.612 cu m/s  
Cd = 0.600  
H = 2.250 m  
2g = 19.620  
A = 0.166 sq m  
D = 0.460 m  
D/2 = 0.230 m

**Overflow Weir**

Q = 0.643 cu m/s  
d1 = 0.900 m  
h = 0.700 m  
H = 0.200 m  
2g = 19.620  
L = 5.000 m

**Stage-Storage-Discharge Table**

<b>Elevation</b>	<b>Stage</b>	<b>Storage</b>	<b>Minor</b>	<b>Major</b>	<b>Major</b>	<b>Overflow</b>	<b>Actual</b>	
<b>(m)</b>	<b>(m)</b>	<b>(m<sup>3</sup>)</b>	<b>Control</b>	<b>Outlet (1)</b>	<b>Outlet (2)</b>	<b>Weir</b>	<b>Discharge</b>	
			<b>(m<sup>3</sup>/s)</b>	<b>(m<sup>3</sup>/s)</b>	<b>(m<sup>3</sup>/s)</b>	<b>(m<sup>3</sup>/s)</b>	<b>(m<sup>3</sup>/s)</b>	
350.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	Minor Outlet
350.70	0.10	277.30	0.007	0.000	0.000	0.000	0.007	
350.80	0.20	592.20	0.017	0.000	0.000	0.000	0.017	DICB Lip (2)
350.90	0.30	944.65	0.000	0.000	0.400	0.000	0.400	DICB Lip (1)
351.00	0.40	1,332.00	0.000	0.424	0.424	0.000	0.847	
351.10	0.50	1,745.15	0.000	0.446	0.446	0.000	0.892	
351.20	0.60	2,178.00	0.000	0.467	0.467	0.000	0.935	
351.30	0.70	2,631.25	0.000	0.488	0.488	0.000	0.976	
351.40	0.80	3,105.65	0.000	0.507	0.507	0.000	1.015	
351.50	0.90	3,602.30	0.000	0.526	0.526	0.000	1.053	
351.60	1.00	4,122.30	0.000	0.545	0.545	0.000	1.089	
351.70	1.10	4,666.75	0.000	0.562	0.562	0.000	1.124	Weir
351.80	1.20	5,236.90	0.000	0.579	0.579	0.220	1.379	
351.90	1.30	5,845.55	0.000	0.596	0.596	0.636	1.828	
352.00	1.40	6,578.25	0.000	0.612	0.612	1.191	2.415	Top of Bank

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"      5.000  Time Step"
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"      1500.000  Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      367.000  Coefficient A"
"      5.000  Constant B"
"      0.700  Exponent C"
"      0.394  Fraction R"
"      120.000  Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                    72.993  mm/hr"
"      Total depth                          24.995  mm"
"      7  0025hyd  Hydrograph extension used in this file"
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"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101  Catchment 101"
"      10.000  % Impervious"
"      1.570  Total Area"
"      100.000  Flow length"
"      5.000  Overland slope"
"      1.413  Pervious Area"
"      100.000  Pervious length"
"      5.000  Pervious slope"
"      0.157  Impervious Area"
"      100.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.024  0.000  0.000  0.000 c.m/sec"
"      Catchment 101  Pervious  Impervious  Total Area  "
"      Surface Area  1.413  0.157  1.570  hectare"
"      Time of concentration  ---  3.936  3.936  minutes"
"      Time to Centroid  0.000  65.176  65.176  minutes"
"      Rainfall depth  24.995  24.995  24.995  mm"
"      Rainfall volume  353.18  39.24  392.43  c.m"
"      Rainfall losses  24.995  1.866  22.682  mm"
"      Runoff depth  0.000  23.130  2.313  mm"
"      Runoff volume  0.00  36.31  36.31  c.m"
"      Runoff coefficient  0.000  0.925  0.093  "
"      Maximum flow  0.000  0.024  0.024  c.m/sec"
" 40  HYDROGRAPH Add Runoff "

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Post__25mm
"      4  Add Runoff "
"      0.024  0.024  0.000  0.000"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.024  0.024  0.024  0.000"
" 40  HYDROGRAPH Combine 200"
"      6  Combine "
"     200  Node #"
"      Combined Outflow"
"      Maximum flow 0.024 c.m/sec"
"      Hydrograph volume 36.314 c.m"
"      0.024  0.024  0.024  0.024"
" 40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.024  0.000  0.024  0.024"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     102  Catchment 102"
"    50.000  % Impervious"
"     5.460  Total Area"
"   150.000  Flow length"
"     5.000  Overland Slope"
"     2.730  Pervious Area"
"   150.000  Pervious length"
"     5.000  Pervious slope"
"     2.730  Impervious Area"
"   150.000  Impervious length"
"     5.000  Impervious slope"
"     0.250  Pervious Manning 'n'"
"    60.000  Pervious Max.infiltration"
"   13.000  Pervious Min.infiltration"
"     0.500  Pervious Lag constant (hours)"
"     5.000  Pervious Depression storage"
"     0.015  Impervious Manning 'n'"
"     0.000  Impervious Max.infiltration"
"     0.000  Impervious Min.infiltration"
"     0.001  Impervious Lag constant (hours)"
"     1.500  Impervious Depression storage"
"     0.421  0.000  0.024  0.024 c.m/sec"
"     Catchment 102 Pervious Impervious Total Area "
"     Surface Area 2.730 2.730 5.460 hectare"
"     Time of concentration --- 5.020 5.020 minutes"
"     Time to Centroid 0.000 66.548 66.548 minutes"
"     Rainfall depth 24.995 24.995 24.995 mm"
"     Rainfall volume 682.37 682.37 1364.75 c.m"
"     Rainfall losses 24.995 1.682 13.338 mm"
"     Runoff depth 0.000 23.314 11.657 mm"
"     Runoff volume 0.00 636.46 636.46 c.m"
"     Runoff coefficient 0.000 0.933 0.466 "
"     Maximum flow 0.000 0.421 0.421 c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.421  0.421  0.024  0.024"
" 56  DIVERSION"
"     102  Node number"
"    0.848  Overflow threshold"
"    1.000  Required diverted fraction"
"     0  Conduit type; 1=Pipe;2=Channel"
"     Peak of diverted flow 0.000 c.m/sec"
"     Volume of diverted flow 0.000 c.m"
"     DIV00102.0025hyd"

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"                                     Post__25mm
"      Major flow at 102"
"      0.421      0.421      0.421      0.024 c.m/sec"
40  HYDROGRAPH Next link "
"      5  Next link "
"      0.421      0.421      0.421      0.024"
54  POND DESIGN"
"      0.421  Current peak flow      c.m/sec"
"      0.304  Target outflow      c.m/sec"
"      636.5  Hydrograph volume      c.m"
"      18.    Number of stages"
"      353.100  Minimum water level      metre"
"      357.000  Maximum water level      metre"
"      353.100  Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      353.100      0.000      0.000"
"      353.300      0.01800      255.800"
"      353.550      0.02300      618.490"
"      353.800      0.02800      1032.300"
"      354.050      0.03100      1500.300"
"      354.300      0.03500      2025.050"
"      354.550      0.03800      2609.050"
"      354.800      0.04100      3254.800"
"      355.050      0.04300      3951.550"
"      355.300      0.04600      4711.420"
"      355.550      0.04800      5541.800"
"      355.800      0.05100      6427.670"
"      356.050      0.05300      7375.360"
"      356.100      0.05300      7573.280"
"      356.400      1.196      8840.470"
"      356.650      2.937      9990.790"
"      356.900      5.189      11203.72"
"      357.000      6.216      11702.48"
"      Peak outflow      0.022      c.m/sec"
"      Maximum level      353.485      metre"
"      Maximum storage      524.863      c.m"
"      Centroidal lag      5.974      hours"
"      0.421      0.421      0.022      0.024 c.m/sec"
40  HYDROGRAPH Combine      100"
"      6  Combine "
"      100  Node #"
"      to Block 42 SWM Facility"
"      Maximum flow      0.022      c.m/sec"
"      Hydrograph volume      634.409      c.m"
"      0.421      0.421      0.022      0.022"
40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.421      0.000      0.022      0.022"
33  CATCHMENT 103"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      103  Catchment 103"
"      55.000  % Impervious"
"      1.850  Total Area"
"      80.000  Flow length"
"      5.000  Overland Slope"
"      0.832  Pervious Area"
"      80.000  Pervious length"
"      5.000  Pervious slope"
"      1.018  Impervious Area"
"      80.000  Impervious length"
"      5.000  Impervious slope"

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                                Post__25mm
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"      0.150 0.000 0.022 0.022 c.m/sec"
"      Catchment 103 Pervious Impervious Total Area "
"      Surface Area 0.832 1.018 1.850 hectare"
"      Time of concentration --- 3.443 3.443 minutes"
"      Time to Centroid 0.000 64.505 64.505 minutes"
"      Rainfall depth 24.995 24.995 24.995 mm"
"      Rainfall volume 208.09 254.33 462.41 c.m"
"      Rainfall losses 24.995 1.956 12.324 mm"
"      Runoff depth 0.000 23.039 12.672 mm"
"      Runoff volume 0.00 234.43 234.43 c.m"
"      Runoff coefficient 0.000 0.922 0.507 "
"      Maximum flow 0.000 0.150 0.150 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.150 0.150 0.022 0.022"
" 33 CATCHMENT 104"
"      1 Triangular SCS"
"      1 Equal length"
"      2 Horton equation"
"      104 Catchment 104"
"      20.000 % Impervious"
"      2.230 Total Area"
"      40.000 Flow length"
"      5.000 Overland slope"
"      1.784 Pervious Area"
"      40.000 Pervious length"
"      5.000 Pervious slope"
"      0.446 Impervious Area"
"      40.000 Impervious length"
"      5.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"      0.071 0.150 0.022 0.022 c.m/sec"
"      Catchment 104 Pervious Impervious Total Area "
"      Surface Area 1.784 0.446 2.230 hectare"
"      Time of concentration --- 2.271 2.271 minutes"
"      Time to Centroid 0.000 62.793 62.793 minutes"
"      Rainfall depth 24.995 24.995 24.995 mm"
"      Rainfall volume 445.92 111.48 557.40 c.m"
"      Rainfall losses 24.995 1.893 20.375 mm"
"      Runoff depth 0.000 23.103 4.621 mm"
"      Runoff volume 0.00 103.04 103.04 c.m"
"      Runoff coefficient 0.000 0.924 0.185 "
"      Maximum flow 0.000 0.071 0.071 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

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Post__25mm
"      4  Add Runoff "
"      0.071    0.215    0.022    0.022"
" 33    CATCHMENT 201"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      201  Catchment 201"
"      20.000  % Impervious"
"      0.080  Total Area"
"      20.000  Flow length"
"      5.000  Overland Slope"
"      0.064  Pervious Area"
"      20.000  Pervious length"
"      5.000  Pervious slope"
"      0.016  Impervious Area"
"      20.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.003    0.215    0.022    0.022 c.m/sec"
"      Catchment 201      Pervious      Impervious      Total Area  "
"      Surface Area      0.064      0.016      0.080      hectare"
"      Time of concentration      ---      1.499      1.499      minutes"
"      Time to Centroid      0.000      61.721      61.721      minutes"
"      Rainfall depth      24.995      24.995      24.995      mm"
"      Rainfall volume      16.00      4.00      20.00      c.m"
"      Rainfall losses      24.995      1.974      20.391      mm"
"      Runoff depth      0.000      23.021      4.604      mm"
"      Runoff volume      0.00      3.68      3.68      c.m"
"      Runoff coefficient      0.000      0.921      0.184      "
"      Maximum flow      0.000      0.003      0.003      c.m/sec"
" 40    HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.003    0.218    0.022    0.022"
" 33    CATCHMENT 202"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      202  Catchment 202"
"      1.000  % Impervious"
"      6.950  Total Area"
"      100.000  Flow length"
"      5.000  Overland Slope"
"      6.880  Pervious Area"
"      100.000  Pervious length"
"      5.000  Pervious slope"
"      0.069  Impervious Area"
"      100.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

```

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"                               Post_25mm
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           0.010   0.218   0.022   0.022 c.m/sec"
" Catchment 202 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration --- 3.936 3.936 minutes"
" Time to Centroid 0.000 65.176 65.176 minutes"
" Rainfall depth 24.995 24.995 24.995 mm"
" Rainfall volume 1719.80 17.37 1737.18 c.m"
" Rainfall losses 24.995 1.866 24.764 mm"
" Runoff depth 0.000 23.130 0.231 mm"
" Runoff volume 0.00 16.08 16.08 c.m"
" Runoff coefficient 0.000 0.925 0.009 "
" Maximum flow 0.000 0.010 0.010 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.010   0.227   0.022   0.022"
" 47 FILEI_O Read/Open DIV00102.0025hyd"
" 1 1=read/open; 2=write/save"
" 2 1=rainfall; 2=hydrograph"
" 1 1=runoff; 2=inflow; 3=outflow; 4=junction"
" DIV00102.0025hyd"
" Major flow at 102"
" Total volume 0.000 c.m"
" Maximum flow 0.000 c.m/sec"
"           0.000   0.227   0.022   0.022 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.000   0.227   0.022   0.022"
" 40 HYDROGRAPH Copy to Outflow"
" 8 Copy to Outflow"
"           0.000   0.227   0.227   0.022"
" 40 HYDROGRAPH Combine 100"
" 6 Combine "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 0.237 c.m/sec"
" Hydrograph volume 991.632 c.m"
"           0.000   0.227   0.227   0.237"
" 40 HYDROGRAPH Confluence 100"
" 7 Confluence "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 0.237 c.m/sec"
" Hydrograph volume 991.632 c.m"
"           0.000   0.237   0.227   0.000"
" 54 POND DESIGN"
" 0.237 Current peak flow c.m/sec"
" 0.304 Target outflow c.m/sec"
" 991.6 Hydrograph volume c.m"
" 15. Number of stages"
" 350.600 Minimum water level metre"
" 352.000 Maximum water level metre"
" 350.600 Starting water level metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge Volume"
" 350.600 0.000 0.000"
" 350.700 0.00700 277.300"
" 350.800 0.01700 592.200"
" 350.900 0.4000 944.650"
" 351.000 0.8470 1332.000"

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			Post_25mm			
"		351.100	0.8920	1745.150"		
"		351.200	0.9350	2178.000"		
"		351.300	0.9760	2631.250"		
"		351.400	1.015	3105.650"		
"		351.500	1.053	3602.300"		
"		351.600	1.089	4122.300"		
"		351.700	1.124	4666.750"		
"		351.800	1.379	5236.900"		
"		351.900	1.828	5845.550"		
"		352.000	2.415	6578.250"		
"		Peak outflow		0.015	c.m/sec"	
"		Maximum level		350.776	metre"	
"		Maximum storage		516.065	c.m"	
"		Centroidal lag		14.010	hours"	
"		0.000	0.237	0.015	0.000	c.m/sec"
" 40		HYDROGRAPH Next link "				
"	5	Next link "				
"		0.000	0.015	0.015	0.000"	
" 33		CATCHMENT 105"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	2	Horton equation"				
"	105	Catchment 105"				
"	15.000	% Impervious"				
"	4.040	Total Area"				
"	150.000	Flow length"				
"	5.000	Overland Slope"				
"	3.434	Pervious Area"				
"	150.000	Pervious length"				
"	5.000	Pervious slope"				
"	0.606	Impervious Area"				
"	150.000	Impervious length"				
"	5.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	60.000	Pervious Max.infiltration"				
"	13.000	Pervious Min.infiltration"				
"	0.500	Pervious Lag constant (hours)"				
"	5.000	Pervious Depression storage"				
"	0.015	Impervious Manning 'n'"				
"	0.000	Impervious Max.infiltration"				
"	0.000	Impervious Min.infiltration"				
"	0.001	Impervious Lag constant (hours)"				
"	1.500	Impervious Depression storage"				
"		0.093	0.015	0.015	0.000	c.m/sec"
"		Catchment 105	Pervious	Impervious	Total Area	"
"		Surface Area	3.434	0.606	4.040	hectare"
"		Time of concentration	---	5.020	5.020	minutes"
"		Time to Centroid	0.000	66.548	66.548	minutes"
"		Rainfall depth	24.995	24.995	24.995	mm"
"		Rainfall volume	858.34	151.47	1009.81	c.m"
"		Rainfall losses	24.995	1.682	21.498	mm"
"		Runoff depth	0.000	23.314	3.497	mm"
"		Runoff volume	0.00	141.28	141.28	c.m"
"		Runoff coefficient	0.000	0.933	0.140	"
"		Maximum flow	0.000	0.093	0.093	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.093	0.098	0.015	0.000"	
" 40		HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"				
"		0.093	0.098	0.098	0.000"	
" 40		HYDROGRAPH Combine	200"			
"	6	Combine "				

"						
"	200	Node #"	Post__25mm			
"		Combined Outflow"				
"		Maximum flow	0.121	c.m/sec"		
"		Hydrograph volume	1020.083	c.m"		
"		0.093 0.098 0.098	0.098	0.121"		
" 38		START/RE-START TOTALS 105"				
"	3	Runoff Totals on EXIT"				
"		Total Catchment area	22.180	hectare"		
"		Total Impervious area	5.042	hectare"		
"		Total % impervious	22.732"			
" 19		EXIT"				

```

"                                     Post__2yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        w:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-12-07"
"      Output filename:                    Post__2yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              12/7/2018 at 11:43:36 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      412.629 Coefficient A"
"      0.104  Constant B"
"      0.701  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                    131.621  mm/hr"
"      Total depth                          32.476  mm"
"      6 002hyd Hydrograph extension used in this file"
" 33  CATCHMENT 101"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101  Catchment 101"
"      10.000 % Impervious"
"      1.570  Total Area"
"      100.000 Flow length"
"      5.000  Overland slope"
"      1.413  Pervious Area"
"      100.000 Pervious length"
"      5.000  Pervious slope"
"      0.157  Impervious Area"
"      100.000 Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.041  0.000  0.000  0.000 c.m/sec"
"      Catchment 101  Pervious  Impervious  Total Area  "
"      Surface Area  1.413  0.157  1.570  hectare"
"      Time of concentration  31.551  3.109  14.522  minutes"
"      Time to Centroid  98.638  91.883  94.593  minutes"
"      Rainfall depth  32.476  32.476  32.476  mm"
"      Rainfall volume  458.88  50.99  509.87  c.m"
"      Rainfall losses  30.206  1.992  27.384  mm"
"      Runoff depth  2.270  30.484  5.091  mm"
"      Runoff volume  32.07  47.86  79.93  c.m"
"      Runoff coefficient  0.070  0.939  0.157  "
"      Maximum flow  0.018  0.035  0.041  c.m/sec"
" 40  HYDROGRAPH Add Runoff "

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"          Post__2yr
"          4  Add Runoff "
"          0.041  0.041  0.000  0.000"
" 40  HYDROGRAPH Copy to Outflow"
"          8  Copy to Outflow"
"          0.041  0.041  0.041  0.000"
" 40  HYDROGRAPH Combine 200"
"          6  Combine "
"          200 Node #"
"          Combined Outflow"
"          Maximum flow          0.041  c.m/sec"
"          Hydrograph volume      79.934  c.m"
"          0.041  0.041  0.041  0.041"
" 40  HYDROGRAPH Start - New Tributary"
"          2  Start - New Tributary"
"          0.041  0.000  0.041  0.041"
" 33  CATCHMENT 102"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          102 Catchment 102"
"          50.000 % Impervious"
"          5.460 Total Area"
"          150.000 Flow length"
"          5.000 Overland Slope"
"          2.730 Pervious Area"
"          150.000 Pervious length"
"          5.000 Pervious slope"
"          2.730 Impervious Area"
"          150.000 Impervious length"
"          5.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          60.000 Pervious Max.infiltration"
"          13.000 Pervious Min.infiltration"
"          0.500 Pervious Lag constant (hours)"
"          5.000 Pervious Depression storage"
"          0.015 Impervious Manning 'n'"
"          0.000 Impervious Max.infiltration"
"          0.000 Impervious Min.infiltration"
"          0.001 Impervious Lag constant (hours)"
"          1.500 Impervious Depression storage"
"          0.634  0.000  0.041  0.041 c.m/sec"
"          Catchment 102 Pervious Impervious Total Area "
"          Surface Area 2.730 2.730 5.460 hectare"
"          Time of concentration 40.241 3.966 6.487 minutes"
"          Time to Centroid 105.064 93.389 94.200 minutes"
"          Rainfall depth 32.476 32.476 32.476 mm"
"          Rainfall volume 886.59 886.59 1773.18 c.m"
"          Rainfall losses 30.202 2.027 16.114 mm"
"          Runoff depth 2.274 30.449 16.361 mm"
"          Runoff volume 62.09 831.25 893.34 c.m"
"          Runoff coefficient 0.070 0.938 0.504 "
"          Maximum flow 0.029 0.626 0.634 c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"          4  Add Runoff "
"          0.634  0.634  0.041  0.041"
" 56  DIVERSION"
"          102 Node number"
"          0.848 Overflow threshold"
"          1.000 Required diverted fraction"
"          0 Conduit type; 1=Pipe;2=Channel"
"          Peak of diverted flow 0.000 c.m/sec"
"          Volume of diverted flow 0.000 c.m"
"          DIV00102.002hyd"

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"                                     Post__2yr
"      Major flow at 102"
"      0.634      0.634      0.634      0.041 c.m/sec"
40  HYDROGRAPH Next link "
"      5  Next link "
"      0.634      0.634      0.634      0.041"
54  POND DESIGN"
"      0.634  Current peak flow      c.m/sec"
"      0.304  Target outflow      c.m/sec"
"      893.3  Hydrograph volume      c.m"
"      18.    Number of stages"
"      353.100  Minimum water level      metre"
"      357.000  Maximum water level      metre"
"      353.100  Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      353.100      0.000      0.000"
"      353.300      0.01800      255.800"
"      353.550      0.02300      618.490"
"      353.800      0.02800      1032.300"
"      354.050      0.03100      1500.300"
"      354.300      0.03500      2025.050"
"      354.550      0.03800      2609.050"
"      354.800      0.04100      3254.800"
"      355.050      0.04300      3951.550"
"      355.300      0.04600      4711.420"
"      355.550      0.04800      5541.800"
"      355.800      0.05100      6427.670"
"      356.050      0.05300      7375.360"
"      356.100      0.05300      7573.280"
"      356.400      1.196      8840.470"
"      356.650      2.937      9990.790"
"      356.900      5.189      11203.72"
"      357.000      6.216      11702.48"
"      Peak outflow      0.024      c.m/sec"
"      Maximum level      353.609      metre"
"      Maximum storage      715.921      c.m"
"      Centroidal lag      7.310      hours"
"      0.634      0.634      0.024      0.041 c.m/sec"
40  HYDROGRAPH Combine      100"
"      6  Combine "
"      100  Node #"
"      to Block 42 SWM Facility"
"      Maximum flow      0.024      c.m/sec"
"      Hydrograph volume      888.438      c.m"
"      0.634      0.634      0.024      0.024"
40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.634      0.000      0.024      0.024"
33  CATCHMENT 103"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      103  Catchment 103"
"      55.000  % Impervious"
"      1.850  Total Area"
"      80.000  Flow length"
"      5.000  Overland Slope"
"      0.832  Pervious Area"
"      80.000  Pervious length"
"      5.000  Pervious slope"
"      1.018  Impervious Area"
"      80.000  Impervious length"
"      5.000  Impervious slope"

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"                                     Post__2yr
"   0.250   Pervious Manning 'n'"
"   60.000   Pervious Max.infiltration"
"   13.000   Pervious Min.infiltration"
"   0.500   Pervious Lag constant (hours)"
"   5.000   Pervious Depression storage"
"   0.015   Impervious Manning 'n'"
"   0.000   Impervious Max.infiltration"
"   0.000   Impervious Min.infiltration"
"   0.001   Impervious Lag constant (hours)"
"   1.500   Impervious Depression storage"
"           0.245   0.000   0.024   0.024 c.m/sec"
"   Catchment 103   Pervious   Impervious   Total Area   "
"   Surface Area   0.832   1.018   1.850   hectare"
"   Time of concentration   27.598   2.720   4.143   minutes"
"   Time to Centroid   95.777   91.228   91.488   minutes"
"   Rainfall depth   32.476   32.476   32.476   mm"
"   Rainfall volume   270.36   330.44   600.80   c.m"
"   Rainfall losses   30.202   1.806   14.584   mm"
"   Runoff depth   2.274   30.670   17.892   mm"
"   Runoff volume   18.93   312.07   331.00   c.m"
"   Runoff coefficient   0.070   0.944   0.551   "
"   Maximum flow   0.011   0.243   0.245   c.m/sec"
" 40   HYDROGRAPH Add Runoff "
"   4   Add Runoff "
"           0.245   0.245   0.024   0.024"
" 33   CATCHMENT 104"
"   1   Triangular SCS"
"   1   Equal length"
"   2   Horton equation"
"   104   Catchment 104"
"   20.000   % Impervious"
"   2.230   Total Area"
"   40.000   Flow length"
"   5.000   Overland Slope"
"   1.784   Pervious Area"
"   40.000   Pervious length"
"   5.000   Pervious slope"
"   0.446   Impervious Area"
"   40.000   Impervious length"
"   5.000   Impervious slope"
"   0.250   Pervious Manning 'n'"
"   60.000   Pervious Max.infiltration"
"   13.000   Pervious Min.infiltration"
"   0.500   Pervious Lag constant (hours)"
"   5.000   Pervious Depression storage"
"   0.015   Impervious Manning 'n'"
"   0.000   Impervious Max.infiltration"
"   0.000   Impervious Min.infiltration"
"   0.001   Impervious Lag constant (hours)"
"   1.500   Impervious Depression storage"
"           0.128   0.245   0.024   0.024 c.m/sec"
"   Catchment 104   Pervious   Impervious   Total Area   "
"   Surface Area   1.784   0.446   2.230   hectare"
"   Time of concentration   18.208   1.794   5.562   minutes"
"   Time to Centroid   88.883   89.648   89.473   minutes"
"   Rainfall depth   32.476   32.476   32.476   mm"
"   Rainfall volume   579.37   144.84   724.21   c.m"
"   Rainfall losses   30.203   1.957   24.554   mm"
"   Runoff depth   2.273   30.518   7.922   mm"
"   Runoff volume   40.56   136.11   176.67   c.m"
"   Runoff coefficient   0.070   0.940   0.244   "
"   Maximum flow   0.034   0.121   0.128   c.m/sec"
" 40   HYDROGRAPH Add Runoff "

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"                               Post__2yr
"           4  Add Runoff "
"           0.128      0.373      0.024      0.024"
" 33    CATCHMENT 201"
"           1  Triangular SCS"
"           1  Equal length"
"           2  Horton equation"
"           201  Catchment 201"
"           20.000 % Impervious"
"           0.080 Total Area"
"           20.000 Flow length"
"           5.000 Overland Slope"
"           0.064 Pervious Area"
"           20.000 Pervious length"
"           5.000 Pervious slope"
"           0.016 Impervious Area"
"           20.000 Impervious length"
"           5.000 Impervious slope"
"           0.250 Pervious Manning 'n'"
"           60.000 Pervious Max.infiltration"
"           13.000 Pervious Min.infiltration"
"           0.500 Pervious Lag constant (hours)"
"           5.000 Pervious Depression storage"
"           0.015 Impervious Manning 'n'"
"           0.000 Impervious Max.infiltration"
"           0.000 Impervious Min.infiltration"
"           0.001 Impervious Lag constant (hours)"
"           1.500 Impervious Depression storage"
"           0.005      0.373      0.024      0.024 c.m/sec"
"           Catchment 201      Pervious      Impervious      Total Area "
"           Surface Area      0.064      0.016      0.080      hectare"
"           Time of concentration      12.013      1.184      3.697      minutes"
"           Time to Centroid      84.324      88.700      87.684      minutes"
"           Rainfall depth      32.476      32.476      32.476      mm"
"           Rainfall volume      20.78      5.20      25.98      c.m"
"           Rainfall losses      30.205      2.429      24.650      mm"
"           Runoff depth      2.271      30.047      7.826      mm"
"           Runoff volume      1.45      4.81      6.26      c.m"
"           Runoff coefficient      0.070      0.925      0.241      "
"           Maximum flow      0.002      0.005      0.005      c.m/sec"
" 40    HYDROGRAPH Add Runoff "
"           4  Add Runoff "
"           0.005      0.379      0.024      0.024"
" 33    CATCHMENT 202"
"           1  Triangular SCS"
"           1  Equal length"
"           2  Horton equation"
"           202  Catchment 202"
"           1.000 % Impervious"
"           6.950 Total Area"
"           100.000 Flow length"
"           5.000 Overland Slope"
"           6.880 Pervious Area"
"           100.000 Pervious length"
"           5.000 Pervious slope"
"           0.069 Impervious Area"
"           100.000 Impervious length"
"           5.000 Impervious slope"
"           0.250 Pervious Manning 'n'"
"           60.000 Pervious Max.infiltration"
"           13.000 Pervious Min.infiltration"
"           0.500 Pervious Lag constant (hours)"
"           5.000 Pervious Depression storage"
"           0.015 Impervious Manning 'n'"

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			Post__2yr		
"	351.100	0.8920	1745.150"		
"	351.200	0.9350	2178.000"		
"	351.300	0.9760	2631.250"		
"	351.400	1.015	3105.650"		
"	351.500	1.053	3602.300"		
"	351.600	1.089	4122.300"		
"	351.700	1.124	4666.750"		
"	351.800	1.379	5236.900"		
"	351.900	1.828	5845.550"		
"	352.000	2.415	6578.250"		
"	Peak outflow		0.056	c.m/sec"	
"	Maximum level		350.810	metre"	
"	Maximum storage		628.400	c.m"	
"	Centroidal lag		12.847	hours"	
"	0.000	0.419	0.056	0.000	c.m/sec"
" 40	HYDROGRAPH Next link "				
"	5 Next link "				
"	0.000	0.056	0.056	0.000"	
" 33	CATCHMENT 105"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	2 Horton equation"				
"	105 Catchment 105"				
"	15.000 % Impervious"				
"	4.040 Total Area"				
"	150.000 Flow length"				
"	5.000 Overland Slope"				
"	3.434 Pervious Area"				
"	150.000 Pervious length"				
"	5.000 Pervious slope"				
"	0.606 Impervious Area"				
"	150.000 Impervious length"				
"	5.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	60.000 Pervious Max.infiltration"				
"	13.000 Pervious Min.infiltration"				
"	0.500 Pervious Lag constant (hours)"				
"	5.000 Pervious Depression storage"				
"	0.015 Impervious Manning 'n'"				
"	0.000 Impervious Max.infiltration"				
"	0.000 Impervious Min.infiltration"				
"	0.001 Impervious Lag constant (hours)"				
"	1.500 Impervious Depression storage"				
"	0.149	0.056	0.056	0.000	c.m/sec"
"	Catchment 105	Pervious	Impervious	Total Area	"
"	Surface Area	3.434	0.606	4.040	hectare"
"	Time of concentration	40.241	3.966	14.753	minutes"
"	Time to Centroid	105.064	93.389	96.861	minutes"
"	Rainfall depth	32.476	32.476	32.476	mm"
"	Rainfall volume	1115.22	196.80	1312.02	c.m"
"	Rainfall losses	30.202	2.027	25.975	mm"
"	Runoff depth	2.274	30.449	6.500	mm"
"	Runoff volume	78.10	184.52	262.62	c.m"
"	Runoff coefficient	0.070	0.938	0.200	"
"	Maximum flow	0.036	0.139	0.149	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.149	0.156	0.056	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.149	0.156	0.156	0.000"	
" 40	HYDROGRAPH Combine	200"			
"	6 Combine "				

"					
"	200	Node #"	Post__2yr		
"		Combined Outflow"			
"		Maximum flow	0.196	c.m/sec"	
"		Hydrograph volume	1709.404	c.m"	
"		0.149 0.156 0.156	0.156	0.196"	
" 38		START/RE-START TOTALS 105"			
"	3	Runoff Totals on EXIT"			
"		Total Catchment area	22.180	hectare"	
"		Total Impervious area	5.042	hectare"	
"		Total % impervious	22.732"		
" 19		EXIT"			

```

"                                     Post__5yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        w:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-12-07"
"      Output filename:                    Post__5yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              12/7/2018 at 11:44:45 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      541.973 Coefficient A"
"      0.093  Constant B"
"      0.701  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity          173.271  mm/hr"
"      Total depth                42.768  mm"
"      6  005hyd Hydrograph extension used in this file"
" 33  CATCHMENT 101"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101  Catchment 101"
"      10.000 % Impervious"
"      1.570  Total Area"
"      100.000 Flow length"
"      5.000  Overland slope"
"      1.413  Pervious Area"
"      100.000 Pervious length"
"      5.000  Pervious slope"
"      0.157  Impervious Area"
"      100.000 Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.077  0.000  0.000  0.000 c.m/sec"
"      Catchment 101  Pervious  Impervious  Total Area  "
"      Surface Area  1.413  0.157  1.570  hectare"
"      Time of concentration  21.345  2.785  13.392  minutes"
"      Time to Centroid  91.546  90.671  91.171  minutes"
"      Rainfall depth  42.768  42.768  42.768  mm"
"      Rainfall volume  604.32  67.15  671.46  c.m"
"      Rainfall losses  36.717  1.929  33.238  mm"
"      Runoff depth  6.052  40.839  9.530  mm"
"      Runoff volume  85.51  64.12  149.63  c.m"
"      Runoff coefficient  0.141  0.955  0.223  "
"      Maximum flow  0.064  0.049  0.077  c.m/sec"
" 40  HYDROGRAPH Add Runoff "

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Post__5yr
"      4  Add Runoff "
"      0.077  0.077  0.000  0.000"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.077  0.077  0.077  0.000"
" 40  HYDROGRAPH Combine 200"
"      6  Combine "
"     200  Node #"
"      Combined Outflow"
"      Maximum flow 0.077 c.m/sec"
"      Hydrograph volume 149.628 c.m"
"      0.077  0.077  0.077  0.077"
" 40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.077  0.000  0.077  0.077"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     102  Catchment 102"
"    50.000  % Impervious"
"     5.460  Total Area"
"   150.000  Flow length"
"     5.000  Overland Slope"
"     2.730  Pervious Area"
"   150.000  Pervious length"
"     5.000  Pervious slope"
"     2.730  Impervious Area"
"   150.000  Impervious length"
"     5.000  Impervious slope"
"     0.250  Pervious Manning 'n'"
"    60.000  Pervious Max.infiltration"
"   13.000  Pervious Min.infiltration"
"     0.500  Pervious Lag constant (hours)"
"     5.000  Pervious Depression storage"
"     0.015  Impervious Manning 'n'"
"     0.000  Impervious Max.infiltration"
"     0.000  Impervious Min.infiltration"
"     0.001  Impervious Lag constant (hours)"
"     1.500  Impervious Depression storage"
"     0.848  0.000  0.077  0.077 c.m/sec"
"     Catchment 102 Pervious Impervious Total Area "
"     Surface Area 2.730 2.730 5.460 hectare"
"     Time of concentration 27.224 3.553 6.653 minutes"
"     Time to Centroid 95.959 92.084 92.592 minutes"
"     Rainfall depth 42.768 42.768 42.768 mm"
"     Rainfall volume 1167.58 1167.58 2335.15 c.m"
"     Rainfall losses 36.713 2.594 19.654 mm"
"     Runoff depth 6.055 40.174 23.115 mm"
"     Runoff volume 165.31 1096.76 1262.07 c.m"
"     Runoff coefficient 0.142 0.939 0.540 "
"     Maximum flow 0.100 0.805 0.848 c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.848  0.848  0.077  0.077"
" 56  DIVERSION"
"     102  Node number"
"    0.848  Overflow threshold"
"     1.000  Required diverted fraction"
"     0  Conduit type; 1=Pipe;2=Channel"
"     Peak of diverted flow 0.000 c.m/sec"
"     Volume of diverted flow 0.049 c.m"
"     DIV00102.005hyd"

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"                                     Post__5yr
"      Major flow at 102"
"      0.848      0.848      0.848      0.077 c.m/sec"
40  HYDROGRAPH Next link "
"      5  Next link "
"      0.848      0.848      0.848      0.077"
54  POND DESIGN"
"      0.848      Current peak flow      c.m/sec"
"      0.304      Target outflow      c.m/sec"
"      1262.0     Hydrograph volume      c.m"
"      18.        Number of stages"
"      353.100    Minimum water level      metre"
"      357.000    Maximum water level      metre"
"      353.100    Starting water level      metre"
"      0          Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      353.100      0.000      0.000"
"      353.300      0.01800    255.800"
"      353.550      0.02300    618.490"
"      353.800      0.02800    1032.300"
"      354.050      0.03100    1500.300"
"      354.300      0.03500    2025.050"
"      354.550      0.03800    2609.050"
"      354.800      0.04100    3254.800"
"      355.050      0.04300    3951.550"
"      355.300      0.04600    4711.420"
"      355.550      0.04800    5541.800"
"      355.800      0.05100    6427.670"
"      356.050      0.05300    7375.360"
"      356.100      0.05300    7573.280"
"      356.400      1.196     8840.470"
"      356.650      2.937     9990.790"
"      356.900      5.189     11203.72"
"      357.000      6.216     11702.48"
"      Peak outflow      0.028      c.m/sec"
"      Maximum level      353.811    metre"
"      Maximum storage      1052.438    c.m"
"      Centroidal lag      8.482     hours"
"      0.848      0.848      0.028      0.077 c.m/sec"
40  HYDROGRAPH Combine      100"
"      6  Combine "
"      100  Node #"
"      to Block 42 SWM Facility"
"      Maximum flow      0.028      c.m/sec"
"      Hydrograph volume      1250.231    c.m"
"      0.848      0.848      0.028      0.028"
40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.848      0.000      0.028      0.028"
33  CATCHMENT 103"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      103  Catchment 103"
"      55.000  % Impervious"
"      1.850  Total Area"
"      80.000  Flow length"
"      5.000  Overland Slope"
"      0.832  Pervious Area"
"      80.000  Pervious length"
"      5.000  Pervious slope"
"      1.018  Impervious Area"
"      80.000  Impervious length"
"      5.000  Impervious slope"

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                                Post__5yr
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"              0.341      0.000      0.028      0.028 c.m/sec"
"      Catchment 103 Pervious Impervious Total Area "
"      Surface Area 0.832 1.018 1.850 hectare"
"      Time of concentration 18.670 2.436 4.184 minutes"
"      Time to Centroid 89.488 90.017 89.960 minutes"
"      Rainfall depth 42.768 42.768 42.768 mm"
"      Rainfall volume 356.05 435.17 791.22 c.m"
"      Rainfall losses 36.730 1.817 17.528 mm"
"      Runoff depth 6.038 40.952 25.241 mm"
"      Runoff volume 50.27 416.69 466.96 c.m"
"      Runoff coefficient 0.141 0.958 0.590 "
"      Maximum flow 0.041 0.333 0.341 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"              0.341      0.341      0.028      0.028"
" 33 CATCHMENT 104"
"      1 Triangular SCS"
"      1 Equal length"
"      2 Horton equation"
"      104 Catchment 104"
"      20.000 % Impervious"
"      2.230 Total Area"
"      40.000 Flow length"
"      5.000 Overland slope"
"      1.784 Pervious Area"
"      40.000 Pervious length"
"      5.000 Pervious slope"
"      0.446 Impervious Area"
"      40.000 Impervious length"
"      5.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"              0.198      0.341      0.028      0.028 c.m/sec"
"      Catchment 104 Pervious Impervious Total Area "
"      Surface Area 1.784 0.446 2.230 hectare"
"      Time of concentration 12.318 1.607 5.601 minutes"
"      Time to Centroid 84.722 88.574 87.138 minutes"
"      Rainfall depth 42.768 42.768 42.768 mm"
"      Rainfall volume 762.99 190.75 953.74 c.m"
"      Rainfall losses 36.739 2.202 29.832 mm"
"      Runoff depth 6.029 40.566 12.937 mm"
"      Runoff volume 107.56 180.93 288.49 c.m"
"      Runoff coefficient 0.141 0.949 0.302 "
"      Maximum flow 0.115 0.163 0.198 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

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```

"          4  Add Runoff "          Post__5yr
"          0.198      0.539      0.028      0.028"
" 33      CATCHMENT 201"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          201  Catchment 201"
"          20.000  % Impervious"
"          0.080  Total Area"
"          20.000  Flow length"
"          5.000  Overland Slope"
"          0.064  Pervious Area"
"          20.000  Pervious length"
"          5.000  Pervious slope"
"          0.016  Impervious Area"
"          20.000  Impervious length"
"          5.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          60.000  Pervious Max.infiltration"
"          13.000  Pervious Min.infiltration"
"          0.500  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.001  Impervious Lag constant (hours)"
"          1.500  Impervious Depression storage"
"          0.009      0.539      0.028      0.028 c.m/sec"
"          Catchment 201      Pervious      Impervious      Total Area "
"          Surface Area      0.064      0.016      0.080      hectare"
"          Time of concentration      8.127      1.060      3.735      minutes"
"          Rainfall depth      42.768      42.768      42.768      mm"
"          Rainfall volume      27.37      6.84      34.21      c.m"
"          Rainfall losses      36.716      3.004      29.973      mm"
"          Runoff depth      6.053      39.764      12.795      mm"
"          Runoff volume      3.87      6.36      10.24      c.m"
"          Runoff coefficient      0.142      0.930      0.299      "
"          Maximum flow      0.006      0.006      0.009      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4  Add Runoff "
"          0.009      0.547      0.028      0.028"
" 33      CATCHMENT 202"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          202  Catchment 202"
"          1.000  % Impervious"
"          6.950  Total Area"
"          100.000  Flow length"
"          5.000  Overland Slope"
"          6.880  Pervious Area"
"          100.000  Pervious length"
"          5.000  Pervious slope"
"          0.069  Impervious Area"
"          100.000  Impervious length"
"          5.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          60.000  Pervious Max.infiltration"
"          13.000  Pervious Min.infiltration"
"          0.500  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"

```

```

Post_5yr
0.000 Impervious Max.infiltration"
0.000 Impervious Min.infiltration"
0.001 Impervious Lag constant (hours)"
1.500 Impervious Depression storage"
0.314 0.547 0.028 0.028 c.m/sec"
Catchment 202 Pervious Impervious Total Area "
Surface Area 6.880 0.069 6.950 hectare"
Time of concentration 21.345 2.785 20.160 minutes"
Time to Centroid 91.546 90.671 91.490 minutes"
Rainfall depth 42.768 42.768 42.768 mm"
Rainfall volume 2942.68 29.72 2972.40 c.m"
Rainfall losses 36.717 1.929 36.369 mm"
Runoff depth 6.052 40.839 6.400 mm"
Runoff volume 416.39 28.38 444.77 c.m"
Runoff coefficient 0.141 0.955 0.150 "
Maximum flow 0.310 0.022 0.314 c.m/sec"
40 HYDROGRAPH Add Runoff "
4 Add Runoff "
0.314 0.679 0.028 0.028"
47 FILEI_O Read/Open DIV00102.005hyd"
1 1=read/open; 2=write/save"
2 1=rainfall; 2=hydrograph"
1 1=runoff; 2=inflow; 3=outflow; 4=junction"
DIV00102.005hyd"
Major flow at 102"
Total volume 0.049 c.m"
Maximum flow 0.000 c.m/sec"
0.000 0.679 0.028 0.028 c.m/sec"
40 HYDROGRAPH Add Runoff "
4 Add Runoff "
0.000 0.679 0.028 0.028"
40 HYDROGRAPH Copy to Outflow"
8 Copy to Outflow"
0.000 0.679 0.679 0.028"
40 HYDROGRAPH Combine 100"
6 Combine "
100 Node #"
to Block 42 SWM Facility"
Maximum flow 0.700 c.m/sec"
Hydrograph volume 2460.731 c.m"
0.000 0.679 0.679 0.700"
40 HYDROGRAPH Confluence 100"
7 Confluence "
100 Node #"
to Block 42 SWM Facility"
Maximum flow 0.700 c.m/sec"
Hydrograph volume 2460.731 c.m"
0.000 0.700 0.679 0.000"
54 POND DESIGN"
0.700 Current peak flow c.m/sec"
0.304 Target outflow c.m/sec"
2460.7 Hydrograph volume c.m"
15. Number of stages"
350.600 Minimum water level metre"
352.000 Maximum water level metre"
350.600 Starting water level metre"
0 Keep Design Data: 1 = True; 0 = False"
Level Discharge Volume"
350.600 0.000 0.000"
350.700 0.00700 277.300"
350.800 0.01700 592.200"
350.900 0.4000 944.650"
351.000 0.8470 1332.000"

```



			Post__5yr		
"	351.100	0.8920	1745.150"		
"	351.200	0.9350	2178.000"		
"	351.300	0.9760	2631.250"		
"	351.400	1.015	3105.650"		
"	351.500	1.053	3602.300"		
"	351.600	1.089	4122.300"		
"	351.700	1.124	4666.750"		
"	351.800	1.379	5236.900"		
"	351.900	1.828	5845.550"		
"	352.000	2.415	6578.250"		
"	Peak outflow		0.278	c.m/sec"	
"	Maximum level		350.868	metre"	
"	Maximum storage		832.582	c.m"	
"	Centroidal lag		11.060	hours"	
"	0.000	0.700	0.278	0.000	c.m/sec"
" 40	HYDROGRAPH Next link "				
"	5 Next link "				
"	0.000	0.278	0.278	0.000"	
" 33	CATCHMENT 105"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	2 Horton equation"				
"	105 Catchment 105"				
"	15.000 % Impervious"				
"	4.040 Total Area"				
"	150.000 Flow length"				
"	5.000 Overland Slope"				
"	3.434 Pervious Area"				
"	150.000 Pervious length"				
"	5.000 Pervious slope"				
"	0.606 Impervious Area"				
"	150.000 Impervious length"				
"	5.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	60.000 Pervious Max.infiltration"				
"	13.000 Pervious Min.infiltration"				
"	0.500 Pervious Lag constant (hours)"				
"	5.000 Pervious Depression storage"				
"	0.015 Impervious Manning 'n'"				
"	0.000 Impervious Max.infiltration"				
"	0.000 Impervious Min.infiltration"				
"	0.001 Impervious Lag constant (hours)"				
"	1.500 Impervious Depression storage"				
"	0.233	0.278	0.278	0.000	c.m/sec"
"	Catchment 105	Pervious	Impervious	Total Area	"
"	Surface Area	3.434	0.606	4.040	hectare"
"	Time of concentration	27.224	3.553	14.457	minutes"
"	Time to Centroid	95.959	92.084	93.869	minutes"
"	Rainfall depth	42.768	42.768	42.768	mm"
"	Rainfall volume	1468.67	259.18	1727.84	c.m"
"	Rainfall losses	36.713	2.594	31.595	mm"
"	Runoff depth	6.055	40.174	11.173	mm"
"	Runoff volume	207.94	243.46	451.40	c.m"
"	Runoff coefficient	0.142	0.939	0.261	"
"	Maximum flow	0.126	0.179	0.233	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.233	0.404	0.278	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.233	0.404	0.404	0.000"	
" 40	HYDROGRAPH Combine	200"			
"	6 Combine "				

"			Post__5yr		
"	200	Node #"			
"		Combined Outflow"			
"		Maximum flow	0.461	c.m/sec"	
"		Hydrograph volume	2773.786	c.m"	
"		0.233 0.404 0.404	0.404	0.461"	
" 38		START/RE-START TOTALS 105"			
"	3	Runoff Totals on EXIT"			
"		Total Catchment area	22.180	hectare"	
"		Total Impervious area	5.042	hectare"	
"		Total % impervious	22.732"		
" 19		EXIT"			

```

"                                     Post__10yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-12-07"
"      Output filename:                    Post__10yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              12/7/2018 at 11:45:42 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      621.728 Coefficient A"
"      0.010  Constant B"
"      0.699  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity          201.494  mm/hr"
"      Total depth                49.410  mm"
"      6  010hyd Hydrograph extension used in this file"
" 33  CATCHMENT 101"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101 Catchment 101"
"      10.000 % Impervious"
"      1.570 Total Area"
"      100.000 Flow length"
"      5.000 Overland Slope"
"      1.413 Pervious Area"
"      100.000 Pervious length"
"      5.000 Pervious slope"
"      0.157 Impervious Area"
"      100.000 Impervious length"
"      5.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"      0.112 0.000 0.000 0.000 c.m/sec"
"      Catchment 101 Pervious Impervious Total Area "
"      Surface Area 1.413 0.157 1.570 hectare"
"      Time of concentration 18.556 2.622 12.724 minutes"
"      Time to Centroid 91.105 90.085 90.731 minutes"
"      Rainfall depth 49.410 49.410 49.410 mm"
"      Rainfall volume 698.17 77.57 775.74 c.m"
"      Rainfall losses 40.269 1.917 36.434 mm"
"      Runoff depth 9.141 47.493 12.976 mm"
"      Runoff volume 129.16 74.56 203.73 c.m"
"      Runoff coefficient 0.185 0.961 0.263 "
"      Maximum flow 0.100 0.058 0.112 c.m/sec"
" 40  HYDROGRAPH Add Runoff "

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Post__10yr
"      4  Add Runoff "
"      0.112  0.112  0.000  0.000"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.112  0.112  0.112  0.000"
" 40  HYDROGRAPH Combine 200"
"      6  Combine "
"     200  Node #"
"      Combined Outflow"
"      Maximum flow 0.112 c.m/sec"
"      Hydrograph volume 203.725 c.m"
"      0.112  0.112  0.112  0.112"
" 40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.112  0.000  0.112  0.112"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     102  Catchment 102"
"    50.000  % Impervious"
"     5.460  Total Area"
"   150.000  Flow length"
"     5.000  Overland Slope"
"     2.730  Pervious Area"
"   150.000  Pervious length"
"     5.000  Pervious slope"
"     2.730  Impervious Area"
"   150.000  Impervious length"
"     5.000  Impervious slope"
"     0.250  Pervious Manning 'n'"
"    60.000  Pervious Max.infiltration"
"   13.000  Pervious Min.infiltration"
"     0.500  Pervious Lag constant (hours)"
"     5.000  Pervious Depression storage"
"     0.015  Impervious Manning 'n'"
"     0.000  Impervious Max.infiltration"
"     0.000  Impervious Min.infiltration"
"     0.001  Impervious Lag constant (hours)"
"     1.500  Impervious Depression storage"
"     0.998  0.000  0.112  0.112 c.m/sec"
"     Catchment 102 Pervious Impervious Total Area "
"     Surface Area 2.730 2.730 5.460 hectare"
"     Time of concentration 23.666 3.344 6.665 minutes"
"     Time to Centroid 95.388 91.401 92.053 minutes"
"     Rainfall depth 49.410 49.410 49.410 mm"
"     Rainfall volume 1348.90 1348.90 2697.81 c.m"
"     Rainfall losses 40.252 2.528 21.390 mm"
"     Runoff depth 9.158 46.882 28.020 mm"
"     Runoff volume 250.02 1279.89 1529.91 c.m"
"     Runoff coefficient 0.185 0.949 0.567 "
"     Maximum flow 0.172 0.919 0.998 c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      0.998  0.998  0.112  0.112"
" 56  DIVERSION"
"     102  Node number"
"    0.848  Overflow threshold"
"    1.000  Required diverted fraction"
"     0  Conduit type; 1=Pipe;2=Channel"
"     Peak of diverted flow 0.150 c.m/sec"
"     Volume of diverted flow 70.456 c.m"
"     DIV00102.010hyd"

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"                                     Post__10yr
"      Major flow at 102"
"      0.998      0.998      0.848      0.112 c.m/sec"
40  HYDROGRAPH Next link "
"      5  Next link "
"      0.998      0.848      0.848      0.112"
54  POND DESIGN"
"      0.848  Current peak flow      c.m/sec"
"      0.304  Target outflow      c.m/sec"
"      1459.5 Hydrograph volume      c.m"
"      18.    Number of stages"
"      353.100 Minimum water level      metre"
"      357.000 Maximum water level      metre"
"      353.100 Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      353.100      0.000      0.000"
"      353.300      0.01800      255.800"
"      353.550      0.02300      618.490"
"      353.800      0.02800      1032.300"
"      354.050      0.03100      1500.300"
"      354.300      0.03500      2025.050"
"      354.550      0.03800      2609.050"
"      354.800      0.04100      3254.800"
"      355.050      0.04300      3951.550"
"      355.300      0.04600      4711.420"
"      355.550      0.04800      5541.800"
"      355.800      0.05100      6427.670"
"      356.050      0.05300      7375.360"
"      356.100      0.05300      7573.280"
"      356.400      1.196      8840.470"
"      356.650      2.937      9990.790"
"      356.900      5.189      11203.72"
"      357.000      6.216      11702.48"
"      Peak outflow      0.029      c.m/sec"
"      Maximum level      353.910      metre"
"      Maximum storage      1237.654      c.m"
"      Centroidal lag      9.322      hours"
"      0.998      0.848      0.029      0.112 c.m/sec"
40  HYDROGRAPH Combine      100"
"      6  Combine "
"      100 Node #"
"      to Block 42 SWM Facility"
"      Maximum flow      0.029      c.m/sec"
"      Hydrograph volume      1440.645      c.m"
"      0.998      0.848      0.029      0.029"
40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.998      0.000      0.029      0.029"
33  CATCHMENT 103"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      103 Catchment 103"
"      55.000 % Impervious"
"      1.850 Total Area"
"      80.000 Flow length"
"      5.000 Overland Slope"
"      0.832 Pervious Area"
"      80.000 Pervious length"
"      5.000 Pervious slope"
"      1.018 Impervious Area"
"      80.000 Impervious length"
"      5.000 Impervious slope"

```

```

Post_10yr
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.409 0.000 0.029 0.029 c.m/sec"
" Catchment 103 Pervious Impervious Total Area "
" Surface Area 0.832 1.018 1.850 hectare"
" Time of concentration 16.230 2.294 4.178 minutes"
" Time to Centroid 89.206 89.485 89.447 minutes"
" Rainfall depth 49.410 49.410 49.410 mm"
" Rainfall volume 411.34 502.75 914.09 c.m"
" Rainfall losses 40.323 1.846 19.161 mm"
" Runoff depth 9.087 47.564 30.250 mm"
" Runoff volume 75.65 483.97 559.62 c.m"
" Runoff coefficient 0.184 0.963 0.612 "
" Maximum flow 0.072 0.394 0.409 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.409 0.409 0.029 0.029"
33 CATCHMENT 104"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 104 Catchment 104"
" 20.000 % Impervious"
" 2.230 Total Area"
" 40.000 Flow length"
" 5.000 Overland slope"
" 1.784 Pervious Area"
" 40.000 Pervious length"
" 5.000 Pervious slope"
" 0.446 Impervious Area"
" 40.000 Impervious length"
" 5.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.279 0.409 0.029 0.029 c.m/sec"
" Catchment 104 Pervious Impervious Total Area "
" Surface Area 1.784 0.446 2.230 hectare"
" Time of concentration 10.708 1.513 5.530 minutes"
" Time to Centroid 84.638 88.179 86.632 minutes"
" Rainfall depth 49.410 49.410 49.410 mm"
" Rainfall volume 881.48 220.37 1101.85 c.m"
" Rainfall losses 40.286 2.367 32.702 mm"
" Runoff depth 9.124 47.043 16.708 mm"
" Runoff volume 162.78 209.81 372.59 c.m"
" Runoff coefficient 0.185 0.952 0.338 "
" Maximum flow 0.176 0.191 0.279 c.m/sec"
40 HYDROGRAPH Add Runoff "

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"          4  Add Runoff "
"          0.279    0.661    0.029    0.029"
" 33  CATCHMENT 201"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      201  Catchment 201"
"      20.000  % Impervious"
"      0.080  Total Area"
"      20.000  Flow length"
"      5.000  Overland Slope"
"      0.064  Pervious Area"
"      20.000  Pervious length"
"      5.000  Pervious slope"
"      0.016  Impervious Area"
"      20.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"          0.012    0.661    0.029    0.029 c.m/sec"
"      Catchment 201      Pervious      Impervious      Total Area "
"      Surface Area      0.064      0.016      0.080      hectare"
"      Time of concentration      7.065      0.998      3.659      minutes"
"      Time to Centroid      81.742      87.230      84.823      minutes"
"      Rainfall depth      49.410      49.410      49.410      mm"
"      Rainfall volume      31.62      7.91      39.53      c.m"
"      Rainfall losses      40.425      3.409      33.022      mm"
"      Runoff depth      8.985      46.001      16.388      mm"
"      Runoff volume      5.75      7.36      13.11      c.m"
"      Runoff coefficient      0.182      0.931      0.332      "
"      Maximum flow      0.010      0.007      0.012      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.012    0.671    0.029    0.029"
" 33  CATCHMENT 202"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      202  Catchment 202"
"      1.000  % Impervious"
"      6.950  Total Area"
"      100.000  Flow length"
"      5.000  Overland Slope"
"      6.880  Pervious Area"
"      100.000  Pervious length"
"      5.000  Pervious slope"
"      0.069  Impervious Area"
"      100.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

```

```

"                               Post_10yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           0.493      0.671      0.029      0.029 c.m/sec"
" Catchment 202 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 18.556 2.622 17.761 minutes"
" Time to Centroid 91.105 90.085 91.054 minutes"
" Rainfall depth 49.410 49.410 49.410 mm"
" Rainfall volume 3399.68 34.34 3434.02 c.m"
" Rainfall losses 40.269 1.917 39.886 mm"
" Runoff depth 9.141 47.493 9.524 mm"
" Runoff volume 628.94 33.01 661.95 c.m"
" Runoff coefficient 0.185 0.961 0.193 "
" Maximum flow 0.487 0.026 0.493 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.493      0.949      0.029      0.029"
" 47 FILEI_O Read/Open DIV00102.010hyd"
" 1 1=read/open; 2=write/save"
" 2 1=rainfall; 2=hydrograph"
" 1 1=runoff; 2=inflow; 3=outflow; 4=junction"
" DIV00102.010hyd"
" Major flow at 102"
" Total volume 70.456 c.m"
" Maximum flow 0.150 c.m/sec"
"           0.150      0.949      0.029      0.029 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.150      1.099      0.029      0.029"
" 40 HYDROGRAPH Copy to Outflow"
" 8 Copy to Outflow"
"           0.150      1.099      1.099      0.029"
" 40 HYDROGRAPH Combine 100"
" 6 Combine "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 1.121 c.m/sec"
" Hydrograph volume 3118.364 c.m"
"           0.150      1.099      1.099      1.121"
" 40 HYDROGRAPH Confluence 100"
" 7 Confluence "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 1.121 c.m/sec"
" Hydrograph volume 3118.364 c.m"
"           0.150      1.121      1.099      0.000"
" 54 POND DESIGN"
" 1.121 Current peak flow c.m/sec"
" 0.304 Target outflow c.m/sec"
" 3118.4 Hydrograph volume c.m"
" 15. Number of stages"
" 350.600 Minimum water level metre"
" 352.000 Maximum water level metre"
" 350.600 Starting water level metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge Volume"
" 350.600 0.000 0.000"
" 350.700 0.00700 277.300"
" 350.800 0.01700 592.200"
" 350.900 0.4000 944.650"
" 351.000 0.8470 1332.000"

```



			Post_10yr		
"	351.100	0.8920	1745.150"		
"	351.200	0.9350	2178.000"		
"	351.300	0.9760	2631.250"		
"	351.400	1.015	3105.650"		
"	351.500	1.053	3602.300"		
"	351.600	1.089	4122.300"		
"	351.700	1.124	4666.750"		
"	351.800	1.379	5236.900"		
"	351.900	1.828	5845.550"		
"	352.000	2.415	6578.250"		
"	Peak outflow		0.483	c.m/sec"	
"	Maximum level		350.919	metre"	
"	Maximum storage		1016.601	c.m"	
"	Centroidal lag		10.088	hours"	
"	0.150	1.121	0.483	0.000	c.m/sec"
" 40	HYDROGRAPH Next link "				
"	5 Next link "				
"	0.150	0.483	0.483	0.000"	
" 33	CATCHMENT 105"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	2 Horton equation"				
"	105 Catchment 105"				
"	15.000 % Impervious"				
"	4.040 Total Area"				
"	150.000 Flow length"				
"	5.000 Overland Slope"				
"	3.434 Pervious Area"				
"	150.000 Pervious length"				
"	5.000 Pervious slope"				
"	0.606 Impervious Area"				
"	150.000 Impervious length"				
"	5.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	60.000 Pervious Max.infiltration"				
"	13.000 Pervious Min.infiltration"				
"	0.500 Pervious Lag constant (hours)"				
"	5.000 Pervious Depression storage"				
"	0.015 Impervious Manning 'n'"				
"	0.000 Impervious Max.infiltration"				
"	0.000 Impervious Min.infiltration"				
"	0.001 Impervious Lag constant (hours)"				
"	1.500 Impervious Depression storage"				
"	0.303	0.483	0.483	0.000	c.m/sec"
"	Catchment 105	Pervious	Impervious	Total Area	"
"	Surface Area	3.434	0.606	4.040	hectare"
"	Time of concentration	23.666	3.344	14.021	minutes"
"	Time to Centroid	95.388	91.401	93.496	minutes"
"	Rainfall depth	49.410	49.410	49.410	mm"
"	Rainfall volume	1696.75	299.43	1996.18	c.m"
"	Rainfall losses	40.252	2.528	34.593	mm"
"	Runoff depth	9.158	46.882	14.817	mm"
"	Runoff volume	314.49	284.11	598.60	c.m"
"	Runoff coefficient	0.185	0.949	0.300	"
"	Maximum flow	0.216	0.204	0.303	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.303	0.691	0.483	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.303	0.691	0.691	0.000"	
" 40	HYDROGRAPH Combine	200"			
"	6 Combine "				

"						
"	200	Node #"		Post__10yr		
"		Combined Outflow"				
"		Maximum flow		0.795	c.m/sec"	
"		Hydrograph volume		3583.756	c.m"	
"		0.303	0.691	0.691	0.795"	
" 38		START/RE-START TOTALS 105"				
"	3	Runoff Totals on EXIT"				
"		Total Catchment area		22.180	hectare"	
"		Total Impervious area		5.042	hectare"	
"		Total % impervious		22.732"		
" 19		EXIT"				

```

"                                     Post__25yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-12-07"
"      Output filename:                    Post__25yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              12/7/2018 at 11:46:37 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      732.700 Coefficient A"
"      0.046  Constant B"
"      0.700  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                    236.075  mm/hr"
"      Total depth                          58.070  mm"
"      6  025hyd  Hydrograph extension used in this file"
" 33  CATCHMENT 101"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101  Catchment 101"
"      10.000 % Impervious"
"      1.570  Total Area"
"      100.000 Flow length"
"      5.000  Overland slope"
"      1.413  Pervious Area"
"      100.000 Pervious length"
"      5.000  Pervious slope"
"      0.157  Impervious Area"
"      100.000 Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.188  0.000  0.000  0.000 c.m/sec"
"      Catchment 101  Pervious  Impervious  Total Area  "
"      Surface Area  1.413  0.157  1.570  hectare"
"      Time of concentration  16.246  2.461  11.847  minutes"
"      Time to Centroid  90.060  89.484  89.876  minutes"
"      Rainfall depth  58.070  58.070  58.070  mm"
"      Rainfall volume  820.54  91.17  911.71  c.m"
"      Rainfall losses  44.762  1.940  40.480  mm"
"      Runoff depth  13.309  56.130  17.591  mm"
"      Runoff volume  188.05  88.12  276.17  c.m"
"      Runoff coefficient  0.229  0.967  0.303  "
"      Maximum flow  0.173  0.070  0.188  c.m/sec"
" 40  HYDROGRAPH Add Runoff "

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Post__25yr
"      4  Add Runoff "
"      0.188  0.188  0.000  0.000"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.188  0.188  0.188  0.000"
" 40  HYDROGRAPH Combine 200"
"      6  Combine "
"     200  Node #"
"      Combined Outflow"
"      Maximum flow 0.188 c.m/sec"
"      Hydrograph volume 276.174 c.m"
"      0.188  0.188  0.188  0.188"
" 40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.188  0.000  0.188  0.188"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     102  Catchment 102"
"    50.000  % Impervious"
"     5.460  Total Area"
"   150.000  Flow length"
"     5.000  Overland Slope"
"     2.730  Pervious Area"
"   150.000  Pervious length"
"     5.000  Pervious slope"
"     2.730  Impervious Area"
"   150.000  Impervious length"
"     5.000  Impervious slope"
"     0.250  Pervious Manning 'n'"
"    60.000  Pervious Max.infiltration"
"   13.000  Pervious Min.infiltration"
"     0.500  Pervious Lag constant (hours)"
"     5.000  Pervious Depression storage"
"     0.015  Impervious Manning 'n'"
"     0.000  Impervious Max.infiltration"
"     0.000  Impervious Min.infiltration"
"     0.001  Impervious Lag constant (hours)"
"     1.500  Impervious Depression storage"
"     1.198  0.000  0.188  0.188 c.m/sec"
"     Catchment 102 Pervious Impervious Total Area "
"     Surface Area 2.730 2.730 5.460 hectare"
"     Time of concentration 20.720 3.139 6.553 minutes"
"     Time to Centroid 93.932 90.693 91.322 minutes"
"     Rainfall depth 58.070 58.070 58.070 mm"
"     Rainfall volume 1585.32 1585.32 3170.65 c.m"
"     Rainfall losses 44.662 2.424 23.543 mm"
"     Runoff depth 13.408 55.647 34.528 mm"
"     Runoff volume 366.05 1519.16 1885.20 c.m"
"     Runoff coefficient 0.231 0.958 0.595 "
"     Maximum flow 0.251 1.098 1.198 c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      1.198  1.198  0.188  0.188"
" 56  DIVERSION"
"     102  Node number"
"     0.848  Overflow threshold"
"     1.000  Required diverted fraction"
"     0  Conduit type; 1=Pipe;2=Channel"
"     Peak of diverted flow 0.350 c.m/sec"
"     Volume of diverted flow 193.665 c.m"
"     DIV00102.025hyd"

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"                                     Post__25yr
"      Major flow at 102"
"      1.198      1.198      0.848      0.188 c.m/sec"
40  HYDROGRAPH Next link "
"      5  Next link "
"      1.198      0.848      0.848      0.188"
54  POND DESIGN"
"      0.848  Current peak flow      c.m/sec"
"      0.304  Target outflow      c.m/sec"
"      1691.5 Hydrograph volume      c.m"
"      18.    Number of stages"
"      353.100 Minimum water level      metre"
"      357.000 Maximum water level      metre"
"      353.100 Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      353.100      0.000      0.000"
"      353.300      0.01800      255.800"
"      353.550      0.02300      618.490"
"      353.800      0.02800      1032.300"
"      354.050      0.03100      1500.300"
"      354.300      0.03500      2025.050"
"      354.550      0.03800      2609.050"
"      354.800      0.04100      3254.800"
"      355.050      0.04300      3951.550"
"      355.300      0.04600      4711.420"
"      355.550      0.04800      5541.800"
"      355.800      0.05100      6427.670"
"      356.050      0.05300      7375.360"
"      356.100      0.05300      7573.280"
"      356.400      1.196      8840.470"
"      356.650      2.937      9990.790"
"      356.900      5.189      11203.72"
"      357.000      6.216      11702.48"
"      Peak outflow      0.031      c.m/sec"
"      Maximum level      354.026      metre"
"      Maximum storage      1455.919      c.m"
"      Centroidal lag      10.082      hours"
"      1.198      0.848      0.031      0.188 c.m/sec"
40  HYDROGRAPH Combine      100"
"      6  Combine "
"      100 Node #"
"      to Block 42 SWM Facility"
"      Maximum flow      0.031      c.m/sec"
"      Hydrograph volume      1660.170      c.m"
"      1.198      0.848      0.031      0.031"
40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      1.198      0.000      0.031      0.031"
33  CATCHMENT 103"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      103 Catchment 103"
"      55.000 % Impervious"
"      1.850 Total Area"
"      80.000 Flow length"
"      5.000 Overland Slope"
"      0.832 Pervious Area"
"      80.000 Pervious length"
"      5.000 Pervious slope"
"      1.018 Impervious Area"
"      80.000 Impervious length"
"      5.000 Impervious slope"

```

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Post__25yr
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.498 0.000 0.031 0.031 c.m/sec"
" Catchment 103 Pervious Impervious Total Area "
" Surface Area 0.832 1.018 1.850 hectare"
" Time of concentration 14.210 2.153 4.124 minutes"
" Time to Centroid 88.361 89.005 88.900 minutes"
" Rainfall depth 58.070 58.070 58.070 mm"
" Rainfall volume 483.44 590.87 1074.30 c.m"
" Rainfall losses 44.670 1.959 21.179 mm"
" Runoff depth 13.401 56.111 36.891 mm"
" Runoff volume 111.56 570.93 682.49 c.m"
" Runoff coefficient 0.231 0.966 0.635 "
" Maximum flow 0.106 0.472 0.498 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.498 0.498 0.031 0.031"
33 CATCHMENT 104"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 104 Catchment 104"
" 20.000 % Impervious"
" 2.230 Total Area"
" 40.000 Flow length"
" 5.000 Overland slope"
" 1.784 Pervious Area"
" 40.000 Pervious length"
" 5.000 Pervious slope"
" 0.446 Impervious Area"
" 40.000 Impervious length"
" 5.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.400 0.498 0.031 0.031 c.m/sec"
" Catchment 104 Pervious Impervious Total Area "
" Surface Area 1.784 0.446 2.230 hectare"
" Time of concentration 9.375 1.420 5.314 minutes"
" Time to Centroid 84.056 87.768 85.951 minutes"
" Rainfall depth 58.070 58.070 58.070 mm"
" Rainfall volume 1035.98 258.99 1294.97 c.m"
" Rainfall losses 44.780 2.635 36.351 mm"
" Runoff depth 13.290 55.435 21.719 mm"
" Runoff volume 237.09 247.24 484.33 c.m"
" Runoff coefficient 0.229 0.955 0.374 "
" Maximum flow 0.283 0.227 0.400 c.m/sec"
40 HYDROGRAPH Add Runoff "

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"          4  Add Runoff "          Post__25yr
"          0.400      0.826      0.031      0.031"
" 33      CATCHMENT 201"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          201  Catchment 201"
"          20.000  % Impervious"
"          0.080  Total Area"
"          20.000  Flow length"
"          5.000  Overland Slope"
"          0.064  Pervious Area"
"          20.000  Pervious length"
"          5.000  Pervious slope"
"          0.016  Impervious Area"
"          20.000  Impervious length"
"          5.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          60.000  Pervious Max.infiltration"
"          13.000  Pervious Min.infiltration"
"          0.500  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.001  Impervious Lag constant (hours)"
"          1.500  Impervious Depression storage"
"          0.017      0.826      0.031      0.031 c.m/sec"
"          Catchment 201      Pervious      Impervious      Total Area "
"          Surface Area      0.064      0.016      0.080      hectare"
"          Time of concentration      6.185      0.937      3.532      minutes"
"          Time to Centroid      81.450      86.777      84.143      minutes"
"          Rainfall depth      58.070      58.070      58.070      mm"
"          Rainfall volume      37.17      9.29      46.46      c.m"
"          Rainfall losses      44.832      3.927      36.651      mm"
"          Runoff depth      13.238      54.143      21.419      mm"
"          Runoff volume      8.47      8.66      17.14      c.m"
"          Runoff coefficient      0.228      0.932      0.369      "
"          Maximum flow      0.014      0.009      0.017      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4  Add Runoff "
"          0.017      0.840      0.031      0.031"
" 33      CATCHMENT 202"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          202  Catchment 202"
"          1.000  % Impervious"
"          6.950  Total Area"
"          100.000  Flow length"
"          5.000  Overland Slope"
"          6.880  Pervious Area"
"          100.000  Pervious length"
"          5.000  Pervious slope"
"          0.069  Impervious Area"
"          100.000  Impervious length"
"          5.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          60.000  Pervious Max.infiltration"
"          13.000  Pervious Min.infiltration"
"          0.500  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"

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"                               Post_25yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           0.850      0.840      0.031      0.031 c.m/sec"
" Catchment 202 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 16.246 2.461 15.682 minutes"
" Time to Centroid 90.060 89.484 90.036 minutes"
" Rainfall depth 58.070 58.070 58.070 mm"
" Rainfall volume 3995.54 40.36 4035.90 c.m"
" Rainfall losses 44.762 1.940 44.334 mm"
" Runoff depth 13.309 56.130 13.737 mm"
" Runoff volume 915.70 39.01 954.71 c.m"
" Runoff coefficient 0.229 0.967 0.237 "
" Maximum flow 0.843 0.031 0.850 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.850      1.340      0.031      0.031"
" 47 FILEI_O Read/Open DIV00102.025hyd"
" 1 1=read/open; 2=write/save"
" 2 1=rainfall; 2=hydrograph"
" 1 1=runoff; 2=inflow; 3=outflow; 4=junction"
" DIV00102.025hyd"
" Major flow at 102"
" Total volume 193.665 c.m"
" Maximum flow 0.350 c.m/sec"
"           0.350      1.340      0.031      0.031 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.350      1.667      0.031      0.031"
" 40 HYDROGRAPH Copy to Outflow"
" 8 Copy to Outflow"
"           0.350      1.667      1.667      0.031"
" 40 HYDROGRAPH Combine 100"
" 6 Combine "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 1.691 c.m/sec"
" Hydrograph volume 3992.500 c.m"
"           0.350      1.667      1.667      1.691"
" 40 HYDROGRAPH Confluence 100"
" 7 Confluence "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 1.691 c.m/sec"
" Hydrograph volume 3992.500 c.m"
"           0.350      1.691      1.667      0.000"
" 54 POND DESIGN"
" 1.691 Current peak flow c.m/sec"
" 0.304 Target outflow c.m/sec"
" 3992.5 Hydrograph volume c.m"
" 15. Number of stages"
" 350.600 Minimum water level metre"
" 352.000 Maximum water level metre"
" 350.600 Starting water level metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge Volume"
" 350.600 0.000 0.000"
" 350.700 0.00700 277.300"
" 350.800 0.01700 592.200"
" 350.900 0.4000 944.650"
" 351.000 0.8470 1332.000"

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			Post_25yr		
"		351.100	0.8920	1745.150"	
"		351.200	0.9350	2178.000"	
"		351.300	0.9760	2631.250"	
"		351.400	1.015	3105.650"	
"		351.500	1.053	3602.300"	
"		351.600	1.089	4122.300"	
"		351.700	1.124	4666.750"	
"		351.800	1.379	5236.900"	
"		351.900	1.828	5845.550"	
"		352.000	2.415	6578.250"	
"		Peak outflow		0.789	c.m/sec"
"		Maximum level		350.990	metre"
"		Maximum storage		1293.193	c.m"
"		Centroidal lag		9.005	hours"
"		0.350	1.691	0.789	0.000 c.m/sec"
" 40		HYDROGRAPH Next link "			
"	5	Next link "			
"		0.350	0.789	0.789	0.000"
" 33		CATCHMENT 105"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	2	Horton equation"			
"	105	Catchment 105"			
"	15.000	% Impervious"			
"	4.040	Total Area"			
"	150.000	Flow length"			
"	5.000	Overland Slope"			
"	3.434	Pervious Area"			
"	150.000	Pervious length"			
"	5.000	Pervious slope"			
"	0.606	Impervious Area"			
"	150.000	Impervious length"			
"	5.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	60.000	Pervious Max.infiltration"			
"	13.000	Pervious Min.infiltration"			
"	0.500	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			
"	0.000	Impervious Max.infiltration"			
"	0.000	Impervious Min.infiltration"			
"	0.001	Impervious Lag constant (hours)"			
"	1.500	Impervious Depression storage"			
"		0.409	0.789	0.789	0.000 c.m/sec"
"		Catchment 105	Pervious	Impervious	Total Area "
"		Surface Area	3.434	0.606	4.040 hectare"
"		Time of concentration	20.720	3.139	13.288 minutes"
"		Time to Centroid	93.932	90.693	92.563 minutes"
"		Rainfall depth	58.070	58.070	58.070 mm"
"		Rainfall volume	1994.14	351.91	2346.05 c.m"
"		Rainfall losses	44.662	2.424	38.326 mm"
"		Runoff depth	13.408	55.647	19.744 mm"
"		Runoff volume	460.44	337.22	797.66 c.m"
"		Runoff coefficient	0.231	0.958	0.340 "
"		Maximum flow	0.316	0.244	0.409 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.409	1.150	0.789	0.000"
" 40		HYDROGRAPH Copy to Outflow"			
"	8	Copy to Outflow"			
"		0.409	1.150	1.150	0.000"
" 40		HYDROGRAPH Combine	200"		
"	6	Combine "			

"			Post__25yr		
"	200	Node #"			
"		Combined Outflow"			
"		Maximum flow	1.295	c.m/sec"	
"		Hydrograph volume	4686.456	c.m"	
"		0.409 1.150 1.150	1.150	1.295"	
" 38		START/RE-START TOTALS 105"			
"	3	Runoff Totals on EXIT"			
"		Total Catchment area	22.180	hectare"	
"		Total Impervious area	5.042	hectare"	
"		Total % impervious	22.732"		
" 19		EXIT"			

```

"                                     Post__50yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-12-07"
"      Output filename:                    Post__50yr.out"
"      Licensee name:                      gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:              12/7/2018 at 11:47:29 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      813.857 Coefficient A"
"      0.043  Constant B"
"      0.700  Exponent C"
"      0.400  Fraction R"
"      180.000 Duration"
"      1.000  Time step multiplier"
"      Maximum intensity                    262.316  mm/hr"
"      Total depth                          64.470  mm"
"      6  050hyd  Hydrograph extension used in this file"
" 33  CATCHMENT 101"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101  Catchment 101"
"      10.000 % Impervious"
"      1.570  Total Area"
"      100.000 Flow length"
"      5.000  Overland slope"
"      1.413  Pervious Area"
"      100.000 Pervious length"
"      5.000  Pervious slope"
"      0.157  Impervious Area"
"      100.000 Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"      0.237  0.000  0.000  0.000 c.m/sec"
"      Catchment 101  Pervious  Impervious  Total Area  "
"      Surface Area  1.413  0.157  1.570  hectare"
"      Time of concentration  14.920  2.360  11.298  minutes"
"      Time to Centroid  89.732  89.119  89.555  minutes"
"      Rainfall depth  64.470  64.470  64.470  mm"
"      Rainfall volume  910.96  101.22  1012.18  c.m"
"      Rainfall losses  47.328  1.961  42.791  mm"
"      Runoff depth  17.142  62.509  21.679  mm"
"      Runoff volume  242.22  98.14  340.36  c.m"
"      Runoff coefficient  0.266  0.970  0.336  "
"      Maximum flow  0.221  0.079  0.237  c.m/sec"
" 40  HYDROGRAPH Add Runoff "

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Post__50yr
"      4  Add Runoff "
"      0.237      0.237      0.000      0.000"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.237      0.237      0.237      0.000"
" 40  HYDROGRAPH Combine 200"
"      6  Combine "
"     200  Node #"
"      Combined Outflow"
"      Maximum flow      0.237      c.m/sec"
"      Hydrograph volume      340.362      c.m"
"      0.237      0.237      0.237      0.237"
" 40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.237      0.000      0.237      0.237"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     102  Catchment 102"
"    50.000  % Impervious"
"     5.460  Total Area"
"   150.000  Flow length"
"     5.000  Overland Slope"
"     2.730  Pervious Area"
"   150.000  Pervious length"
"     5.000  Pervious slope"
"     2.730  Impervious Area"
"   150.000  Impervious length"
"     5.000  Impervious slope"
"     0.250  Pervious Manning 'n'"
"    60.000  Pervious Max.infiltration"
"   13.000  Pervious Min.infiltration"
"     0.500  Pervious Lag constant (hours)"
"     5.000  Pervious Depression storage"
"     0.015  Impervious Manning 'n'"
"     0.000  Impervious Max.infiltration"
"     0.000  Impervious Min.infiltration"
"     0.001  Impervious Lag constant (hours)"
"     1.500  Impervious Depression storage"
"     1.358      0.000      0.237      0.237 c.m/sec"
"     Catchment 102      Pervious      Impervious      Total Area "
"     Surface Area      2.730      2.730      5.460      hectare"
"     Time of concentration      19.029      3.010      6.464      minutes"
"     Time to Centroid      93.284      90.276      90.924      minutes"
"     Rainfall depth      64.470      64.470      64.470      mm"
"     Rainfall volume      1760.03      1760.03      3520.06      c.m"
"     Rainfall losses      47.397      2.377      24.887      mm"
"     Runoff depth      17.073      62.093      39.583      mm"
"     Runoff volume      466.10      1695.13      2161.23      c.m"
"     Runoff coefficient      0.265      0.963      0.614      "
"     Maximum flow      0.327      1.244      1.358      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      1.358      1.358      0.237      0.237"
" 56  DIVERSION"
"     102  Node number"
"     0.848  Overflow threshold"
"     1.000  Required diverted fraction"
"     0  Conduit type; 1=Pipe;2=Channel"
"     Peak of diverted flow      0.510      c.m/sec"
"     Volume of diverted flow      291.483      c.m"
"     DIV00102.050hyd"

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"                                     Post__50yr
"      Major flow at 102"
"      1.358      1.358      0.848      0.237 c.m/sec"
40  HYDROGRAPH Next link "
"      5  Next link "
"      1.358      0.848      0.848      0.237"
54  POND DESIGN"
"      0.848  Current peak flow      c.m/sec"
"      0.304  Target outflow      c.m/sec"
"      1869.7 Hydrograph volume      c.m"
"      18.    Number of stages"
"      353.100 Minimum water level      metre"
"      357.000 Maximum water level      metre"
"      353.100 Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      353.100      0.000      0.000"
"      353.300      0.01800      255.800"
"      353.550      0.02300      618.490"
"      353.800      0.02800      1032.300"
"      354.050      0.03100      1500.300"
"      354.300      0.03500      2025.050"
"      354.550      0.03800      2609.050"
"      354.800      0.04100      3254.800"
"      355.050      0.04300      3951.550"
"      355.300      0.04600      4711.420"
"      355.550      0.04800      5541.800"
"      355.800      0.05100      6427.670"
"      356.050      0.05300      7375.360"
"      356.100      0.05300      7573.280"
"      356.400      1.196      8840.470"
"      356.650      2.937      9990.790"
"      356.900      5.189      11203.72"
"      357.000      6.216      11702.48"
"      Peak outflow      0.032      c.m/sec"
"      Maximum level      354.109      metre"
"      Maximum storage      1624.568      c.m"
"      Centroidal lag      10.640      hours"
"      1.358      0.848      0.032      0.237 c.m/sec"
40  HYDROGRAPH Combine      100"
"      6  Combine "
"      100  Node #"
"      to Block 42 SWM Facility"
"      Maximum flow      0.032      c.m/sec"
"      Hydrograph volume      1824.175      c.m"
"      1.358      0.848      0.032      0.032"
40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      1.358      0.000      0.032      0.032"
33  CATCHMENT 103"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      103  Catchment 103"
"      55.000  % Impervious"
"      1.850  Total Area"
"      80.000  Flow length"
"      5.000  Overland Slope"
"      0.832  Pervious Area"
"      80.000  Pervious length"
"      5.000  Pervious slope"
"      1.018  Impervious Area"
"      80.000  Impervious length"
"      5.000  Impervious slope"

```

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Post__50yr
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.568 0.000 0.032 0.032 c.m/sec"
" Catchment 103 Pervious Impervious Total Area "
" Surface Area 0.832 1.018 1.850 hectare"
" Time of concentration 13.050 2.064 4.064 minutes"
" Time to Centroid 87.894 88.695 88.549 minutes"
" Rainfall depth 64.470 64.470 64.470 mm"
" Rainfall volume 536.71 655.98 1192.69 c.m"
" Rainfall losses 47.509 2.109 22.539 mm"
" Runoff depth 16.961 62.361 41.931 mm"
" Runoff volume 141.20 634.53 775.72 c.m"
" Runoff coefficient 0.263 0.967 0.650 "
" Maximum flow 0.134 0.532 0.568 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.568 0.568 0.032 0.032"
33 CATCHMENT 104"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 104 Catchment 104"
" 20.000 % Impervious"
" 2.230 Total Area"
" 40.000 Flow length"
" 5.000 Overland slope"
" 1.784 Pervious Area"
" 40.000 Pervious length"
" 5.000 Pervious slope"
" 0.446 Impervious Area"
" 40.000 Impervious length"
" 5.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.504 0.568 0.032 0.032 c.m/sec"
" Catchment 104 Pervious Impervious Total Area "
" Surface Area 1.784 0.446 2.230 hectare"
" Time of concentration 8.610 1.362 5.178 minutes"
" Time to Centroid 84.019 87.506 85.670 minutes"
" Rainfall depth 64.470 64.470 64.470 mm"
" Rainfall volume 1150.14 287.54 1437.68 c.m"
" Rainfall losses 47.343 2.855 38.445 mm"
" Runoff depth 17.127 61.615 26.025 mm"
" Runoff volume 305.55 274.80 580.36 c.m"
" Runoff coefficient 0.266 0.956 0.404 "
" Maximum flow 0.378 0.254 0.504 c.m/sec"
40 HYDROGRAPH Add Runoff "

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"          4  Add Runoff "          Post__50yr
"          0.504      0.978      0.032      0.032"
" 33  CATCHMENT 201"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      201  Catchment 201"
"      20.000  % Impervious"
"      0.080  Total Area"
"      20.000  Flow length"
"      5.000  Overland Slope"
"      0.064  Pervious Area"
"      20.000  Pervious length"
"      5.000  Pervious slope"
"      0.016  Impervious Area"
"      20.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"          0.020      0.978      0.032      0.032 c.m/sec"
"      Catchment 201      Pervious      Impervious      Total Area "
"      Surface Area      0.064      0.016      0.080      hectare"
"      Time of concentration      5.680      0.898      3.441      minutes"
"      Time to Centroid      81.465      86.503      83.825      minutes"
"      Rainfall depth      64.470      64.470      64.470      mm"
"      Rainfall volume      41.26      10.32      51.58      c.m"
"      Rainfall losses      47.394      4.294      38.774      mm"
"      Runoff depth      17.076      60.176      25.696      mm"
"      Runoff volume      10.93      9.63      20.56      c.m"
"      Runoff coefficient      0.265      0.933      0.399      "
"      Maximum flow      0.017      0.010      0.020      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.020      0.999      0.032      0.032"
" 33  CATCHMENT 202"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      202  Catchment 202"
"      1.000  % Impervious"
"      6.950  Total Area"
"      100.000  Flow length"
"      5.000  Overland Slope"
"      6.880  Pervious Area"
"      100.000  Pervious length"
"      5.000  Pervious slope"
"      0.069  Impervious Area"
"      100.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

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"                               Post_50yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           1.082      0.999      0.032      0.032 c.m/sec"
" Catchment 202 Pervious Impervious Total Area "
" Surface Area 6.880 0.069 6.950 hectare"
" Time of concentration 14.920 2.360 14.473 minutes"
" Time to Centroid 89.732 89.119 89.710 minutes"
" Rainfall depth 64.470 64.470 64.470 mm"
" Rainfall volume 4435.86 44.81 4480.66 c.m"
" Rainfall losses 47.328 1.961 46.874 mm"
" Runoff depth 17.142 62.509 17.596 mm"
" Runoff volume 1179.49 43.44 1222.93 c.m"
" Runoff coefficient 0.266 0.970 0.273 "
" Maximum flow 1.075 0.035 1.082 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           1.082      1.729      0.032      0.032"
" 47 FILEI_O Read/Open DIV00102.050hyd"
" 1 1=read/open; 2=write/save"
" 2 1=rainfall; 2=hydrograph"
" 1 1=runoff; 2=inflow; 3=outflow; 4=junction"
" DIV00102.050hyd"
" Major flow at 102"
" Total volume 291.483 c.m"
" Maximum flow 0.510 c.m/sec"
"           0.510      1.729      0.032      0.032 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.510      2.239      0.032      0.032"
" 40 HYDROGRAPH Copy to Outflow"
" 8 Copy to Outflow"
"           0.510      2.239      2.239      0.032"
" 40 HYDROGRAPH Combine 100"
" 6 Combine "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 2.262 c.m/sec"
" Hydrograph volume 4715.228 c.m"
"           0.510      2.239      2.239      2.262"
" 40 HYDROGRAPH Confluence 100"
" 7 Confluence "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 2.262 c.m/sec"
" Hydrograph volume 4715.228 c.m"
"           0.510      2.262      2.239      0.000"
" 54 POND DESIGN"
" 2.262 Current peak flow c.m/sec"
" 0.304 Target outflow c.m/sec"
" 4715.2 Hydrograph volume c.m"
" 15. Number of stages"
" 350.600 Minimum water level metre"
" 352.000 Maximum water level metre"
" 350.600 Starting water level metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge Volume"
" 350.600 0.000 0.000"
" 350.700 0.00700 277.300"
" 350.800 0.01700 592.200"
" 350.900 0.4000 944.650"
" 351.000 0.8470 1332.000"

```



			Post_50yr			
"		351.100	0.8920	1745.150"		
"		351.200	0.9350	2178.000"		
"		351.300	0.9760	2631.250"		
"		351.400	1.015	3105.650"		
"		351.500	1.053	3602.300"		
"		351.600	1.089	4122.300"		
"		351.700	1.124	4666.750"		
"		351.800	1.379	5236.900"		
"		351.900	1.828	5845.550"		
"		352.000	2.415	6578.250"		
"		Peak outflow		0.875	c.m/sec"	
"		Maximum level		351.063	metre"	
"		Maximum storage		1592.902	c.m"	
"		Centroidal lag		8.518	hours"	
"		0.510	2.262	0.875	0.000	c.m/sec"
" 40		HYDROGRAPH Next link "				
"	5	Next link "				
"		0.510	0.875	0.875	0.000"	
" 33		CATCHMENT 105"				
"	1	Triangular SCS"				
"	1	Equal length"				
"	2	Horton equation"				
"	105	Catchment 105"				
"	15.000	% Impervious"				
"	4.040	Total Area"				
"	150.000	Flow length"				
"	5.000	Overland Slope"				
"	3.434	Pervious Area"				
"	150.000	Pervious length"				
"	5.000	Pervious slope"				
"	0.606	Impervious Area"				
"	150.000	Impervious length"				
"	5.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	60.000	Pervious Max.infiltration"				
"	13.000	Pervious Min.infiltration"				
"	0.500	Pervious Lag constant (hours)"				
"	5.000	Pervious Depression storage"				
"	0.015	Impervious Manning 'n'"				
"	0.000	Impervious Max.infiltration"				
"	0.000	Impervious Min.infiltration"				
"	0.001	Impervious Lag constant (hours)"				
"	1.500	Impervious Depression storage"				
"		0.506	0.875	0.875	0.000	c.m/sec"
"		Catchment 105	Pervious	Impervious	Total Area	"
"		Surface Area	3.434	0.606	4.040	hectare"
"		Time of concentration	19.029	3.010	12.767	minutes"
"		Time to Centroid	93.284	90.276	92.108	minutes"
"		Rainfall depth	64.470	64.470	64.470	mm"
"		Rainfall volume	2213.90	390.69	2604.59	c.m"
"		Rainfall losses	47.397	2.377	40.644	mm"
"		Runoff depth	17.073	62.093	23.826	mm"
"		Runoff volume	586.30	376.28	962.58	c.m"
"		Runoff coefficient	0.265	0.963	0.370	"
"		Maximum flow	0.412	0.276	0.506	c.m/sec"
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.506	1.326	0.875	0.000"	
" 40		HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"				
"		0.506	1.326	1.326	0.000"	
" 40		HYDROGRAPH Combine	200"			
"	6	Combine "				

"			Post__50yr		
"	200	Node #"			
"		Combined Outflow"			
"		Maximum flow	1.562	c.m/sec"	
"		Hydrograph volume	5586.709	c.m"	
"		0.506 1.326 1.326	1.326	1.562"	
" 38		START/RE-START TOTALS 105"			
"	3	Runoff Totals on EXIT"			
"		Total Catchment area	22.180	hectare"	
"		Total Impervious area	5.042	hectare"	
"		Total % impervious	22.732"		
" 19		EXIT"			

```

"                                     Post__100yr
"                                     ----->"
"      MIDUSS Output ----->"
"      MIDUSS version                      Version 2.25 rev. 473"
"      MIDUSS created                      Sunday, February 07, 2010"
"      10  Units used:                      ie METRIC"
"      Job folder:                        W:\Guelph\117-2017\117021 Inverhaugh Ridge\"
"      5 work in Progress\Design Calcs\Modelling Files\2018-12-07"
"      Output filename:                   Post__100yr.out"
"      Licensee name:                     gmbp"
"      Company                            Hewlett-Packard Company"
"      Date & Time last used:             12/7/2018 at 11:48:47 AM"
" 31  TIME PARAMETERS"
"      5.000  Time Step"
"      180.000 Max. Storm length"
"      1500.000 Max. Hydrograph"
" 32  STORM Chicago storm"
"      1  Chicago storm"
"      891.458 Coefficient A"
"      0.034 Constant B"
"      0.700 Exponent C"
"      0.400 Fraction R"
"      180.000 Duration"
"      1.000 Time step multiplier"
"      Maximum intensity                287.794  mm/hr"
"      Total depth                      70.730  mm"
"      6  100hyd Hydrograph extension used in this file"
" 33  CATCHMENT 101"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      101 Catchment 101"
"      10.000 % Impervious"
"      1.570 Total Area"
"      100.000 Flow length"
"      5.000 Overland Slope"
"      1.413 Pervious Area"
"      100.000 Pervious length"
"      5.000 Pervious slope"
"      0.157 Impervious Area"
"      100.000 Impervious length"
"      5.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      60.000 Pervious Max.infiltration"
"      13.000 Pervious Min.infiltration"
"      0.500 Pervious Lag constant (hours)"
"      5.000 Pervious Depression storage"
"      0.015 Impervious Manning 'n'"
"      0.000 Impervious Max.infiltration"
"      0.000 Impervious Min.infiltration"
"      0.001 Impervious Lag constant (hours)"
"      1.500 Impervious Depression storage"
"      0.286 0.000 0.000 0.000 c.m/sec"
"      Catchment 101 Pervious Impervious Total Area "
"      Surface Area 1.413 0.157 1.570 hectare"
"      Time of concentration 13.935 2.274 10.820 minutes"
"      Time to Centroid 89.729 88.847 89.493 minutes"
"      Rainfall depth 70.730 70.730 70.730 mm"
"      Rainfall volume 999.41 111.05 1110.45 c.m"
"      Rainfall losses 49.785 2.004 45.007 mm"
"      Runoff depth 20.944 68.725 25.722 mm"
"      Runoff volume 295.94 107.90 403.84 c.m"
"      Runoff coefficient 0.296 0.972 0.364 "
"      Maximum flow 0.267 0.087 0.286 c.m/sec"
" 40  HYDROGRAPH Add Runoff "

```

```

Post__100yr
"      4  Add Runoff "
"      0.286      0.286      0.000      0.000"
" 40  HYDROGRAPH Copy to Outflow"
"      8  Copy to Outflow"
"      0.286      0.286      0.286      0.000"
" 40  HYDROGRAPH Combine 200"
"      6  Combine "
"     200 Node #"
"      Combined Outflow"
"      Maximum flow      0.286      c.m/sec"
"      Hydrograph volume      403.842      c.m"
"      0.286      0.286      0.286      0.286"
" 40  HYDROGRAPH Start - New Tributary"
"      2  Start - New Tributary"
"      0.286      0.000      0.286      0.286"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"     102 Catchment 102"
"     50.000 % Impervious"
"     5.460 Total Area"
"    150.000 Flow length"
"     5.000 Overland Slope"
"     2.730 Pervious Area"
"    150.000 Pervious length"
"     5.000 Pervious slope"
"     2.730 Impervious Area"
"    150.000 Impervious length"
"     5.000 Impervious slope"
"     0.250 Pervious Manning 'n'"
"    60.000 Pervious Max.infiltration"
"    13.000 Pervious Min.infiltration"
"     0.500 Pervious Lag constant (hours)"
"     5.000 Pervious Depression storage"
"     0.015 Impervious Manning 'n'"
"     0.000 Impervious Max.infiltration"
"     0.000 Impervious Min.infiltration"
"     0.001 Impervious Lag constant (hours)"
"     1.500 Impervious Depression storage"
"     1.518      0.000      0.286      0.286 c.m/sec"
"     Catchment 102      Pervious      Impervious      Total Area "
"     Surface Area      2.730      2.730      5.460      hectare"
"     Time of concentration      17.774      2.900      6.391      minutes"
"     Time to Centroid      93.311      89.962      90.748      minutes"
"     Rainfall depth      70.730      70.730      70.730      mm"
"     Rainfall volume      1930.92      1930.92      3861.83      c.m"
"     Rainfall losses      49.750      2.321      26.036      mm"
"     Runoff depth      20.979      68.408      44.694      mm"
"     Runoff volume      572.73      1867.54      2440.27      c.m"
"     Runoff coefficient      0.297      0.967      0.632      "
"     Maximum flow      0.423      1.387      1.518      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"      1.518      1.518      0.286      0.286"
" 56  DIVERSION"
"     102 Node number"
"     0.848 Overflow threshold"
"     1.000 Required diverted fraction"
"     0 Conduit type; 1=Pipe;2=Channel"
"     Peak of diverted flow      0.670      c.m/sec"
"     Volume of diverted flow      388.785      c.m"
"     DIV00102.100hyd"

```

```

"                                     Post__100yr
" Major flow at 102"
" 1.518 1.518 0.848 0.286 c.m/sec"
40 HYDROGRAPH Next link "
" 5 Next link "
" 1.518 0.848 0.848 0.286"
54 POND DESIGN"
" 0.848 Current peak flow c.m/sec"
" 0.304 Target outflow c.m/sec"
" 2051.5 Hydrograph volume c.m"
" 18. Number of stages"
" 353.100 Minimum water level metre"
" 357.000 Maximum water level metre"
" 353.100 Starting water level metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge Volume"
" 353.100 0.000 0.000"
" 353.300 0.01800 255.800"
" 353.550 0.02300 618.490"
" 353.800 0.02800 1032.300"
" 354.050 0.03100 1500.300"
" 354.300 0.03500 2025.050"
" 354.550 0.03800 2609.050"
" 354.800 0.04100 3254.800"
" 355.050 0.04300 3951.550"
" 355.300 0.04600 4711.420"
" 355.550 0.04800 5541.800"
" 355.800 0.05100 6427.670"
" 356.050 0.05300 7375.360"
" 356.100 0.05300 7573.280"
" 356.400 1.196 8840.470"
" 356.650 2.937 9990.790"
" 356.900 5.189 11203.72"
" 357.000 6.216 11702.48"
" Peak outflow 0.033 c.m/sec"
" Maximum level 354.190 metre"
" Maximum storage 1795.084 c.m"
" Centroidal lag 11.186 hours"
40 1.518 0.848 0.033 0.286 c.m/sec"
40 HYDROGRAPH Combine 100"
" 6 Combine "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow 0.033 c.m/sec"
" Hydrograph volume 1985.316 c.m"
" 1.518 0.848 0.033 0.033"
40 HYDROGRAPH Start - New Tributary"
" 2 Start - New Tributary"
" 1.518 0.000 0.033 0.033"
33 CATCHMENT 103"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 103 Catchment 103"
" 55.000 % Impervious"
" 1.850 Total Area"
" 80.000 Flow length"
" 5.000 Overland Slope"
" 0.832 Pervious Area"
" 80.000 Pervious length"
" 5.000 Pervious slope"
" 1.018 Impervious Area"
" 80.000 Impervious length"
" 5.000 Impervious slope"

```

```

Post__100yr
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.637 0.000 0.033 0.033 c.m/sec"
" Catchment 103 Pervious Impervious Total Area "
" Surface Area 0.832 1.018 1.850 hectare"
" Time of concentration 12.189 1.989 4.030 minutes"
" Time to Centroid 88.040 88.440 88.360 minutes"
" Rainfall depth 70.730 70.730 70.730 mm"
" Rainfall volume 588.82 719.67 1308.50 c.m"
" Rainfall losses 49.806 2.308 23.682 mm"
" Runoff depth 20.924 68.422 47.048 mm"
" Runoff volume 174.19 696.19 870.38 c.m"
" Runoff coefficient 0.296 0.967 0.665 "
" Maximum flow 0.161 0.589 0.637 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.637 0.637 0.033 0.033"
" 33 CATCHMENT 104"
" 1 Triangular SCS"
" 1 Equal length"
" 2 Horton equation"
" 104 Catchment 104"
" 20.000 % Impervious"
" 2.230 Total Area"
" 40.000 Flow length"
" 5.000 Overland slope"
" 1.784 Pervious Area"
" 40.000 Pervious length"
" 5.000 Pervious slope"
" 0.446 Impervious Area"
" 40.000 Impervious length"
" 5.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 60.000 Pervious Max.infiltration"
" 13.000 Pervious Min.infiltration"
" 0.500 Pervious Lag constant (hours)"
" 5.000 Pervious Depression storage"
" 0.015 Impervious Manning 'n'"
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
" 0.670 0.637 0.033 0.033 c.m/sec"
" Catchment 104 Pervious Impervious Total Area "
" Surface Area 1.784 0.446 2.230 hectare"
" Time of concentration 8.042 1.312 5.038 minutes"
" Time to Centroid 84.444 87.297 85.718 minutes"
" Rainfall depth 70.730 70.730 70.730 mm"
" Rainfall volume 1261.81 315.45 1577.27 c.m"
" Rainfall losses 49.767 3.139 40.441 mm"
" Runoff depth 20.963 67.590 30.288 mm"
" Runoff volume 373.98 301.45 675.43 c.m"
" Runoff coefficient 0.296 0.956 0.428 "
" Maximum flow 0.535 0.281 0.670 c.m/sec"
" 40 HYDROGRAPH Add Runoff "

```

```

"          4  Add Runoff "          Post__100yr
"          0.670      1.205      0.033      0.033"
" 33  CATCHMENT 201"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      201  Catchment 201"
"      20.000  % Impervious"
"      0.080  Total Area"
"      20.000  Flow length"
"      5.000  Overland Slope"
"      0.064  Pervious Area"
"      20.000  Pervious length"
"      5.000  Pervious slope"
"      0.016  Impervious Area"
"      20.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"
"      0.000  Impervious Max.infiltration"
"      0.000  Impervious Min.infiltration"
"      0.001  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"          0.024      1.205      0.033      0.033 c.m/sec"
"      Catchment 201      Pervious      Impervious      Total Area "
"      Surface Area      0.064      0.016      0.080      hectare"
"      Time of concentration      5.306      0.866      3.349      minutes"
"      Time to Centroid      81.678      86.306      83.717      minutes"
"      Rainfall depth      70.730      70.730      70.730      mm"
"      Rainfall volume      45.27      11.32      56.58      c.m"
"      Rainfall losses      49.755      4.637      40.731      mm"
"      Runoff depth      20.975      66.093      29.998      mm"
"      Runoff volume      13.42      10.57      24.00      c.m"
"      Runoff coefficient      0.297      0.934      0.424      "
"      Maximum flow      0.021      0.011      0.024      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.024      1.229      0.033      0.033"
" 33  CATCHMENT 202"
"      1  Triangular SCS"
"      1  Equal length"
"      2  Horton equation"
"      202  Catchment 202"
"      1.000  % Impervious"
"      6.950  Total Area"
"      100.000  Flow length"
"      5.000  Overland Slope"
"      6.880  Pervious Area"
"      100.000  Pervious length"
"      5.000  Pervious slope"
"      0.069  Impervious Area"
"      100.000  Impervious length"
"      5.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      60.000  Pervious Max.infiltration"
"      13.000  Pervious Min.infiltration"
"      0.500  Pervious Lag constant (hours)"
"      5.000  Pervious Depression storage"
"      0.015  Impervious Manning 'n'"

```

```

"                               Post_100yr
" 0.000 Impervious Max.infiltration"
" 0.000 Impervious Min.infiltration"
" 0.001 Impervious Lag constant (hours)"
" 1.500 Impervious Depression storage"
"           1.310      1.229      0.033      0.033 c.m/sec"
" Catchment 202      Pervious      Impervious      Total Area "
" Surface Area      6.880      0.069      6.950      hectare"
" Time of concentration 13.935      2.274      13.561      minutes"
" Time to Centroid      89.729      88.847      89.701      minutes"
" Rainfall depth      70.730      70.730      70.730      mm"
" Rainfall volume      4866.54      49.16      4915.70      c.m"
" Rainfall losses      49.785      2.004      49.307      mm"
" Runoff depth      20.944      68.725      21.422      mm"
" Runoff volume      1441.07      47.76      1488.84      c.m"
" Runoff coefficient      0.296      0.972      0.303      "
" Maximum flow      1.302      0.039      1.310      c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           1.310      2.215      0.033      0.033"
" 47 FILEI_O Read/Open DIV00102.100hyd"
" 1 1=read/open; 2=write/save"
" 2 1=rainfall; 2=hydrograph"
" 1 1=runoff; 2=inflow; 3=outflow; 4=junction"
" DIV00102.100hyd"
" Major flow at 102"
" Total volume      388.785      c.m"
" Maximum flow      0.670      c.m/sec"
"           0.670      2.215      0.033      0.033 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
"           0.670      2.885      0.033      0.033"
" 40 HYDROGRAPH Copy to Outflow"
" 8 Copy to Outflow"
"           0.670      2.885      2.885      0.033"
" 40 HYDROGRAPH Combine 100"
" 6 Combine "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow      2.909      c.m/sec"
" Hydrograph volume      5432.746      c.m"
"           0.670      2.885      2.885      2.909"
" 40 HYDROGRAPH Confluence 100"
" 7 Confluence "
" 100 Node #"
" to Block 42 SWM Facility"
" Maximum flow      2.909      c.m/sec"
" Hydrograph volume      5432.746      c.m"
"           0.670      2.909      2.885      0.000"
" 54 POND DESIGN"
" 2.909 Current peak flow      c.m/sec"
" 0.304 Target outflow      c.m/sec"
" 5432.7 Hydrograph volume      c.m"
" 15. Number of stages"
" 350.600 Minimum water level      metre"
" 352.000 Maximum water level      metre"
" 350.600 Starting water level      metre"
" 0 Keep Design Data: 1 = True; 0 = False"
" Level Discharge      Volume"
" 350.600      0.000      0.000"
" 350.700      0.00700      277.300"
" 350.800      0.01700      592.200"
" 350.900      0.4000      944.650"
" 351.000      0.8470      1332.000"

```



			Post__100yr		
"	351.100	0.8920	1745.150"		
"	351.200	0.9350	2178.000"		
"	351.300	0.9760	2631.250"		
"	351.400	1.015	3105.650"		
"	351.500	1.053	3602.300"		
"	351.600	1.089	4122.300"		
"	351.700	1.124	4666.750"		
"	351.800	1.379	5236.900"		
"	351.900	1.828	5845.550"		
"	352.000	2.415	6578.250"		
"	Peak outflow		0.914	c.m/sec"	
"	Maximum level		351.152	metre"	
"	Maximum storage		1970.474	c.m"	
"	Centroidal lag		8.183	hours"	
"	0.670	2.909	0.914	0.000	c.m/sec"
" 40	HYDROGRAPH Next link "				
"	5 Next link "				
"	0.670	0.914	0.914	0.000"	
" 33	CATCHMENT 105"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	2 Horton equation"				
"	105 Catchment 105"				
"	15.000 % Impervious"				
"	4.040 Total Area"				
"	150.000 Flow length"				
"	5.000 Overland Slope"				
"	3.434 Pervious Area"				
"	150.000 Pervious length"				
"	5.000 Pervious slope"				
"	0.606 Impervious Area"				
"	150.000 Impervious length"				
"	5.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	60.000 Pervious Max.infiltration"				
"	13.000 Pervious Min.infiltration"				
"	0.500 Pervious Lag constant (hours)"				
"	5.000 Pervious Depression storage"				
"	0.015 Impervious Manning 'n'"				
"	0.000 Impervious Max.infiltration"				
"	0.000 Impervious Min.infiltration"				
"	0.001 Impervious Lag constant (hours)"				
"	1.500 Impervious Depression storage"				
"	0.609	0.914	0.914	0.000	c.m/sec"
"	Catchment 105	Pervious	Impervious	Total Area	"
"	Surface Area	3.434	0.606	4.040	hectare"
"	Time of concentration	17.774	2.900	12.341	minutes"
"	Time to Centroid	93.311	89.962	92.088	minutes"
"	Rainfall depth	70.730	70.730	70.730	mm"
"	Rainfall volume	2428.85	428.62	2857.47	c.m"
"	Rainfall losses	49.750	2.321	42.636	mm"
"	Runoff depth	20.979	68.408	28.094	mm"
"	Runoff volume	720.43	414.55	1134.98	c.m"
"	Runoff coefficient	0.297	0.967	0.397	"
"	Maximum flow	0.532	0.308	0.609	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.609	1.483	0.914	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.609	1.483	1.483	0.000"	
" 40	HYDROGRAPH Combine	200"			
"	6 Combine "				

"			Post__100yr		
"	200	Node #"			
"		Combined Outflow"			
"		Maximum flow	1.769	c.m/sec"	
"		Hydrograph volume	6487.746	c.m"	
"		0.609 1.483 1.483	1.483	1.769"	
" 38		START/RE-START TOTALS 105"			
"	3	Runoff Totals on EXIT"			
"		Total Catchment area	22.180	hectare"	
"		Total Impervious area	5.042	hectare"	
"		Total % impervious	22.732"		
" 19		EXIT"			



**CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION  
BASED ON THE RATIONAL RAINFALL METHOD  
BASED ON A FINE PARTICLE SIZE DISTRIBUTION**



**Project Name:** Inverhaugh Ridge Subdivision  
**Location:** Wellington, ON  
**OGS #:** OGS

**Engineer:** GM Blueplan  
**Contact:** Patricia Wiebe, E.I.T  
**Report Date:** 30-Nov-18

**Area** 1.85 ha  
**Weighted C** 0.61  
**CDS Model** 3020

**Rainfall Station #** 200  
**Particle Size Distribution** FINE  
**CDS Treatment Capacity** 57 l/s

<u>Rainfall Intensity<sup>1</sup></u> <u>(mm/hr)</u>	<u>Percent Rainfall Volume<sup>1</sup></u>	<u>Cumulative Rainfall Volume</u>	<u>Total Flowrate (l/s)</u>	<u>Treated Flowrate (l/s)</u>	<u>Operating Rate (%)</u>	<u>Removal Efficiency (%)</u>	<u>Incremental Removal (%)</u>
1.0	9.7%	18.2%	3.1	3.1	5.5	97.3	9.5
1.5	8.5%	26.7%	4.7	4.7	8.3	96.5	8.2
2.0	8.2%	34.9%	6.2	6.2	11.0	95.7	7.8
2.5	6.2%	41.1%	7.8	7.8	13.8	94.9	5.9
3.0	6.3%	47.4%	9.4	9.4	16.5	94.1	5.9
3.5	3.9%	51.3%	10.9	10.9	19.3	93.3	3.6
4.0	4.0%	55.3%	12.5	12.5	22.1	92.5	3.7
4.5	4.0%	59.3%	14.1	14.1	24.8	91.7	3.7
5.0	3.5%	62.8%	15.6	15.6	27.6	91.0	3.2
6.0	6.4%	69.2%	18.7	18.7	33.1	89.4	5.8
7.0	4.7%	74.0%	21.9	21.9	38.6	87.8	4.2
8.0	3.4%	77.4%	25.0	25.0	44.1	86.2	2.9
9.0	2.6%	79.9%	28.1	28.1	49.6	84.6	2.2
10.0	1.9%	81.9%	31.2	31.2	55.2	83.0	1.6
15.0	9.1%	90.9%	46.9	46.9	82.7	75.1	6.8
20.0	3.8%	94.7%	62.5	56.6	100.0	63.6	2.4
25.0	2.7%	97.5%	78.1	56.6	100.0	50.9	1.4
30.0	0.7%	98.1%	93.7	56.6	100.0	42.4	0.3
35.0	0.8%	98.9%	109.4	56.6	100.0	36.4	0.3
40.0	0.5%	99.4%	125.0	56.6	100.0	31.8	0.1
45.0	0.3%	99.6%	140.6	56.6	100.0	28.3	0.1
50.0	0.0%	99.6%	156.2	56.6	100.0	25.4	0.0
							87.9

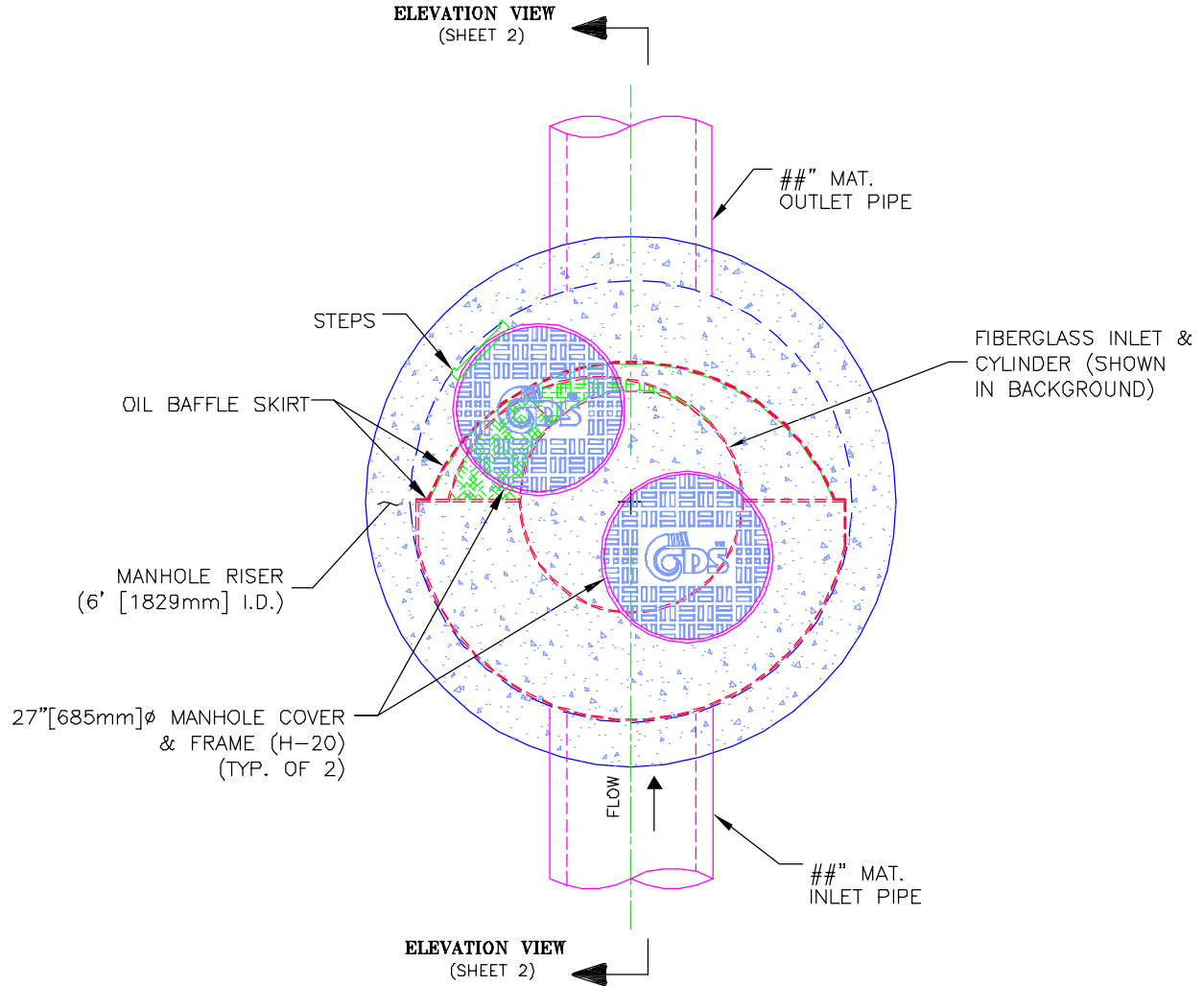
Removal Efficiency Adjustment<sup>2</sup> = 6.5%  
**Predicted Net Annual Load Removal Efficiency = 81.4%**  
**Predicted Annual Rainfall Treated = 96.8%**

1 - Based on 34 years of hourly rainfall data from Canadian Station 6149387, Waterloo ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



# PLAN VIEW



## CDS MODEL PMSU30\_20m, 2 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT



PROJECT NAME  
CITY, STATE

JOB#	CAN-##-###
DATE	##/##/##
DRAWN	INITIALS
APPROV.	

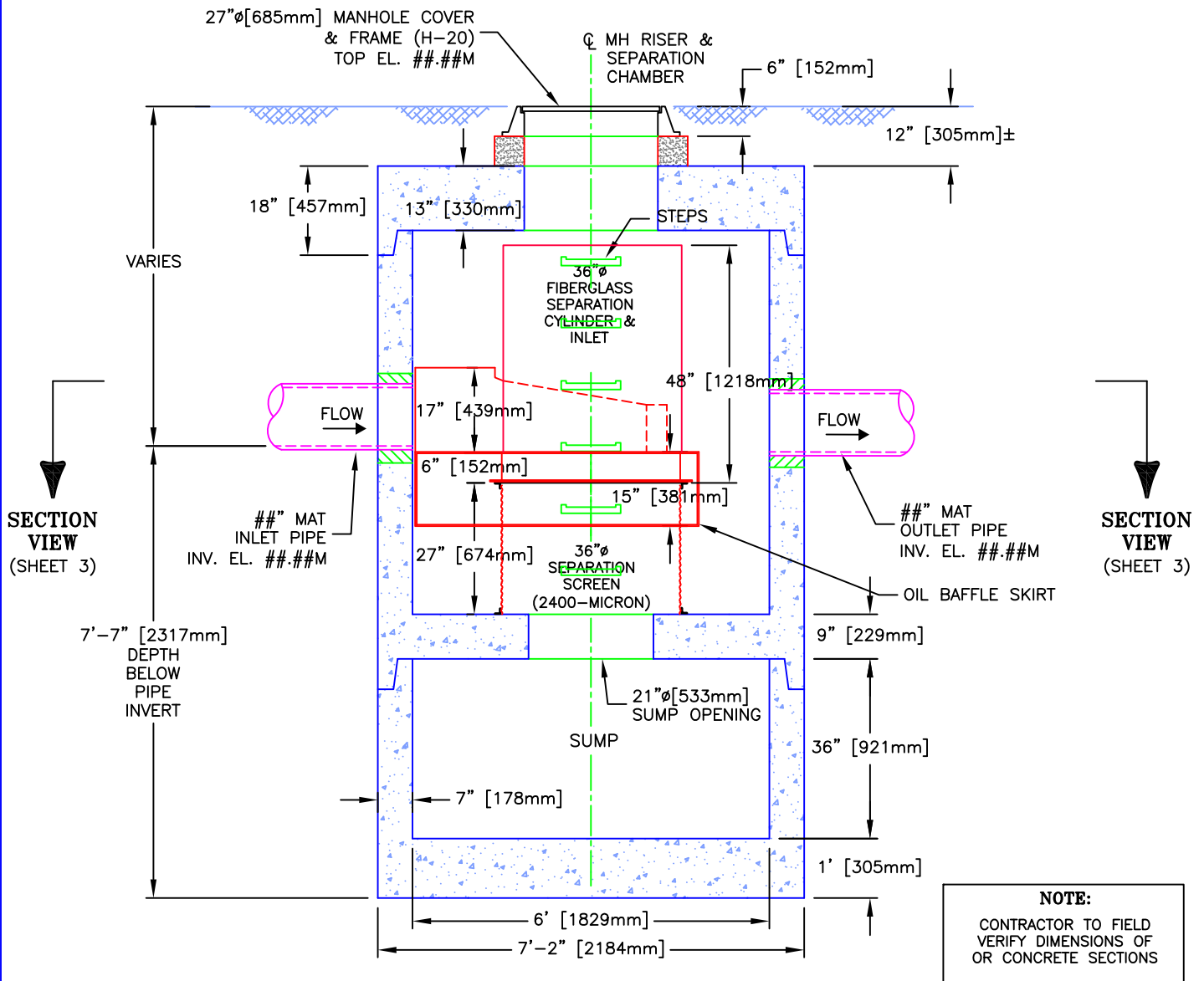
SCALE  
1" = 2.5'

SHEET

1



# ELEVATION VIEW



## CDS MODEL PMSU30\_20m, 2 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

	<b>PROJECT NAME</b> CITY, STATE	JOB#    CAN-##-###	SCALE 1" = 3'
		DATE    ##/##/##	SHEET
		DRAWN    INITIALS	<b>2</b>
		APPROV.	

**Appendix E**  
Cooling Trench Sizing Details

**117021 - Inverhaugh Ridge Subdivision**  
**Cooling Trench Sizing Calculations (Energy Dissipation/Dispersion Structure)**

**Knowns:**

Q 25mm = 0.015 m<sup>3</sup>/s  
 Q 2yr = 0.056 m<sup>3</sup>/s  
 Q 5yr = 0.278 m<sup>3</sup>/s  
 Q 10yr = 0.483 m<sup>3</sup>/s  
 Q 25yr = 0.790 m<sup>3</sup>/s  
 Q 50yr = 0.877 m<sup>3</sup>/s  
 Q 100yr = 0.916 m<sup>3</sup>/s  
  
 v = 8.01E-07 m<sup>2</sup>/s  
 Pr = 5.42  
 k = 0.615  
 Cross Sectional Void Space = 0.43 m<sup>2</sup>  
 Rho = 996 kg/m<sup>3</sup>  
 Cp = 810 J/kg K

**Assumptions:**

Tin = 36 °C  
 = 309 K  
 Tout = 24 °C  
 = 297 K  
 Tavg = 30 °C  
 = 303 K  
 Tstone = 21 °C  
 = 294 K  
  
 L = 30 m  
 W = 2 m  
 D = 1 m  
  
 Diam. = 0.02 m

Storm	V (m/s)	Re	Nu	h <sub>s</sub> J/m <sup>2</sup> ·K·s	As m <sup>2</sup>	qr (J/s)	qa (J/s)	SF (%)
25 mm	0.035	874	28.2	867.15	9,425	145,217	73,555,999	50553%
2	0.130	3,246	51.9	1595.93	9,425	542,143	135,374,338	24870%
5	0.648	16,180	135.3	4160.48	9,425	2,691,351	352,912,292	13013%
10	1.125	28,090	190.3	5851.73	9,425	4,675,981	496,372,573	10515%
25	1.841	45,968	268.7	8262.53	9,425	7,648,085	700,868,683	9064%
50	2.043	51,011	292.2	8985.15	9,425	8,490,342	762,165,349	8877%
100	2.134	53,283	302.6	9304.95	9,425	8,867,906	789,292,384	8801%

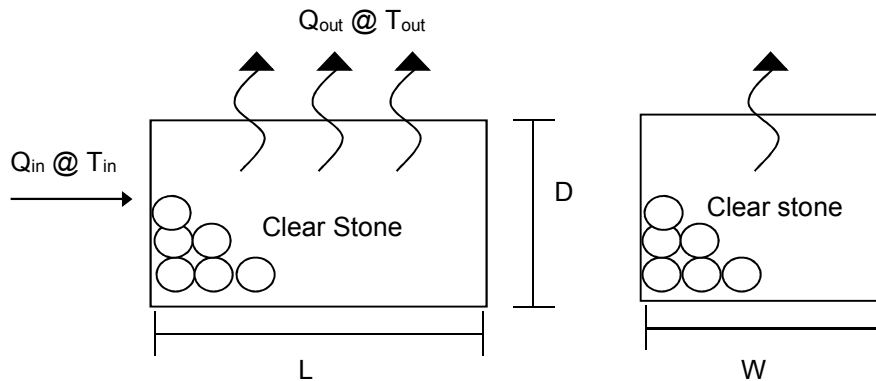
Inverhaugh Ridge Subdivision  
Township of Centre Wellington  
File No.: 117021

### Cooling Trench Sample Calculations

#### Assumptions:

- Cooling trench is treated as a “black box”, therefore the specific design of the trench is ignored.
- Solid media (clear stone) in trench is isothermal (ie. at a constant temperature).
- Temperature of fluid moving through trench is assumed to be constant.
- Temperature of fluid moving through trench is approximated as the average inlet and outlet temperature.
- Each trench section is rectangular with spherical particles.
- Thermal conductivity of granite is approximate to the thermal conductivity of clear stone.

#### Schematic:





**Design Variables:**

Q = flowrate through trench ( $\text{m}^3/\text{s}$ )  
=  $0.056\text{m}^3/\text{s}$  for 2-year design storm event.

$T_{\text{in}}$  = temperature of fluid at inlet (K)  
=  $36^\circ\text{C}$   
= 309 K

$T_{\text{out}}$  = temperature of fluid at outlet (K)  
=  $24^\circ\text{C}$   
= 297 K

$T_{\text{avg}}$  = average temperature of inflow and outflow (K)  
=  $30^\circ\text{C}$   
= 303 K

$T_{\text{stone}}$  = average temperature of clear stone (K)  
=  $21^\circ\text{C}$   
= 294 K

L = length of trench (m)  
= 30 m

W = width of trench (m)  
= 2.0 m

D = depth of trench (m)  
= 1.0 m

Dia. = diameter of clear stone (m)  
= 0.020 m

**Physical Properties:**

$\mu$  = dynamic viscosity  
=  $0.798 \times 10^{-3} \text{ kg/m s}$  water @ 303 K  
(Table A-9, p. 918, Çengel, Ghajar, 5<sup>th</sup> Edition)

$\rho$  = fluid density  
=  $996.0 \text{ kg/m}^3$  for water at 303K  
(Table A-9, p. 918, Çengel, Ghajar, 5<sup>th</sup> Edition)

$Pr$  = Prandtl number  
= 5.42 for water @ 303K  
(Table A-9, p. 918, Çengel, Ghajar, 5<sup>th</sup> Edition)

k = Thermal Conductivity of Water  
=  $0.615 \text{ W/m K}$  for water at 303K  
(Table A-9, p. 918, Çengel, Ghajar, 5<sup>th</sup> Edition)

$C_p$  = Specific Heat (J/kg K) of limestone  
= 810 J/kg K  
(Table A.3, p. 838, Incropera, DeWitt, 4<sup>th</sup> Edition)

**Analysis:**

Calculate the Reynolds number using the following equation:

$$Re = \frac{VD}{\nu} \quad \text{Eq. 1}$$

Where:

- V = velocity of water (m/s)
- D = stone diameter (m)
- $\nu$  = kinematic viscosity (m<sup>2</sup>/s)

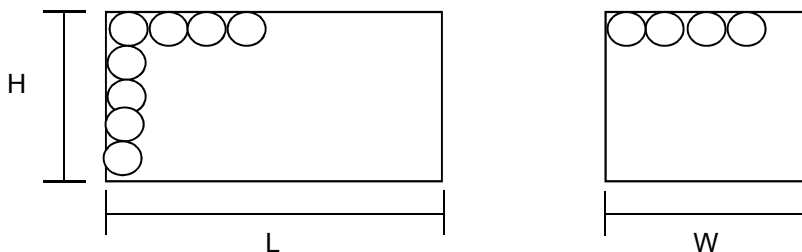
$$V = \frac{Q}{Av} \quad \text{Eq. 2}$$

Where:

- Q = Flow rate (m<sup>3</sup>/s)
- Av = Void area in the cross section of the cooling trench (m<sup>2</sup>)

Step 1: Estimate the total cross sectional area of the clear stone particles using the following equation:

$$As = (\pi \times r^2) \times \left( \frac{H}{D} \times \frac{W}{D} \right) \quad \text{Eq. 3}$$



$$As = (\pi \times 0.01^2) \times \left( \frac{1}{0.02} \times \frac{2}{0.02} \right)$$

$$A = 1.57m^2$$

Step 2: Estimate the void space by subtracting the cross sectional area of the stone from the total cross sectional area.

$$Av = (H \times W) - As$$

$$Av = (1.0 \times 2) - 1.57$$

$$Av = 0.43m^2$$

Step 3: Calculate the velocity using equation 2.

$$V = \frac{0.056m^3/s}{0.43m^2}$$

$$V = 0.130m/s$$

Step 4: Calculate the kinematic viscosity using the following formula:

$$\nu = \frac{\mu}{\rho}$$

$$\nu = \frac{0.798 \times 10^{-3}}{996.0}$$

$$\nu = 8.01 \times 10^{-7} \text{ m}^2/\text{s}$$

Eq. 4

Step 5: Calculate the Reynolds number using Equation 1:

$$Re = \frac{VD}{\nu}$$

$$Re = \frac{0.130 \times 0.02}{8.01 \times 10^{-7}}$$

$$Re = 3,246$$

Step 6: Calculate the Nusselt number

For  $40 < Re < 4,000$   $Nu = 0.683 Re^{0.466} Pr^{1/3}$  Eq. 5

For  $4,000 < Re < 40,000$   $Nu = 0.193 Re^{0.618} Pr^{1/3}$  Eq. 6

For  $40,000 < Re < 400,000$   $Nu = 0.027 Re^{0.805} Pr^{1/3}$  Eq. 7

Note: The above formulas have been taken from Heat and Mass Transfer Fundamentals, 5<sup>th</sup> Edition, Çengel, Ghajar, p.441 Table 7-1.

As  $Re = 3,246$ , use Equation 5.

$$Nu = 0.683 Re^{0.466} Pr^{1/3}$$

$$Nu = 0.683(3,246)^{0.466}(5.42)^{1/3}$$

$$Nu = 51.9$$

Step 7: Calculate the heat transfer coefficient.

$$h_s = \frac{k}{D} Nu$$

Where:

$k$  = Thermal Conductivity of water at 303K (W/m K)

$D$  = stone diameter (m)

$Nu$  = Nusselt Number

$$h_s = \frac{0.615}{0.02} (51.9)$$

$$h_s = 1,595.93 \text{ W/m}^2\text{K}$$

Step 8: Calculate the required heat transfer rate ( $q_r$ ) using the following equation:

$$q_r = Q\rho C_p(T_{in} - T_{out})$$

$$q_r = 0.056(996)(810)(309 - 297)$$

$$q_r = 542,143 \text{ W}$$

Eq. 8

Step 9: Calculate the available heat transfer rate ( $q_a$ ) using the following equation:

$$q_a = h_s A_s (T_{avg} - T_{stone})$$

Eq. 9

Where:

$h_s$  = Heat transfer coefficient (W/m K)

$A$  = Surface area of clear stone particles (m<sup>2</sup>)

$$\begin{aligned}
 A &= (\pi \times D^2) \times \left( \frac{L}{D} \times \frac{H}{D} \times \frac{W}{D} \right) \\
 A &= \pi \times \left( \frac{LHW}{D} \right) \\
 A &= \pi \times \left( \frac{30 \times 2 \times 1}{0.02} \right) \\
 A &= 9,425m^2 \\
 q_a &= h_s A_s (T_{avg} - T_{stone}) \\
 q_a &= (1,595.93)(9,425)(303 - 294) \\
 q_a &= 135,374,338 \text{ W}
 \end{aligned}$$

Therefore, the available heat transfer rate to reduce the temperature of water to 297 K (24°C) from 309K (36°C) is 140,330,239 W.

Step 10: Calculate the Safety Factor (SF) using the following equation:

$$\begin{aligned}
 SF &= \frac{q_a - q_r}{q_r} && \text{Eq. 10} \\
 SF &= \frac{135,374,338 - 542,143}{542,143} \\
 SF &= 24,870\%
 \end{aligned}$$

Therefore, the Safety Factor for the cooling trench is 24,870% based on the assumptions used in the calculations.

Therefore, since the available heat transfer rate ( $q_a$ ) of 135,374,338 W is greater than the required heat transfer rate ( $q_r$ ) of 542,143 W, we conclude that a cooling trench 30m long by 2m wide by 1m deep, constructed with 0.020m diameter clear stone, has the ability to reduce the temperature of the inflow from 309 K (36°C) to 297 K (24°C).

**Appendix F**  
Water Balance Calculations

117021 - Inverhaugh  
Township of Centre Wellington  
Table No. 9 - Water Budget Analysis - Existing Conditions

	Existing Conditions								
	Catchment 10		Catchment 20		Catchment 30		Catchment 40		Total
	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	
<b>Total Area (ha)</b>	14.36		0.63		0.24		6.95		<b>22.18</b>
Imperviousness	5%		0%		25%		0%		
Area (ha)	0.72	13.64	0.00	0.63	0.06	0.18	0.00	6.95	
Area (m <sup>2</sup> )	7180	136420	0	6300	600	1800	0	69500	221,800
<b>Annual Precipitation (Fergus Shand Dam) (mm)</b>	945.7		945.7		945.7		945.7		
Precipitation (m <sup>3</sup> )	6,790	129,012	0	5,958	567	1,702	0	65,726	
Total Precipitation (m <sup>3</sup> /year)	135,803		5,958		2,270		65,726		<b>209,756</b>
<b>Annual Evapotranspiration (mm)</b>	180	571	180	571	180	571	180	571	
Evapotranspiration (m <sup>3</sup> )	1,292	77,896	0	3,597	108	1,028	0	39,685	
Total Evapotranspiration (m <sup>3</sup> /year)	79,188		3,597		1,136		39,685		<b>123,606</b>
<b>Available for Recharge &amp; Runoff (mm)</b>	765.7	375	765.7	375	765.7	375	765.7	375	
Recharge & Runoff (m <sup>3</sup> )	5,498	51,117	0	2,361	459	674	0	26,042	
Total Recharge & Runoff (m <sup>3</sup> /year)	56,614		2,361		1,134		26,042		<b>86,150</b>
<b>Annual Natural Infiltration (mm) (Sandy Silt Till):</b>	0	159	0	159	0	159	0	159	
Pervious @ 159 mm/year		21,691		1,002		286		11,051	34,029
Impervious @ 0 mm/year	0		0		0		0		0
Total Annual Natural Infiltration (m <sup>3</sup> /year)	21,691		1,002		286		11,051		<b>34,029</b>
<b>Annual Runoff (mm) (Sandy Silt Till):</b>	765.7	216	765.7	216	765.7	216	765.7	216	
Pervious @ 527 mm/year		29,426		1,359		388		14,991	46,164
Impervious @ 776.5 mm/year	5,498		0		459		0		5,957
Total Annual Runoff (m <sup>3</sup> /year)	34,924		1,359		848		14,991		<b>52,121</b>
<b>Additional Infiltration:</b>									
Catchment Percent Infiltrated <sup>1</sup>									
Infiltrated m <sup>3</sup> /year									
Total Annual Infiltration (m <sup>3</sup> /year)	21,691		1,002		286		11,051		34,029
Total Annual Runoff (m <sup>3</sup> /year)	34,924		1,359		848		14,991		52,121

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Table No. 9 - Water Budget Analysis - Post-Development Conditions

	Post-Development Conditions														
	Catchment 101		Catchment 102		Catchment 103		Catchment 104		Catchment 105		Catchment 201		Catchment 202		Total
	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	
<b>Total Area (ha)</b>	1.57		5.46		1.85		2.23		4.04		0.08		6.95		<b>22.18</b>
Imperviousness	10%		50%		55%		20%		15%		20%		1%		
Area (ha)	0.16	1.41	2.73	2.73	1.02	0.83	0.45	1.78	0.61	3.43	0.02	0.06	0.07	6.88	
Area (m <sup>2</sup> )	1,570	14,130	27,300	27,300	10,175	8,325	4,460	17,840	6,060	34,340	160	640	695	68,805	221,800
<b>Annual Precipitation (Fergus Shand Dam) (mm)</b>	945.7		945.7		945.7		945.7		945.7		945.7		945.7		
Precipitation (m <sup>3</sup> )	1,485	13,363	25,818	25,818	9,622	7,873	4,218	16,871	5,731	32,475	151	605	657	65,069	
Total Precipitation (m <sup>3</sup> /year)	14,847		51,635		17,495		21,089		38,206		757		65,726		<b>209,756</b>
<b>Annual Evapotranspiration (mm)</b>	180	571	180	571	180	571	180	571	180	571	180	571	180	571	
Evapotranspiration (m <sup>3</sup> )	283	8,068	4,914	15,588	1,832	4,754	803	10,187	1,091	19,608	29	365	125	39,288	
Total Evapotranspiration (m <sup>3</sup> /year)	8,351		20,502		6,585		10,989		20,699		394		39,413		<b>106,934</b>
<b>Available for Recharge &amp; Runoff (mm)</b>	765.7	375	765.7	375	765.7	375	765.7	375	765.7	375	765.7	375	765.7	375	
Recharge & Runoff (m <sup>3</sup> )	1,202	5,295	20,904	10,229	7,791	3,119	3,415	6,685	4,640	12,867	123	240	532	25,781	
Total Recharge & Runoff (m <sup>3</sup> /year)	6,497		31,133		10,910		10,100		17,507		362		26,313		<b>102,823</b>
<b>Annual Natural Infiltration (mm) (Sandy Silt Till):</b>	0	159	0	159	0	159	0	159	0	159	0	159	0	159	
Pervious @ 159 mm/year		2,247		4,341		1,324		2,837		5,460		102		10,940	27,249
Impervious @ 0 mm/year	0		0		0		0		0		0		0		0
Total Annual Natural Infiltration (m <sup>3</sup> /year)	2,247		4,341		1,324		2,837		5,460		102		10,940		<b>27,249</b>
<b>Annual Runoff (mm) (Sandy Silt Till):</b>	765.7	216	765.7	216	765.7	216	765.7	216	765.7	216	765.7	216	765.7	216	
Pervious @ 527 mm/year		3,048		5,889		1,796		3,848		7,407		138		14,841	36,967
Impervious @ 776.5 mm/year	1,202		20,904		7,791		3,415		4,640		123		532		38,607
Total Annual Runoff (m <sup>3</sup> /year)	4,250		26,792		9,587		7,263		12,047		261		15,373		<b>75,573</b>
<b>Additional Infiltration:</b>															
Catchment Percent Infiltrated <sup>1</sup>			15.7%		0.80%										
Infiltrated m <sup>3</sup> /year	0	0	3,282	925	62	14	0	0	0	0	0	0	0	0	4,283
Total Annual Infiltration (m <sup>3</sup> /year)	2,247		8,547		1,400		2,837		5,460		102		10,940		31,532
Total Annual Runoff (m <sup>3</sup> /year)	4,250		22,586		9,510		7,263		12,047		261		15,373		71,290

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Township of Centre Wellington  
Table No. 9 - Water Budget Analysis - Summary

Totals			
	Existing Total	Post-Dev Total	
Area (ha)	22.18	22.18	0%
Precipitation (m <sup>3</sup> /year)	209,756	209,756	0%
Evapotranspiration (m <sup>3</sup> /year)	123,606	106,934	-13%
Recharge & Runoff (m <sup>3</sup> /year)	86,150	102,823	19%
Natural Infiltration (m <sup>3</sup> /year)	34,029	27,249	-20%
Total Annual Runoff (m <sup>3</sup> /year)	52,121	75,573	45%
Additional Recharge (m <sup>3</sup> /year)	0	4,283	
Annual Infiltration (m <sup>3</sup> /year)	34,029	31,532	-7%
Total Annual Runoff (m <sup>3</sup> /year)	52,121	71,290	80%



Portion of Catchment Area	Lot	Contributing Area	Infil. Gallery				Depth of Rainfall Captured	Approximate Probability of Exceedance (Fergus Shand Dam 2000-2010 Events)	Percentage of Rainfall in Area Infiltrated by Gallery
			Length	Height	Width	Volume (Water)			
103	6	170	14	0.5	1	2.33	13.7	11%	89%
	7	170	14	0.5	1	2.33	13.7	11%	89%
	8	990	14	0.6	1	2.80	2.8	48%	52%
	9	990	14	0.6	1	2.80	2.8	48%	52%
	10	990	14	0.6	1	2.80	2.8	48%	52%
	11	990	10	1	1	3.33	3.4	43%	57%
	12	650	10	1	1	3.33	5.1	32%	68%
	13	650	12	1	1	4.00	6.2	27%	73%
	14	650	8	1	1	2.67	4.1	40%	60%
	15	330	14	1	1	4.67	14.1	10%	90%
	16	330	14	1	1	4.67	14.1	10%	90%
	17	330	14	1	1	4.67	14.1	10%	90%
	18	330	14	1	1	4.67	14.1	10%	90%
	19	330	14	1	1	4.67	14.1	10%	90%
	20	330	14	1	1	4.67	14.1	10%	90%
102	21	600	14	1	1	4.67	7.8	22%	78%
	22	288	10	1	1	3.33	11.6	14%	86%
	23	288	10	1	1	3.33	11.6	14%	86%
	24	288	10	1	1	3.33	11.6	14%	86%
	25	180	10	1	1	3.33	18.5	6%	94%
	26	280	14	1	1	4.67	16.7	7%	93%
	27	680	14	0.5	1	2.33	3.4	43%	57%
	28	202.5	14	0.5	1	2.33	11.5	14%	86%
	29	180	14	0.3	1	1.40	7.8	22%	78%
	33	180	14	1	1	4.67	25.9	3%	97%
	34	180	14	1	1	4.67	25.9	3%	97%
	35	206	14	1	1	4.67	22.7	4%	96%
	36	137	8	0.6	1	1.60	11.7	14%	86%
	37	180	14	0.3	1	1.40	7.8	22%	78%
	38	180	14	0.3	1	1.40	7.8	22%	78%
Totals		<b>12109.5 m2</b>							<b>71%</b>

Catchment Area to	Percentage of Rainfall		Overall Catchment Area	Percent of Rainfall in Overall Catchment Infiltrated
	Infiltration Galleries	Captured by Infil. Gallery		
103	12109.5	71	54600	15.7%
102	170	89	18500	0.8%