Preliminary Servicing & Stormwater Management Design Report for:

Ainley Farm Subdivision
Township of Centre Wellington (Elora)

GMBP File: 411009
Revised April 2023

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA
330 Trillium Drive, Unit D, Kitchener ON N2E 3J2 P: 519.748.1440
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STORMWATER MANAGEMENT REPORT
AINLEY FARM SUBDIVISION
TOWNSHIP OF CENTRE WELLINGTON (ELORA)

Revised April 2023

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1.0 INTRODUCTION

In support of the Draft Plan of Subdivision Application for Part of Lots 17 and 18, Concession 12 in the Township of Centre Wellington (Geographic Township of Nichol) herein after referred to as the Ainley Farm Subdivision, GM BluePlan Engineering Limited have prepared this report to address the preliminary servicing and stormwater management requirements for the site and to address the comments received from Grand River Conservation Authority (dated July 31, 2018) and from the Township of Centre Wellington (dated March 20, 2020).

The servicing and stormwater management techniques were derived from the recommendations presented in the following reports:

- Stormwater Management Plan for The North Valley Subdivision (Cambridge Engineering and Planning Consultants Limited, January 1994),
- Design Report, Ville Lora Downs North Subdivision, Phase III (Gamsby and Mannerow Limited, July 2004),
- Design Report, Ville Lora Downs Subdivision, Stage VI (Gamsby and Mannerow Limited, April 1998),
- Preliminary Geotechnical Investigation completed CMT Engineering Inc. (March 29, 2006), and
- Environmental Impact Study completed by North-South Environmental Inc. (July 24, 2019).

Together, these reports form the overview for the development of these lands while maintaining the adjacent natural features.

2.0 SITE INFORMATION

Figure 1 shows the location of the Ainley Farm Subdivision and the surrounding area. The 21.46-hectare site is bound by existing agricultural and future development lands to the north, Gerrie Road to the east, existing residential lands to the south (Ville Lora Downs Subdivision, Phase V and Phase VI) and existing wetland and residential lands to the west (Ville Lora Downs North Subdivision, Phase III).

3.0 EXISTING CONDITIONS

3.1 LAND USE

The site is currently comprised of agricultural fields and a natural heritage feature consisting of a woodlot and wetland. The existing site features are shown on the General Plans (GM BluePlan Engineering Limited Drawing No. 1 to 4).

3.2 TOPOGRAPHY

The topography throughout the Ainley Farm Subdivision is undulating and consists of rolling slopes with gradients ranging from 0.5% to 20%. Original ground elevations on site range from approximately 410.0m to approximately 416.0m. The northeastern portion of the site generally drains in a northeast direction towards Gerrie Road. The remainder of the site generally drains in a southwest direction towards the existing wetland, ultimately discharging to the existing channel located immediately south of the wetland. The northwestern

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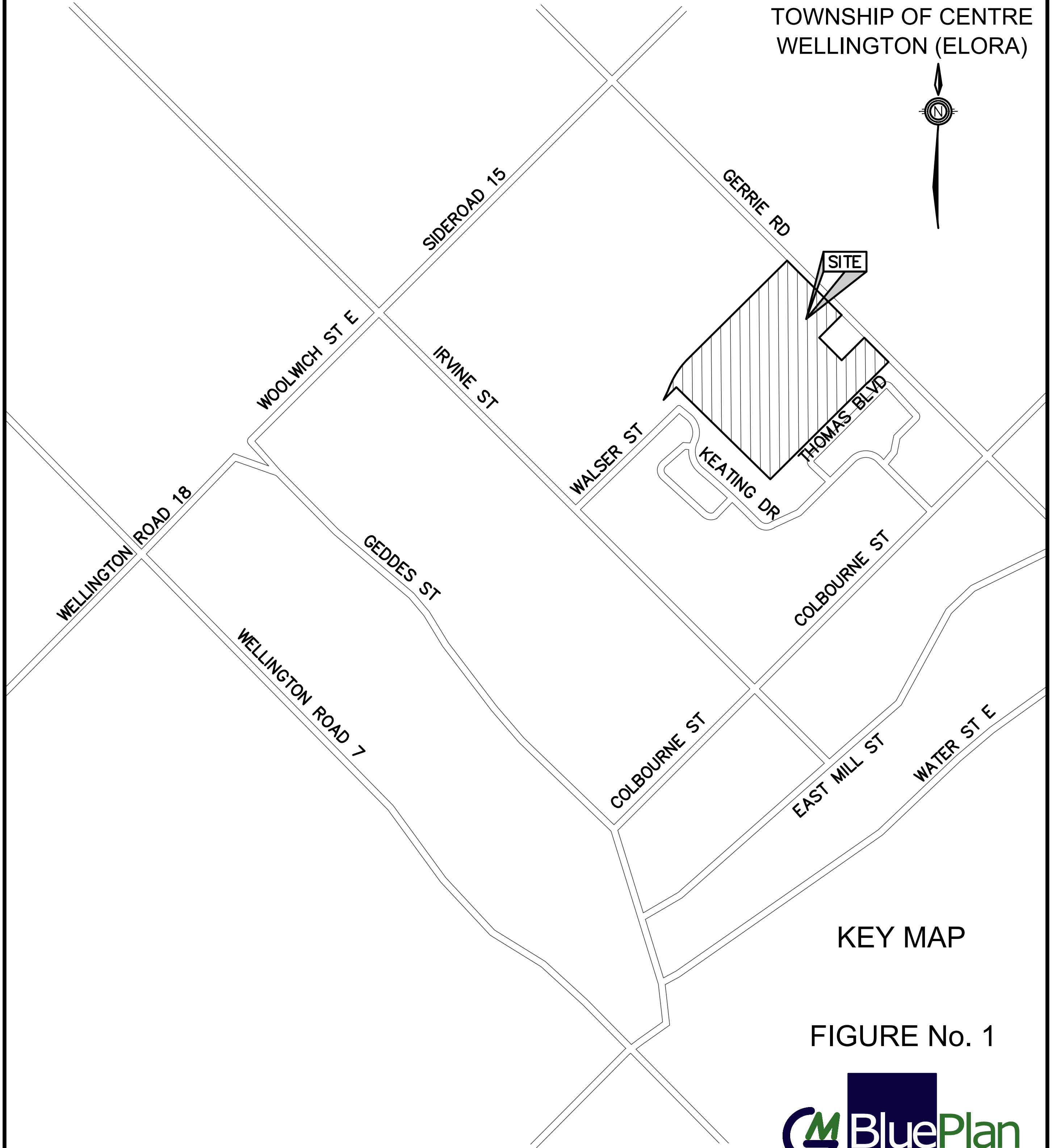

KEY MAP

FIGURE No. 1

BluePlan ENGINEERING

JOB NUMBER 411009
FEBRUARY 2019
NOT TO SCALE

portion of the site, adjacent to the existing Walser Street right-of-way, drains in a southerly direction towards Walser Street.

3.3 SOILS

The predominant surface soil type on the site is Harriston Loam (Soil Survey of Wellington County Report No. 35). Harriston Loam has a hydrologic soil classification of BC and generally has good drainage characteristics.

The Preliminary Geotechnical Investigation by CMT Engineering Inc. (March 2006) established the characteristics of the underlying soils. The boreholes identified the underlying soils as topsoil overlying organic silt, silt or sandy silt, silt till or sandy silt till, sand or silty sand and clayey silt. The results of the geotechnical investigation are included in Appendix 'A'.

4.0 PROPOSED DEVELOPMENT

The Draft Plan of Subdivision, prepared by J.D. Barnes Limited (March 23, 2023) (Figure 2), illustrates the proposed lot fabric, internal roads, park block, and open space areas and stormwater management blocks.

Access to the 21.46-hectare development will be provided via Gerrie Road and the extension of Walser Street.

Within the development, there are 101 single family lots, three (3) on-street townhouse blocks, one (1) apartment block, one (1) cluster townhouse block, one (1) open space block, one (1) park block and two (2) stormwater management blocks.

In addition, four (4) future single detached lots will be created on the north side of Walser Avenue through the extension of Walser Avenue into the Ainley Farm property (Future Development Block 120).

4.1 SITE GRADING

The site layout and internal road network for the Ainley Farm Subdivision are shown on the General Plans (GM BluePlan Engineering Limited Drawing No. 1 to 4). The grade and elevation of the internal streets are controlled by the existing centre line elevations of Walser Street and Gerrie Road, the major overland flow route to the stormwater management facilities, existing groundwater elevations and the elevation of the existing sanitary sewers on Walser Street and Keating Drive.

The site has been graded to match the existing elevations along the property boundary of the adjacent lands. Minor grading on the adjacent lands located along the north boundary of the site is required. The adjacent lands along the north boundary of the site are owned by the Developer (James Keating Construction (2004) Limited).

4.2 STREETS

All streets will be constructed with a minimum grade of 0.5% and a maximum grade of 8.0% as per Township of Centre Wellington standards. An urban road cross-section (20 m right-of-way width), with concrete curb and gutter will be provided for Street No.1, 2, 3, 4 and the extension of Walser Street, as per Township of Centre Wellington Standard Drawing STD R1.

Concrete sidewalks (1.5 metre wide) will be constructed along both sides of the Walser Street extension and Street No. 1, 2, 3 and 4.

4.3 WATER SUPPLY

As part of the Ville Lora Downs North Subdivision Phase III, a 200mm diameter watermain was terminated at the easterly limit of Walser Street. There is currently no watermain on Gerrie Road across the frontage of the Ainley Farm Subdivision.

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TOWNSHIP OF CENTRE
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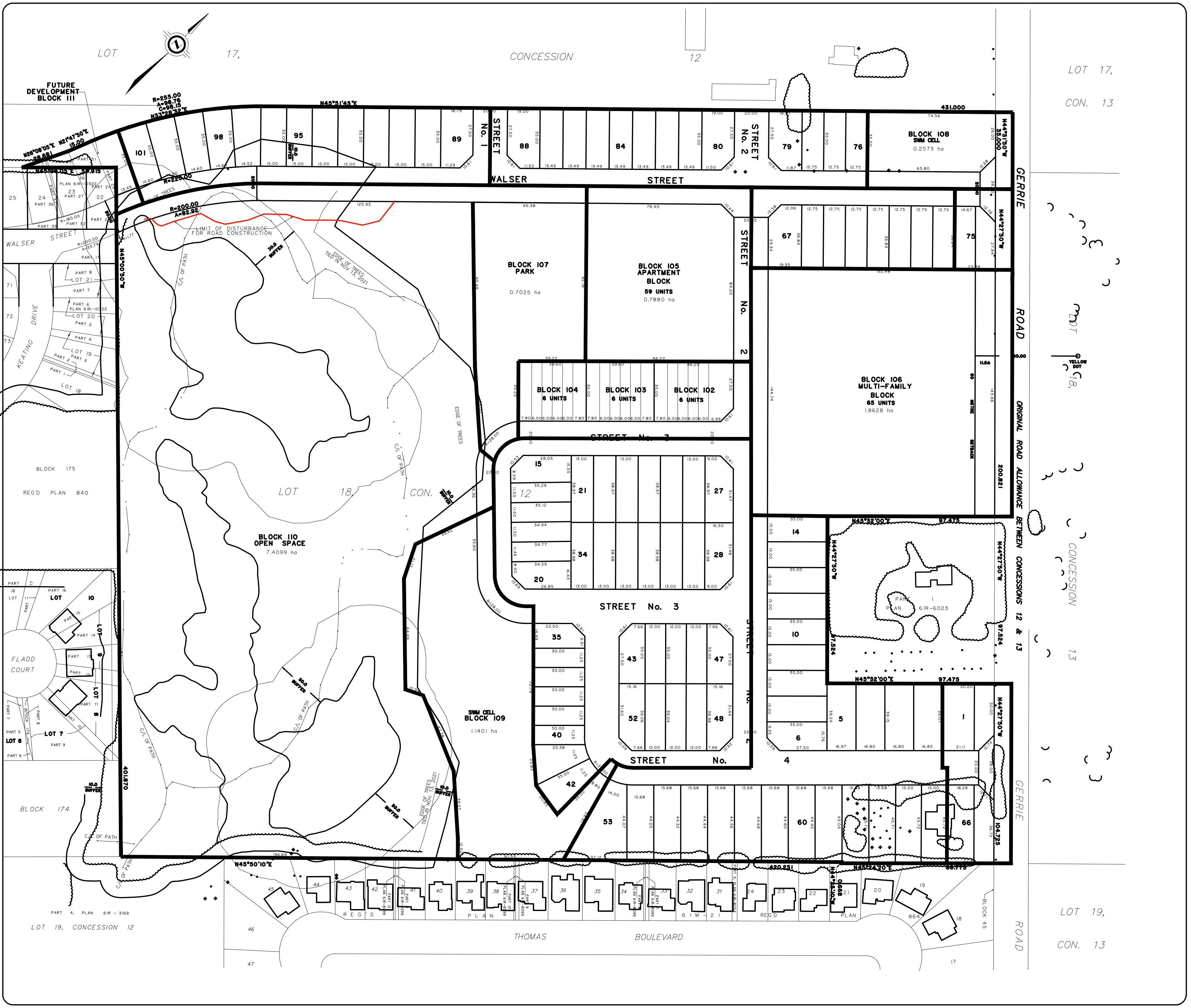

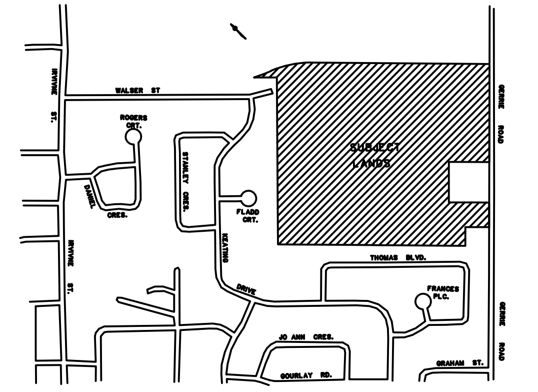

KEY PLAN N.T.S.

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

51 (17) (a) – (c) AS SHOWN
(d) SEE SCHEDULE
(e) – (g) AS SHOWN
(h) MUNICIPAL WATER SUPPLY
(i) HARRISTON LOAM
(j) AS SHOWN
(k) MUNICIPAL STORM AND SANITARY SEWERS
(l) NONE KNOWN

OWNERS CERTIFICATE

WE HEREBY AUTHORIZE BLACK, SHOEMAKER, ROBINSON, AND DONALDSON LIMITED, ONTARIO LAND SURVEYORS, URBAN AND RURAL PLANNERS TO SUBMIT THIS DRAFT PLAN OF PROPOSED SUBDIVISION.

DATE

JAMES KEATING CONSTRUCTION (2004) LTD.

SURVEYOR'S CERTIFICATE

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

DATE

KERRY F. HILLIS
ONTARIO LAND SURVEYOR

METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

RELEVANT INFORMATION

LOTS/BLOCKS	LAND USE	UNITS	AREAS (ha)
LOTS 1 TO 101	SINGLE-DETACHED RESIDENTIAL	101	5.6078
BLOCKS 102 TO 104	STREET TOWNHOUSES	18	0.4364
BLOCK 105	APARTMENT SITE	59	0.7880
BLOCK 106	CLUSTER TOWNHOUSES	65	1.8628
BLOCK 107	PARK		0.7039
BLOCKS 108 & 109	STORMWATER MANAGEMENT		1.3974
BLOCK 110	OPEN SPACE		7.3820
STREETS	ROADS		3.2004
BLOCK 111	FUTURE DEVELOPMENT	4	0.0816
TOTAL		247	21.4603 ha.

NOTES:
ELEVATIONS AND RELEVANT INFORMATION TAKEN FROM

DRAFT PLAN OF SUBDIVISION

OF PART OF
LOTS 17 & 18, CONCESSION 12
TOWNSHIP OF CENTRE WELLINGTON
(GEOGRAPHIC TOWNSHIP OF NICHOL)
COUNTY OF WELLINGTON

SCALE ~~1 : 1000~~

J.D.BARNES LIMITED
LAND INFORMATION SPECIALISTS
257 WOODLAWN ROAD WEST, UNIT 101, GUELPH, ON N1H 8J1
T: (519) 822-4031 F: (519) 822-1220 www.jdbarnes.com
SURVEYING
MAPPING
GIS

DATE: MARCH 23, 2023
DRAWN BY: KS/RA
PROJECT
04-5865-18
16-14-086-01

DRAFT PLAN OF SUBDIVISION

FIGURE No. 2

GM BluePlan
ENGINEERING

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SCALE 1:2750

Water supply for the Ainley Farm Subdivision will be provided via the extension of a 200mm diameter watermain, along the Walser Street extension, Street No. 2 and a portion of Street No. 1. A 150mm diameter watermain will also be extended along the remainder of Street No. 1, Street No. 3, and Street No. 4.

4.4 SANITARY SEWER

During the municipal servicing of the Ville Lora Downs North Subdivision Phase III, a 200mm diameter sanitary sewer was designed, approved and constructed on Walser Street. The existing 200mm diameter sanitary sewer is currently terminated at the easterly limit of Walser Street. As part of the Ville Lora Downs Subdivision, Phase VI, a 200mm diameter sanitary sewer was also designed, approved and constructed on Keating Drive. There are currently no sanitary sewers on Gerrie Road across the frontage of the Ainley Farm.

Sanitary service for the Ainley Farm Subdivision will be provided via connections to both the existing 200mm diameter sanitary sewer on Walser Street and the existing 200mm diameter sanitary sewer on Keating Drive.

The extension of a 200mm diameter sanitary sewer along the Walser Street extension will service the lots fronting on to Walser Street, as well as a portion of the lots fronting onto Street No. 2. The extension of a 200mm diameter sanitary sewer on easement through Drimmie Park to Street No. 1, from the existing 200mm diameter sanitary sewer on Keating Drive, will service the remainder of the subdivision (Street No. 2, Street No. 3 and Street No. 4).

Sanitary sewer design sheets have been included in Appendix C.

4.5 STORM SEWER

The storm sewer system for the Ainley Farm Subdivision will be sized to convey the 5-year design storm event and the storm sewer system will discharge to the two (2) proposed stormwater management facilities or to the existing storm sewer on Walser Street.

The storm sewers on Street No. 1, Street No. 3, Street No. 4, a portion of Street No. 2 and a portion of the Walser Street extension will discharge to the proposed Stormwater Management Facility No. 1 located to the east of the existing wetland.

The storm sewers on the remainder of Street No. 2, along with a portion of the Walser Street extension, will discharge to the proposed Stormwater Management Facility No. 2 located to the west of Gerrie Road.

The storm sewers on the remainder of the Walser Street extension will discharge directly to the existing storm sewer system on Walser Street, ultimately discharging to the existing storm sewers on Keating Drive.

Storm sewer design sheets have been included in Appendix C.

4.6 DEWATERING

Dewatering may be required during the installation of sanitary sewer, storm sewer and watermain. A Permit to Take Water (PTTW) or an Environmental Activity and Sector Registry (EASR) from the Ministry of Environment, Conservation and Parks (MECP) will be required if dewatering activities will involve the removal of more than 400,000 litres of groundwater per day from the site.

If dewatering activities are required during the installation of sewers and watermain, all discharge will be directed to the interim sediment control pond prior to discharge from the site.

As part of the area grading of the site, the interim stormwater management facility will be constructed and will act as an interim sedimentation control pond for the remainder of the municipal servicing and home building construction. This will prevent sediment from being discharged to the wetland. Upon build-out, accumulated sediment will be collected and removed from the interim sediment control pond before it is constructed on Stormwater Management Facility No. 1.

4.7 FOUNDATION DRAINAGE

As per the Township of Centre Wellington municipal standards, foundation drainage will be provided via sump pits and sump pumps in each residential unit, ultimately discharging via individual storm sewer lateral connections to the storm sewer system located within the municipal right-of-way.

5.0 STORMWATER MANAGEMENT

5.1 DESIGN CRITERIA

The studies, policies and guidelines used to develop the stormwater management plan for this development were as follows:

1) Stormwater Management Planning and Design Manual, 2003
2) Design Principles for Stormwater Management Facilities, 1996
3) The Interim Stormwater Quality Control Guidelines, 1991
4) The Stormwater Quality Best Management Practices Manual, 1991
5) The MTO Drainage Management Technical Guidelines, 1989
6) The Ontario Urban Design Guidelines, 1987

The objectives of the stormwater management plan are as follows:

a) Provide Enhanced (80% Total Suspended Solids) water quality control prior to discharge to the existing wetland and to an existing tributary of the Grand River.
b) Provide quantity control for the full range of design storms to attenuate post-development runoff to the existing condition level.
c) Match pre- and post-development infiltration rates.
d) Route the Regional Storm to minimize flood damage.

A three-hour duration rainfall event was used to generate the mass rainfall data required for the 2, 5, 10, 25, 50 and 100-year design storms. The Fergus Shand Dam Chicago parameters and the total depth of rainfall for each storm are as follows:

Table No. 1: Chicago Rainfall Distribution Parameters

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
a =	695.047	1459.072	2327.596	3701.648	5089.418	6933.019
b =	6.387	13.690	19.500	25.500	30.000	34.699
c =	0.793	0.850	0.894	0.937	0.967	0.998
r =	0.38	0.38	0.38	0.38	0.38	0.38
Duration = (minutes)	180	180	180	180	180	180
Rainfall Depth = (mm)	33.014	49.792	61.359	75.581	86.737	97.921

The SCS infiltration method was used in the runoff calculations. The CN parameters used in the MIDUSS modelling are as follows:

Table No. 2: SCS Curve Number Parameters

	IMPERVIOUS AREAS	PERVIOUS AREAS
Residential	98	78
Agricultural	98	74
Wetland/Forest	98	50

The hydrologic model MIDUSS was used to create the runoff hydrographs and to route the flows through the storage structures.

5.2 STORMWATER MANAGEMENT APPROACH

In line with current practices and guidelines, the stormwater management plan for the Ainley Farm Subdivision is a “treatment train” to attenuate post-development flows and to provide Enhanced (80% total suspended solids removal) water quality control treatment prior to discharge from the site. The “treatment train” will include a combination of lot level, conveyance and end-of-pipe best management practices.

Lot level controls will simply consist of directing roof leaders to grassed areas and grassed swales.

Conveyance controls will include the use of storm sewers, grassed swales, four (4) oil/grit separator structures for Stormwater Management Facility No.1 and Stormwater Management Facility No.2.

End-of-pipe controls will be provided by two (2) extended detention stormwater management facilities designed to attenuate post-development runoff prior to discharge from the site. Runoff generated from Stormwater Management Facility No.1 will discharge to the existing wetland, ultimately discharging to the existing swale in Drimmie Park and the existing storm sewers on Keating Drive. The stormwater management facility has been designed as a wetland with 5,464m^3 of storage, discharging via a multi-stage outlet consisting of a minor outlet with a 300mm diameter orifice plate and a major outlet with a 350mm diameter orifice place, as well as a 20m wide overflow weir.

Runoff generated from Stormwater Management Facility No.2 will discharge to the roadside ditch along Gerrie Road, ultimately discharging to a tributary of the Grand River. The stormwater management facility has been designed as a wetland with 1,195m^3 of storage, discharging via a multi-stage outlet consisting of a 120mm knockout for minor storms and a 260mm orifice plate for major storms, as well as a 10m wide overflow weir.

A small portion of runoff from the westerly portion of Walser Street will discharge uncontrolled to the existing storm sewer system on Walser Street.

Major storm flows from the development will sheetflow overland via the municipal right-of-ways to either Stormwater Management Facility No.1 or Stormwater Management Facility No. 2.

This combination of lot-level, conveyance and end-of-pipe controls will control the release of the runoff from the site.

5.3 STORMWATER MANAGEMENT PLAN

The best management practices (BMP's) in the Stormwater Management Planning and Design Manual (2003) were screened. Those found to be applicable to this development are discussed in the following sections.

5.3.1 LOT LEVEL CONTROLS

Stormwater management practices recommended to provide lot level control on this site are as follows:

a) Roof Drainage to Ground Surface

The driveways and front yards will drain to the street. The roof and rear yard will generally drain to the rear of the lot with exception for lots with back to front drainage.

The roof runoff will be filtered across the grassed surface and some will infiltrate. The runoff for any event large enough to generate flow to the swale system will be adequately filtered by the grass en route.

b) Rear Yard Swales

The lots will be graded to current Township of Centre Wellington Standards. Where practical, the length of the rear lot swales between catch basins will be increased to extend the contact time with the grassed surfaces.

To promote infiltration on the lots and in the swales, it is recommended that the average depth of graded topsoil be 300 mm.

5.3.2 CONVEYANCE CONTROLS

The storm conveyance system for the development will consist of grassed swales, storm sewers, major overland channel and four (4) oil/grit separator structures. Conveyance controls will be achieved through the regular maintenance of the grassed swales, storm sewers, major overland channel, and oil/grit separator structures as part of the Township's annual maintenance program. Maintenance requirements will include the annual removal of accumulated sediments and debris from manholes, catch basins, and oil/grit separator structures.

5.3.3 END-OF-PIPE CONTROLS

a) Existing Conditions

Under existing conditions, the majority of the site is utilized for agricultural purposes. For hydrologic modelling purposes, the 21.42-hectare site and 1.20 hectares of external areas was modelled as seven (7) catchments. These catchments are shown on the Existing Conditions Storm Drainage Area Plan (Figure 3).

Catchment 10 (7.66 hectares, 0% impervious) consists primarily of agricultural lands and an existing residential lot.

Catchment 11 (0.13 hectares, 0% impervious) represents the external lands, which consists primarily of agricultural lands of an existing residential lot.

Runoff generated from Catchment 10 and 11 currently sheetflows overland in an east to west direction, ultimately discharging to the existing wetland.

Catchment 20 (6.66 hectares, 0% impervious) consists primarily of agricultural lands and an existing residential lot.

Catchment 21 (0.83 hectares, 10% impervious) represents external lands consisting of an existing residential dwelling.

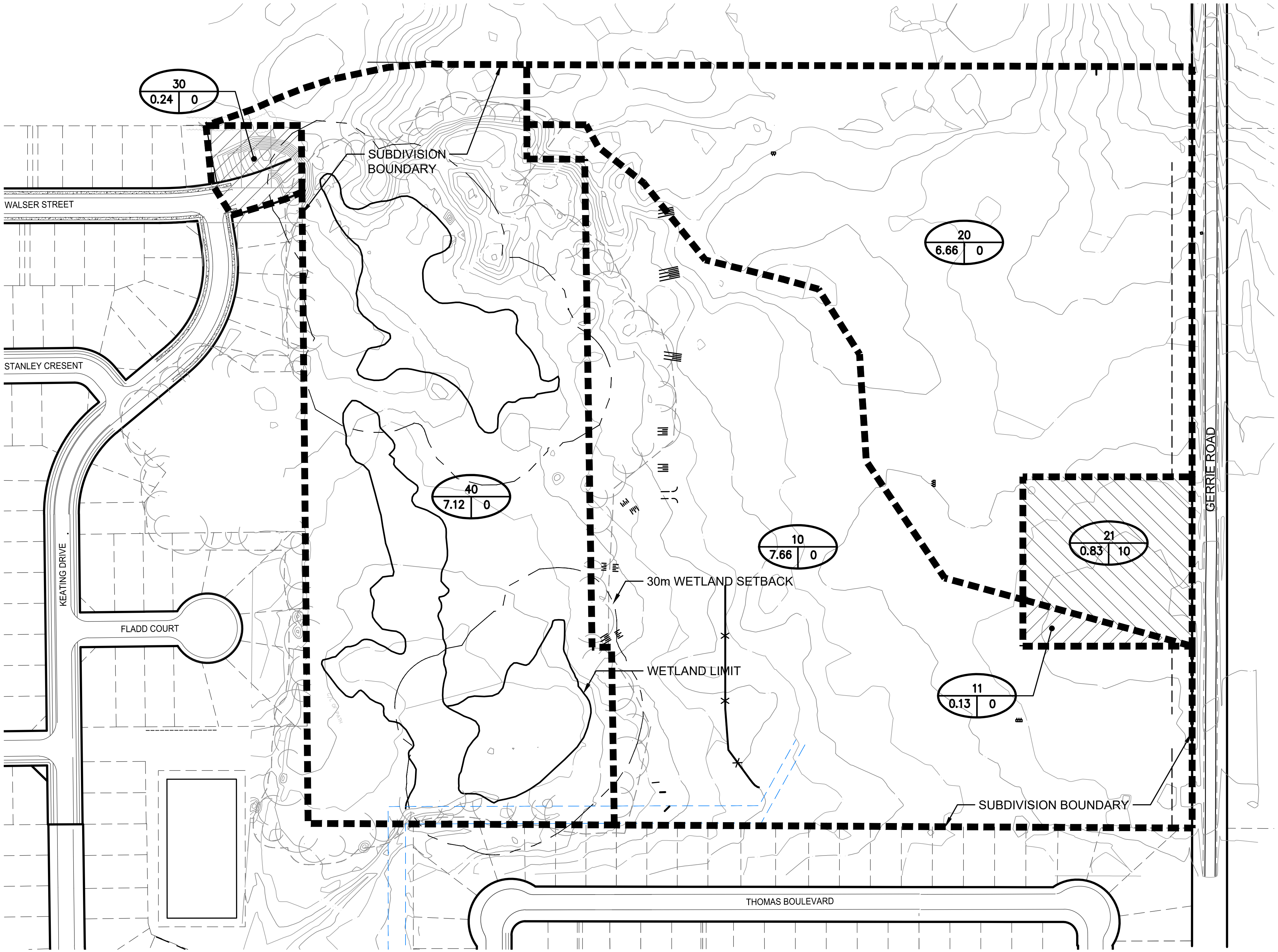
Runoff generated from Catchment 20 and 21 currently sheetflows overland to the existing roadside ditch along Gerrie Road and ultimately to a tributary of the Grand River.

Catchment 30 (0.24 hectares, 0% impervious) represents the external lands, which consists primarily of an existing wetland and agricultural lands.

Runoff generated from Catchment 30 currently sheetflows overland, ultimately discharging to the existing wetland.

Catchment 40 (7.12 hectares, 0% impervious) represents the south-westerly portion of the site, consisting of a natural heritage feature (wetland and woodlot).

Runoff generated from Catchment 40 currently sheetflows overland in an east to west direction, discharging to an existing swale in Drimmie Park and ultimately the existing storm sewer system on Keating Drive.



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LEGEND

DRAINAGE AREA BOUNDARY

10 / 1.23 / 0
CATCHMENT NUMBER
% IMPERVIOUS
AREA IN HECTARES

▨ EXTERNAL LANDS

EXISTING CONDITIONS STORM DRAINAGE AREA PLAN

FIGURE No. 3

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FEBRUARY 2019
Scale: 1:2500

Table No. 3 summarizes the existing condition flow rates and runoff volumes from the site for the full range of design storm events.

Table No. 3: Existing Condition Flow Rates and Runoff Volumes

	CATCHMENTS									
	30	**Total to Walser**	**10**	**11**	**40**	**Total to Ex. Wetland**	**20**	**21**	**Total to Tributary of Grand River**	**Total from Site**
2-Year										
Flow Rate (m^3/s)	0.003	0.003	0.044	0.001	0.060	0.099	0.038	0.016	0.043	**0.138**
Runoff Volume (m^3)	12.3	12.3	397.3	6.7	364.5	768.4	340.5	61.1	401.6	**1,170.0**
5-Year										
Flow Rate (m^3/s)	0.010	0.010	0.157	0.004	0.209	0.353	0.135	0.030	0.153	**0.472**
Runoff Volume (m^3)	30.7	30.7	995.9	16.7	913.0	1,925.6	853.4	132.1	985.5	**2,911.1**
10-Year										
Flow Rate (m^3/s)	0.017	0.017	0.273	0.008	0.359	0.608	0.234	0.050	0.264	**0.806**
Runoff Volume (m^3)	46.5	46.5	1,505.1	25.2	1,380.7	2,911.0	1,289.8	190.6	1,480.4	**4,391.4**
25-Year										
Flow Rate (m^3/s)	0.026	0.026	0.454	0.012	0.584	1.001	0.389	0.079	0.436	**1.308**
Runoff Volume (m^3)	68.1	68.1	2,210.7	37.0	2,027.3	4,274.9	1,894.4	269.8	2,164.2	**6,439.2**
50-Year										
Flow Rate (m^3/s)	0.035	0.035	0.618	0.016	0.789	1.341	0.530	0.104	0.593	**1.755**
Runoff Volume (m^3)	86.8	86.8	2,811.2	47.1	2,577.4	5,435.7	2,409.1	336.8	2,745.9	**8,181.5**
100-Year										
Flow Rate (m^3/s)	0.043	0.043	0.801	0.020	0.985	1.721	0.687	0.135	0.765	**2.244**
Runoff Volume (m^3)	106.3	106.3	3,447.0	57.6	3,160.5	6,665.1	2,953.9	406.6	3,360.5	**10,025.6**
Regional										
Flow Rate (m^3/s)	0.027	0.027	0.881	0.014	0.772	1.667	0.755	0.088	0.841	**2.444**
Runoff Volume (m^3)	487.6	487.6	15,780.0	267.9	14,536.0	30,583.9	13,523.0	1,740.4	15,263.6	**45,846.2**

Table No. 4 gives the results of the ponding in the existing wetland.

Table No. 4: Wetland (Stage/Storage/Discharge)

	Available Capacity			Actual Capacity Used			Drawdown Time (hr)**
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	
Wetland Bottom	0.000	0.0	409.63	---	---	---	---
2-Year	---	---	---	0.095	57	409.65	9.3
5-Year	---	---	---	0.322	195	409.69	5.6
10-Year	---	---	---	0.546	330	409.73	5.6
25-Year	---	---	---	0.881	534	409.77	5.5
50-Year	---	---	---	1.176	715	409.79	5.4
100-Year	---	---	---	1.499	912	409.82	5.4
Regional Storm	---	---	---	1.601	971	409.83	52.0
Overflow	18.965	15,227.7	410.75	---	---	---	---

**Drawdown time obtained from the hydrologic modelling software MIDUSS

Table No. 5 gives the results of the existing condition drainage channel routing downstream of the existing wetland.

Table No. 5: Wetland (Existing Condition Drainage Channel Downstream of Wetland – Section 1 of 2)

	Channel Design Capacity			Actual Channel Capacity Used		
	Peak Flow m³/s	Average Channel Depth m	Velocity m/s	Peak Flow m³/s	Average Channel Depth m	Velocity m/s
2-Year	---	---	---	0.095	0.162	0.541
5-Year	---	---	---	0.322	0.256	0.734
10-Year	---	---	---	0.546	0.312	0.838
25-Year	---	---	---	0.881	0.373	0.944
50-Year	---	---	---	1.176	0.416	1.015
100-Year	---	---	---	1.499	0.455	1.078
Regional Storm	---	---	---	1.601	0.467	1.096
Top of Bank	10.655	0.95	1.602	---	---	---

Table No. 6 gives the results of the existing condition drainage channel routing downstream of the existing wetland.

Table No. 6: Wetland (Existing Condition Drainage Channel Downstream of Wetland – Section 2 of 2)

	Channel Design Capacity			Actual Channel Capacity Used		
	Peak Flow m^3/s	**Average Channel Depth m**	**Velocity m/s**	**Peak Flow m^3/s**	**Average Channel Depth m**	**Velocity m/s**
2-Year	---	---	---	0.094	0.082	0.510
5-Year	---	---	---	0.321	0.167	0.772
10-Year	---	---	---	0.544	0.224	0.912
25-Year	---	---	---	0.876	0.290	1.054
50-Year	---	---	---	1.174	0.340	1.148
100-Year	---	---	---	1.490	0.385	1.230
Regional Storm	---	---	---	1.595	0.399	1.254
Top of Bank	9.246	0.95	1.966	---	---	---

b) Proposed Release Rates

In order to maintain the existing condition drainage pattern to the existing wetland and Grand River tributary, the release rates have been determined by the existing condition release rates. Under post-development conditions, runoff generated from the site will be attenuated to the existing condition levels conveyed to the existing wetland and the Grand River tributary.

The release rate to Walser Street under minor storm design events is determined by the capacity of the existing storm sewers in Ville Lora Downs North Subdivision Phase III, which were designed to incorporate a small contributing area from Walser Street. The capacity of the existing 300mm diameter storm sewer conveying a portion of the proposed development is approximately 0.110 m^3/s, based on a grade of 1.34%. Excluding the existing contributing area to this storm sewer (0.05ha), the proposed development's allotment of the pipe's capacity is 0.106 m^3/s. The allowable to Walser Street under major storm events has been determined based on the allotted area of 0.65 ha, as per the Villa Lora Downs North Phase III storm drainage area plans.

Therefore, the proposed release rates from the site under post-development conditions are outlined in Table No. 7.

Table No. 7: Proposed Release Rates

Release Route	**2-Year**	**5-Year**	**10-Year**	**25-Year**	**50-Year**	**100-Year**	**Regional**
To Ex. Wetland	0.099 m^3/s	0.353 m^3/s	0.608 m^3/s	1.001 m^3/s	1.341 m^3/s	1.721 m^3/s	1.667 m^3/s
To Tributary of Grand River	0.043 m^3/s	0.153 m^3/s	0.264 m^3/s	0.436 m^3/s	0.593 m^3/s	0.765 m^3/s	0.841 m^3/s
To Walser Street	0.106 m^3/s		0.122 m^3/s	0.150m^3/s	0.173m^3/s	0.196m^3/s	0.080m^3/s

c) Post-Development Conditions

Under post-development conditions, the existing drainage patterns of the site will be maintained. Post-development flows from the site will be attenuated to existing condition levels through the use of two (2) stormwater management facilities. Stormwater Management Facility No. 1 will outlet to the existing wetland. Stormwater Management Facility No. 2 will outlet to the existing roadside ditch along Gerrie Road and ultimately a tributary of the Grand River.

For the post-development condition analysis, the 21.42-hectare site and 1.20 hectares of external areas was modelled as fifteen (15) drainage catchments. These catchments are shown on the Post-Development Storm Drainage Area Plan (Figure 4).

Catchment 1000 (6.98-hectares, 50% Impervious) represents a central portion of the development, including Street No. 3, Street No. 4, and a portion of Street No. 2. Major and minor storm runoff generated from Catchment 1000 will be directed to Stormwater Management Facility No. 1.

Catchment 1100 (0.48-hectares, 0% Impervious) represents a portion of external lands including existing residential lot. Major and minor storm runoff generated from Catchment 1100 will be directed to Stormwater Management Facility No. 1.

Catchment 1200 (0.22-hectares, 50% Impervious) represents the rear yards of lots 35-42. Runoff generated from Catchment 1200 will be directed to Infiltration Gallery No. 1.

Catchment 1300 (0.70-hectares, 50% Impervious) represents the rear yards of lots 53-64. Runoff generated from Catchment 1300 will be directed to Infiltration Gallery No. 1.

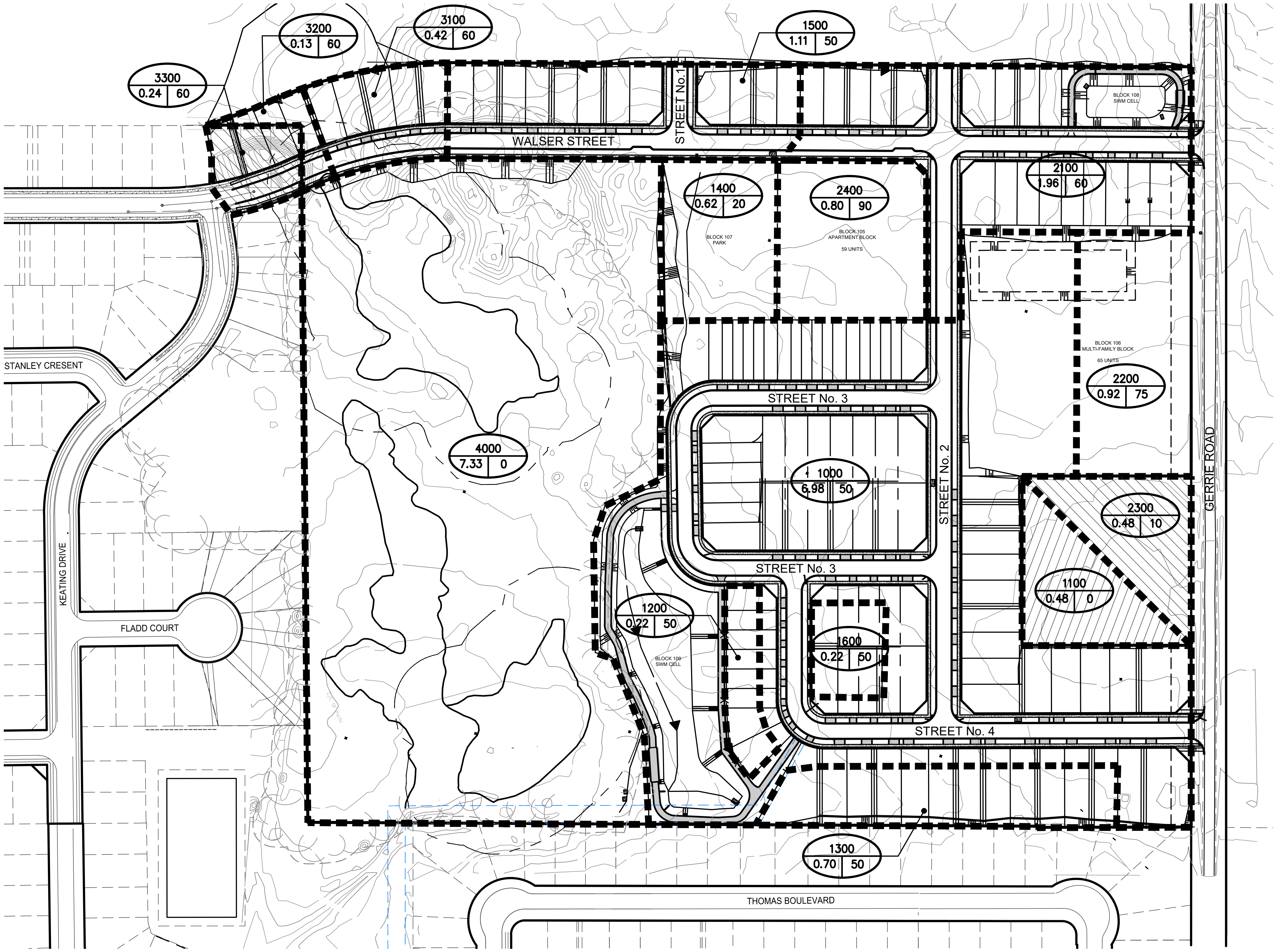
Catchment 1400 (0.62-hectares, 20% Impervious) represents the park block. Runoff generated from Catchment 1400 will be directed to Infiltration Gallery No. 2. The clear stone infiltration gallery (80m L x 10m W x 0.70m D) with two (2) 300mm diameter perforated pipes which run the length of the gallery will provide approximately 192 m^3 of storage. The clear stone infiltration gallery has been designed with sufficient capacity to infiltrate minor storm runoff generated by Catchment 1400. Flows exceeding the capacity of the clear stone infiltration gallery will be directed to Stormwater Management Facility No. 1.

Catchment 1500 (1.11-hectares, 50% Impervious) represents a portion of Walser Street and Street No. 1. Minor runoff generated from Catchment 1500 will be conveyed via storm sewers to Stormwater Management Facility No. 1, ultimately discharging to the existing wetland. Major runoff generated from Catchment 1500 will sheetflow uncontrolled to the existing wetland.

Quality control treatment (80% TSS removal) for runoff generated from Catchment 1000, 1100, 1400, and 1500 will be provided by three (3) oil/grit separator structures. The first oil/grit separator structure (Stormceptor EF8 or approved equivalent) will be located north of the northerly inlet to Stormwater Management Facility No. 1 (Street 3). The second oil/grit separator structure (Stormceptor STC EF6 or approved equivalent) will be located south of the northerly inlet to Stormwater Management Facility No. 1 (Street 4). The third oil/grit separator structure (Stormceptor STC EF6 or approved equivalent) will be located at the southerly inlet to Stormwater Management Facility No. 1 (Street 1).

Catchment 1600 (0.22-hectares, 50% Impervious) represents the rear yards of lots 43-45 and 50-52. Runoff generated from Catchment 1600 will be directed to Infiltration Gallery No. 1. The clear stone infiltration gallery (145m L x 3.5-5m W x 0.70m D), receiving flows from Catchments 1200, 1300, and 1600 with four to six (4 to 6) 450mm diameter perforated pipes which run the length of the gallery will provide approximately 192.1 m^3 of storage. Flows exceeding the capacity of the clear stone infiltration gallery will be directed to Stormwater Management Facility No. 1.

411009
AINLEY FARM SUBDIVISION
TOWNSHIP OF CENTRE WELLINGTON (ELORA)



LEGEND

▬ ▬ ▬ DRAINAGE AREA BOUNDARY

2200 — CATCHMENT NUMBER
0.92 | 75 — % IMPERVIOUS
AREA IN HECTARES

▨ EXTERNAL LANDS

POST DEVELOPMENT STORM DRAINAGE AREA PLAN

FIGURE No. 4

BluePlan
ENGINEERING

JOB NUMBER 411009
APRIL 2023
Scale: 1:2500

Stormwater Management Facility No. 1 has been designed as a dry pond with approximately 3,030 m^3 of storage. Discharging from this pond will be via a multi-stage outlet consisting of a double inlet catchbasin with a 250 mm orifice for minor storms and a double inlet catchbasin with a 350mm diameter orifice for major storms, as well as a 20 m wide overflow weir.

Catchment 2100 (1.96-hectares, 60% Impervious) represents the north portion of development, including the remainder of Street 2, and a portion of Walser Street. Major and minor storm runoff generated from Catchment 2100 will be directed to Stormwater Management Facility No. 2, ultimately discharging to a tributary of the Grand River via the existing roadside ditch along Gerrie Road.

Catchment 2200 (0.92-hectares, 75% Impervious) represents a portion of the multi-family residential block. Runoff generated from Catchment 2200 will discharge to the roadside ditch along Gerrie Road, and ultimately a tributary of the Grand River. At such time as development of Catchment 2200 proceeds, a privately owned and operated on-site quality and quantity control stormwater management facility will be required to attenuate stormwater runoff to the existing condition level, prior to discharge to the existing roadside ditch along Gerrie Road.

The privately owned and operated on-site stormwater management facility will be designed, reviewed and approved as part of the site plan approval process for the development block. The on-site stormwater management controls which may be utilized include, but are not limited to, a stormwater management facility (i.e. SWM pond), rooftop storage, parking lot ponding (to a maximum depth of 0.3m), below grade storage (i.e. clear stone storage, superpipe storage, etc.) and oil/grit separators. A preliminary stormwater management facility with approximately 2,085 m^3 of storage has been modelled to provide attenuation levels for the post-development runoff generated by Catchment 2200.

Catchment 2300 (0.48-hectares, 10% Impervious) represents the remainder of the existing residential lot on Gerrie Road. Major and minor storm runoff generated from Catchment 2300 will be directed to the existing roadside ditch on Gerrie Road, ultimately discharging to a tributary of the Grand River.

Catchment 2400 (0.80-hectares, 90% Impervious) represents the apartment block. Runoff generated from Catchment 2400 will be directed to Stormwater Management Facility No. 2, ultimately discharging to a tributary of the Grand River via the existing roadside ditch along Gerrie Road.

Stormwater Management Facility No. 2 has been designed as a dry pond with approximately 1,741 m^3 of storage. Discharging from this pond will be via a multi-stage outlet consisting of a 150 mm knockout for minor storms and a 300mm diameter orifice for major storms, as well as a 10 m wide overflow weir.

Quality control treatment (80% TSS removal) for runoff generated from Catchment 2100 and 2400 will be provided by one (1) oil/grit separator structure. The oil/grit separator structure (Stormceptor EF8 or approved equivalent) will be located at the inlet to Stormwater Management Facility No. 2.

Catchment 3100 (0.42-hectares, 60% Impervious) represents five (5) new single family lots and a portion of Walser Street that form part of the Ville Lora Downs North Phase III development. Minor storm runoff generated from Catchment 3100 will be captured and attenuated via a 1350mm diameter super-pipe system which is controlled by a 120 mm diameter orifice plate prior to discharging to on-site storm sewers. The super-pipe system has approximately 75.2 m^3 of storage when combined with storage generated from the storm sewer structures. Runoff from the super-pipe system will be directed to the existing storm sewers on Walser Street. Major storm runoff generated from Catchment 3100 will sheetflow overland to the existing Walser Street right-of-way.

Catchment 3200 (0.13-hectares, 60% Impervious) represents five (5) new single family lots and a portion of Walser Street that form part of the Ville Lora Downs North Phase III development. Minor storm runoff generated from Catchment 3200 will be directed to the existing storm sewers on Walser Street. Major storm runoff generated from Catchment 3200 will sheetflow overland to the existing Walser Street right-of-way.

Catchment 3300 (0.24-hectares, 60% Impervious) represents three (3) new single family lots and a portion of Walser Street that form part of the Ville Lora Downs North Phase III development. Minor storm runoff generated from Catchment 3300 will be directed to the existing storm sewers on Walser Street. Major storm runoff generated from Catchment 3300 will discharge overland to the existing Walser Street right-of-way.

Quality and quantity control for stormwater runoff generated from Catchments 3200 and 3300 will be provided by the existing stormwater management facilities approved and constructed as part of the Villa Lora Downs North Phase II development.

Catchment 4000 (7.33 hectares, 0% impervious) represents the remainder of the site, which is a natural heritage feature consisting of a woodlot and wetland area. Runoff generated from Catchment 4000 will continue to sheetflow overland, ultimately discharging to the existing swale in Drimmie Park and the existing storm sewers on Keating Drive.

Table No. 8 lists the uncontrolled flow rate and runoff volumes generated from each catchment area shown on Figure No. 4, for the 2, 5, 10, 25, 50 and 100-year design storm events and the Regional storm.

Table No. 8: Post-Development Uncontrolled Flow Rate and Runoff Volume

	CATCHMENTS																	
	1000	**1100**	**1200**	**1300**	**1400**	**1500**	**1600**	**4000**	**To Ex. Wetland**	**2100**	**2200**	**2300**	**2400**	**To Roadside Ditch**	**3100**	**3200**	**3300**	**To Walser Street**
2-Year																		
Flow Rate (m^3/s)	0.662	0.009	0.021	0.063	0.024	0.105	0.020	0.001	**0.895**	0.223	0.130	0.011	0.129	**0.489**	0.049	0.014	0.026	**0.088**
Runoff Volume (m^3)	1,213.7	32.9	37.6	120.7	68.2	190.9	37.9	16.2	**1,718.2**	377.7	205.8	42.8	204.6	**830.9**	80.6	25.1	46.4	**152.1**
5-Year																		
Flow Rate (m^3/s)	0.935	0.028	0.029	0.093	0.038	0.146	0.029	0.019	**1.280**	0.304	0.176	0.030	0.177	**0.678**	0.067	0.020	0.037	**0.124**
Runoff Volume (m^3)	2,097.7	76.2	65.1	209.5	133.2	330.9	65.7	156.6	**3,134.8**	638.8	338.3	89.7	329.4	**1,396.1**	136.7	42.5	78.6	**257.8**
10-Year																		
Flow Rate (m^3/s)	1.094	0.043	0.037	0.114	0.056	0.174	0.036	0.050	**1.526**	0.359	0.206	0.045	0.208	**0.805**	0.078	0.024	0.045	**0.147**
Runoff Volume (m^3)	2,751.8	111.7	85.4	275.0	184.0	434.9	86.2	326.8	**4,255.8**	830.1	433.4	127.0	416.9	**1,807.5**	177.6	55.2	102.0	**334.8**
25-Year																		
Flow Rate (m^3/s)	1.292	0.065	0.047	0.144	0.082	0.213	0.046	0.114	**1.852**	0.435	0.245	0.067	0.246	**0.975**	0.091	0.029	0.055	**0.176**
Runoff Volume (m^3)	3,583.9	160.0	111.3	359.0	251.3	568.2	112.3	606.6	**5,752.7**	1,073.0	552.8	177.2	525.3	**2,328.3**	228.9	71.3	131.7	**432.0**
50-Year																		
Flow Rate (m^3/s)	1.452	0.082	0.055	0.169	0.105	0.242	0.054	0.183	**2.124**	0.491	0.275	0.086	0.274	**1.107**	0.102	0.034	0.064	**0.200**
Runoff Volume (m^3)	4,253.0	200.4	132.0	426.7	306.8	675.6	133.5	874.1	**7,002.0**	1,267.8	647.8	218.8	610.7	**2,745.1**	270.7	84.3	155.5	**510.5**
100-Year																		
Flow Rate (m^3/s)	1.610	0.101	0.063	0.194	0.129	0.277	0.062	0.268	**2.406**	0.554	0.306	0.105	0.301	**1.245**	0.114	0.038	0.072	**0.225**
Runoff Volume (m^3)	4,934.5	242.1	152.9	495.5	363.6	785.9	155.1	1,180.1	**8,309.9**	1,466.7	744.1	261.6	696.5	**3,169.0**	313.1	97.5	179.7	**590.2**
Regional Storm																		
Flow Rate (m^3/s)	0.768	0.055	0.027	0.085	0.071	0.129	0.027	0.619	**1.666**	0.232	0.112	0.055	0.102	**0.501**	0.049	0.016	0.029	**0.094**
Runoff Volume (m^3)	16,390.0	1031.7	490.7	1,595.8	1,379.9	2,555.4	496.2	9,470.4	**33,410.0**	4,559.9	2,173.8	1,044.2	1,907.3	**9,685.2**	981.6	301.7	553.4	**1,836.7**

d) Routing

Table No. 9 compares the routing results through the proposed Infiltration Gallery No. 1.

Table No. 9: Catchment 1200, 1300 & 1600 – Infiltration Gallery No. 1 Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used		
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m
Bottom of Stone	0.000	0.0	412.00	---	---	---
2-Year	---	---	---	0.000	104.0	412.30
Top of Stone	0.000	192.1	412.70	---	---	---
CB Lip (1)	0.000	193.0	413.23	---	---	---
5-Year	---	---	---	0.074	194.3	413.51
Regional Storm	---	---	---	0.127	195.4	413.64
10-Year	---	---	---	0.130	195.6	413.66
25-Year	---	---	---	0.213	197.2	413.79
50-Year	---	---	---	0.270	198.4	413.87
100-Year	---	---	---	0.316	199.4	413.93
CB Lip (2)	0.437	202.6	414.09	---	---	---
Overflow	0.928	214.6	414.49	---	---	---

Table No. 10 compares the routing results through the proposed Infiltration Gallery No. 2.

Table No. 10: Catchment 1400 – Infiltration Gallery No. 2 Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used		
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m
Bottom of Stone	0.000	0.0	413.92	---	---	---
2-Year	---	---	---	0.001	55.2	414.12
5-Year	---	---	---	0.001	123.6	414.36
10-Year	---	---	---	0.001	139.6	414.42
Top of Stone	0.001	191.8	414.62	---	---	---
Pipe Invert	0.001	191.8	414.72	---	---	---
25-Year	---	---	---	0.017	191.9	414.83
50-Year	---	---	---	0.046	192.3	415.12
Top of Grate	0.053	192.1	415.12	---	---	---
Regional Storm	---	---	---	0.070	192.9	415.13
100-Year	---	---	---	0.090	193.7	415.14
Weir	1.244	304.7	415.42	---	---	---

Table No. 11 compares the routing results through the proposed Stormwater Management Facility No. 1.

Table No. 11: Catchment 1000, 1100, 1200, 1300, 1400, 1500 (minor) & 1600 – Stormwater Management Facility No. 1 Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used			Drawdown Time (hr)
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	
CB Lip 1 Elevation	0.00	0.0	411.00	---	---	---	---
2-Year	---	---	---	0.097	726.7	411.51	3
CB Lip 2 Elevation	0.105	1,027.6	411.60	---	---	---	---
5-Year	---	---	---	0.234	1,286.5	411.66	4
10-Year	---	---	---	0.323	1,623.0	411.74	4
Weir	0.349	2,195.7	411.85	---	---	---	---
25-Year	---	---	---	0.398	2,237.9	411.86	5
50-Year	---	---	---	0.658	2,458.1	411.90	5
Regional Storm	---	---	---	0.875	2,573.8	411.92	5
100-Year	---	---	---	0.970	2,593.1	411.92	5
Top of Bank	2.018	3,030.1	412.00	---	---	---	---

Table No. 12 gives the results of the post-development condition of the existing wetland.

Table No. 12: Wetland Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used			Drawdown Time (hr)
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	
Wetland Bottom	0.000	0.0	409.63	---	---	---	---
2-Year	---	---	---	0.097	58.6	409.65	6.8
5-Year	---	---	---	0.237	143.1	409.67	8.0
10-Year	---	---	---	0.367	222.3	409.70	8.1
25-Year	---	---	---	0.485	293.3	409.72	8.5
50-Year	---	---	---	0.768	466.3	409.76	8.8
100-Year	---	---	---	1.083	656.4	409.79	8.8
Regional Storm	---	---	---	1.444	875.7	409.82	55.0
Overflow	18.965	15,227.7	410.75	---	---	---	---

Table No. 13 gives the results of the post-development condition drainage channel routing downstream of the existing wetland.

Table No. 13: Wetland (Post-Development Condition Drainage Channel Downstream of Wetland – Section 1 of 2)

	Channel Design Capacity			**Actual Channel Capacity Used**		
	Peak Flow m³/s	**Average Channel Depth m**	**Velocity m/s**	**Peak Flow m³/s**	**Average Channel Depth m**	**Velocity m/s**
2-Year	---	---	---	0.097	0.163	0.544
5-Year	---	---	---	0.237	0.228	0.680
10-Year	---	---	---	0.367	0.269	0.759
25-Year	---	---	---	0.485	0.298	0.813
50-Year	---	---	---	0.768	0.354	0.912
100-Year	---	---	---	1.083	0.403	0.994
Regional Storm	---	---	---	1.444	0.449	1.068
Top of Bank	10.655	0.95	1.602	---	---	---

Table No. 14 gives the results of the post-development condition drainage channel routing downstream of the existing wetland.

Table No. 14: Wetland (Post-Development Condition Drainage Channel Downstream of Wetland – Section 2 of 2)

	Channel Design Capacity			**Actual Channel Capacity Used**		
	Peak Flow m³/s	**Average Channel Depth m**	**Velocity m/s**	**Peak Flow m³/s**	**Average Channel Depth m**	**Velocity m/s**
2-Year	---	---	---	0.097	0.084	0.516
5-Year	---	---	---	0.236	0.140	0.699
10-Year	---	---	---	0.367	0.180	0.806
25-Year	---	---	---	0.484	0.210	0.880
50-Year	---	---	---	0.767	0.270	1.013
100-Year	---	---	---	1.078	0.325	1.120
Regional Storm	---	---	---	1.438	0.378	1.217
Top of Bank	9.246	0.950	1.966	---	---	---

Table No. 15 compares the routing results through the proposed Stormwater Management Facility No. 2.

Table No. 15: Catchment 2100, 2400 – Stormwater Management Facility No. 2 Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used			Drawdown Time (hr)
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	
150mm Knockout	0.00	0.0	410.65	---	---	---	---
2-Year	---	---	---	0.027	400.2	411.06	7
CB Lip Elevation	0.029	442.0	411.10	---	---	---	---
5-Year	---	---	---	0.121	550.4	411.20	8
10-Year	---	---	---	0.141	693.3	411.31	9
25-Year	---	---	---	0.161	911.7	411.48	12
50-Year	---	---	---	0.175	1,094.9	411.62	13
Weir	0.187	1,143.0	411.65	---	---	---	---
Regional Storm	---	---	---	0.268	1,184.5	411.68	13
100-Year	---	---	---	0.306	1,201.9	411.69	13
Top of bank	1.015	1,367.8	411.80	---	---	---	---

Table No. 16 compares the routing results through the proposed super-pipe storage system on Walser Street.

Table No. 16: Catchment 3100 – Super-Pipe Storage System Available Stage/Storage/Discharge

CONTROL	Available Capacity			Actual Capacity Used		
	Peak Flow m³/s	Storage Volume m³	Storage Elevation m	Peak Flow m³/s	Storage Volume m³	Storage Elevation m
Orifice Invert	0.00	0.0	410.62	---	---	---
2-Year	---	---	---	0.022	19.0	411.24
5-Year	---	---	---	0.029	34.3	411.63
10-Year	---	---	---	0.033	45.2	411.91
25-Year	---	---	---	0.038	59.4	412.27
Regional Storm	---	---	---	0.040	67.2	412.47
50-Year	---	---	---	0.041	70.1	412.54
100-Year	---	---	---	0.050	76.2	413.47
CBMH.43 T/G Weir	0.055	77.9	413.92	---	---	---
Overflow	0.160	78.5	414.23	---	---	---

Table No. 17 summarizes the post-development flow rates from the site.

Table No. 17: Summary of Post-Development Flow Rates and Runoff Volumes from the Site

	CATCHMENTS												
	1000, 1100, 1200, 1300, 1400, 1500 (minor), 1600 (controlled)	**1500 (major) (uncontrolled)**	**4000 (uncontrolled)**	**To Ex. Wetland**	**2100, 2400 (controlled)**	**2200 (controlled)**	**2300 (uncontrolled)**	**To Roadside Ditch**	**3100 (minor) (controlled)**	**3100 (major) (controlled)**	**3200 (uncontrolled)**	**3300 (uncontrolled)**	**To Walser Street**
2-Year													
Flow Rate (m^3/s)	0.097	0.000	0.001	**0.097**	0.027	0.008	0.011	**0.043**	0.022	0.000	0.014	0.026	**0.060**
Runoff Volume (m^3)	1,437.5	0.0	16.2	**1,454.3**	582.2	205.8	42.8	**830.9**	80.6	0	25.1	46.4	**152.2**
5-Year													
Flow Rate (m^3/s)	0.234	0.000	0.019	**0.244**	0.121	0.012	0.030	**0.151**	0.029	0.000	0.020	0.037	**0.082**
Runoff Volume (m^3)	2,504.7	0.0	156.6	**2,662.1**	968.1	338.3	89.7	**1,395.2**	136.7	0	42.5	78.6	**257.9**
10-Year													
Flow Rate (m^3/s)	0.323	0.028	0.050	**0.372**	0.141	0.014	0.045	**0.190**	0.033	0.011	0.024	0.045	**0.107**
Runoff Volume (m^3)	3,287.6	10.7	326.8	**3,625.2**	1,247.0	433.4	127.0	**1807.2**	174.4	3.2	55.2	102.0	**334.7**
25-Year													
Flow Rate (m^3/s)	0.398	0.067	0.114	**0.512**	0.161	0.027	0.067	**0.227**	0.038	0.024	0.029	0.055	**0.137**
Runoff Volume (m^3)	4,266.0	46.1	606.6	**4,920.7**	1,598.3	552.8	177.2	**2,329.8**	216.2	12.8	71.3	131.7	**431.9**
50-Year													
Flow Rate (m^3/s)	0.658	0.096	0.183	**0.841**	0.175	0.061	0.086	**0.267**	0.041	0.035	0.034	0.064	**0.163**
Runoff Volume (m^3)	5,038.2	90.8	874.1	**6,000.2**	1,878.4	647.8	218.8	**2,744.6**	246.4	24.2	84.3	155.5	**510.6**
100-Year													
Flow Rate (m^3/s)	0.970	0.131	0.268	**1.235**	0.306	0.099	0.105	**0.454**	0.050	0.047	0.038	0.072	**0.190**
Runoff Volume (m^3)	5,817.0	145.5	1,180.1	**7,146.6**	2,163.2	744.1	261.6	**3,165.4**	273.1	40.0	97.5	179.7	**590.0**
Regional Storm													
Flow Rate (m^3/s)	0.875	0.000	0.619	**1.494**	0.268	0.099	0.055	**0.406**	0.040	0.000	0.016	0.029	**0.077**
Runoff Volume (m^3)	19,977.0	0.0	9,470.4	**29,575.5**	6,467.2	2,173.8	1,044.2	**9,743.4**	981.6	0.0	301.7	553.4	**1,827.1**

The following table compares the proposed release rates to the post-development flow rates for the site.

Table No. 18: Comparison of Release Rates and Post-Development Conditions Flow Rates

DESIGN STORM	To Ex. Wetland		To Tributary of Grand River		To Walser Street	
	Proposed Release Rate (m^3/s)	Post Flow Rate (m^3/s)	Proposed Release Rate (m^3/s)	Post Flow Rate (m^3/s)	Proposed Release Rate (m^3/s)	Post Flow Rate (m^3/s)
2 Year	0.099	0.097	0.043	0.043	0.106	0.060
5 Year	0.353	0.244	0.153	0.151		0.082
10 Year	0.608	0.372	0.264	0.190	0.122	0.107
25 Year	1.001	0.512	0.436	0.227	0.150	0.137
50 Year	1.341	0.841	0.593	0.267	0.173	0.163
100 Year	1.721	1.235	0.765	0.454	0.196	0.190
Regional	1.667	1.494	0.841	0.406	0.080	0.077

Therefore, the post-development runoff generated from the site will be attenuated to the less than the proposed release rates to all outlets.

5.3.4 MINOR / MAJOR DRAINAGE SYSTEM

Minor storm drainage will be conveyed to the proposed stormwater management facilities and the existing storm sewers on Walser Street via storm sewers with the capacity to convey the 5-year design storm event.

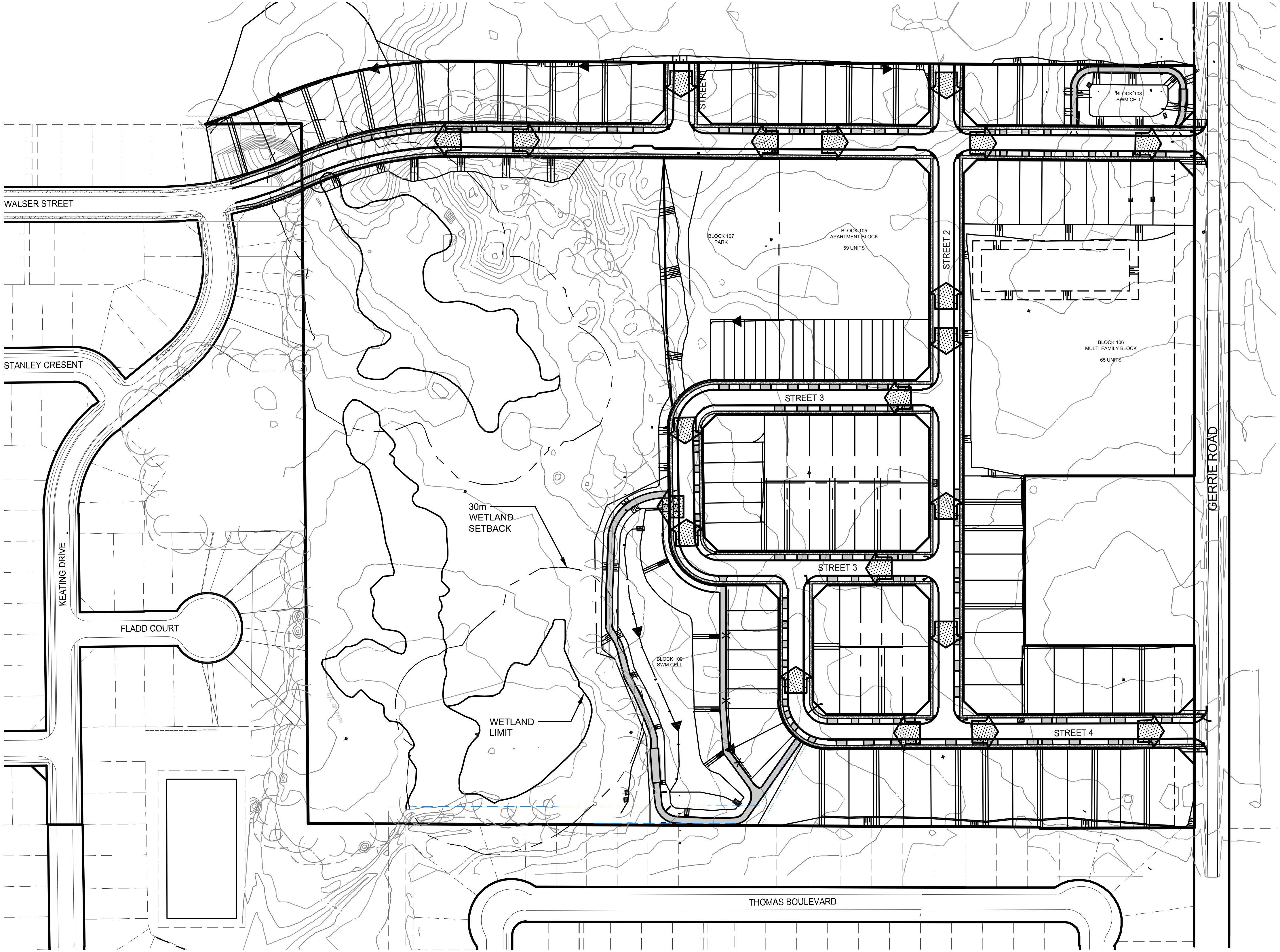
The major storm runoff generated from Street 1, and a portion of Street 2, Street 3 and Street 4 will discharge to the proposed stormwater management facility located east of the existing wetland (Stormwater Management Facility No. 1), which outlets to the existing wetland, ultimately discharging to the existing storm sewers on Keating Drive.

The major storm runoff generated from the remainder of Street 2 and a portion of the Walser Street extension will discharge to the proposed stormwater management facility (Stormwater Management Facility No. 2), ultimately discharging to a tributary of the Grand River.

The major storm runoff generated from the remainder of the Walser Street extension will discharge directly to the existing Walser Street Right-of-Way, ultimately discharging to the Keating Drive Right-of-Way.

Preliminary analysis indicates that the municipal right-of-way has the capacity to convey the runoff from a major design storm event.

The major design storm drainage patterns expected for the Ainley Farm Subdivision are shown on Figure 5.



411009
AINLEY FARM SUBDIVISION
TOWNSHIP OF CENTRE
WELLINGTON (ELORA)

LEGEND

➡ MAJOR OVERLAND FLOW

MAJOR STORM DRAINAGE PATTERN PLAN

FIGURE No. 5

GM BluePlan ENGINEERING

JOB NUMBER 411009
APRIL 2023
Scale: 1:2500

5.4 WATER BUDGET

The average annual precipitation for the site is estimated to be 945.9 mm. This amount is based on precipitation data recorded at the Fergus Shand Dam meteorological station for the period from 1981 to 2010.

From the Preliminary Geotechnical Investigation (CMT Engineering Inc., March 26, 2006), the surficial deposits across the majority of the site are described as native silt tills, with some sandy silt tills. As there are no areas of consistent sandy soils across the site, the characteristics of the silt tills will be used to develop the water budget analysis across the site.

The potential for evapotranspiration for this area is estimated to be 557.8 mm for the pervious surfaces. Therefore, 388.1 mm remain available for infiltration and runoff from the silt till.

Per Table 3.1 of the Stormwater Management Planning and Design Manual (Ministry of Environment, dated 2003), a silt till, which acts similar to clay (hence the low conductivity values), in flat cultivated land has an approximate infiltration rate of 87 mm/yr. Therefore, the runoff is estimated to be 301.1 mm/yr.

Based on the annual infiltration rates, the existing annual average groundwater recharge occurring within the 21.42-hectare site, and 1.20 hectares of external areas discharging to the site, is estimated to be 12,674 m^3. Under post-development conditions, the annual average groundwater recharge occurring on-site and within the external areas naturally is estimated to be 5,473 m^3. The additional annual recharge that will occur on-site via the two (2) proposed infiltration galleries is estimated to be 6,502 m^3, resulting in a total post-development annual recharge rate of 11,974 m^3.

Under existing conditions, the annual average runoff from the site and external areas is estimated to be 68,109 m^3. As a result of the proposed development the impervious area (rooftop and paved surfaces) of the site increases, the annual potential evapotranspiration for impervious surfaces decreases to 200 mm and the runoff from the site increases. The runoff from the site and external areas under post-development conditions is estimated to be 97,828 m^3 per year.

The estimated existing and post-development recharge and runoff volumes for the Ainley Farm Subdivision are detailed in Table No. 19. The estimations take into account the surficial geology, which is comprised mainly of glacial tills. The net recharge values are for the uppermost overburden aquifer. The water budget analysis has been included in Appendix D.

Table No. 19: Summary of Recharge and Runoff Volume

	Existing Condition	Post-Development Condition	Percent Change
Total Estimated Recharge	12,674 m^3	11,974 m^3	-5.5%
Total Estimated Runoff	68,109 m^3	98,828 m^3	+45.1%

The opportunities for further recharge are limited by the high groundwater elevations across the site, as noted in CMT's groundwater monitoring across the site from 2006 to 2016.

6.0 SEDIMENT AND EROSION CONTROL PLAN

A silt fence will be installed along the property boundary. The silt fence will serve to minimize the opportunity for water borne sediments to be transported from the site to the adjacent properties.

Temporary straw bale check dams will be installed in rear yard swales after the initial grading has been completed to slow the flow rates and promote the settlement of water borne sediments before they reach the silt fences and stormwater management facilities.

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

Once catch basins have been installed, the grates will be wrapped in filter cloth. This feature will be maintained until all building and landscaping has been completed.

Inspection and maintenance of all silt fencing and sediment and erosion controls will start after installation is complete. These features will be inspected on a weekly basis or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the controls found to need repair.

Once construction and landscaping within the limits of the subdivision has been substantially completed (75% house building construction is complete), the silt fence will be removed, any accumulated sediment will be collected, and the area will be restored.

After construction of the subdivision, erosion and sediment transport will be minimal.

7.0 MAINTENANCE PLAN

A two-phase maintenance plan is recommended. Phase I will address the short-term more intensive maintenance necessary during and immediately after construction. Once all landscaping has been completed, maintenance will shift to Phase II.

As outlined in the section on Sediment and Erosion Control, Phase I will include weekly inspection of all sediment and erosion control devices plus “as needed” inspection after significant rainfall, with the repair of any damaged works and collection of captured sediment.

Phase II will be the maintenance carried out by the Township of Centre Wellington after all construction has been completed. This work will involve a yearly visual inspection of the stormwater management facilities and catch basins to determine the amount of sediment accumulation. Sediment should be removed as required and the recommended vegetation replanted.

8.0 CONCLUSIONS

From the foregoing analysis, the following conclusions are drawn:

- Water supply for the Ainley Farm Subdivision will be provided via the extension of a 200 mm diameter watermain along the Walser Street extension, Street No. 2 and a portion of Street No. 1. A 150 mm diameter watermain will be extended along the remainder of Street No. 1, Street No. 3, and Street No. 4.
- Sanitary service for the proposed lots along the Walser Street extension and a portion of Street No. 2 will be provided by the extension of a 200 mm diameter sanitary sewer from the existing 200 mm diameter sanitary sewer on Walser Street. Sanitary service for the remainder of the site will be provided by the extension of a 200 mm diameter sanitary sewer on easement from the existing 200 mm diameter sanitary sewer on Keating Drive.
- Storm sewers will be designed to convey the 5-year design storm event and will discharge to the two (2) stormwater management facilities and the existing storm sewer on Walser Street.
- Major storm runoff will be conveyed within the limits of the street right-of-ways to the two (2) stormwater management facilities and the existing Walser Street right-of-way.
- As per the Township of Centre Wellington municipal standards, foundation drainage will be collected in sump pits in each residential unit and pumped to the storm sewer system located within the municipal right-of-way.
- Quantity control for runoff generated from the development will be provided by two (2) stormwater management facilities,
- Quality control for runoff generated from the development will be provided by four (4) oil/grit separators (Stormceptor or approved equivalent).
- The post-development runoff generated from the site will be attenuated to the less than the proposed release rates to all outlets.
- Infiltration rates under post-development conditions are 5.5% less than existing conditions with two (2) infiltration galleries to provide additional recharge. The opportunities for further recharge are limited by the high groundwater elevations across the site, as noted in CMT's groundwater monitoring across the site from 2006 to 2016.
- During the construction phase, the erosion control measures will minimize the transport of sediment off-site during the construction period.

All of which is respectfully submitted.

GM BLUEPLAN ENGINEERING LIMITED
Per:

P. Grier

Patrick Grier, P.Eng.

LICENSED PROFESSIONAL ENGINEER
Apr. 12/23
P.F. GRIER
100188305
PROVINCE OF ONTARIO

PG/

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APPENDIX A

PRELIMINARY GEOTECHNICAL INVESTIGATION

CMT ENGINEERING INC.

MARCH 29, 2006

PRELIMINARY GEOTECHNICAL INVESTIGATION

AINLEY SUBDIVISION
TOWNSHIP OF CENTRE WELLINGTON
VILLAGE OF ELORA, ONTARIO

CMT Project 06-004

Prepared For:

Gamsby and Mannerow Limited

March 29, 2006

CMT ENGINEERING INC.

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
P.O. Box 159
St. Clements, Ontario N0B 2M0
Tel: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

March 29, 2006 06-004.R01

Gamsby and Mannerow Limited
255 Woodlawn Road West, Suite 210
Guelph, Ontario
N1H 8J1

Attention: Mr. Glenn Anderson, C.E.T.

Dear Sir:

Re: Preliminary Geotechnical Investigation
Ainley Subdivision
Township of Centre Wellington
Village of Elora, Ontario

As requested, CMT Engineering Inc. conducted a subsoil investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements and we thank you for this opportunity to have been of service. Should you have any questions, please do not hesitate to contact our office.

Yours very truly,

Robert Koopmans, P.Eng.

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TABLE OF CONTENTS

1.0 INTRODUCTION

The services of CMT Engineering Inc. were retained by Mr. Glenn Anderson of Gamsby and Mannerow Limited to carry out a subsurface investigation for the proposed Ainley Subdivision in the Township of Centre Wellington (Village of Elora).

It is our understanding that single-family and multi-family residences are proposed to be built on the eastern two-thirds of the property. The western one-third of the property is proposed for open space and may contain a storm water management pond.

The purpose of the investigation was to determine the subsurface soil profile, the water levels in the boreholes and provide recommendations with respect to site grading, bearing capacity for house foundations, trench excavations, bedding and backfilling for service pipes, site dewatering, road construction, pavement design recommendations and soil hydraulic conductivity for storm water management design.

2.0 SITE CONDITIONS

The geotechnical investigation was conducted on Part Lot 18, Concession 12 of the Township of Centre Wellington. In general, the eastern two-thirds of the property is currently farm land, while the western one-third is treed. The site topography undulates slightly and the ground surface elevation drops towards the southwest corner of the property.

3.0 FIELD AND LABORATORY PROCEDURES

On January 25, 2006, a track-mount CME 55 drillrig operated by Aardvark Drilling Inc. was used to drill eight (8) boreholes (referenced as Boreholes 101 to 108) to depths of between 3.5 m (11.5 ft) and 5.0 m (16.4 ft) below the existing ground surface elevation. Standard penetration tests were conducted at 0.76 m (2.5 ft) intervals to depths of 3.0 m (10.0 ft) and at 1.5 m (5.0 ft) intervals below 3.0 m (10.0 ft) in all boreholes. Monitoring wells were installed in all eight boreholes to determine the presence and depth of the groundwater table.

Technical staff from CMT Engineering Inc. observed the drilling operation and collected and logged the recovered soil samples. Soil samples taken from Borehole 102 (3.05 to 3.51 m), Borehole 103 (4.57 to 5.03 m), Borehole 105 (2.29 to 2.74 m) and Borehole 107 (2.29 to 2.74 m) were placed in marked sample bags for grain size analyses (refer to Appendix C for laboratory test results). A bulk sample from Borehole 103 (1.5 to 2.0 m) was submitted for laboratory Proctor testing (refer to Appendix D for the laboratory test results). A small portion of each sample was placed in a sealed marked jar for moisture content determinations.

Gamsby and Mannerow Limited surveyed the ground surface elevations for all boreholes, as well as the tops of the monitoring wells.

Drawing 1 shows the site plan with all of the borehole locations.

4.0 SUBSOIL CONDITIONS

The soil conditions at the borehole locations are summarized briefly below, while a more detailed stratigraphic description is provided in the borehole logs in Appendix A. Cross-section profiles through Boreholes 101-103-102-104 and Boreholes 105-106-107-108 are provided in Appendix B.

4.1 Topsoil

Dark brown silt topsoil was found at the top of all eight boreholes. The topsoil was frozen at the time of the investigation. The thickness of the topsoil ranged from 30 mm to 60 mm (average 42 mm).

4.2 Organic Silt

Organic silt was found underlying the topsoil in Borehole 103. The organic silt was saturated, loose and brown with some sand and occasional topsoil nodules. The moisture content of the organic silt was 83.5% and the N-count was 8 blows per 0.30 m.

4.3 Silt or Sandy Silt

Silt was found underlying the sandy silt in Borehole 105. The silt was very moist, loose and brown with some clay, trace sand and trace gravel. The moisture content of the silt was 18.5% and the N-count was 8 blows per 0.30 m.

Sandy silt was found underlying the topsoil in Borehole 102. In general, the sandy silt was moist, compact and brown with a trace of clay and a trace of gravel. The moisture content was 10.4% and the N-count was 12 blows per 0.30 m.

4.4 Silt Till or Sandy Silt Till

Glacial till comprising silt or sandy silt was found in all boreholes (101 to 108). In general, the silt till was moist, compact to very dense and brown with trace to some sand, gravel and clay. The moisture content ranged from 6.8% to 20.4% (average 11.7%) and the N-count ranged from 14 to 100 blows per 0.30 m (average 37 blows per 0.30 m). The sandy silt till was generally moist, compact to very dense and brown with trace to some sand, gravel and clay. The moisture content ranged from 7.6% to 26.7% (average 13.4%) and the N-count ranged from 7 to 100 blows per 0.30 m (average 36 blows per 0.30 m).

4.5 Sand or Silty Sand

Sand was found in Boreholes 101, 102, 105 and 107. In general, the sand was very moist to wet, compact and brown with trace silt and/or trace gravel. The moisture content ranged from 14.3% to 20.0% (average 17.2%) and the N-count ranged from 7 to 22 blows per 0.30 m (average 15 blows per 0.30 m).

Silty sand was found in Boreholes 101, 103, 104, 105, 106 and 108. In general, the silty sand was wet to saturated, compact and brown with occasional trace gravel. The moisture content ranged from 10.5% to 27.7% (average 20.8%) and the N-count ranged from 1 to 25 blows per 0.30 m (average 10 blows per 0.30 m).

4.6 Clayey Silt

A localized layer of clayey silt was found in Borehole 107. The clayey silt was moist, compact and brown with trace sand and trace gravel. The moisture content was 13.6% and the N-count was 11 blows per 0.30 m.

4.7 Groundwater Conditions

Monitoring wells were installed in all boreholes. The monitoring wells were constructed utilizing 50 mm Schedule 40 PVC pipe with a 3 m long slot 10 screen surrounded by the sand filter comprising #3 industrial sand. The boreholes were backfilled with 3/8" bentonite holeplug from the top of the sand filter to the existing ground surface. For protection and security purposes, locking steel protective covers were installed on all of the monitoring wells.

A copy of the well record has been included in Appendix E. It is a requirement of Regulation 903 of the Ontario Water Resources Act that the monitoring well installations be abandoned within 180 days after they are no longer in use.

At the time of writing, the static water levels in the monitoring wells had been read on February 8, 2006, February 20, 2006, March 9, 2006, March 25, 2006 and March 29, 2006. A summary showing the ground surface, borehole bottom and water level elevations for Boreholes 101 to 108 are provided below:

Borehole No.	**Ground Surface Elevation (m)**	**Elevation of Borehole Bottom (m)**	**Elevation of Water Table (m) (F) - Frozen**				
			Feb 8, 2006	**Feb 20, 2006**	**Mar 9, 2006**	**Mar 25, 2006**	**Mar 29, 2006**
101	413.64	408.64	413.07	413.11	412.83	412.96	--
102	414.37	409.37	411.57	411.96	411.91	412.48	--
103	414.89	409.89	412.65	412.98	412.88	412.77	--
104	410.93	407.43	410.36	410.60	410.17	410.66	--
105	414.05	409.28	414.05	414.07 (F)	414.15 (F)	414.15 (F)	414.68
106	410.91	405.94	410.67	410.86 (F)	410.93 (F)	410.75	--
107	409.58	406.08	409.43	409.06 (F)	409.12 (F)	409.41	--
108	410.32	406.82	409.06	409.21	408.82	409.01	--

Due to the close proximity of the groundwater to the ground surface, some of the monitoring wells were frozen at the time of the water level readings.

The groundwater levels will be measured on a monthly basis in an effort to try and establish extreme (high and low) groundwater elevations.

5.0 <u>DISCUSSION</u>

It is our understanding that the property owner is proposing to develop a residential subdivision on the property investigated. The subdivision will be fully serviced with municipal sewers and water supply. A storm water management facility is proposed to be constructed in the western portion of the site.

5.1 Site Grading

Prior to the commencement of any site grading, all topsoil and organic silt soils (Borehole 103) must be removed from the proposed building envelopes (including extended zone of influence areas), road allowance and driveways.

Due to the high water table and isolated wet surface conditions, it may be necessary to utilize an excavator during topsoil stripping to minimize over-excavation as a result of soil disturbance from heavy construction traffic.

At this time, the proposed founding elevations for the residences are not available. However, it would appear that some cut and fill operations will be required to level the building site.

Prior to any placement of structural fill, the subgrade for the building envelope must be prepared large enough to accommodate a 1:1 slope commencing at a distance of 1.0 m beyond the outside edge of the proposed foundation down to approved native founding soils.

Soils approved for use as structural fill must be placed in loose lifts not exceeding 0.3 m (1 ft) in depth for granular soils and 0.2 m (8") in depth for fine grained (silt and clay) soils and compacted using adequate heavy vibratory padfoot compaction equipment to a minimum of 98% standard Proctor maximum dry density (SPMDD). The approved structural fill materials must be free of frozen materials, organics or other deleterious materials and must not contain particles exceeding 150 mm (6") in diameter. The soils must be at moisture contents suitable to achieve the specified compaction.

A laboratory Proctor moisture-density test was performed on a bulk sample of the silt till from Borehole 103 (depth 1.5 to 2.0 m). The results of the laboratory Proctor test indicate that the optimum moisture content of the sample is 8.3%. Since the insitu moisture contents of the split spoon sample of silt till ranged from 6.8% to 20.4% (average 11.7%), it should be anticipated that the majority of the silt till will require air-drying in order to achieve the specified compaction during construction.

The fine grained soils encountered in the geotechnical investigation are highly susceptible to strength losses if subjected to frequent disturbance by construction traffic. Therefore, it is recommended to minimize construction traffic on subgrade soils.

It would be recommended that the site grading and underground service installation be undertaken during drier warm weather conditions in order to minimize dewatering operations, eliminate frost problems and most importantly improve the placement and compaction of structural fill and backfill materials. Proper compaction and backfilling operations are imperative in order to provide adequate support for structures, service pipes, driveway and roadways.

If site grading and site servicing is undertaken during cold or wet weather conditions, projected overall costs would be anticipated to be higher and the project would be expected to take longer to complete.

5.2 Site Dewatering

Based on this geotechnical investigation and similar high water tables encountered during the construction of the neighbouring Ville Lora Downs Subdivision, water concerns should be anticipated for this project. Static water levels measured in the monitoring wells suggest that perched groundwater can be expected at the locations of Boreholes 101, 102, 103, 105 and 106 which were advanced within the proposed residential development area. The water appears to be surface water that has perched on top of the relatively impermeable sandy silt till, sandy silt and silt till soils. Furthermore, artesian conditions can also be expected at the locations of Boreholes 101, 102 and 103. The artesian water appears to be located between the upper sandy silt till and lower silt till in Borehole 101, between the upper and lower silt tills in Borehole 102 and below the silt till layer in Borehole 103.

Provisions for site dewatering should be part of the site development and construction process. Normally, it would be recommended that well points be installed in order to dewater the site so that site services and residential foundations could be installed. However, based on past experience, the installation of a well point dewatering system by qualified contractors can be very expensive and not necessarily guaranteed. It is probably most cost-effective to install a series of inverted drainage pipes in advance of the service (sanitary, storm and water) trench excavations and also at the locations of the manholes. Water pumps should be utilized to pump water from the inverted pipes on a continuous basis in order to keep the water table drawn down below the excavation level. Temporary drainage trenches should be constructed to remove the site water to a storm water retention pond (or reasonable alternative). The removal of considerable amounts of fine soil particles from the pumping operation can be anticipated. As such, the drainage trenches, storm water pond, pumps and hoses will most likely require regular cleanout. It might be cost-effective in regard to road construction and house construction to investigate the possibility of installing a permanent deep drainage system to lower the water table in the immediate area. Caution would be necessary with this option, since it could affect wells and building structures on adjacent properties.

The dewatering conditions may improve if work is conducted during the drier summer months as well as following the installation of the services.

5.3 Excavations

The anticipated sanitary, storm and water pipe invert elevations are all expected to be well below the water table and therefore site dewatering will be required (see Section 5.2 above). Based on observations from the neighbouring Ville Lora Downs Subdivision, the water levels in the summer are generally lower and therefore dewatering requirements may be less. However, the anticipated effects of the artesian water conditions are still expected to be of concern.

All excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

Type 2 Soils: The native glacial till soils would be classified as Type 2 soils under Reg 213/91 and must be sloped to within 1.2 m of the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical. Where excavations expose glacial till soils underlain by wet sand or silt soils, the recommendations for Type 4 soils below must be adhered to.

Type 3 Soils: The native sand and silt soils in an unsaturated condition (above the water table) would be classified as Type 3 soils under Reg 213/91 and must be sloped from the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical.

Type 4 Soils: All native sand or silt soils in a saturated condition (below the water table) would be classified as Type 4 soils under Reg 213/91. Excavations that expose the Type 2 and Type 3 soils noted above but are underlain by saturated sand or silt soils must be treated as Type 4 soils as well. Type 4 soils must be sloped at a minimum gradient of 3 horizontal to 1 vertical. The loose wet condition of the Type 4 soils makes them very susceptible to sloughing and slope failure during excavation.

If it is not practical to excavate according to the above requirements, then a trench box system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized.

It should be noted that some of the native glacial till soils become very dense with depth (N-values in excess of 100 blows per 0.30 m) and may prove difficult to excavate with conventional excavating equipment. It is also imperative that when the very dense soils are utilized for backfilling of service trenches, the material must be broken down (pulverized) to minimize voids and reduce the potential for settlement.

5.4 Service Pipe Bedding

The native soils are generally considered to be suitable for indirect support of the proposed service pipes. Where water inflow is a concern and the soil conditions are not suitable to support the pipe, then 80 mm to 120 mm (3" to 5") river stone (or equivalent) with a 150 mm (6") layer of 19 mm clear stone should be used to create an adequate supporting base for the pipe.

Pipe embedment and backfill for flexible pipes should be undertaken in accordance with OPSD-802.010. Pipe embedment, cover and backfill for rigid pipes should be undertaken in accordance with OPSD-802.030 or OPSD-802.031. Trenching, backfilling and compaction with respect to storm sewer pipe installations should comply with OPSS 514.

Flexible Pipes: The pipe bedding should be shaped to receive the bottom of the pipe. If necessary, pipe culvert frost treatment should be undertaken in accordance with OPSD-803.030 and OPSD-803.031. The trench excavations should be symmetrical with respect to the centreline of the pipe. The granular material placed under the haunches of the pipe must be compacted to 95% SPMDD prior to the continued placement and compaction of the embedment material. The homogeneous granular material used for embedment should be placed and compacted uniformly around the pipe. Should wet conditions be encountered at the base of the trench, then the pipe should consist of 19 mm clear stone (meeting OPS Specifications). Normally, it would be advisable to wrap the clear stone with geotextile to prevent fine soils from entering the clear stone and thereby creating voids around the pipe. In wet conditions, this is not possible to do and generally not necessary since most of the void spaces are quickly filled with fine soils as water (with suspended fine soils) rapidly enters the excavation. It is imperative that the newly installed pipe be backfilled as soon as possible in order to prevent the potential for pipe uplift. This can occur due to buoyancy, as water enters the excavation. It is also advisable to check the elevation of the installed pipe at regular intervals to ensure that uplift has not occurred. Protection against heavy construction equipment should be undertaken in accordance with OPSD-808.010.

Rigid Pipes: In general, the pipe installation recommendations for rigid pipes are the same as those for flexible pipes except that the minimum depth of bedding below a rigid pipe should be 0.15 D (where D is the pipe diameter). In no case should this dimension be less than 150 mm or greater than 300 mm.

5.5 Trench Backfill

Native backfill material can be used to fill the trench from 12" (30 cm) above the pipe to the subgrade elevation provided that the material is free of organics, not frozen and is not overly wet (above the optimum moisture).

Based on the existing water table, the moisture contents determined from soil samples that were taken during the geotechnical investigation, and the laboratory Proctor test (see Appendix C), it can be assumed that most soils will be too wet to enable proper compaction. As such, these soils should be allowed to drain and air-dry as long as possible before backfilling.

If wet or frozen soils are used for backfill purposes, proper compaction of the backfill will not be possible and settlement of the trenches can be expected. Site assessments will be required to determine what options can be undertaken to construct a suitable road base. These options may include subexcavating and increasing the thickness of the granular subbase, the possible use of high strength geotextiles, or a combination of both.

5.6 Sensitivity of Subsoils

The silty nature of many of the soils encountered in the boreholes can make them highly susceptible to strength losses and will prove difficult to place and compact if they become overly wet as a result of inclement weather or water seepage. If the soils become overly wet and disturbed, they may become unsuitable for reuse and require subexcavation. As such, the following is recommended:

- provide proper measures for adequate drainage during construction
- use a smooth-lipped bucket while excavating to the subgrade elevation to reduce disturbance
- minimize construction traffic traveling over the subgrade soils

5.7 Road Construction and Pavement Design

In order to achieve a suitable subgrade for the construction of the pavement structure, the following recommendations are provided:

a) If necessary, maintain the site dewatering system during preparation of the road subgrade. Once the road subgrade is completed, the drainage pipes should be removed or cut off at the subgrade elevation and infilled with lean concrete or a bentonite slurry.

b) The design subgrade for the road should be proof-rolled using heavy rubber-tire equipment, such as a grader. Compactive effort should be applied and compaction tests should be undertaken. Areas requiring fill to achieve the subgrade elevation should be treated as indicated above prior to placement of any additional fill. The subgrade should be evaluated to determine if subexcavation and additional Granular 'B' will be required or if the installation of a reinforcing geotextile will be necessary.

c) The road subgrade should be cut to grade using a smooth-lipped bucket. The subgrade should be graded smooth (with no depressions) and sloped at a minimum of 2%. Construction traffic should not be allowed onto the prepared road subgrade. Construction traffic should travel only on the Granular 'B' subbase. It may be necessary to temporarily increase the thickness of the Granular 'B' during road construction to accommodate the truck traffic.

d) It is recommended that 100 mm diameter perforated subdrains fitted with a filter sock be installed along each curb line to collect and redirect water beneath the pavement surface. It is suggested that the subdrains be installed in a 0.3 m (1 ft) by 0.3 m (1 ft) trench and placed approximately 50 mm (2") from the trench bottom. In drier conditions, the perforated subdrain with a factory-installed filter sock can be installed in Granular 'A' bedding. In wet conditions, 19 mm clear stone wrapped completely in non-woven geotextile (such as Terrafix 270R or equivalent) is recommended. Rapid drainage of the pavement structure is critical to ensure long-term performance of the road.

Based on the anticipated loading and considering that the subsoils contain frost-susceptible soils, the following pavement design is recommended for the proposed roads:

Material	**Recommended Thickness**
Asphaltic Concrete	HL3 - 40 mm (1.5") HL4 or HL8 - 50 mm (2.0")
Granular 'A' Base	150 mm (6.0")
Granular 'B' Subbase	450 mm (18.0")

The granular subbase materials should be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed and compacted to 97% Marshall bulk relative density in accordance with OPSS 1150 and OPSS 310.

The pavement should be designed to ensure that water will not pond on the pavement surface. If the surface asphalt is not placed in a reasonable time following the placement of the binder asphalt, it is recommended that the catch basin lids be lowered or apertures provided to allow the surface water to drain rather than accumulating around the catch basins.

5.8 ***Bearing Capacity / Settlement***

The proposed residential buildings may be supported on conventional spread and pier footings provided they are founded on undisturbed native soils at or below the elevations listed in the following table or structural fill prepared as detailed in Section 5.1 of this report:

Borehole No.	Existing Ground Surface Elevation (m)	Highest Recommended Footing Elevation (m)	Soil Type
101	413.64	413.01	sandy silt till
102	414.37	412.70	silt till
103	414.89	413.59	silt till
105	414.05	411.65	sandy silt till
106	410.91	408.51	silt till

It is ideally recommended that foundations be constructed above the water table. The native founding soils and structural fill in a drained condition would be considered suitable to support foundations designed with a safe net allowable bearing capacity of 150 kPa. It is anticipated that the water table may be within one footing width below the founding elevation. Therefore, a safe net allowable bearing capacity of 75 kPa should be used for design purposes.

With respect to the bearing capacities as determined above, total and differential settlements are estimated to be within the generally acceptable limits of 25 mm (1") and 19 mm (3/4") respectively.

A minimum of 1.2 m (4 ft) of soil cover above the footing grade must be provided for frost protection.

5.9 ***Residential Drainage Considerations***

If high water conditions continue to exist during the construction of the residential foundations, and the foundations are constructed near or below the water table, then the following will be required:

- a granular drainage layer and sump pump will be required as per Section 9.14.4 of the current Ontario Building Code

- slab-on-grades constructed where groundwater levels may cause hydrostatic pressure must be designed to resist such pressures
- slab-on-grade and exterior walls must be waterproofed

If foundation construction occurs above the high water table, then conventional construction methods can be utilized.

5.10 Potential Storm Water Management Facility

Boreholes 104, 107 and 108 were all drilled in the open space area (west side of property) where a storm water management facility is proposed. In general, Borehole 104 has silt till underlain by silty sand. It would appear that artesian conditions are present in the silty sand layer below the more impermeable silt till layer. Based on the monitoring well readings, the water level fluctuates to just below the ground surface elevation.

In general, Borehole 107 has sand underlain by clayey silt and lower sandy silt till. Artesian conditions may be present in the sandy silt till below the more impermeable clayey silt layer. Based on the monitoring well readings, the water level was just below the ground surface elevation. The upper sand layer has a high moisture content due to the infiltration of surface water, which is in turn impeded by the lower clayey silt layer.

In general, Borehole 108 has silty sand underlain by sandy silt till. Artesian conditions may be present in the lower portion of the sandy silt layer below the more impermeable silty sand layer (higher density, lower moisture). Based on the monitoring well readings, the water level has fluctuated to within approximately 1.0 m of the ground surface elevation.

Based on the results of the geotechnical investigation, it can be concluded that the soil and groundwater conditions in the area of Boreholes 104, 107 and 108 are unsuitable for an inground storm water management facility.

6.0 SITE INSPECTIONS

Site grading, dewatering, trench excavations, backfilling and compaction of the service pipes should be supervised by qualified geotechnical personnel to ensure that a suitable subbase is prepared, proper backfill materials are used and that the specified compaction is achieved.

The construction of the pavement structure should also be supervised by qualified personnel to ensure that suitable materials are used and that the specified compaction is achieved. It is also recommended that the residential foundation excavations be examined to ensure that the bearing capacity of the soil is suitable to support the structures.

CMT Engineering Inc. would be pleased to provide inspection, testing and consulting services for this project.

7.0 LIMITATIONS OF THE INVESTIGATION

This investigation was conducted to determine the subsurface conditions for this project and the comments are based on the information gathered at the borehole locations only. It is therefore assumed that the borehole information is representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the borehole locations, we request that we be notified immediately.

This report is intended solely for the client named. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Respectfully submitted,

LICENSED PROFESSIONAL ENGINEER
March 31/06
R. KOOPMANS
PROVINCE OF ONTARIO

Robert Koopmans, P.Eng.
Consulting Engineer

Tim Salter, C.E.T.

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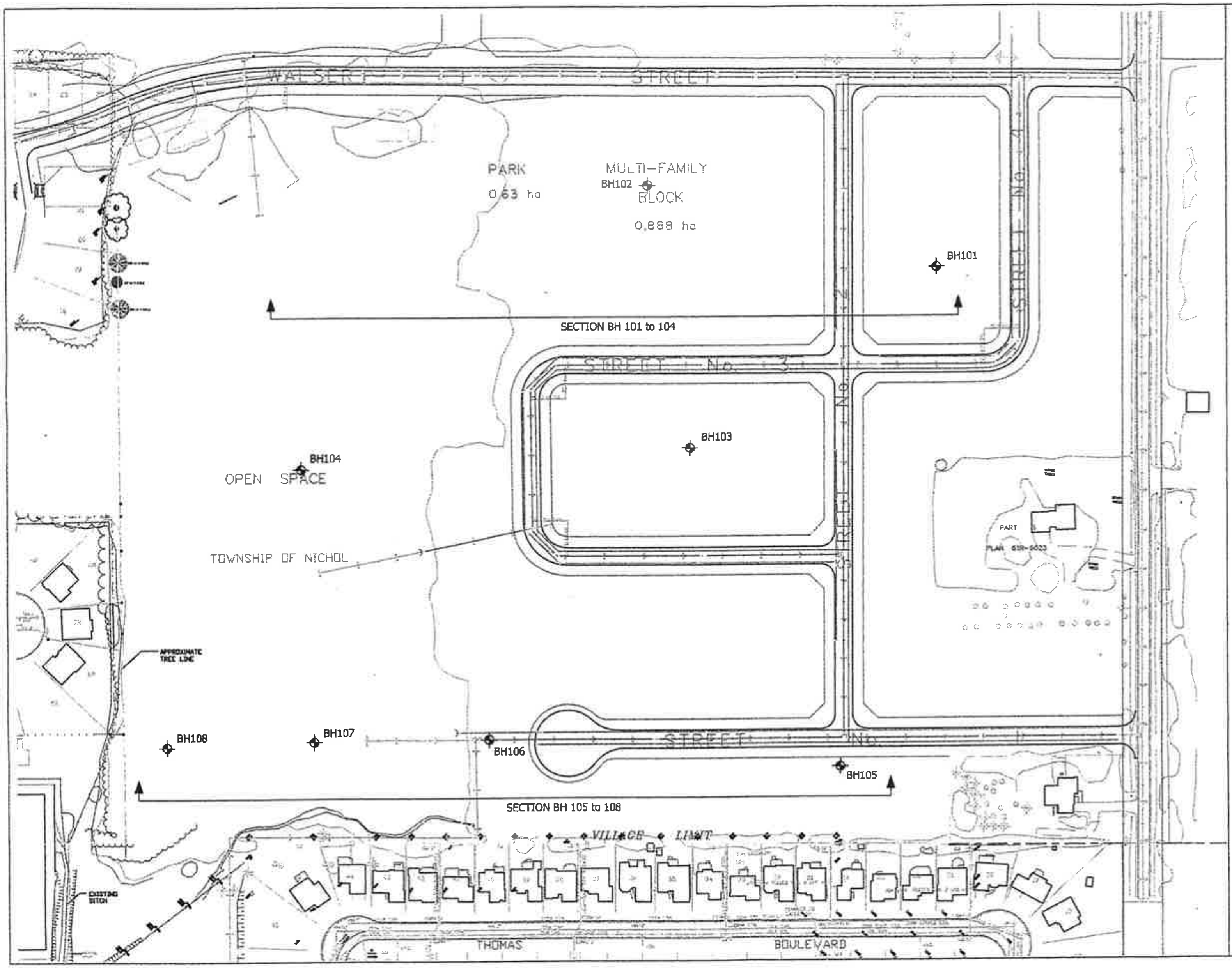


Base plan provided by:

CMT ENGINEERING INC.

1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel.: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

BOREHOLE LOCATION PLAN

Ainley Subdivision
Township of Centre Wellington
Village of Elora, ON

Project: 06-004	Drawing: 2
Date: Mar. 2006	Sheet: 1
Scale: 1:2000	

APPENDIX A

BOREHOLE LOGS
Boreholes 101 to 108

BOREHOLE 101

Page 1 of 1

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

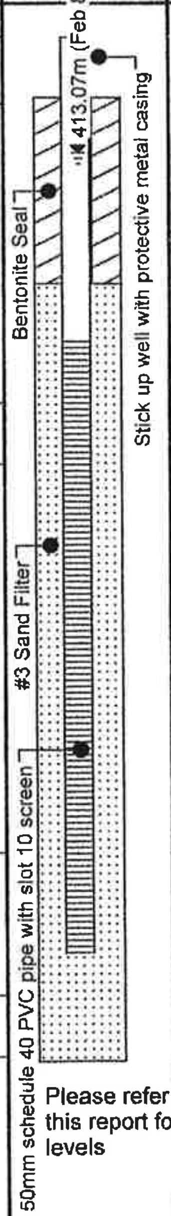
Elevation: 413.64m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

SOIL DESCRIPTION	
Ground Surface (m)	413.64
Topsoil Dark brown silt, frozen	0.00
Sandy Silt Till Compact brown sandy silt till, some clay, some gravel, moist	413.31 0.33
Sand Compact brown sand, very moist to wet	411.84 1.80
Silty Sand Compact brown silty sand, wet spoon sank through silty sand under weight of rods	411.54 2.10
Sand Dense brown sand, trace silt, wet	409.64 4.00
Silt Till Dense brown silt till, some sand, gravel and clay, moist	408.94 4.70
End of Borehole	408.64 5.00

Sample Type	Sample Number	Moisture Content % Wp [----X----] Wl	SPT (N) Blows/0.3 m
SS	1	9.7	22
SS	2	20.7	20
SS	3	24.9	14
SS	4	27.7	1
SS	5	20.4	40

Pocket Penetrometer ● kPa ● 100 300



Please refer to section 4.7 of this report for additional water levels

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

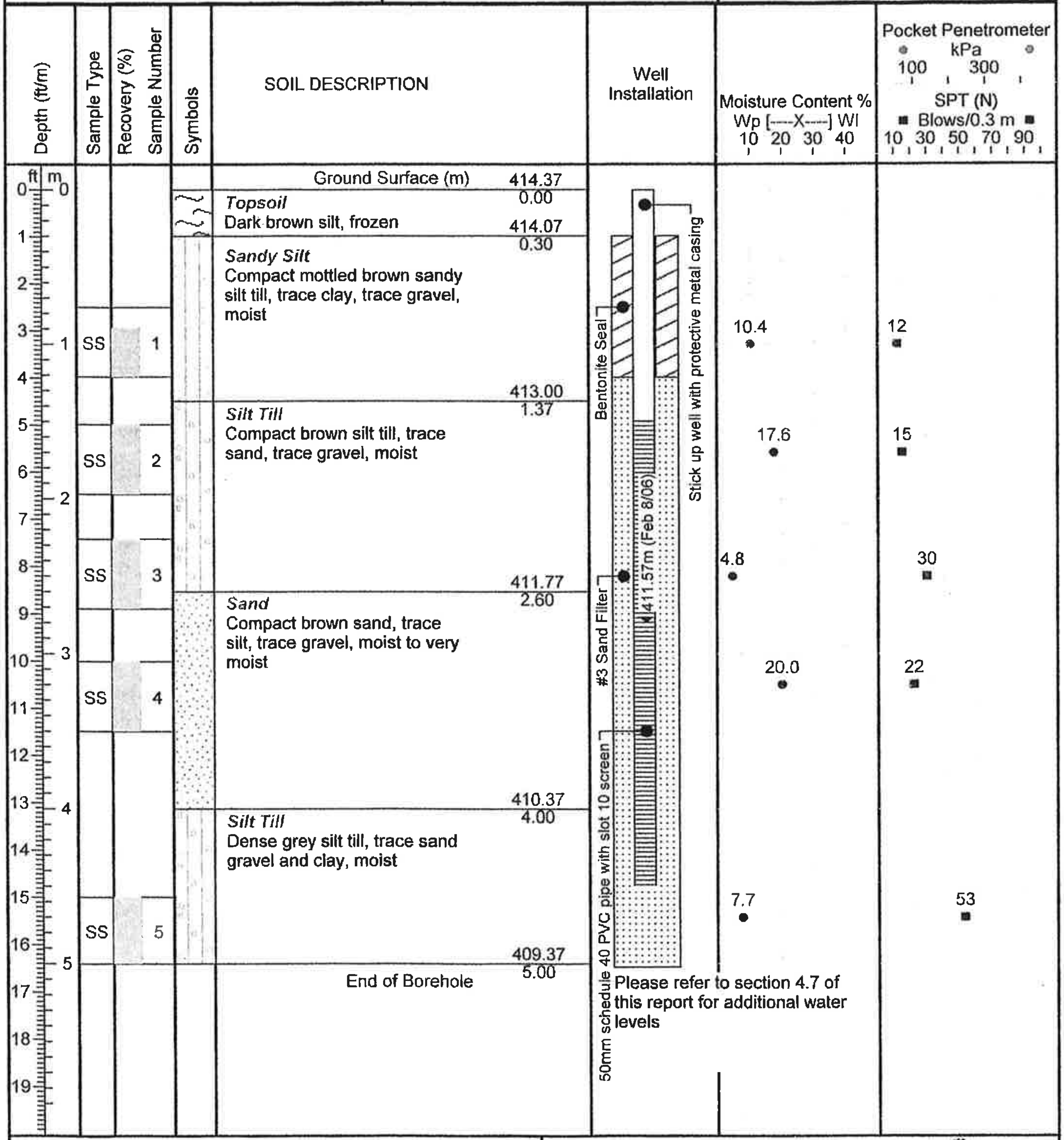
BOREHOLE 102

Page 1 of 1

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 414.37m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora



Ground Surface (m)		414.37
Topsoil Dark brown silt, frozen	0.00	414.07
Sandy Silt Compact mottled brown sandy silt till, trace clay, trace gravel, moist	0.30	413.00
Silt Till Compact brown silt till, trace sand, trace gravel, moist	1.37	411.77
Sand Compact brown sand, trace silt, trace gravel, moist to very moist	2.60	410.37
Silt Till Dense grey silt till, trace sand gravel and clay, moist	4.00	409.37
End of Borehole	5.00	

SS	1	10.4	12
SS	2	17.6	15
SS	3	4.8	30
SS	4	20.0	22
SS	5	7.7	53

Please refer to section 4.7 of this report for additional water levels

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
phone 519-699-5775 fax 519-699-4664
www.cmtinc.net

BOREHOLE 103

Page 1 of 1

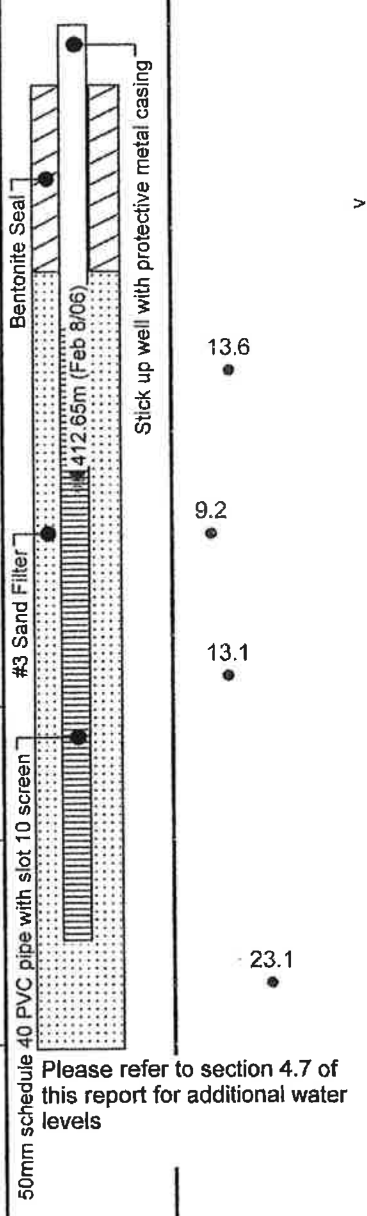
Date Drilled: Jan. 24, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 414.89m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

SOIL DESCRIPTION	
Ground Surface (m)	414.89
Topsoil Dark brown silt, frozen	0.00
Organic Silt Loose brown organic silt, some sand, occasional topsoil nodule, very moist	414.34 0.55
Silt Till Compact brown silt till, trace sand, trace gravel, moist, becoming dense with depth	413.89 1.00
Silty Sand Dense brown silty sand, wet	411.54 3.35
Becoming loose, trace clay, saturated	410.89 4.00
End of Borehole	409.89 5.00

Sample Type	Sample Number	Moisture Content %	Pocket Penetrometer kPa / SPT (N) Blows/0.3 m
SS	1		>508)
AS	2	13.6	20
SS	3	9.2	32
SS	4	13.1	37
SS	5	23.1	6



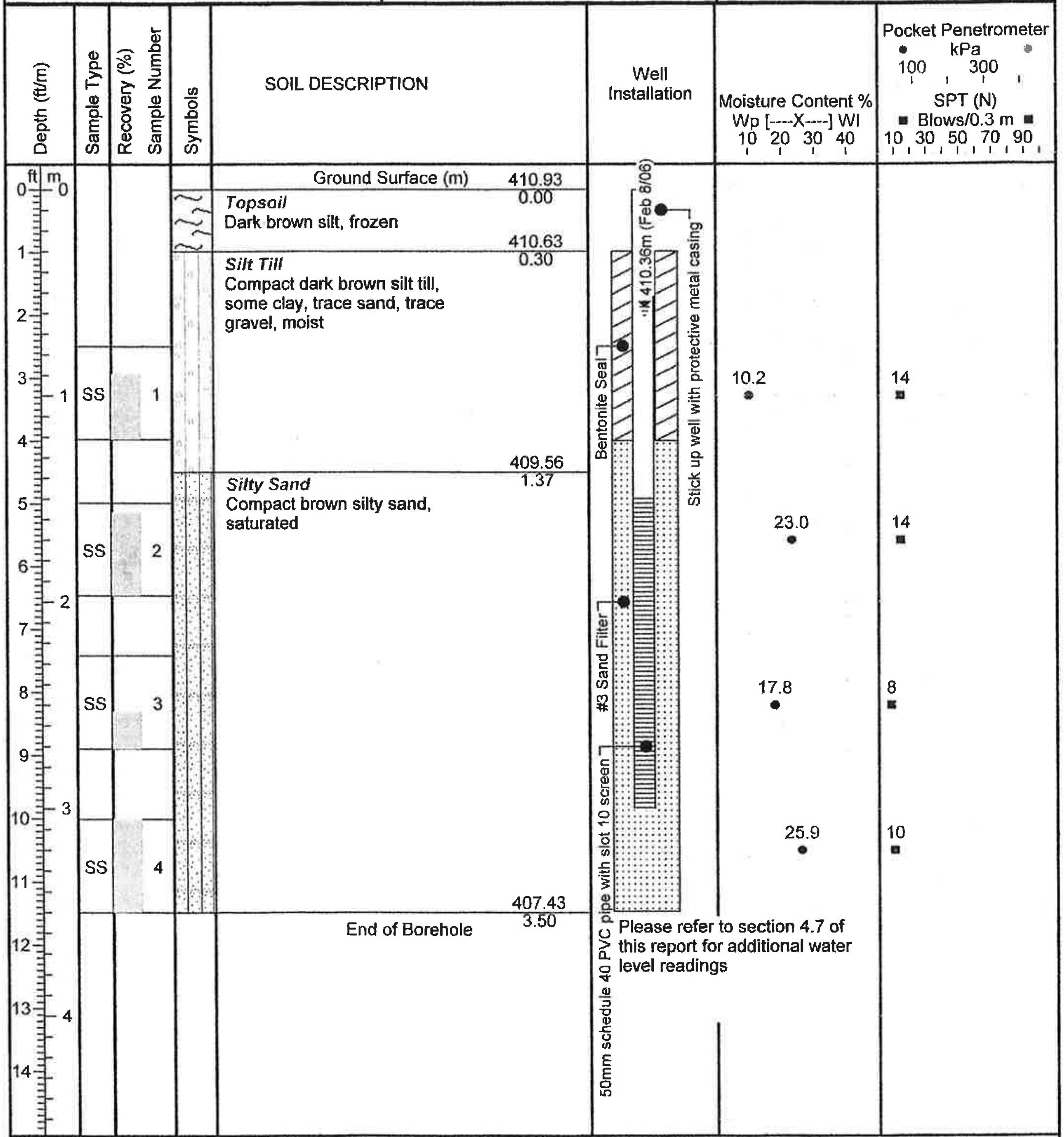
Please refer to section 4.7 of this report for additional water levels

BOREHOLE 104

Date Drilled: Jan. 24, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 410.93m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora



SOIL DESCRIPTION	Elevation (m) / Depth (m)
Ground Surface (m)	410.93
Topsoil Dark brown silt, frozen	0.00
Silt Till Compact dark brown silt till, some clay, trace sand, trace gravel, moist	410.63 0.30
Silty Sand Compact brown silty sand, saturated	409.56 1.37
End of Borehole	407.43 3.50

Sample Type	Sample Number	Moisture Content %	SPT (N)
SS	1	10.2	14
SS	2	23.0	14
SS	3	17.8	8
SS	4	25.9	10

Please refer to section 4.7 of this report for additional water level readings

BOREHOLE 105

Page 1 of 1

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

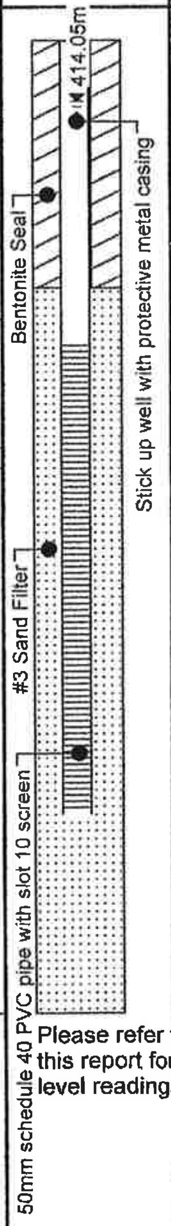
Elevation: 414.05m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

SOIL DESCRIPTION	Elevation (m)	Depth (m)
Ground Surface (m)	414.05	
Topsoil Dark brown silt, frozen		0.00
Silty Sand Loose red-brown silty sand, moist	413.67	0.38
Silt Loose brown silt, some clay, trace sand, trace gravel, very moist	412.68	1.37
Sand wet sand seam at 2.0m depth *Sandy Silt Till* Very dense brown sandy silt till, some clay, trace gravel, moist	412.05	2.00
End of Borehole	409.28	4.77

Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m
SS	1	18.5	4
SS	2	18.5	8
SS	3	7.7	26
SS	4	8.1	100
SS	5	7.6	100

Well Installation



Please refer to section 4.7 of this report for additional water level readings

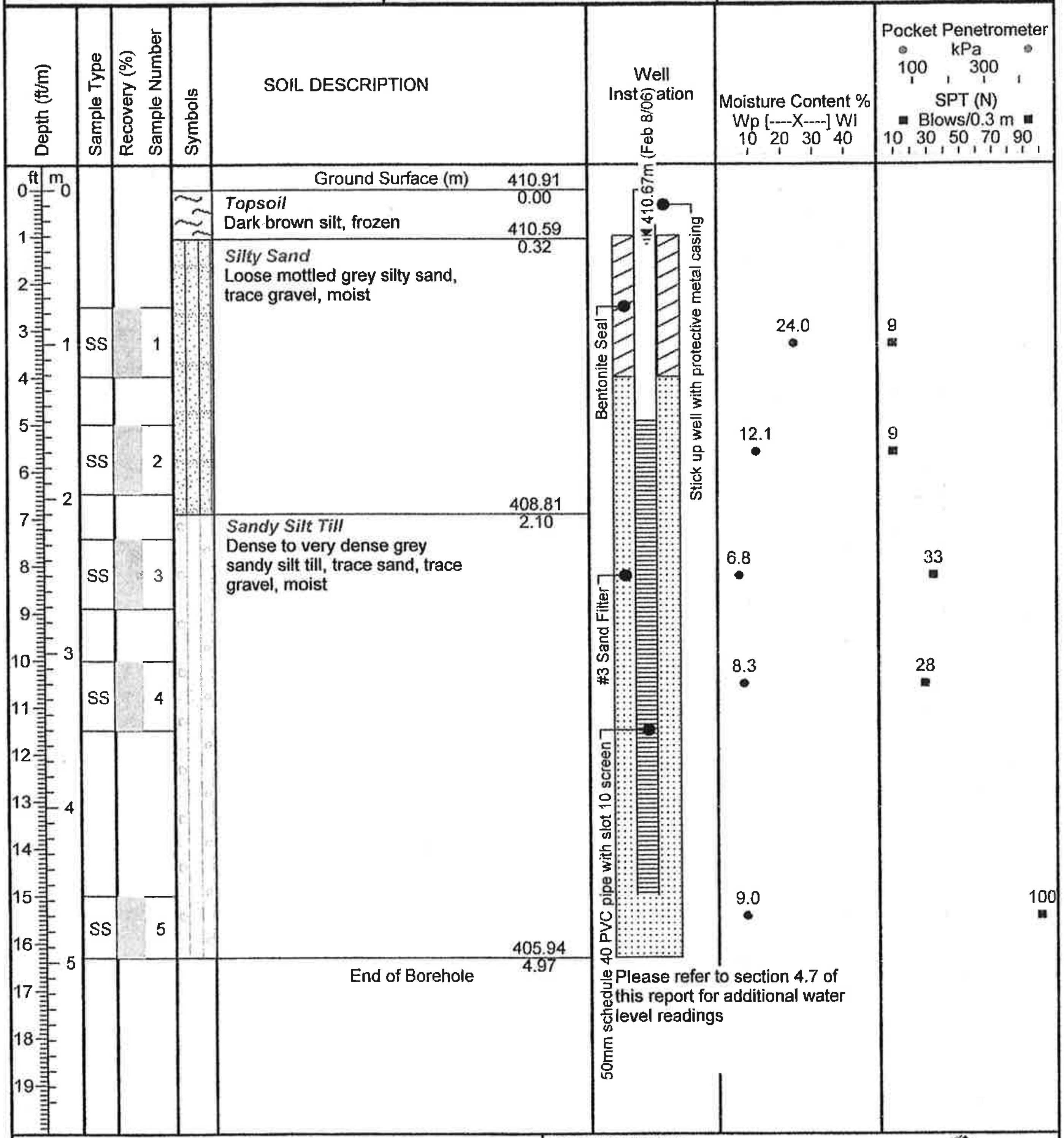
BOREHOLE 106

Page 1 of 1

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 410.91m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora



SOIL DESCRIPTION

Ground Surface (m) 410.91 / 0.00

Topsoil
Dark brown silt, frozen
410.59 / 0.32

Silty Sand
Loose mottled grey silty sand, trace gravel, moist
408.81 / 2.10

Sandy Silt Till
Dense to very dense grey sandy silt till, trace sand, trace gravel, moist
405.94 / 4.97

End of Borehole

Please refer to section 4.7 of this report for additional water level readings

BOREHOLE 107

Page 1 of 1

Date Drilled: Jan. 24, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

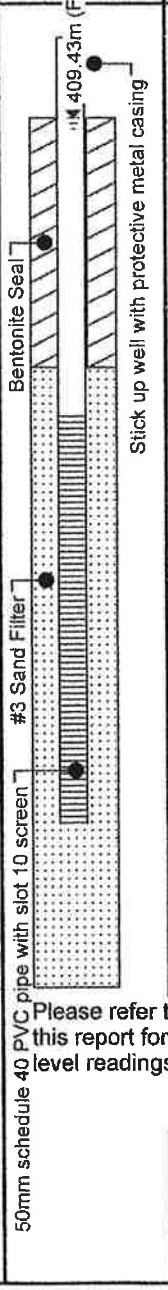
Elevation: 409.58m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora

SOIL DESCRIPTION	
Ground Surface (m)	409.58
Topsoil Dark brown silt, frozen	0.00
Sand Loose red-brown sand, some silt, moist to wet	408.98 0.60
Clayey Silt Compact brown clayey silt, trace sand, trace gravel, moist	408.21 1.37
Sandy Silt Till Compact to loose brown sandy silt till, trace clay, saturated	407.48 2.10
End of Borehole	406.08 3.50

Depth (ft/m)

Sample Type	Recovery (%)	Sample Number	Moisture Content % Wp [----X----] Wl 10 20 30 40	Pocket Penetrometer kPa 100 300 SPT (N) Blows/0.3 m 10 30 50 70 90
SS		1	14.3	7
SS		2	13.6	11
AS		3	19.1	25
SS		4	17.3	7



Please refer to section 4.7 of this report for additional water level readings

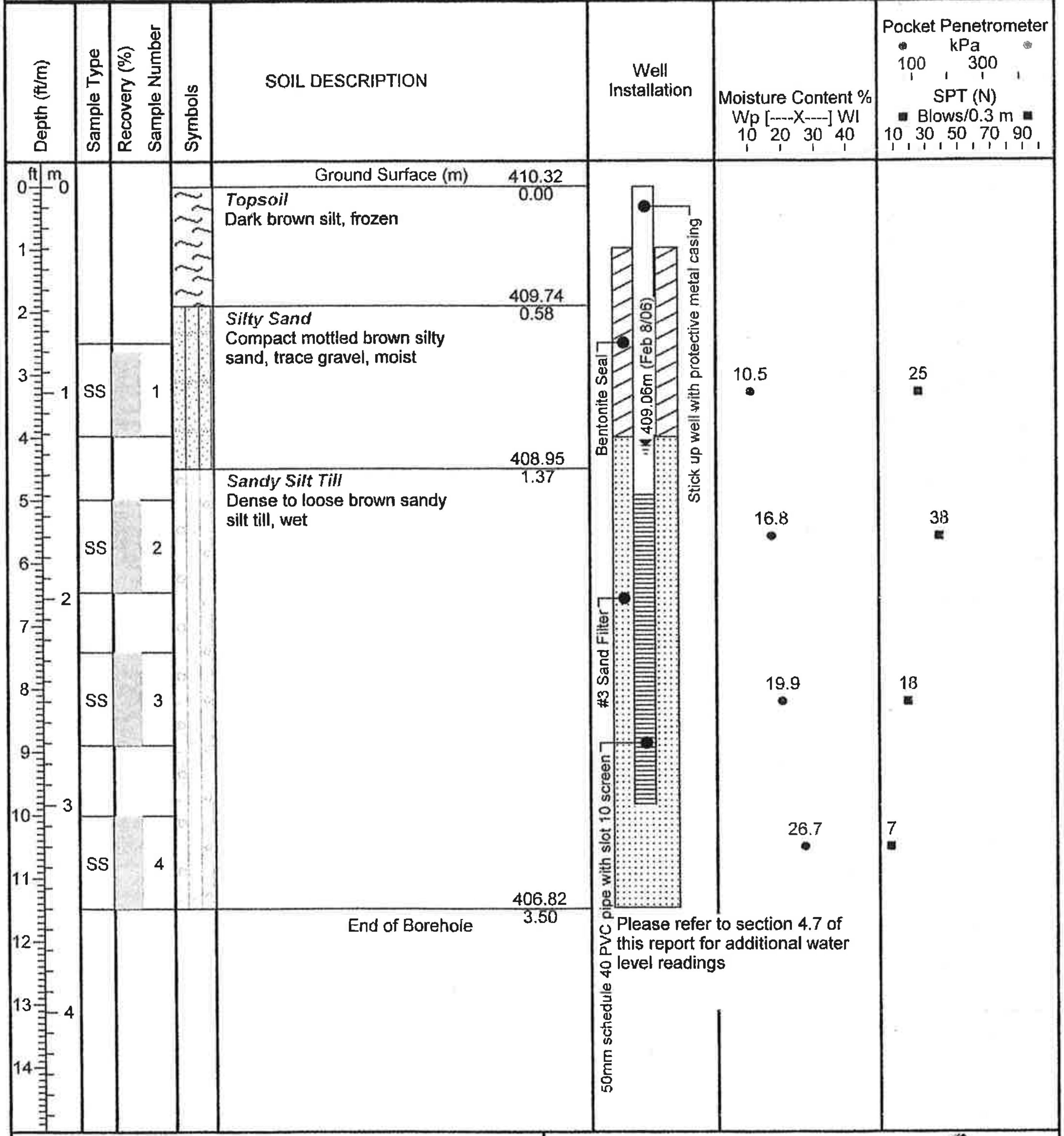
BOREHOLE 108

Page 1 of 1

Date Drilled: Jan. 25, 2006
Rig: CME 55
Contractor: Aardvark
Drilling Method: HSA

Elevation: 410.32m
Logged by: CD

Project No.: 06-004
Project: Ainley Subdivision
Township of Centre Wellington
Location: Elora



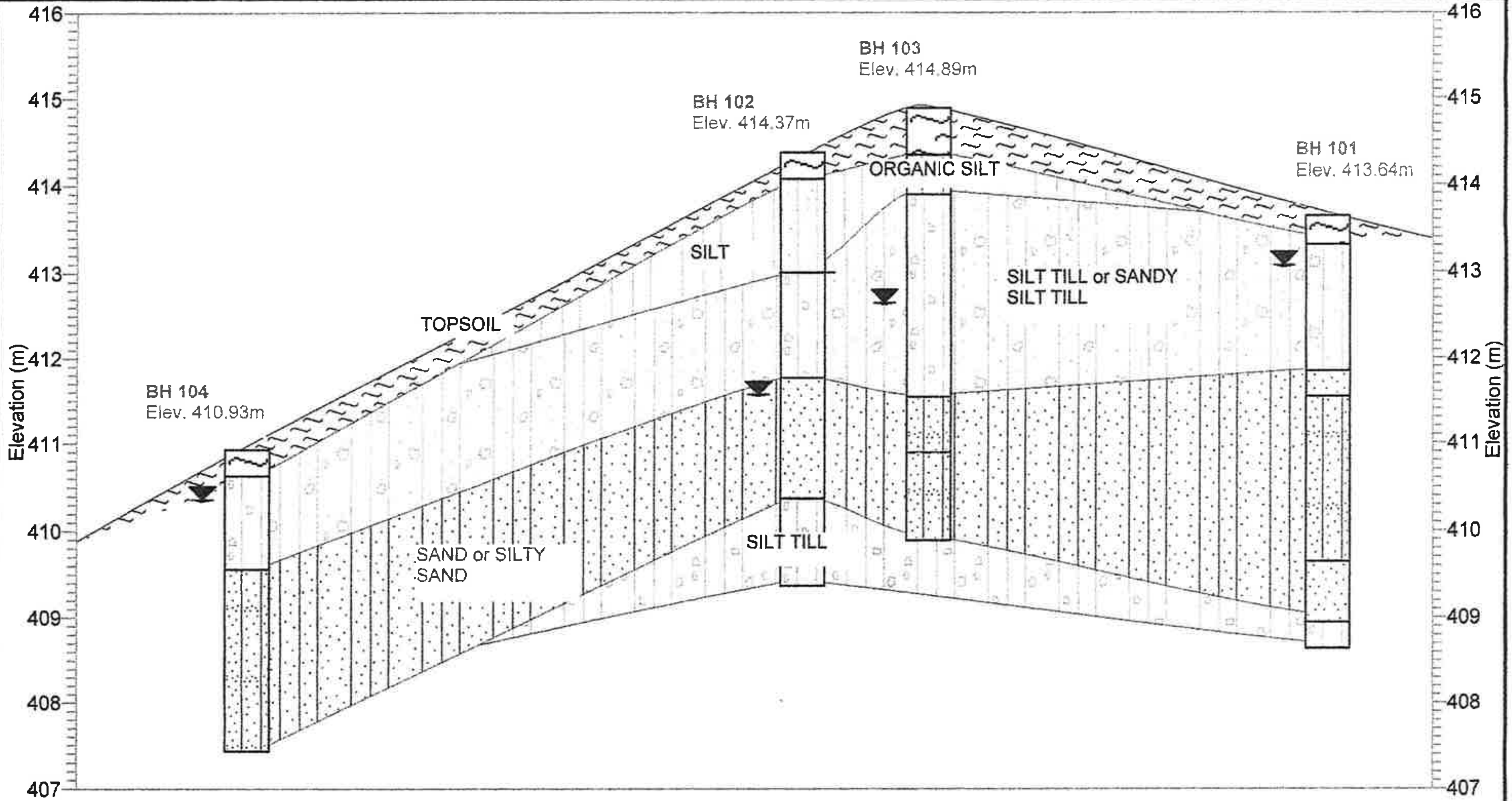
Depth (m)	Elevation (m)	SOIL DESCRIPTION
	410.32	Ground Surface (m)
0.00		*Topsoil* Dark brown silt, frozen
0.58	409.74	*Silty Sand* Compact mottled brown silty sand, trace gravel, moist
1.37	408.95	*Sandy Silt Till* Dense to loose brown sandy silt till, wet
3.50	406.82	End of Borehole

Sample Type	Sample Number	Moisture Content %	SPT (N) Blows/0.3 m
SS	1	10.5	25
SS	2	16.8	38
SS	3	19.9	18
SS	4	26.7	7

Please refer to section 4.7 of this report for additional water level readings

APPENDIX B

CROSS-SECTIONS



CMT ENGINEERING INC.

1011 Industrial Cres.,
Unit 1
St. Clements, Ontario

Project: AINLEY SUBDIVISION

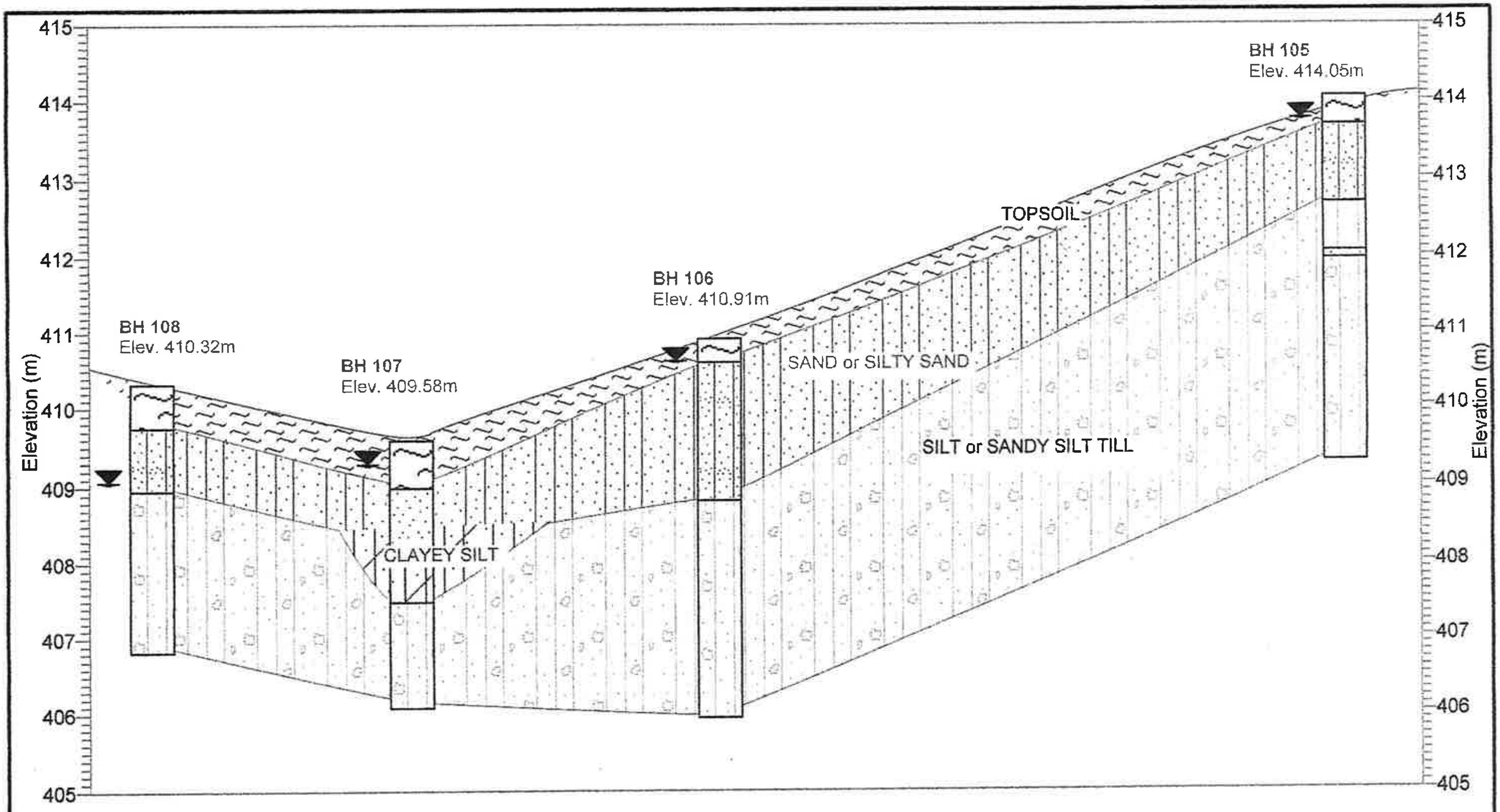
Project Number: 06-004

Location: Elora, Ontario

Drawn By: JS

Date: February, 2006

NOTE: Water levels shown were measured on Feb. 8, 2006. Please refer to Section 4.7 of this report for additional water levels.



1011 Industrial Cres.,
Unit 1
St. Clements, Ontario

Project: AINLEY SUBDIVISION

Project Number: 06-004

Location: Elora, Ontario

Drawn By: JS

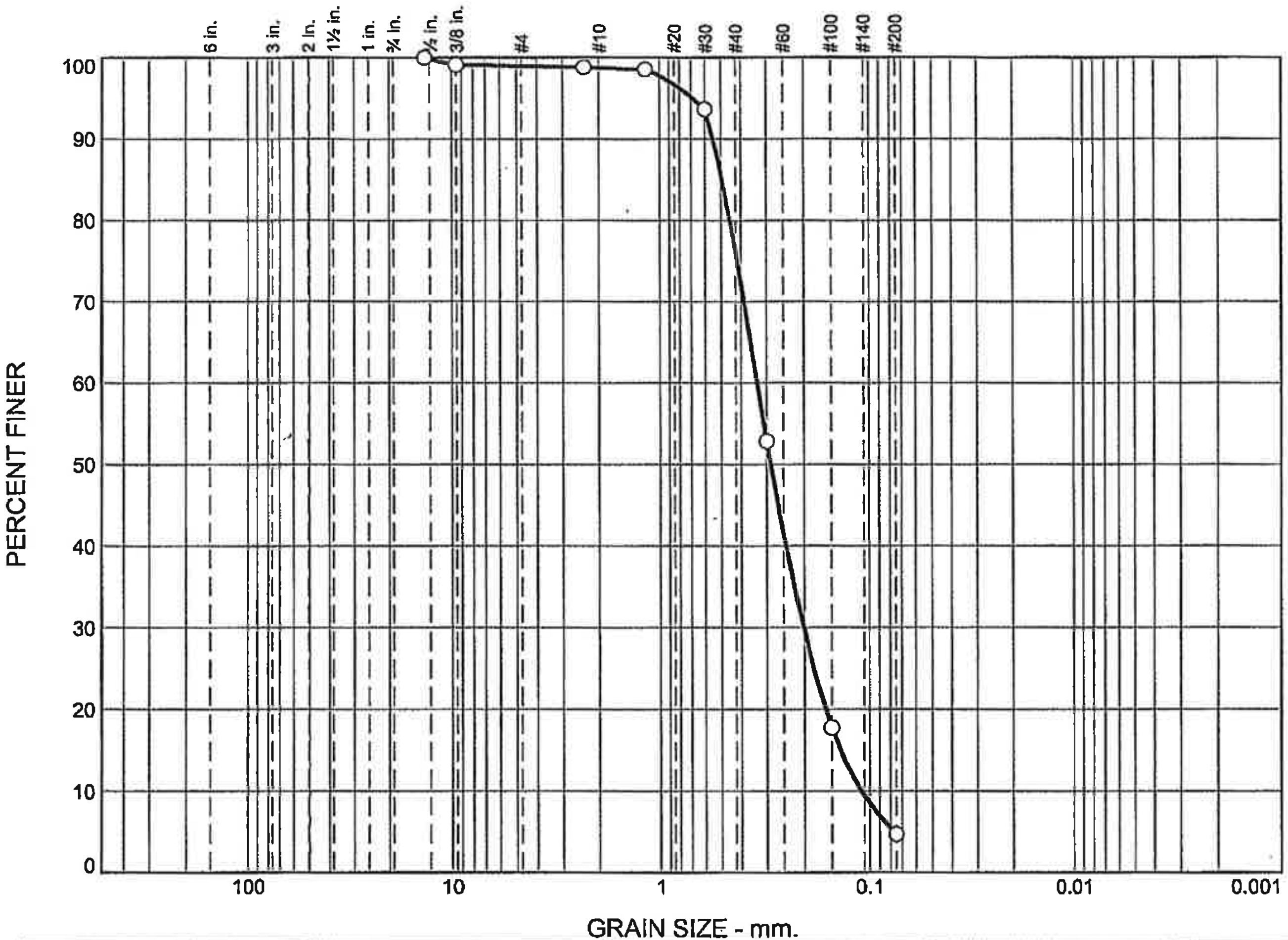
Date: February 2006

NOTE: Water levels shown were measured on Feb. 8, 2006. Please refer to Section 4.7 of this report for additional water levels.

APPENDIX C

GRAIN SIZE ANALYSES

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.2	22.7	71.4	4.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH102 - SS4	1	3.05-3.51m	Sand, trace silt, trace gravel	SP
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

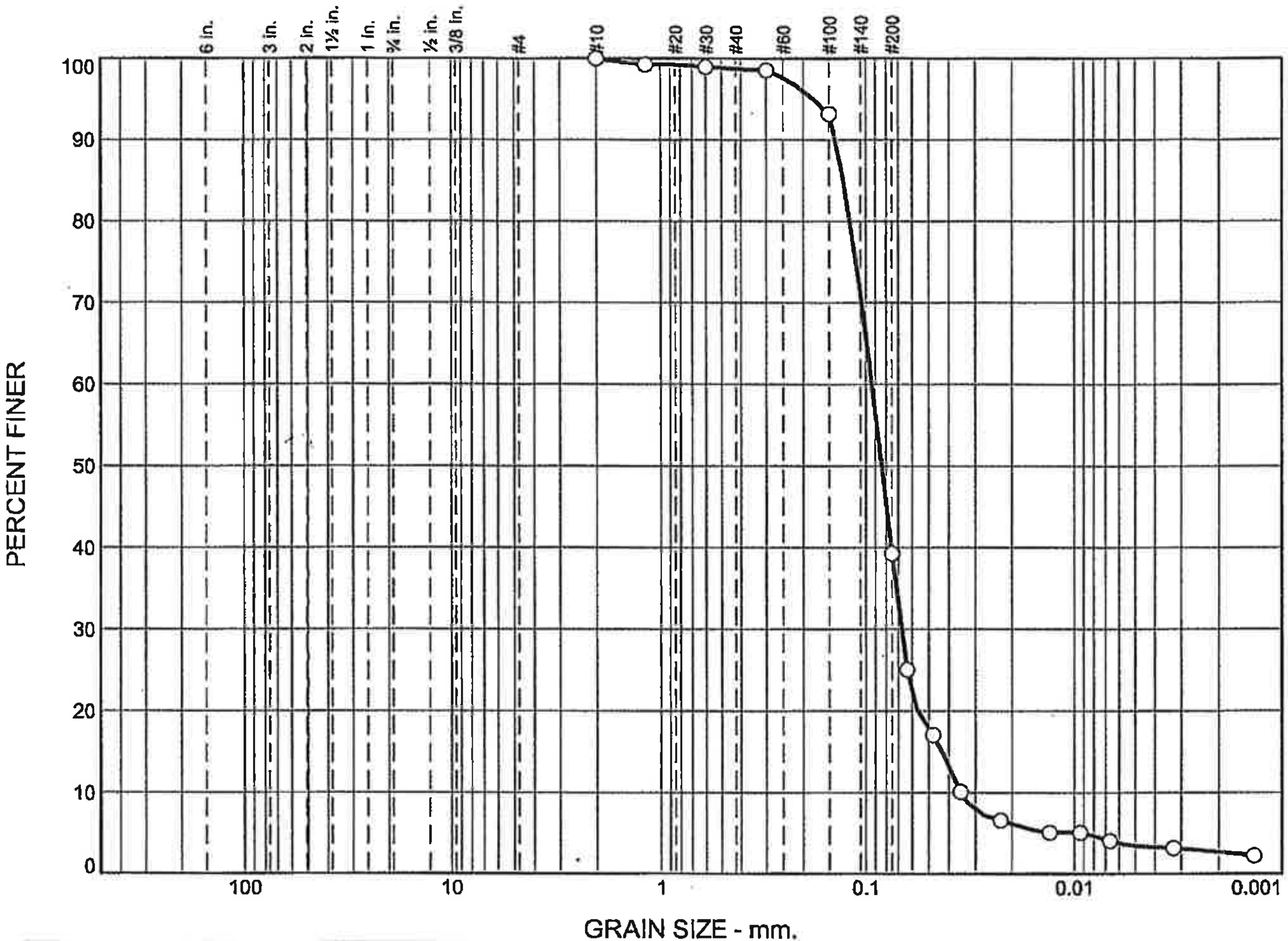
Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 1

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.2	59.5	36.6	2.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH103 - SS5	1	4.57-5.03m	Silty sand, trace clay	SM
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

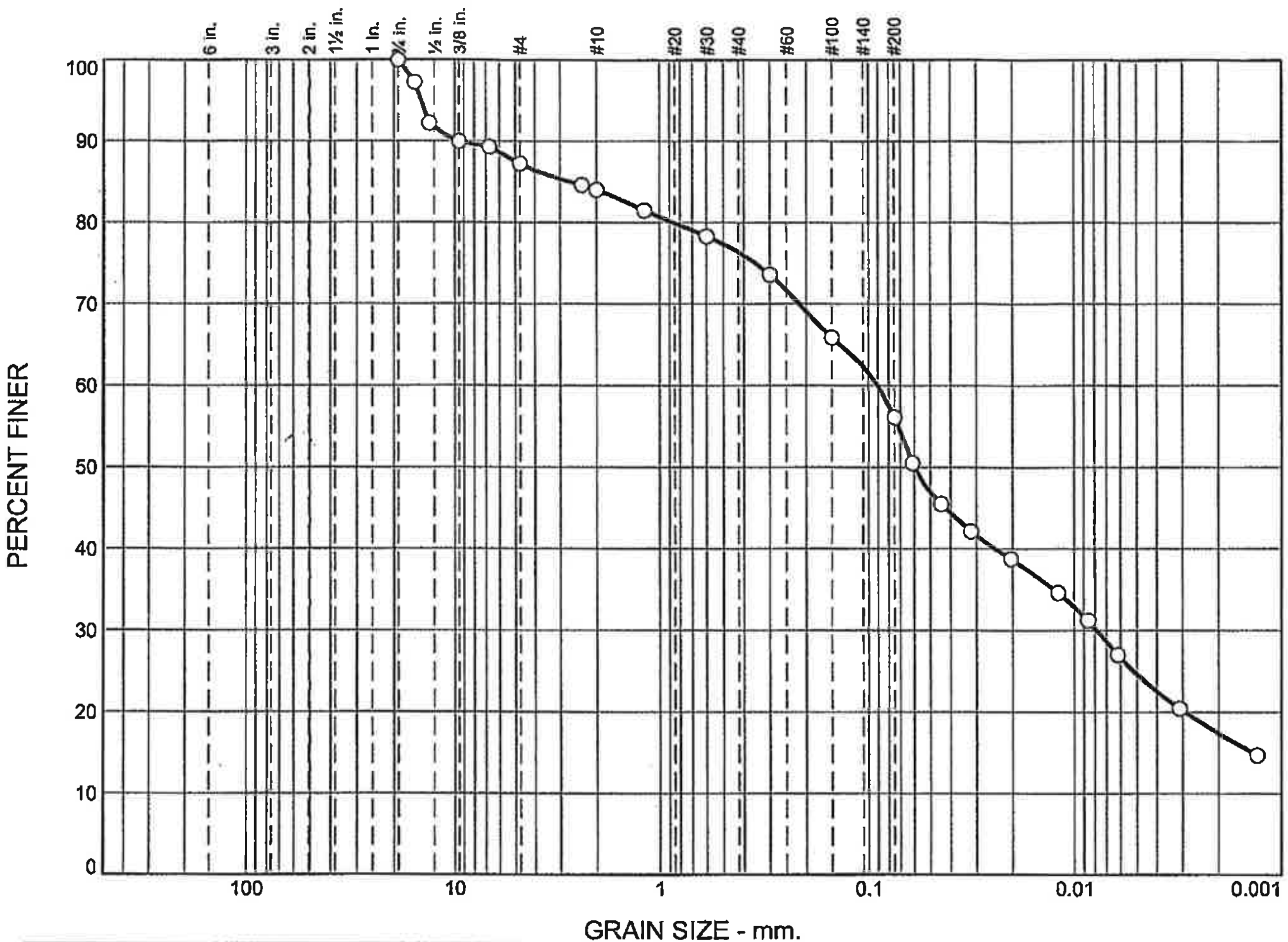
Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 2

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	12.8	3.2	7.6	20.3	38.7	17.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH105 - SS3	1	2.29-2.74m	Sandy silt, some clay, some gravel	ML
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

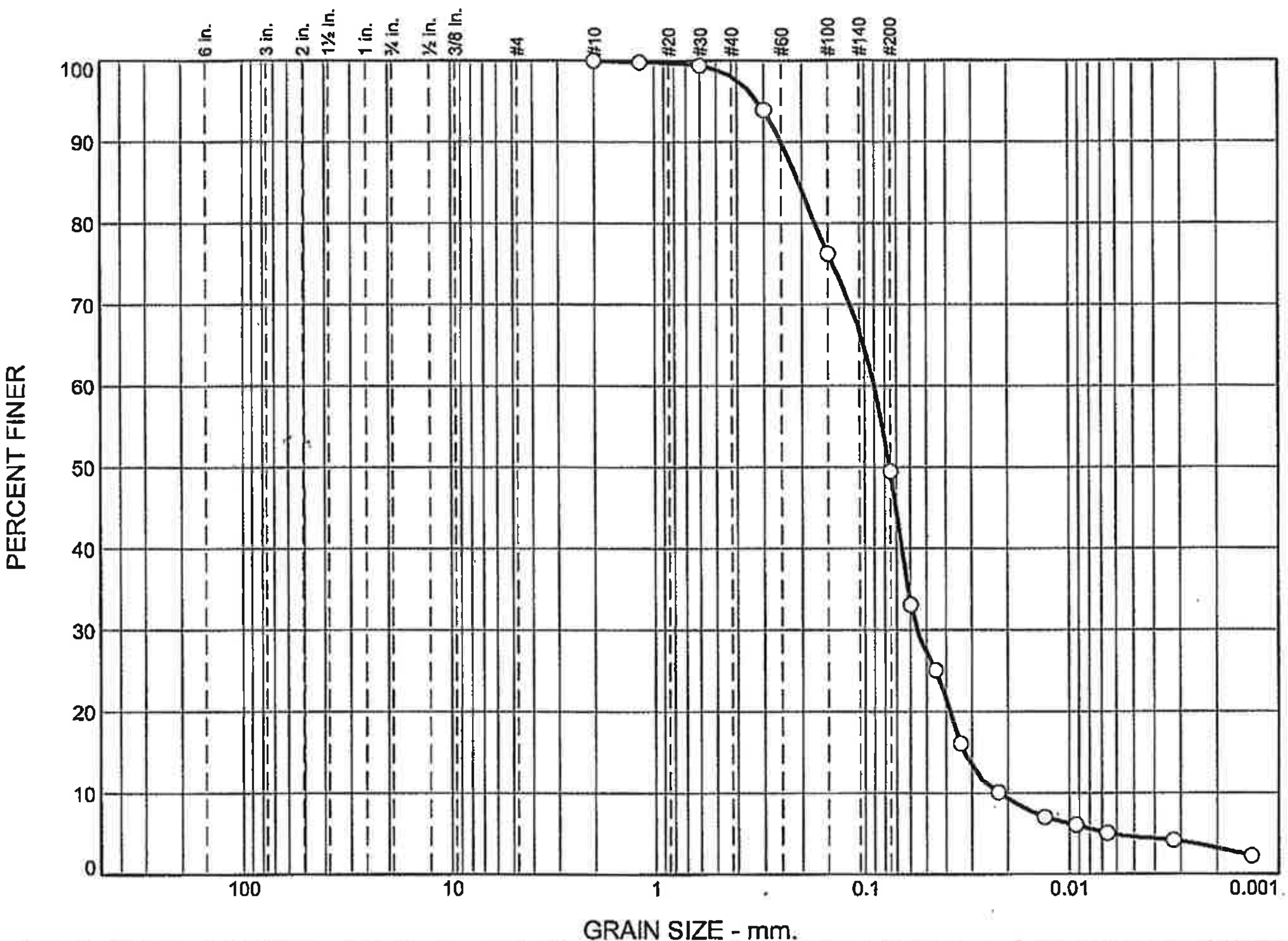
Client: Ainley Subdivision

Project: Township of Centre Wellington
Elora, Ontario

Project No.: 06-004

Figure 3

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.9	48.6	46.3	3.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	BH107 - SS3	1	2.29-2.74m	Sand and silt, trace clay	SM
				Tested by CMT - January 27, 2006	

CMT Engineering Inc.

St. Clements, ON

Client: Ainley Subdivision
Project: Township of Centre Wellington
Elora, Ontario
Project No.: 06-004

Figure 4

APPENDIX D

LABORATORY PROCTOR TEST

CMT ENGINEERING INC.

LABORATORY PROCTOR TEST

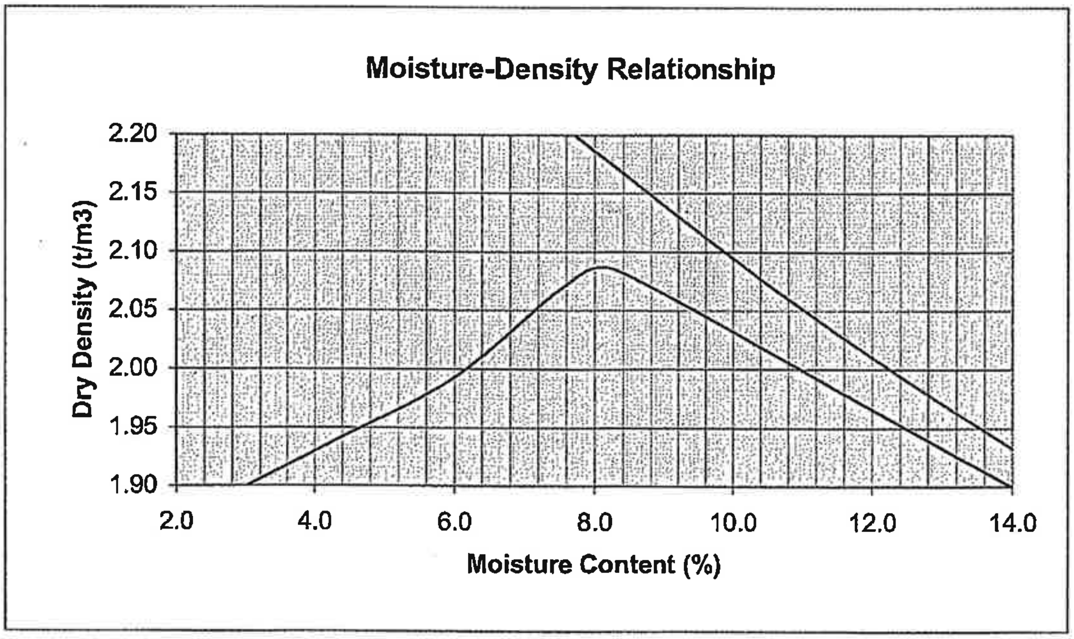
PROJECT NO.: 06-004
PROJECT: Ainley Subdivision
PROJECT LOCATION: Township of Centre Wellington (Elora)

SAMPLED FROM: Borehole 103, BS, depth 1.5 to 2.0 m
DATE SAMPLED/BY: January 25, 2006 by C.D. of CMT Inc.
DATE TESTED/BY: January 26, 2006 by J.S. of CMT Inc.

SOIL TYPE: silt till
REMARKS:

TEST STANDARD:
ASTM D698
PROCEDURE - ☑ A ☐ B ☐ C

ASSUMED SPECIFIC GRAVITY: 2.65
MAXIMUM DRY DENSITY: 2.085 t/m^3
OPTIMUM MOISTURE CONTENT: 8.3%



APPENDIX E

WELL RECORD

Ontario Ministry of the Environment

Well Tag Number (place sticker and/or print below) A035811

A035811

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the Province of Ontario only. This document is a permanent legal document. Please retain for future reference.
- All Sections must be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- All metre measurements shall be reported to 1/10th of a metre.
- Please print clearly in blue or black ink only.

Ministry Use Only
MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name: James
Last Name: Keating
Mailing Address (Street Number/Name, RR,Lot,Concession): Matheson St.
County/District/Municipality:
Township/City/Town/Village: Elora
Province: Ontario
Postal Code:
Telephone Number (include area code):
Address of Well Location (County/District/Municipality): Gerrie Rd.
Township: Center Wellington
Lot: 17-18
Concession: 12
RR#/Street Number/Name:
City/Town/Village: Elora
Site/Compartment/Block/Tract etc.:
GPS Reading: NAD 83 | Zone | Easting: No SIGNAL | Northing
Unit Make/Model:
Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify _____

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Metres To
Brown	SILT TILL			0	1.5
Brown	SILT SAND			1.5	4.5

Hole Diameter

Depth From	Metres To	Diameter Centimetres
0	4.5	72

Water Record

Water found at Metres / Kind of Water
- ☐ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- ☐ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- ☐ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was
☐ Clear and sediment free
☐ Other, specify _____

Chlorinated ☐ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Metres To
Casing				
4	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized		0	1.5
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	Material	Slot No.		
4	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	10	1.5	4.5
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___ hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☐ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	1	Bentonite Pellets	100 lbs
1	4.5	#3 Well Sand	300 lbs

Method of Construction

☐ Cable Tool ☒ Rotary (conventional) ☐ Rotary (reverse) ☐ Rotary (air) ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving ☐ Digging ☐ Other

Water Use

☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Commercial ☐ Municipal ☐ Public Supply ☐ Not used ☐ Cooling & air conditioning ☐ Other

Final Status of Well

☐ Water Supply ☒ Observation well ☒ Test Hole ☐ Recharge well ☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Unfinished ☐ Dewatering ☐ Replacement well ☐ Abandoned, (Other)

Well Contractor/Technician Information

Name of Well Contractor: Aardvark Drilling Inc
Well Contractor's Licence No.: 7738
Business Address (street name, number, city etc.): C-25 Lewis Rd. Guelph On N1H 1E9
Name of Well Technician (last name, first name): Henry, Nathan
Well Technician's Licence No.: T-3305
Signature of Technician/Contractor: X
Date Submitted YYYY MM DD: 2006 02 01

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.

Audit No. Z 39731
Date Well Completed YYYY MM DD: 2006 01 25
Was the well owner's information package delivered? ☐ Yes ☒ No
Date Delivered YYYY MM DD: 2006 02 01

Ministry Use Only
Data Source | Contractor
Date Received YYYY MM DD | Date of Inspection YYYY MM DD
Remarks | Well Record Number

0506E (09/03)

Contractor's Copy ☑ Ministry's Copy ☐ Well Owner's Copy ☐

Cette formule est disponible en français.

APPENDIX B

GROUNDWATER ELEVATION MONITORING

CMT ENGINEERING INC.

JANUARY 2016

CMT Engineering Inc.
CONSULTING ENGINEERS
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

January 20, 2016 06-004.L85

GM BluePlan Engineering Limited
330 Trillium Drive, Unit D
Kitchener, Ontario
N2E 3J2

Attention: Mr. Glenn Anderson, C.E.T.

Dear Sir:

Re: Groundwater Monitoring
Ainley Subdivision
Elora, Ontario

Attached is a current summary of the water level measurements for the above-referenced site. The graphs include total monthly precipitation as recorded at the Environment Canada Fergus MOE Weather Station.

I trust this information meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Yours very truly,

Tim Salter, C.E.T.

ks

1cc: Tom Keating - James Keating Construction Ltd.

Encl - Water Level Measurements

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Feb 8/06	Water Elevation (m) Feb 20/06	Water Elevation (m) Mar 9/06	Water Elevation (m) Mar 25/06	Water Elevation (m) Mar 29/06	Water Elevation (m) Apr 28/06	Water Elevation (m) June 6/06	Water Elevation (m) July 8/06	Water Elevation (m) Aug 7/06	Water Elevation (m) Sept 7/06
101	413.64	413.07	413.11	412.83	412.96	--	412.94	412.59	411.70	411.34	411.00
102	414.37	411.57	411.96	411.91	412.48	--	412.43	412.12	411.78	411.43	411.14
103	414.89	412.65	412.98	412.88	412.77	--	412.76	411.55	410.95	410.43	410.31
104	410.93	410.36	410.60	410.17	410.66	--	410.69	410.15	409.15	408.71	408.52
105	414.05	414.05	414.07 (F)	414.15 (F)	414.15 (F)	414.68	413.44	412.86	412.27	412.06	411.59
106	410.91	410.67	410.86 (F)	410.93 (F)	410.75	--	410.54	410.36	409.93	409.89	409.39
107	409.58	409.43	409.06 (F)	409.12 (F)	409.41	--	409.42	409.03	408.11	408.00	407.63
108	410.32	409.06	409.21	408.82	409.01	--	408.99	408.43	407.94	407.76	407.11

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Oct 6/06	Water Elevation (m) Nov 11/06	Water Elevation (m) Dec 7/06	Water Elevation (m) Jan 9/07	Water Elevation (m) Feb 12/07	Water Elevation (m) Mar 8/07	Water Elevation (m) Apr 10/07	Water Elevation (m) May 12/07	Water Elevation (m) June 11/07	Water Elevation (m) July 11/07
101	413.64	410.83	412.67	412.97	413.03	412.11	411.61	413.02	412.75	411.87	411.42
102	414.37	411.00	411.25	411.71	411.99	411.69	411.45	412.14	411.96	411.67	411.38
103	414.89	410.36	411.10	411.91	412.27	411.05	410.66	412.50	411.59	410.97	410.54
104	410.93	408.71	409.13	409.45	409.65	409.12	408.96	409.78	409.39	409.24	408.92
105	414.05	411.95	413.94	413.71	413.90	412.95	412.65	413.72	413.29	412.51	412.11
106	410.91	410.13	410.74	410.57	410.59	410.28	410.22	410.55	410.50	410.07	409.59
107	409.58	408.28	408.94	409.11	409.16	408.60	408.43	409.25	409.01	408.24	407.71
108	410.32	407.62	408.21	408.48	408.57	408.07	407.93	408.69	408.36	407.96	407.57

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Aug 15/07	Water Elevation (m) Sept 13/07	Water Elevation (m) Oct 12/07	Water Elevation (m) Nov 8/07	Water Elevation (m) Dec 11/07	Water Elevation (m) Jan 15/08	Water Elevation (m) Feb 12/08	Water Elevation (m) Mar 8/08	Water Elevation (m) Apr 13/08	Water Elevation (m) May 8/08
101	413.64	411.01	410.72	410.50	410.35	410.33	412.73	412.92	413.00	413.19	413.05
102	414.37	411.13	410.98	410.87	410.81	410.77	411.26	411.53	411.80	412.92	412.46
103	414.89	410.34	410.36	410.36	410.36	410.36	411.29	411.74	412.03	413.40	412.50
104	410.93	408.73	408.61	408.57	408.58	408.76	409.70	409.66	409.81	410.70	410.35
105	414.05	411.67	411.34	411.22	411.22	411.22	414.00	414.11	414.10 frozen	413.99	413.71
106	410.91	409.22	408.99	408.89	408.89	409.44	410.63	410.61	410.64	410.77	410.69
107	409.58	407.49	407.40	407.43	407.52	407.91	409.20	409.05	409.10	409.52	409.35
108	410.32	407.36	407.37	407.37	407.37	407.52	408.52	408.50	408.57	409.19	408.89

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) June 10/08	Water Elevation (m) July 8/08	Water Elevation (m) Aug 1/08	Water Elevation (m) Sept 10/08	Water Elevation (m) Oct 8/08	Water Elevation (m) Nov 17/08	Water Elevation (m) Dec 17/08	Water Elevation (m) Jan 23/09	Water Elevation (m) Feb 20/09	Water Elevation (m) Mar 18/09
101	413.64	412.58	412.60	412.55	411.67	410.86	413.08	413.135	412.725	412.960	413.053
102	414.37	412.13	412.06	411.95	411.57	410.30	411.52	411.979	412.147	412.419	412.772
103	414.89	411.53	411.60	411.56	410.86	410.64	412.14	412.746	411.796	412.600	413.046
104	410.93	409.86	409.71	409.76	409.34	408.18	409.98	410.183	409.902	410.238	410.670
105	414.05	412.96	412.87	412.93	412.26	411.60	413.99	413.969	413.221	414.066 (F)	414.070 (F)
106	410.91	410.83	410.24	410.36	410.28	409.04	410.78	410.67	410.567	411.010 (F)	410.963 (F)
107	409.58	409.00	408.72	408.86	408.40	407.36	409.24	409.249	409.009	409.246	409.502
108	410.32	408.33	408.20	408.29	407.95	406.82	408.51	408.662	408.359	408.651	408.948

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Apr 21/09	Water Elevation (m) May 21/09	Water Elevation (m) June 26/09	Water Elevation (m) July 22/09	Water Elevation (m) Aug 27/09	Water Elevation (m) Sept 29/09	Water Elevation (m) Oct 30/09	Water Elevation (m) Dec 7/09	Water Elevation (m) Jan 5/10	Water Elevation (m) Feb 9/10
101	413.64	412.95	412.77	411.93	411.54	411.27	411.16	411.72	412.26	412.04	411.55
102	414.37	412.79	412.43	411.93	411.63	411.28	411.11	411.11	411.15	411.19	411.06
103	414.89	412.88	412.03	411.17	410.80	410.44	410.36	410.57	410.91	410.83	410.47
104	410.93	410.45	410.11	409.61	409.35	409.15	409.04	409.23	409.41	409.36	409.19
105	414.05	413.45	412.98	412.21	411.93	412.05	412.12	412.97	413.25	413.05	412.72
106	410.91	410.55	410.43	410.08	409.87	409.90	410.08	410.33	410.54	410.33	410.22
107	409.58	409.35	409.12	408.62	408.13	407.97	407.97	408.47	408.85	408.81	408.60
108	410.32	408.86	408.51	408.08	407.84	407.66	407.52	407.79	408.01	408.05	407.93

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Mar 2/10	Water Elevation (m) Apr 17/10	Water Elevation (m) May 11/10	Water Elevation (m) June 1/10	Water Elevation (m) June 29/10	Water Elevation (m) Aug 5/10	Water Elevation (m) Sept 22/10	Water Elevation (m) Oct 22/10	Water Elevation (m) Nov 9/10	Water Elevation (m) Dec 6/10
101	413.64	411.31	412.70	412.87	412.31	412.92	411.66	410.97	410.83	410.84	411.37
102	414.37	411.01	411.60	411.65	411.64	411.73	411.43	411.09	410.58	410.89	410.93
103	414.89	410.37	411.53	411.73	411.21	411.80	410.76	dry	dry	dry	dry
104	410.93	409.14	409.82	410.09	409.51	409.90	409.17	408.85	408.86	408.89	409.20
105	414.05	412.47	413.22	413.36	412.67	413.37	412.16	411.49	411.75	412.25	413.30
106	410.91	410.12	410.49	410.55	410.15	410.53	409.90	409.50	409.60	409.75	410.33
107	409.58	408.38	409.12	409.34	408.69	409.23	408.06	407.69	407.80	407.88	408.72
108	410.32	407.81	408.43	408.70	408.16	408.42	407.78	407.41	407.44	407.51	407.59

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Jan 11/11	Water Elevation (m) Feb 19/11	Water Elevation (m) Mar 31/11	Water Elevation (m) July 19/11	Water Elevation (m) Sept 30/11	Water Elevation (m) Dec 7/11	Water Elevation (m) Feb 10/12	Water Elevation (m) Apr 4/12	Water Elevation (m) June 27/12	Water Elevation (m) Aug 1/12
101	413.64	412.24	412.62	413.09	412.33	411.51	413.21	412.91	412.67	411.22	410.84
102	414.37	411.10	411.09	dry	412.09	411.22	412.23	412.16	412.07	411.28	411.05
103	414.89	410.76	411.02	dry	411.42	410.49	413.25	412.28	411.73	410.45	dry
104	410.93	409.27	409.20	410.05	409.54	409.24	410.45	409.95	409.86	409.06	408.73
105	414.05	413.52	413.93	413.86	412.53	412.83	413.93	413.53	412.99	411.75	411.30
106	410.91	410.37	410.61	410.66	410.09	410.23	410.73	410.52	410.46	409.64	409.17
107	409.58	408.85	408.70	409.29	408.21	408.18	409.44	409.14	409.10	407.93	407.52
108	410.32	408.02	407.89	408.66	407.92	407.73	408.92	408.53	408.38	407.69	dry

*(F) = Frozen

WATER LEVEL MEASUREMENTS

AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Oct 11/12	Water Elevation (m) Dec 11/12	Water Elevation (m) Mar 9/13	Water Elevation (m) May 3/13	Water Elevation (m) July 3/13	Water Elevation (m) Sept 30/13	Water Elevation (m) Dec 19/13	Water Elevation (m) Feb 19/14	Water Elevation (m) Apr 8/14	Water Elevation (m) June 6/14
101	413.64	410.48	412.25	412.19	412.94	412.74	412.56	412.58	412.28	413.60	412.70
102	414.37	410.81	411.18	411.42	412.52	412.08	411.59	411.98	411.74	412.51	412.47
103	414.89	dry	410.87	411.00	412.71	411.74	411.30	411.60	411.28	413.77	411.95
104	410.93	408.69	409.36	408.32	410.21	409.94	409.63	409.77	409.56	410.71	409.94
105	414.05	dry	413.48	413.12	413.38	412.89	413.15	413.09	412.90	414.02	412.89
106	410.91	409.26	410.53	410.40	410.55	410.44	410.37	410.46	410.40	411.02	410.38
107	409.58	407.61	408.91	408.84	409.32	409.21	408.97	409.02	408.83	409.61	409.00
108	410.32	dry	418.10	408.09	408.74	408.50	408.22	408.28	408.13	409.33	408.35

*(F) = Frozen

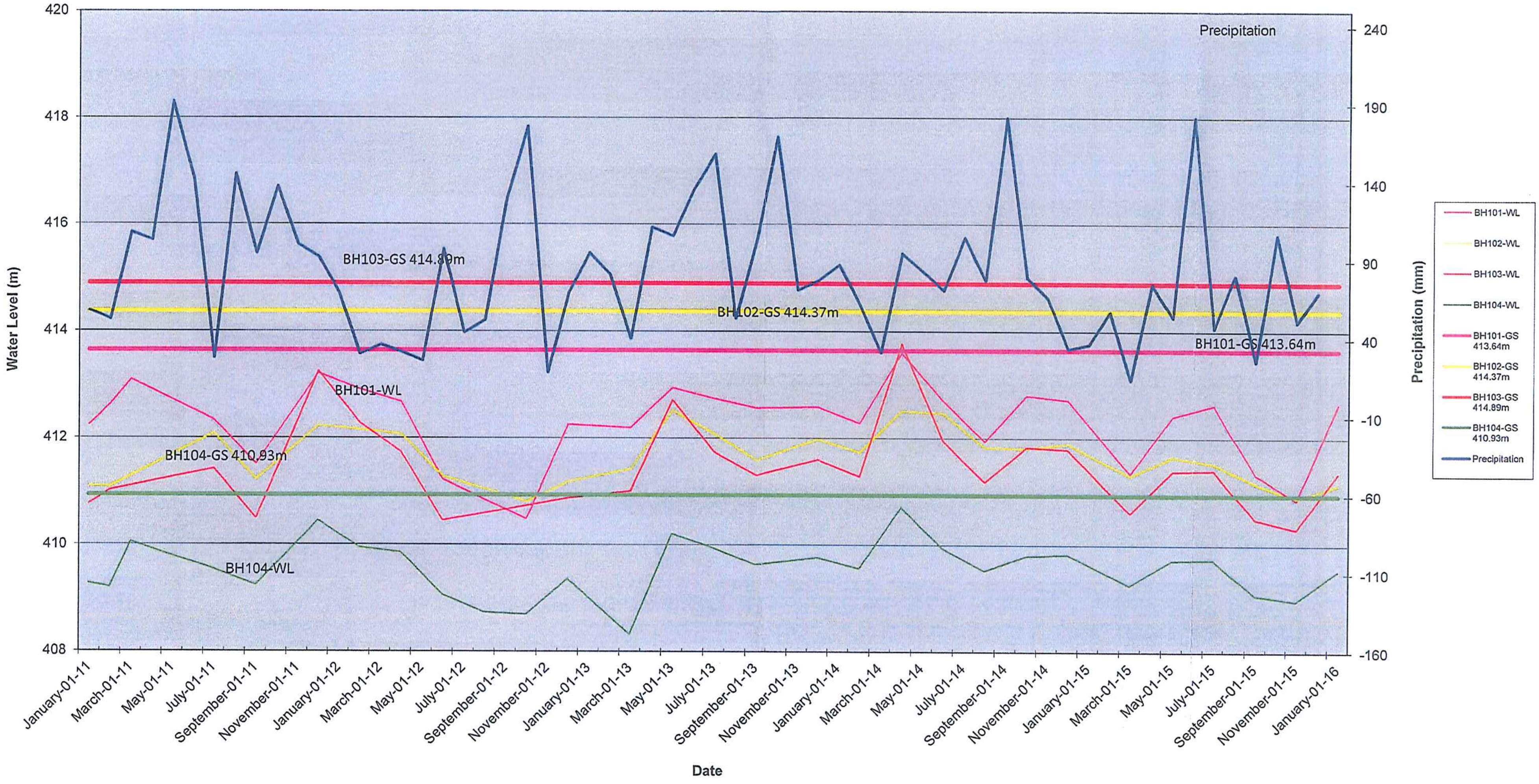
WATER LEVEL MEASUREMENTS

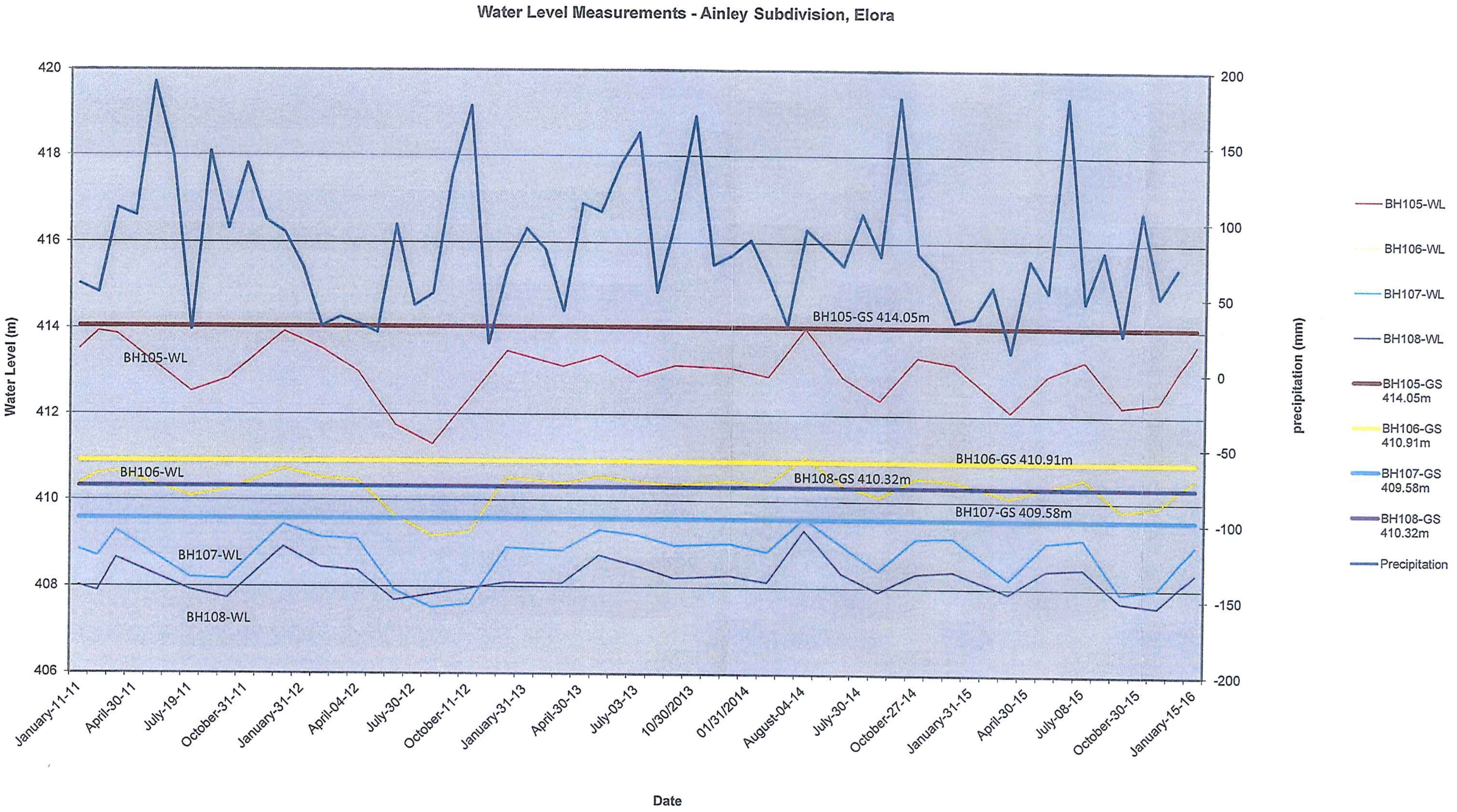
AINLEY SUBDIVISION
ELORA, ONTARIO

Borehole No.	Ground Surface Elevation (m)	Water Elevation (m) Aug 7/14	Water Elevation (m) Oct 27/14	Water Elevation (m) Dec 12/14	Water Elevation (m) Mar 11/15	Water Elevation (m) May 8/15	Water Elevation (m) July 8/15	Water Elevation (m) Sept 1/15	Water Elevation (m) Nov 5/15	Water Elevation (m) Jan 15/16	Water Elevation (m)
101	413.64	411.94	412.80	412.71	411.34	412.41	412.62	411.33	410.85	412.64	
102	414.37	411.83	411.81	411.90	411.30	411.66	411.53	411.16	410.88	411.14	
103	414.89	411.18	411.83	411.79	410.60	411.38	411.39	410.49	410.31	411.35	
104	410.93	409.52	409.80	409.83	409.25	409.72	409.73	409.07	408.96	409.52	
105	414.05	412.36	413.36	413.20	412.10	412.95	413.29	412.23	412.33	413.67	
106	410.91	410.11	410.55	410.48	410.11	410.33	410.55	409.82	409.91	410.57	
107	409.58	408.41	409.15	409.17	408.21	409.07	409.16	407.91	408.02	409.01	
108	410.32	407.92	408.34	408.40	407.90	408.43	408.48	407.71	407.60	408.36	

*(F) = Frozen

Water Level Measurements - Ainley Subdivision, Elora




Water Level Measurements - Ainley Subdivision, Elora

APPENDIX C

SANITARY AND STORM SEWER DESIGN SHEETS

q = average daily per capita flow (450 L/cap.d)
I = unit of peak extraneous flow (0.15 L/ha/s)
A = Tributary area in gross hectares
M = Peaking factor
Q(p) = peak population flow (L/s)
Q(i) = peak extraneous flow (L/s)
Q(d) = peak design flow

SANITARY SEWER DESIGN

TOWNSHIP OF CENTRE WELLINGTON (ELORA)

$M = 1 + \frac{14}{4 + (P)^{1/2}}$ where P is population in 1000's
$Q(p) = \frac{PqM}{86.4}$ (L/s)
Q(i) = IA
Q(d) = Q(p) + Q(i) (L/s)

Ainley Farm Subdivision

											Proposed Sewer						
Street	From	To	Individual Population	Cumulative Population	Individual Area (ha)	Cumulative Area (ha)	Peaking Factor (M)	Pop. Flow Q(p) (L/s)	Peak Extraneous Flow Q(i) (L/s)	Peak Design Flow Q(d) (m3/s)	Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Actual velocity at Q(d)
Street 2	Stub	MH.I	149	149	1.86	1.86	4.000	3.10	0.279	0.0034	10.0	200	0.013	2.00	0.0464	1.476	0.856
Street 2	MH.I	MH.F	0	149	0.21	2.07	4.000	3.10	0.311	0.0034	97.0	200	0.013	1.00	0.0328	1.044	0.668
Street 2	Stub	MH.F	135	135	2.76	2.76	4.000	2.81	0.414	0.0032	43.3	200	0.013	1.00	0.0328	1.044	0.668
Walser Street	MH.H	MH.G	18	18	0.71	0.71	4.000	0.38	0.107	0.0005	55.0	200	0.013	1.00	0.0328	1.044	0.240
Walser Street	MH.G	MH F	28	195	0.56	1.27	4.000	4.06	0.191	0.0043	70.0	200	0.013	0.50	0.0232	0.738	0.568
Walser Street	MH.F	MH.E	18	362	0.42	3.76	4.000	7.54	0.564	0.0081	82.3	200	0.013	0.50	0.0232	0.738	0.664
Walser Street	Stub	MH E	87	87	0.79	0.79	4.000	1.81	0.119	0.0019	10.0	200	0.013	1.00	0.0328	1.044	0.606
Walser Street	MH.E	MH.D	14	463	0.33	4.88	4.000	9.65	0.732	0.0104	69.8	200	0.013	0.50	0.0232	0.738	0.716
Street 1	Stub	MH D	150	0	3.61	3.61	4.000	0.00	0.542	0.0005	43.6	200	0.013	1.01	0.0330	1.049	0.346
Walser Street	MH D	MH C	7	470	0.20	8.69	4.000	9.79	1.304	0.0111	42.6	200	0.013	0.49	0.0230	0.731	0.716
Walser Street	MH C	MH B	21	491	0.51	9.20	4.000	10.23	1.380	0.0116	100.0	200	0.013	0.50	0.0232	0.738	0.738
Walser Street	MH B	MH A	14	505	0.32	9.52	4.000	10.52	1.428	0.0119	44.2	200	0.013	0.50	0.0232	0.738	0.746
Walser Street	MH A	EX.MH OUTLET A	14	519	0.34	9.86	4.000	10.81	1.479	0.0123	63.3	200	0.013	0.50	0.0232	0.738	0.753
Street 2	MH.J	MH.K	14	14	0.24	0.24	4.000	0.29	0.036	0.0003	42.2	200	0.013	0.80	0.0293	0.934	0.215
Street 2	MH.K	MH.L	28	42	0.54	0.78	4.000	0.88	0.117	0.0010	100.0	200	0.013	0.50	0.0232	0.738	0.362
Street 3	MH.M	MH.N	60	60	1.12	1.06	4.000	1.25	0.159	0.0014	100.0	200	0.013	1.00	0.0328	1.044	0.512
Street 3	MH.N	MH.O	7	67	0.11	1.17	4.000	1.40	0.176	0.0016	18.1	200	0.013	0.50	0.0232	0.738	0.428
Street 3	MH.O	MH.P	0	67	0.04	1.21	4.000	1.40	0.182	0.0016	19.2	200	0.013	1.00	0.0328	1.044	0.595
Street 3	MH.P	MH.Q	21	88	0.40	1.61	4.000	1.83	0.242	0.0021	68.0	200	0.013	0.50	0.0232	0.738	0.465

q = average daily per capita flow (450 L/cap.d)
I = unit of peak extraneous flow (0.15 L/ha/s)
A = Tributary area in gross hectares
M = Peaking factor
Q(p) = peak population flow (L/s)
Q(i) = peak extraneous flow (L/s)
Q(d) = peak design flow

SANITARY SEWER DESIGN

TOWNSHIP OF CENTRE WELLINGTON (ELORA)

$M = 1 + \frac{14}{4 + (P)^{1/2}}$ where P is population in 1000's
$Q(p) = \frac{PqM}{86.4}$ (L/s)
Q(i) = IA
Q(d) = Q(p) + Q(i) (L/s)

Ainley Farm Subdivision

											Proposed Sewer						
Street	From	To	Individual Population	Cumulative Population	Individual Area (ha)	Cumulative Area (ha)	Peaking Factor (M)	Pop. Flow Q(p) (L/s)	Peak Extraneous Flow Q(i) (L/s)	Peak Design Flow Q(d) (m3/s)	Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Actual velocity at Q(d)
Street 3	MH.Q	MH.R	0	88	0.05	1.66	4.000	1.83	0.249	0.0021	20.8	200	0.013	0.50	0.0232	0.738	0.465
Street 3	MH.R	MH.S	4	92	0.13	1.79	4.000	1.92	0.269	0.0022	47.6	200	0.013	0.50	0.0232	0.738	0.465
Street 3	MH.T	MH.S	39	39	0.68	0.68	4.000	0.81	0.102	0.0009	67.6	200	0.013	1.00	0.0328	1.044	0.418
Street 4	MH.S	MH U	28	159	0.50	2.97	4.000	3.31	0.446	0.0038	77.9	200	0.013	0.50	0.0232	0.738	0.539
Street 4	MH U	MH.V	0	247	0.00	2.97	4.000	5.15	0.446	0.0056	17.6	200	0.013	0.50	0.0232	0.738	0.613
Street 4	MH.X	MH.W	32	32	0.87	0.87	4.000	0.67	0.131	0.0008	65.0	200	0.013	1.50	0.0402	1.279	0.422
Street 4	MH.W	MH.L	14	46	0.40	1.27	4.000	0.96	0.191	0.0011	65.0	200	0.013	1.50	0.0402	1.279	0.511
Street 2	MH.L	MH.V	39	127	0.87	2.92	4.000	2.65	0.438	0.0031	79.8	200	0.013	1.50	0.0402	1.279	0.780
Sanitary Easement	MH.V	MH.Y	0	374	0.06	5.95	4.000	7.79	0.893	0.0087	54.2	200	0.013	0.50	0.0232	0.738	0.679
Sanitary Easement	MH.Y	MH.Z	0	374	0.06	6.01	4.000	7.79	0.902	0.0087	82.8	200	0.013	0.50	0.0232	0.738	0.679
Sanitary Easement	MH.Z	MH.AA	0	374	0.04	9.02	4.000	7.79	1.353	0.0091	64.3	200	0.013	0.50	0.0232	0.738	0.694
Sanitary Easement	MH.AA	MH.BB	0	374	0.15	9.17	4.000	7.79	1.376	0.0092	62.0	200	0.013	0.50	0.0232	0.738	0.694
Sanitary Easement	MH.BB	MH.CC	0	374	0.04	9.21	4.000	7.79	1.382	0.0092	72.6	200	0.013	0.50	0.0232	0.738	0.694
Sanitary Easement	MH.CC	MH.DD OUTLET B	0	374	0.04	9.25	4.000	7.79	1.388	0.0092	69.8	200	0.013	0.50	0.0232	0.738	0.694

Chicago Storm Parameters

Township of Centre Wellington

A = 1459.072

B = 13.69

C = 0.85

$\text{Intensity} = A / (t + B)^C$

STORM SEWER DESIGN

TOWNSHIP OF CENTRE WELLINGTON (ELORA)

5 Year Design

Ainley Farm Subdivision

$Q = CiA$ (m^3/s)

Location			Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Proposed Sewer						
Street	From	To								Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
Outlet 1 - Walser Street Outlet																
WALSER STREET	MH.4	MH.3	0.21	0.45	0.09	0.09	10.00	99.01	**0.026**	27.4	1200	0.013	1.00	4.051	3.58	0.13
WALSER STREET	MH.3	CBMH.1	0.24	0.45	0.11	0.20	10.13	98.56	**0.055**	28.3	1200	0.013	1.00	4.051	3.58	0.13
WALSER STREET	CBMH.1	EX CBMH 200	0.35	0.45	0.16	0.36	10.26	98.10	**0.098**	48.7	300	0.013	1.70	0.131	1.85	0.44
Outlet 2 - Stormwater Management Facility #1, Storm Outlet # 1																
WALSER STREET	MH.5	MH.6	0.00	0.45	0.00	0.00	10.00	99.01	**0.000**	30.2	300	0.013	0.50	0.071	1.01	0.50
WALSER STREET	MH.6	CBMH.7	0.04	0.45	0.02	0.02	10.50	97.27	**0.005**	30.0	300	0.013	0.50	0.071	1.01	0.50
WALSER STREET	CBMH.7	MH.9	0.17	0.45	0.08	0.09	11.00	95.60	**0.025**	29.0	300	0.013	0.50	0.071	1.01	0.48
WALSER STREET	MH.9	CBMH.10	0.34	0.45	0.15	0.25	11.48	94.05	**0.065**	30.6	300	0.013	0.50	0.071	1.01	0.51
WALSER STREET	CBMH.10	DCBMH.12	0.18	0.45	0.08	0.33	11.99	92.46	**0.084**	10.0	375	0.013	0.50	0.129	1.17	0.14
STREET NO. 1	MH.39	CBMH.103	0.05	0.45	0.02	0.02	10.00	99.01	**0.006**	26.6	300	0.013	0.50	0.071	1.01	0.44
STREET NO. 1	CBMH.103	DCBMH.12	0.07	0.45	0.03	0.05	10.44	97.47	**0.015**	18.0	300	0.013	0.50	0.071	1.01	0.30
WALSER STREET	MH.15	CBMH.13	0.10	0.45	0.05	0.05	10.00	99.01	**0.012**	27.2	300	0.013	0.50	0.071	1.01	0.45
WALSER STREET	CBMH.13	DCBMH.12	0.16	0.45	0.07	0.12	10.45	97.44	**0.032**	18.5	300	0.013	0.50	0.071	1.01	0.31
STM EASEMENT	DCBMH.12	MH.64	0.06	0.45	0.03	0.50	12.13	92.03	**0.127**	74.9	450	0.013	0.50	0.209	1.32	0.95
STM EASEMENT	MH.64	MH.63	0.62	0.32	0.20	0.69	13.08	89.25	**0.172**	64.8	525	0.013	0.36	0.268	1.24	0.87

Minimum diameter = 300 mm
Minimum acceptable velocity = 0.75 m/s
Maximum acceptable velocity = 4.5 m/s

Project: Ainley Farm Subdivision
File: 411009

\\gamsby.local\gmprojects\Kitchener\411-2011\411009\Design Data\Calculation Files\411009 - Storm Sewer Design Sheet_2022-08-03.xlsx

Chicago Storm Parameters

Township of Centre Wellington

A = 1459.072

B = 13.69

C = 0.85

Intensity = A / (t + B)^C

STORM SEWER DESIGN

TOWNSHIP OF CENTRE WELLINGTON (ELORA)

5 Year Design

Ainley Farm Subdivision

Q = CiA (m^3/s)

Location			Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Proposed Sewer						
Street	From	To								Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
STREET NO. 3	STUB	MH.44	0.94	0.45	0.42	0.42	10.00	99.01	**0.116**	14.3	450	0.013	0.50	0.209	1.32	0.18
STREET NO. 3	MH.44	CBMH.59	0.22	0.45	0.10	0.52	10.18	98.38	**0.143**	60.9	450	0.013	0.50	0.209	1.32	0.77
STREET NO. 3	CBMH.59	DCBMH.61	0.36	0.45	0.16	0.68	10.95	95.75	**0.182**	66.8	525	0.013	0.50	0.316	1.46	0.76
STREET NO. 3	DCBMH.61	MH.63	0.44	0.45	0.20	0.88	11.71	93.31	**0.229**	22.3	525	0.013	0.50	0.316	1.46	0.25
STREET NO. 3	MH.63	OGS.3 STORMCEPTOR EF8	0.00	0.45	0.00	1.58	13.95	86.85	**0.380**	59.6	600	0.013	0.50	0.451	1.60	0.62
STREET NO. 3	OGS.3 STORMCEPTOR EF8	DCBMH.68	0.00	0.45	0.00	1.58	14.57	85.22	**0.373**	7.2	600	0.013	0.50	0.451	1.60	0.08
STREET NO. 3	DCBMH.68	MH.70	0.50	0.45	0.23	1.80	14.65	85.03	**0.425**	11.9	675	0.013	0.50	0.618	1.73	0.11
STREET NO. 2	CBMH.47	MH.49	0.17	0.45	0.08	0.08	10.00	99.01	**0.021**	16.0	300	0.013	0.50	0.071	1.01	0.27
STREET NO. 2	MH.49	MH.50	0.21	0.45	0.09	0.17	10.27	98.08	**0.047**	18.6	300	0.013	0.50	0.071	1.01	0.31
STREET NO. 2	MH.51	MH.50	0.49	0.45	0.22	0.22	10.00	99.01	**0.061**	25.5	375	0.013	0.50	0.129	1.17	0.36
STREET NO. 3	MH.50	MH.78	0.00	0.45	0.00	0.39	10.57	97.02	**0.106**	34.8	375	0.013	0.49	0.128	1.15	0.50
STREET NO. 3	MH.78	CBMH.76	0.17	0.45	0.08	0.47	10.36	97.74	**0.127**	26.0	450	0.013	0.50	0.209	1.32	0.33
STREET NO. 3	CBMH.76	MH.75	0.40	0.45	0.18	0.65	10.69	96.62	**0.174**	26.0	450	0.013	0.50	0.209	1.32	0.33
STREET NO. 3	MH.75	MH.74	0.15	0.45	0.07	0.72	11.02	95.52	**0.190**	14.0	450	0.013	0.50	0.209	1.32	0.18
STREET NO. 3	MH.74	DCBMH.72	0.21	0.45	0.09	0.81	11.20	94.94	**0.214**	26.9	525	0.013	0.50	0.316	1.46	0.31

Minimum diameter = 300 mm
Minimum acceptable velocity = 0.75 m/s
Maximum acceptable velocity = 4.5 m/s

Project: Ainley Farm Subdivision
File: 411009

Chicago Storm Parameters
Township of Centre Wellington
A = 1459.072
B = 13.69
C = 0.85
Intensity = $A / (t + B)^C$

STORM SEWER DESIGN
TOWNSHIP OF CENTRE WELLINGTON (ELORA)
5 Year Design
Ainley Farm Subdivision

Q = CiA (m^3/s)

Location			Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Proposed Sewer						
Street	From	To								Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
STREET NO. 3	DCBMH.72	OGS.2 STORMCEPTOR EF6	0.19	0.45	0.09	0.90	11.51	93.96	**0.234**	11.1	525	0.013	0.50	0.316	1.46	0.13
STREET NO. 3	OGS.2 STORMCEPTOR EF6	MH.70	0.00	0.45	0.00	0.90	11.63	93.56	**0.233**	18.3	525	0.013	0.50	0.316	1.46	0.21
STREET NO. 3	MH.70	HEADWALL	0.00	0.45	0.00	2.70	14.76	84.74	**0.635**	18.7	750	0.013	0.50	0.818	1.85	0.17
Outlet 3 - Stormwater Management Facility #1, Storm Outlet # 2																
STREET NO. 4	DCBMH.104	MH.103	0.18	0.45	0.08	0.08	10.00	99.01	**0.022**	24.3	300	0.013	0.50	0.071	1.01	0.40
STREET NO. 4	MH.103	CBMH.102	0.15	0.45	0.07	0.15	10.40	97.60	**0.040**	2.8	300	0.013	0.50	0.071	1.01	0.05
STREET NO. 4	CBMH.102	CBMH.99	0.19	0.45	0.09	0.23	10.45	97.45	**0.063**	67.4	375	0.013	0.50	0.129	1.17	0.96
STREET NO. 4	CBMH.99	CBMH.96	0.20	0.45	0.09	0.32	11.41	94.26	**0.085**	31.5	450	0.013	0.50	0.209	1.32	0.40
STREET NO. 4	CBMH.96	MH.55	0.34	0.45	0.15	0.48	11.81	93.00	**0.123**	18.2	450	0.013	0.50	0.209	1.32	0.23
STREET NO. 2	CBMH.53	MH.55	0.16	0.45	0.07	0.07	10.00	99.01	**0.020**	8.9	300	0.013	0.50	0.071	1.01	0.15
STREET NO. 4	MH.55	MH.94	0.00	0.45	0.00	0.55	12.04	92.30	**0.141**	32.4	525	0.013	0.50	0.316	1.46	0.37
STREET NO. 4	MH.94	CBMH.91	0.15	0.45	0.07	0.62	12.41	91.18	**0.156**	24.5	525	0.013	0.50	0.316	1.46	0.28
STREET NO. 4	CBMH.91	MH.88	0.28	0.45	0.13	0.74	12.69	90.36	**0.186**	17.2	525	0.013	0.50	0.316	1.46	0.20
STREET NO. 4	CBMH.83	CBMH.86	0.19	0.45	0.09	0.09	10.00	99.01	**0.024**	62.1	300	0.013	0.50	0.071	1.01	1.03
STREET NO. 4	CBMH.86	MH.88	0.19	0.45	0.09	0.17	11.03	95.50	**0.045**	10.9	300	0.013	0.50	0.071	1.01	0.18

Minimum diameter = 300 mm
Minimum acceptable velocity = 0.75 m/s
Maximum acceptable velocity = 4.5 m/s

Chicago Storm Parameters
Township of Centre Wellington
A = 1459.072
B = 13.69
C = 0.85
Intensity = A / (t + B)^C

STORM SEWER DESIGN

TOWNSHIP OF CENTRE WELLINGTON (ELORA)

5 Year Design

Ainley Farm Subdivision

Q = CiA (m^3/s)

Location			Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Proposed Sewer						
Street	From	To								Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
SWM EASEMENT	MH.88	OGS.4	0.00	0.45	0.00	0.91	12.89	89.79	**0.228**	63.9	525	0.013	1.05	0.458	2.12	0.50
SWM EASEMENT	OGS.4	HEADWALL	0.00	0.45	0.00	0.91	13.39	88.37	**0.224**	6.0	525	0.013	1.00	0.447	2.06	0.05
Outlet 4 - Stormwater Management Facility #2																
WALSER STREET	MH.16	MH.17	0.07	0.45	0.03	0.03	10.00	99.01	**0.009**	27.0	300	0.013	0.50	0.071	1.01	0.45
WALSER STREET	MH.17	MH.18	0.07	0.45	0.03	0.06	10.45	97.45	**0.017**	13.3	300	0.013	0.50	0.071	1.01	0.22
WALSER STREET	MH.18	MH.19	1.00	0.68	0.68	0.74	10.67	96.70	**0.200**	12.2	525	0.013	1.80	0.600	2.77	0.07
STREET NO. 2	MH.40	CBMH.105	0.05	0.45	0.02	0.02	10.00	99.01	**0.006**	25.7	300	0.013	0.50	0.071	1.01	0.43
STREET NO. 2	CBMH.105	MH.19	0.06	0.45	0.03	0.05	10.00	99.01	**0.014**	19.9	300	0.013	0.50	0.071	1.01	0.33
STREET NO. 2	DCBMH.41	MH.19	0.15	0.45	0.07	0.07	10.00	99.01	**0.019**	18.1	300	0.013	0.50	0.071	1.01	0.30
WALSER STREET	MH.19	MH.20	0.00	0.45	0.00	0.83	10.74	96.45	**0.223**	45.5	525	0.013	1.40	0.529	2.44	0.31
WALSER STREET	MH.20	CBMH.21	0.08	0.45	0.04	0.87	11.05	95.42	**0.230**	25.0	525	0.013	1.40	0.529	2.44	0.17
WALSER STREET	CBMH.21	DCBMH.23	0.39	0.45	0.18	1.04	11.22	94.87	**0.275**	63.2	525	0.013	0.80	0.799	1.81	0.58
WALSER STREET	DCBMH.23	DCBMH.24	0.41	0.45	0.18	1.23	11.80	93.02	**0.318**	8.5	2 - 450	0.013	0.54	0.435	0.99	0.14
WALSER STREET	DCBMH.24	OGS.1 Stormceptor EF8	0.00	0.45	0.00	1.23	11.95	92.58	**0.316**	5.9	2 - 450	0.013	0.49	0.415	0.94	0.10
WALSER STREET	OGS.1 Stormceptor EF8	POND 2	0.00	0.45	0.00	1.23	12.05	92.26	**0.315**	5.1	2 - 450	0.013	0.50	0.419	0.95	0.09
	RYCB 08	POND 2	0.06	0.45	0.03	0.03	10.00	99.01	**0.007**	15.8	300	0.013	0.50	0.071	1.01	0.26

Minimum diameter = 300 mm
Minimum acceptable velocity = 0.75 m/s
Maximum acceptable velocity = 4.5 m/s

Chicago Storm Parameters

Township of Centre Wellington

A = 1459.072

B = 13.69

C = 0.85

Intensity = A / (t + B)^C

STORM SEWER DESIGN

TOWNSHIP OF CENTRE WELLINGTON (ELORA)

5 Year Design

Ainley Farm Subdivision

Q = CiA (m^3/s)

Location			Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Proposed Sewer						
Street	From	To								Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
Outlet 5 - Infiltration Gallery #1																
STREET NO. 4	MH.101	MH.100	0.11	0.45	0.05	0.05	10.00	99.01	**0.014**	31.4	300	0.013	0.50	0.071	1.01	0.52
STREET NO. 4	MH.100	MH.96	0.11	0.45	0.05	0.10	10.52	97.20	**0.027**	31.4	300	0.013	0.50	0.071	1.01	0.52
STREET NO. 4	MH.96	MH.95	0.22	0.45	0.10	0.20	11.04	95.46	**0.053**	15.0	300	0.013	0.50	0.071	1.01	0.25
STREET NO. 4	MH.95	MH.93	0.05	0.45	0.02	0.22	11.29	94.65	**0.058**	47.0	300	0.013	0.50	0.071	1.01	0.78
STREET NO. 4	MH.93	MH.90	0.11	0.45	0.05	0.27	12.07	92.21	**0.069**	31.4	300	0.013	0.50	0.071	1.01	0.52
STREET NO. 4	MH.90	MH.89	0.24	0.45	0.11	0.38	12.59	90.66	**0.095**	12.3	375	0.013	0.50	0.129	1.17	0.18
STREET NO. 4	MH.85	MH.89	0.21	0.45	0.09	0.09	10.00	99.01	**0.026**	53.9	300	0.013	0.50	0.071	1.01	0.89
STM EASEMENT	MH.89	MH.119	0.00	0.45	0.00	0.47	12.77	90.14	**0.118**	37.5	375	0.013	0.50	0.129	1.17	0.54
STM EASEMENT	MH.119	MH.120	0.22	0.45	0.10	0.57	13.30	88.62	**0.141**	32.6	375	0.013	0.50	0.129	1.17	0.47
STM EASEMENT	MH.120	INFILTRATION GALLERY #1	0.00	0.45	0.00	0.57	13.77	87.34	**0.139**	8.0	375	0.013	0.50	0.129	1.17	0.11

Minimum diameter = 300 mm
Minimum acceptable velocity = 0.75 m/s
Maximum acceptable velocity = 4.5 m/s

APPENDIX D

STORMWATER MANAGEMENT ANALYSIS

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"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                Modelling Files\2022-07-25"
"                Output filename:                                   Ex__2yr.out"
"                Licensee name:                                            gmbp"
"                Company                                                   gmbp"
"                Date & Time last used:                    7/25/2022 at 1:42:39 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      695.050   Coefficient A"
"        6.387   Constant B"
"        0.793   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            93.293    mm/hr"
"             Total depth                  33.014    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           30   Catchment 30"
"        0.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.003     0.000     0.000     0.000 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           0.240      0.000      0.240      hectare"
"             Time of concentration  23.304     1.868      23.304     minutes"
"             Time to Centroid       130.781    88.659     130.781    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        79.23      0.00       79.23      c.m"
"             Rainfall losses        27.898     5.363      27.898     mm"
"             Runoff depth           5.116      27.651     5.116      mm"
"             Runoff volume          12.28      0.00       12.28      c.m"
"             Runoff coefficient     0.155      0.000      0.155      "
"             Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.003     0.003     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.003     0.003     0.003     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.003    c.m/sec"
"             Hydrograph volume            12.279    c.m"
"                    0.003     0.003     0.003     0.003"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.003     0.000     0.003     0.003"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.044     0.000     0.003     0.003 c.m/sec"
"              Catchment 10           Pervious   Impervious Total Area "
"              Surface Area           7.760      0.000      7.760      hectare"
"              Time of concentration  78.068     6.258      78.068     minutes"
"              Time to Centroid       195.540    95.197     195.540    minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        2561.88    0.00       2561.88    c.m"
"              Rainfall losses        27.894     5.228      27.894     mm"
"              Runoff depth           5.120      27.786     5.120      mm"
"              Runoff volume          397.31     0.00       397.31     c.m"
"              Runoff coefficient     0.155      0.000      0.155      "
"              Maximum flow           0.044      0.000      0.044      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.044     0.044     0.003     0.003"
" 33           CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.001     0.044     0.003     0.003 c.m/sec"
"              Catchment 11           Pervious   Impervious Total Area "
"              Surface Area           0.130      0.000      0.130      hectare"
"              Time of concentration  35.323     2.832      35.323     minutes"
"              Time to Centroid       144.986    90.217     144.986    minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        42.92      0.00       42.92      c.m"
```

```
"              Rainfall losses        27.897     5.467      27.897     mm"
"              Runoff depth           5.117      27.547     5.117      mm"
"              Runoff volume          6.65       0.00       6.65       c.m"
"              Runoff coefficient     0.155      0.000      0.155      "
"              Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.001     0.045     0.003     0.003"
" 33           CATCHMENT 40"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            40   Catchment 40"
"        0.000   % Impervious"
"        7.120   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.120   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.060     0.045     0.003     0.003 c.m/sec"
"              Catchment 40           Pervious   Impervious Total Area "
"              Surface Area           7.120      0.000      7.120      hectare"
"              Time of concentration  45.052     3.611      45.051     minutes"
"              Time to Centroid       156.495    91.497     156.495    minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        2350.59    0.00       2350.59    c.m"
"              Rainfall losses        27.895     5.642      27.895     mm"
"              Runoff depth           5.119      27.372     5.119      mm"
"              Runoff volume          364.45     0.00       364.45     c.m"
"              Runoff coefficient     0.155      0.000      0.155      "
"              Maximum flow           0.060      0.000      0.060      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.060     0.099     0.003     0.003"
" 54           POND DESIGN"
"        0.099   Current peak flow    c.m/sec"
```

```
"        0.050   Target outflow    c.m/sec"
"        768.4   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                  0.095    c.m/sec"
"             Maximum level               409.647    metre"
"             Maximum storage              57.616    c.m"
"             Centroidal lag                3.111   hours"
"                  0.060     0.099     0.095     0.003 c.m/sec"
" 40         HYDROGRAPH Next link "
"            5   Next link "
"                     0.060     0.095     0.095     0.003"
" 52         CHANNEL DESIGN"
"        0.095   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.162    metre"
"             Velocity                      0.541    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.133    metre"
" 53         ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.460   X-factor <= 0.5"
"      100.360   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.095    c.m/sec"
"                     0.060     0.095     0.095     0.003 c.m/sec"
" 40         HYDROGRAPH Next link "
"            5   Next link "
"                     0.060     0.095     0.095     0.003"
```

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" 52          CHANNEL DESIGN"
"       0.095   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"             Depth of flow                 0.083    metre"
"             Velocity                      0.512    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.059    metre"
" 53          ROUTE    Channel Route 40"
"       39.80      Channel Route 40 Reach length   ( metre)"
"       0.442   X-factor <= 0.5"
"      58.297   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      60.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"             Peak outflow                  0.095    c.m/sec"
"                     0.060     0.095     0.095     0.003 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                     0.060     0.095     0.095     0.003"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                     0.060     0.095     0.095     0.003"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               Total"
"             Maximum flow                  0.095    c.m/sec"
"             Hydrograph volume           768.416    c.m"
"                     0.060     0.095     0.095     0.095"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                     0.060     0.000     0.095     0.095"
" 33          CATCHMENT 20"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          20   Catchment 20"
"       0.000   % Impervious"
"       6.650   Total Area"
"     150.000   Flow length"
"       2.000   Overland Slope"
```

```
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.038     0.000     0.095     0.095 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  78.068     6.258      78.068     minutes"
"             Time to Centroid       195.540    95.197     195.539    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        2195.43    0.00       2195.43    c.m"
"             Rainfall losses        27.894     5.228      27.894     mm"
"             Runoff depth           5.120      27.786     5.120      mm"
"             Runoff volume          340.48     0.00       340.48     c.m"
"             Runoff coefficient     0.155      0.000      0.155      "
"             Maximum flow           0.038      0.000      0.038      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.038     0.038     0.095     0.095"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.830   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.747   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.155   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

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"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.834   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.016     0.038     0.095     0.095 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.747      0.083      0.830      hectare"
"             Time of concentration  35.323     2.832      23.162     minutes"
"             Time to Centroid       144.986    90.217     124.487    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        246.61     27.40      274.02     c.m"
"             Rainfall losses        27.897     5.467      25.654     mm"
"             Runoff depth           5.117      27.547     7.360      mm"
"             Runoff volume          38.22      22.86      61.09      c.m"
"             Runoff coefficient     0.155      0.834      0.223      "
"             Maximum flow           0.007      0.016      0.016      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.016     0.043     0.095     0.095"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.016     0.043     0.043     0.095"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.043    c.m/sec"
"             Hydrograph volume           401.567    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.138    c.m/sec"
"             Hydrograph volume          1169.982    c.m"
"                    0.016     0.043     0.043     0.138"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                     22.730    hectare"
"             Total Impervious area                     0.083    hectare"
"             Total % impervious                        0.365"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                           Version 2.25  rev. 473"
"                MIDUSS created                        Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:           W:\Kitchener\411-2011\411009\Design Data\"
"                                                      Modelling Files\2022-07-25"
"                Output filename:                                    Ex__5yr.out"
"                Licensee name:                                             gmbp"
"                Company                                                    gmbp"
"                Date & Time last used:                  7/25/2022 at 1:44:05 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1459.072   Coefficient A"
"       13.690   Constant B"
"        0.850   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           113.586    mm/hr"
"             Total depth                  49.792    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           30   Catchment 30"
"        0.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.257   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.010     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.240      0.000      0.240      hectare"
"            Time of concentration  16.417     1.691      16.417     minutes"
"            Time to Centroid       118.292    87.210     118.292    minutes"
"            Rainfall depth         49.792     49.792     49.792     mm"
"            Rainfall volume        119.50     0.00       119.50     c.m"
"            Rainfall losses        36.983     5.811      36.983     mm"
"            Runoff depth           12.809     43.981     12.809     mm"
"            Runoff volume          30.74      0.00       30.74      c.m"
"            Runoff coefficient     0.257      0.000      0.257      "
"            Maximum flow           0.010      0.000      0.010      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.010     0.010     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.010     0.010     0.010     0.000"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               To Walser Street"
"            Maximum flow                  0.010    c.m/sec"
"            Hydrograph volume            30.741    c.m"
"                    0.010     0.010     0.010     0.010"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.010     0.000     0.010     0.010"
" 33         CATCHMENT 10"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          10   Catchment 10"
"       0.000   % Impervious"
"       7.760   Total Area"
"     150.000   Flow length"
"       2.000   Overland Slope"
"       7.760   Pervious Area"
"     150.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"     150.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.258   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.157     0.000     0.010     0.010 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  54.995     5.665      54.994     minutes"
"             Time to Centroid       162.955    92.780     162.955    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        3863.83    0.00       3863.84    c.m"
"             Rainfall losses        36.958     5.466      36.958     mm"
"             Runoff depth           12.834     44.325     12.834     mm"
"             Runoff volume          995.89     0.00       995.90     c.m"
"             Runoff coefficient     0.258      0.000      0.258      "
"             Maximum flow           0.157      0.000      0.157      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.157     0.157     0.010     0.010"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.004     0.157     0.010     0.010 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  24.883     2.563      24.883     minutes"
"             Time to Centroid       128.082    88.517     128.082    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        64.73      0.00       64.73      c.m"
```

```
"             Rainfall losses        36.970     6.066      36.969     mm"
"             Runoff depth           12.822     43.726     12.822     mm"
"             Runoff volume          16.67      0.00       16.67      c.m"
"             Runoff coefficient     0.258      0.000      0.258      "
"             Maximum flow           0.004      0.000      0.004      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.004     0.159     0.010     0.010"
" 33          CATCHMENT 40"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           40   Catchment 40"
"        0.000   % Impervious"
"        7.120   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.120   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.209     0.159     0.010     0.010 c.m/sec"
"             Catchment 40           Pervious   Impervious Total Area "
"             Surface Area           7.120      0.000      7.120      hectare"
"             Time of concentration  31.736     3.269      31.736     minutes"
"             Time to Centroid       136.024    89.581     136.024    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        3545.16    0.00       3545.17    c.m"
"             Rainfall losses        36.968     6.236      36.968     mm"
"             Runoff depth           12.824     43.556     12.824     mm"
"             Runoff volume          913.04     0.00       913.04     c.m"
"             Runoff coefficient     0.258      0.000      0.258      "
"             Maximum flow           0.209      0.000      0.209      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.209     0.353     0.010     0.010"
" 54          POND DESIGN"
"        0.353   Current peak flow    c.m/sec"
```

```
"        0.050   Target outflow    c.m/sec"
"       1925.6   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                  0.324    c.m/sec"
"             Maximum level               409.688    metre"
"             Maximum storage             195.955    c.m"
"             Centroidal lag                2.666   hours"
"                  0.209     0.353     0.324     0.010 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.209     0.324     0.324     0.010"
" 52          CHANNEL DESIGN"
"        0.324   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.256    metre"
"             Velocity                      0.735    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.217    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.436   X-factor <= 0.5"
"       73.851   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       75.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.323    c.m/sec"
"                     0.209     0.324     0.323     0.010 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.209     0.323     0.323     0.010"
```

```
" 52          CHANNEL DESIGN"
"        0.323   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.167    metre"
"             Velocity                      0.774    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.129    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.386   X-factor <= 0.5"
"       38.571   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       42.857   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.322    c.m/sec"
"                     0.209     0.323     0.322     0.010 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.209     0.322     0.322     0.010"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.209     0.322     0.322     0.010"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.322    c.m/sec"
"             Hydrograph volume          1925.607    c.m"
"                     0.209     0.322     0.322     0.322"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.209     0.000     0.322     0.322"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
```

```
"         6.650   Pervious Area"
"       150.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"       150.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.135     0.000     0.322     0.322 c.m/sec"
"            Catchment 20           Pervious   Impervious Total Area "
"            Surface Area           6.650      0.000      6.650      hectare"
"            Time of concentration  54.995     5.665      54.994     minutes"
"            Time to Centroid       162.956    92.780     162.955    minutes"
"            Rainfall depth         49.792     49.792     49.792     mm"
"            Rainfall volume        3311.14    0.00       3311.15    c.m"
"            Rainfall losses        36.958     5.466      36.958     mm"
"            Runoff depth           12.834     44.325     12.834     mm"
"            Runoff volume          853.44     0.00       853.44     c.m"
"            Runoff coefficient     0.258      0.000      0.258      "
"            Maximum flow           0.135      0.000      0.135      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                      0.135     0.135     0.322     0.322"
" 33         CATCHMENT 21"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          21   Catchment 20"
"        10.000   % Impervious"
"         0.830   Total Area"
"        40.000   Flow length"
"         2.000   Overland Slope"
"         0.747   Pervious Area"
"        40.000   Pervious length"
"         2.000   Pervious slope"
"         0.083   Impervious Area"
"        40.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
```

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"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.030     0.135     0.322     0.322 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.747      0.083      0.830      hectare"
"             Time of concentration  24.883     2.563      18.750     minutes"
"             Time to Centroid       128.082    88.517     117.210    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        371.94     41.33      413.27     c.m"
"             Rainfall losses        36.970     6.066      33.879     mm"
"             Runoff depth           12.822     43.726     15.913     mm"
"             Runoff volume          95.78      36.29      132.07     c.m"
"             Runoff coefficient     0.258      0.878      0.320      "
"             Maximum flow           0.025      0.021      0.030      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.030     0.153     0.322     0.322"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.030     0.153     0.153     0.322"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.153    c.m/sec"
"             Hydrograph volume           985.517    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.472    c.m/sec"
"             Hydrograph volume          2911.122    c.m"
"                     0.030     0.153     0.153     0.472"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    22.730    hectare"
"             Total Impervious area                    0.083    hectare"
"             Total % impervious                       0.365"
" 19          EXIT"
```

```
"                 MIDUSS Output ----------------------------------------------->"
"                 MIDUSS version                             Version 2.25  rev. 473"
"                 MIDUSS created                          Sunday, February 07, 2010"
"            10   Units used:                                            ie METRIC"
"                 Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                    Modelling Files\2022-07-25"
"                 Output filename:                                   Ex__10yr.out"
"                 Licensee name:                                             gmbp"
"                 Company                                                    gmbp"
"                 Date & Time last used:                   7/25/2022 at 1:46:41 PM"
" 31           TIME PARAMETERS"
"         5.000   Time Step"
"       180.000   Max. Storm length"
"      3600.000   Max. Hydrograph"
" 32           STORM Chicago storm"
"             1   Chicago storm"
"      2327.596   Coefficient A"
"        19.500   Constant B"
"         0.894   Exponent C"
"         0.380   Fraction R"
"       180.000   Duration"
"         1.000   Time step multiplier"
"              Maximum intensity           126.171    mm/hr"
"              Total depth                  61.359    mm"
"             6   010hyd   Hydrograph extension used in this file"
" 33           CATCHMENT 30"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            30   Catchment 30"
"         0.000   % Impervious"
"         0.240   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.240   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.316   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
```

```
"                    0.017     0.000     0.000     0.000 c.m/sec"
"            Catchment 30           Pervious   Impervious Total Area "
"            Surface Area           0.240      0.000      0.240      hectare"
"            Time of concentration  14.182     1.611      14.182     minutes"
"            Time to Centroid       113.893    86.563     113.893    minutes"
"            Rainfall depth         61.359     61.359     61.359     mm"
"            Rainfall volume        147.26     0.00       147.26     c.m"
"            Rainfall losses        41.992     6.044      41.992     mm"
"            Runoff depth           19.367     55.315     19.367     mm"
"            Runoff volume          46.48      0.00       46.48      c.m"
"            Runoff coefficient     0.316      0.000      0.316      "
"            Maximum flow           0.017      0.000      0.017      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.017     0.017     0.000     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.017     0.017     0.017     0.000"
" 40         HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               To Walser Street"
"            Maximum flow                  0.017    c.m/sec"
"            Hydrograph volume            46.481    c.m"
"                    0.017     0.017     0.017     0.017"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.017     0.000     0.017     0.017"
" 33         CATCHMENT 10"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          10   Catchment 10"
"       0.000   % Impervious"
"       7.760   Total Area"
"     150.000   Flow length"
"       2.000   Overland Slope"
"       7.760   Pervious Area"
"     150.000   Pervious length"
"       2.000   Pervious slope"
"       0.000   Impervious Area"
"     150.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      74.000   Pervious SCS Curve No."
"       0.316   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.924   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.273     0.000     0.017     0.017 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  47.507     5.395      47.507     minutes"
"             Time to Centroid       151.963    91.698     151.963    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        4761.47    0.00       4761.48    c.m"
"             Rainfall losses        41.963     5.633      41.963     mm"
"             Runoff depth           19.396     55.726     19.396     mm"
"             Runoff volume          1505.11    0.00       1505.12    c.m"
"             Runoff coefficient     0.316      0.000      0.316      "
"             Maximum flow           0.273      0.000      0.273      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.273     0.273     0.017     0.017"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.008     0.273     0.017     0.017 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  21.495     2.441      21.495     minutes"
"             Time to Centroid       122.241    87.742     122.240    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        79.77      0.00       79.77      c.m"
```

```
"             Rainfall losses        41.967     6.310      41.967     mm"
"             Runoff depth           19.392     55.050     19.393     mm"
"             Runoff volume          25.21      0.00       25.21      c.m"
"             Runoff coefficient     0.316      0.000      0.316      "
"             Maximum flow           0.008      0.000      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.008     0.277     0.017     0.017"
" 33          CATCHMENT 40"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           40   Catchment 40"
"        0.000   % Impervious"
"        7.120   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.120   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.359     0.277     0.017     0.017 c.m/sec"
"             Catchment 40           Pervious   Impervious Total Area "
"             Surface Area           7.120      0.000      7.120      hectare"
"             Time of concentration  27.416     3.114      27.416     minutes"
"             Time to Centroid       128.990    88.727     128.990    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        4368.77    0.00       4368.78    c.m"
"             Rainfall losses        41.968     6.469      41.968     mm"
"             Runoff depth           19.392     54.890     19.392     mm"
"             Runoff volume          1380.67    0.00       1380.68    c.m"
"             Runoff coefficient     0.316      0.000      0.316      "
"             Maximum flow           0.359      0.000      0.359      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.359     0.608     0.017     0.017"
" 54          POND DESIGN"
"        0.608   Current peak flow    c.m/sec"
```

```
"        0.050   Target outflow    c.m/sec"
"       2911.0   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                  0.549    c.m/sec"
"             Maximum level               409.729    metre"
"             Maximum storage             332.166    c.m"
"             Centroidal lag                2.515   hours"
"                  0.359     0.608     0.549     0.017 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.359     0.549     0.549     0.017"
" 52          CHANNEL DESIGN"
"        0.549   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.312    metre"
"             Velocity                      0.839    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.267    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.422   X-factor <= 0.5"
"       64.729   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.547    c.m/sec"
"                     0.359     0.549     0.547     0.017 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.359     0.547     0.547     0.017"
```

```
" 52          CHANNEL DESIGN"
"        0.547   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.224    metre"
"             Velocity                      0.914    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.179    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.350   X-factor <= 0.5"
"       32.667   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.546    c.m/sec"
"                     0.359     0.547     0.546     0.017 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.359     0.546     0.546     0.017"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.359     0.546     0.546     0.017"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.546    c.m/sec"
"             Hydrograph volume          2911.006    c.m"
"                     0.359     0.546     0.546     0.546"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.359     0.000     0.546     0.546"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
```

```
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.234     0.000     0.546     0.546 c.m/sec"
"            Catchment 20           Pervious   Impervious Total Area "
"            Surface Area           6.650      0.000      6.650      hectare"
"            Time of concentration  47.507     5.395      47.507     minutes"
"            Time to Centroid       151.963    91.698     151.963    minutes"
"            Rainfall depth         61.359     61.359     61.359     mm"
"            Rainfall volume        4080.39    0.00       4080.39    c.m"
"            Rainfall losses        41.963     5.633      41.963     mm"
"            Runoff depth           19.396     55.726     19.396     mm"
"            Runoff volume          1289.82    0.00       1289.82    c.m"
"            Runoff coefficient     0.316      0.000      0.316      "
"            Maximum flow           0.234      0.000      0.234      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.234     0.234     0.546     0.546"
" 33         CATCHMENT 21"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          21   Catchment 20"
"       10.000   % Impervious"
"        0.830   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.747   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.316   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

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"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.050     0.234     0.546     0.546 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.747      0.083      0.830      hectare"
"             Time of concentration  21.495     2.441      16.926     minutes"
"             Time to Centroid       122.241    87.742     113.968    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        458.35     50.93      509.28     c.m"
"             Rainfall losses        41.967     6.310      38.401     mm"
"             Runoff depth           19.392     55.050     22.958     mm"
"             Runoff volume          144.86     45.69      190.55     c.m"
"             Runoff coefficient     0.316      0.897      0.374      "
"             Maximum flow           0.044      0.024      0.050      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.050     0.264     0.546     0.546"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.050     0.264     0.264     0.546"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.264    c.m/sec"
"             Hydrograph volume          1480.378    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  0.806    c.m/sec"
"             Hydrograph volume          4391.384    c.m"
"                    0.050     0.264     0.264     0.806"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                     22.730    hectare"
"             Total Impervious area                     0.083    hectare"
"             Total % impervious                        0.365"
" 19          EXIT"
```

```
"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                              Version 2.25  rev. 473"
"               MIDUSS created                           Sunday, February 07, 2010"
"          10   Units used:                                              ie METRIC"
"               Job folder:         W:\Kitchener\411-2011\411009\Design Data\"
"                                                         Modelling Files\2022-07-25"
"               Output filename:                                      Ex__25yr.out"
"               Licensee name:                                                gmbp"
"               Company                                                       gmbp"
"               Date & Time last used:                     7/25/2022 at 1:47:44 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3701.648   Coefficient A"
"       25.500   Constant B"
"        0.937   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"            Maximum intensity           143.371    mm/hr"
"            Total depth                  75.581    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           30   Catchment 30"
"        0.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.376   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

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"                     0.026     0.000     0.000     0.000 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           0.240      0.000      0.240      hectare"
"             Time of concentration  12.370     1.523      12.370     minutes"
"             Time to Centroid       110.314    85.984     110.314    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        181.39     0.00       181.39     c.m"
"             Rainfall losses        47.190     6.330      47.190     mm"
"             Runoff depth           28.391     69.250     28.391     mm"
"             Runoff volume          68.14      0.00       68.14      c.m"
"             Runoff coefficient     0.376      0.000      0.376      "
"             Maximum flow           0.026      0.000      0.026      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.026     0.026     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.026     0.026     0.026     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.026    c.m/sec"
"             Hydrograph volume            68.139    c.m"
"                     0.026     0.026     0.026     0.026"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.026     0.000     0.026     0.026"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.377   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

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"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.454     0.000     0.026     0.026 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  41.437     5.102      41.437     minutes"
"             Time to Centroid       143.191    90.751     143.190    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        5865.07    0.01       5865.07    c.m"
"             Rainfall losses        47.093     5.908      47.093     mm"
"             Runoff depth           28.488     69.673     28.488     mm"
"             Runoff volume          2210.64    0.01       2210.65    c.m"
"             Runoff coefficient     0.377      0.000      0.377      "
"             Maximum flow           0.454      0.000      0.454      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.454     0.454     0.026     0.026"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.376   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.012     0.454     0.026     0.026 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  18.749     2.308      18.749     minutes"
"             Time to Centroid       117.510    87.059     117.510    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        98.25      0.00       98.26      c.m"
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"              Rainfall losses        47.127     6.593      47.127     mm"
"              Runoff depth           28.453     68.988     28.453     mm"
"              Runoff volume          36.99      0.00       36.99      c.m"
"              Runoff coefficient     0.376      0.000      0.376      "
"              Maximum flow           0.012      0.000      0.012      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.012     0.461     0.026     0.026"
" 33           CATCHMENT 40"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           40   Catchment 40"
"        0.000   % Impervious"
"        7.120   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.120   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.377   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.584     0.461     0.026     0.026 c.m/sec"
"              Catchment 40           Pervious   Impervious Total Area "
"              Surface Area           7.120      0.000      7.120      hectare"
"              Time of concentration  23.913     2.944      23.913     minutes"
"              Time to Centroid       123.357    87.974     123.357    minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        5381.35    0.01       5381.36    c.m"
"              Rainfall losses        47.108     6.942      47.107     mm"
"              Runoff depth           28.473     68.639     28.473     mm"
"              Runoff volume          2027.30    0.00       2027.30    c.m"
"              Runoff coefficient     0.377      0.000      0.377      "
"              Maximum flow           0.584      0.000      0.584      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.584     1.001     0.026     0.026"
" 54           POND DESIGN"
"        1.001   Current peak flow    c.m/sec"
```

```
"        0.050   Target outflow    c.m/sec"
"       4274.9   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                  0.886    c.m/sec"
"             Maximum level               409.769    metre"
"             Maximum storage             536.694    c.m"
"             Centroidal lag                2.394   hours"
"                  0.584     1.001     0.886     0.026 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.584     0.886     0.886     0.026"
" 52          CHANNEL DESIGN"
"        0.886   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.374    metre"
"             Velocity                      0.946    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.324    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.407   X-factor <= 0.5"
"       57.429   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.880    c.m/sec"
"                     0.584     0.886     0.880     0.026 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.584     0.880     0.880     0.026"
```

```
" 52          CHANNEL DESIGN"
"        0.880   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"               Depth of flow                 0.291    metre"
"               Velocity                      1.055    m/sec"
"               Channel capacity              9.246    c.m/sec"
"               Critical depth                0.239    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.310   X-factor <= 0.5"
"       28.289   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"               Peak outflow                  0.877    c.m/sec"
"                       0.584     0.880     0.877     0.026 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                       0.584     0.877     0.877     0.026"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                       0.584     0.877     0.877     0.026"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"               Maximum flow                  0.877    c.m/sec"
"               Hydrograph volume          4274.952    c.m"
"                       0.584     0.877     0.877     0.877"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                       0.584     0.000     0.877     0.877"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
```

```
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.377   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.389     0.000     0.877     0.877 c.m/sec"
"            Catchment 20           Pervious   Impervious Total Area "
"            Surface Area           6.650      0.000      6.650      hectare"
"            Time of concentration  41.437     5.102      41.437     minutes"
"            Time to Centroid       143.191    90.751     143.190    minutes"
"            Rainfall depth         75.581     75.581     75.581     mm"
"            Rainfall volume        5026.12    0.01       5026.13    c.m"
"            Rainfall losses        47.093     5.908      47.093     mm"
"            Runoff depth           28.488     69.673     28.488     mm"
"            Runoff volume          1894.43    0.00       1894.44    c.m"
"            Runoff coefficient     0.377      0.000      0.377      "
"            Maximum flow           0.389      0.000      0.389      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.389     0.389     0.877     0.877"
" 33         CATCHMENT 21"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          21   Catchment 20"
"       10.000   % Impervious"
"        0.830   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.747   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.376   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.079     0.389     0.877     0.877 c.m/sec"
"              Catchment 21          Pervious   Impervious Total Area "
"              Surface Area          0.747      0.083      0.830      hectare"
"              Time of concentration  18.749     2.308      15.260     minutes"
"              Time to Centroid       117.510    87.059     111.048    minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        564.59     62.73      627.32     c.m"
"              Rainfall losses        47.127     6.593      43.074     mm"
"              Runoff depth           28.453     68.988     32.507     mm"
"              Runoff volume          212.55     57.26      269.81     c.m"
"              Runoff coefficient     0.376      0.913      0.430      "
"              Maximum flow           0.069      0.028      0.079      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.079     0.436     0.877     0.877"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.079     0.436     0.436     0.877"
" 64           SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                 0.436    c.m/sec"
"              Hydrograph volume         2164.242    c.m"
" 40           HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Total"
"              Maximum flow                 1.308    c.m/sec"
"              Hydrograph volume         6439.194    c.m"
"                    0.079     0.436     0.436     1.308"
" 38           START/RE-START TOTALS 21"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                    22.730    hectare"
"              Total Impervious area                    0.083    hectare"
"              Total % impervious                       0.365"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                         Sunday, February 07, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                      Modelling Files\2022-07-25"
"                Output filename:                                    Ex__50yr.out"
"                Licensee name:                                              gmbp"
"                Company                                                     gmbp"
"                Date & Time last used:                    7/25/2022 at 1:48:38 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     5089.418   Coefficient A"
"       30.000   Constant B"
"        0.967   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           156.350    mm/hr"
"             Total depth                  86.737    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           30   Catchment 30"
"        0.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                     0.035     0.000     0.000     0.000 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           0.240      0.000      0.240      hectare"
"             Time of concentration  11.375     1.467      11.375     minutes"
"             Time to Centroid       108.305    85.675     108.305    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        208.17     0.00       208.17     c.m"
"             Rainfall losses        50.570     6.561      50.570     mm"
"             Runoff depth           36.167     80.176     36.167     mm"
"             Runoff volume          86.80      0.00       86.80      c.m"
"             Runoff coefficient     0.417      0.000      0.417      "
"             Maximum flow           0.035      0.000      0.035      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.035     0.035     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.035     0.035     0.035     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.035    c.m/sec"
"             Hydrograph volume            86.800    c.m"
"                     0.035     0.035     0.035     0.035"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.035     0.000     0.035     0.035"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.418   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.618     0.000     0.035     0.035 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  38.106     4.916      38.106     minutes"
"             Time to Centroid       138.366    90.175     138.366    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        6730.77    0.01       6730.77    c.m"
"             Rainfall losses        50.510     5.941      50.510     mm"
"             Runoff depth           36.227     80.796     36.227     mm"
"             Runoff volume          2811.21    0.01       2811.22    c.m"
"             Runoff coefficient     0.418      0.000      0.418      "
"             Maximum flow           0.618      0.000      0.618      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.618     0.618     0.035     0.035"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.016     0.618     0.035     0.035 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  17.241     2.224      17.241     minutes"
"             Time to Centroid       114.897    86.667     114.896    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        112.76     0.00       112.76     c.m"
```

```
"             Rainfall losses        50.540     6.773      50.540     mm"
"             Runoff depth           36.197     79.963     36.197     mm"
"             Runoff volume          47.06      0.00       47.06      c.m"
"             Runoff coefficient     0.417      0.000      0.417      "
"             Maximum flow           0.016      0.000      0.016      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.016     0.628     0.035     0.035"
" 33          CATCHMENT 40"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           40   Catchment 40"
"        0.000   % Impervious"
"        7.120   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.120   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.789     0.628     0.035     0.035 c.m/sec"
"             Catchment 40           Pervious   Impervious Total Area "
"             Surface Area           7.120      0.000      7.120      hectare"
"             Time of concentration  21.990     2.837      21.990     minutes"
"             Time to Centroid       120.254    87.552     120.254    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        6175.65    0.01       6175.66    c.m"
"             Rainfall losses        50.538     7.307      50.538     mm"
"             Runoff depth           36.199     79.429     36.199     mm"
"             Runoff volume          2577.38    0.01       2577.39    c.m"
"             Runoff coefficient     0.417      0.000      0.417      "
"             Maximum flow           0.789      0.000      0.789      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.789     1.341     0.035     0.035"
" 54          POND DESIGN"
"        1.341   Current peak flow    c.m/sec"
```

```
"        0.050   Target outflow    c.m/sec"
"       5435.7   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                  1.183    c.m/sec"
"             Maximum level               409.794    metre"
"             Maximum storage             718.586    c.m"
"             Centroidal lag                2.328   hours"
"                  0.789     1.341     1.183     0.035 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.789     1.183     1.183     0.035"
" 52          CHANNEL DESIGN"
"        1.183   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.417    metre"
"             Velocity                      1.016    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.364    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.396   X-factor <= 0.5"
"       53.425   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  1.180    c.m/sec"
"                     0.789     1.183     1.180     0.035 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.789     1.180     1.180     0.035"
```

```
" 52          CHANNEL DESIGN"
"        1.180   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.341    metre"
"             Velocity                      1.150    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.283    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.282   X-factor <= 0.5"
"       25.955   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       33.333   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  1.178    c.m/sec"
"                     0.789     1.180     1.178     0.035 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.789     1.178     1.178     0.035"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.789     1.178     1.178     0.035"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  1.178    c.m/sec"
"             Hydrograph volume          5435.673    c.m"
"                     0.789     1.178     1.178     1.178"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.789     0.000     1.178     1.178"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
```

```
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.418   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.530     0.000     1.178     1.178 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  38.106     4.916      38.106     minutes"
"             Time to Centroid       138.366    90.175     138.366    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        5767.99    0.01       5768.00    c.m"
"             Rainfall losses        50.510     5.941      50.510     mm"
"             Runoff depth           36.227     80.796     36.227     mm"
"             Runoff volume          2409.09    0.01       2409.10    c.m"
"             Runoff coefficient     0.418      0.000      0.418      "
"             Maximum flow           0.530      0.000      0.530      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.530     0.530     1.178     1.178"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.830   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.747   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.417   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.104     0.530     1.178     1.178 c.m/sec"
"              Catchment 21           Pervious   Impervious Total Area "
"              Surface Area           0.747      0.083      0.830      hectare"
"              Time of concentration  17.241     2.224      14.282     minutes"
"              Time to Centroid       114.897    86.667     109.333    minutes"
"              Rainfall depth         86.737     86.737     86.737     mm"
"              Rainfall volume        647.92     71.99      719.92     c.m"
"              Rainfall losses        50.540     6.774      46.163     mm"
"              Runoff depth           36.197     79.963     40.574     mm"
"              Runoff volume          270.39     66.37      336.76     c.m"
"              Runoff coefficient     0.417      0.922      0.468      "
"              Maximum flow           0.092      0.031      0.104      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.104     0.593     1.178     1.178"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.104     0.593     0.593     1.178"
" 64           SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                  0.593    c.m/sec"
"              Hydrograph volume          2745.860    c.m"
" 40           HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Total"
"              Maximum flow                  1.755    c.m/sec"
"              Hydrograph volume          8181.533    c.m"
"                    0.104     0.593     0.593     1.755"
" 38           START/RE-START TOTALS 21"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                    22.730    hectare"
"              Total Impervious area                    0.083    hectare"
"              Total % impervious                       0.365"
" 19           EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                        Modelling Files\2022-07-25"
"                Output filename:                                     Ex__100yr.out"
"                Licensee name:                                                gmbp"
"                Company                                                       gmbp"
"                Date & Time last used:                    7/25/2022 at 1:49:40 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     6933.019   Coefficient A"
"       34.699   Constant B"
"        0.998   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           168.777    mm/hr"
"             Total depth                  97.921    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           30   Catchment 30"
"        0.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.452   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                   0.043     0.000     0.000     0.000 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           0.240      0.000      0.240      hectare"
"             Time of concentration  10.606     1.421      10.606     minutes"
"             Time to Centroid       106.728    85.423     106.728    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        235.01     0.00       235.01     c.m"
"             Rainfall losses        53.628     6.787      53.628     mm"
"             Runoff depth           44.294     91.134     44.294     mm"
"             Runoff volume          106.30     0.00       106.30     c.m"
"             Runoff coefficient     0.452      0.000      0.452      "
"             Maximum flow           0.043      0.000      0.043      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.043     0.043     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                   0.043     0.043     0.043     0.000"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                To Walser Street"
"             Maximum flow                  0.043    c.m/sec"
"             Hydrograph volume           106.305    c.m"
"                   0.043     0.043     0.043     0.043"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.043     0.000     0.043     0.043"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.454   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.801     0.000     0.043     0.043 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  35.531     4.759      35.530     minutes"
"             Time to Centroid       134.554    89.737     134.554    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        7598.69    0.01       7598.69    c.m"
"             Rainfall losses        53.501     6.084      53.501     mm"
"             Runoff depth           44.420     91.837     44.420     mm"
"             Runoff volume          3447.00    0.01       3447.01    c.m"
"             Runoff coefficient     0.454      0.000      0.454      "
"             Maximum flow           0.801      0.000      0.801      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.801     0.801     0.043     0.043"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.020     0.801     0.043     0.043 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.130      0.000      0.130      hectare"
"             Time of concentration  16.076     2.153      16.076     minutes"
"             Time to Centroid       112.853    86.345     112.853    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        127.30     0.00       127.30     c.m"
```

```
"              Rainfall losses        53.605     6.948      53.605     mm"
"              Runoff depth           44.316     90.973     44.316     mm"
"              Runoff volume          57.61      0.00       57.61      c.m"
"              Runoff coefficient     0.453      0.000      0.453      "
"              Maximum flow           0.020      0.000      0.020      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.020     0.813     0.043     0.043"
" 33           CATCHMENT 40"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            40   Catchment 40"
"         0.000   % Impervious"
"         7.120   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         7.120   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        74.000   Pervious SCS Curve No."
"         0.453   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.924   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.985     0.813     0.043     0.043 c.m/sec"
"              Catchment 40           Pervious   Impervious Total Area "
"              Surface Area           7.120      0.000      7.120      hectare"
"              Time of concentration  20.504     2.747      20.504     minutes"
"              Time to Centroid       117.777    87.189     117.777    minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        6971.99    0.01       6972.00    c.m"
"              Rainfall losses        53.532     7.496      53.532     mm"
"              Runoff depth           44.389     90.426     44.389     mm"
"              Runoff volume          3160.50    0.01       3160.50    c.m"
"              Runoff coefficient     0.453      0.000      0.453      "
"              Maximum flow           0.985      0.000      0.985      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.985     1.721     0.043     0.043"
" 54           POND DESIGN"
"         1.721   Current peak flow    c.m/sec"
```

```
"        0.050   Target outflow    c.m/sec"
"       6665.1   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                 1.507    c.m/sec"
"             Maximum level              409.822    metre"
"             Maximum storage            917.762    c.m"
"             Centroidal lag               2.275   hours"
"                  0.985     1.721     1.507     0.043 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.985     1.507     1.507     0.043"
" 52          CHANNEL DESIGN"
"        1.507   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                0.456    metre"
"             Velocity                     1.080    m/sec"
"             Channel capacity            10.655    c.m/sec"
"             Critical depth               0.400    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.386   X-factor <= 0.5"
"       50.288   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 1.499    c.m/sec"
"                     0.985     1.507     1.499     0.043 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.985     1.499     1.499     0.043"
```

```
" 52          CHANNEL DESIGN"
"        1.499   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.386    metre"
"             Velocity                      1.232    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.325    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.256   X-factor <= 0.5"
"       24.228   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       33.333   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  1.499    c.m/sec"
"                     0.985     1.499     1.499     0.043 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.985     1.499     1.499     0.043"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.985     1.499     1.499     0.043"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  1.499    c.m/sec"
"             Hydrograph volume          6665.152    c.m"
"                     0.985     1.499     1.499     1.499"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.985     0.000     1.499     1.499"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
```

```
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.454   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.687     0.000     1.499     1.499 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           6.650      0.000      6.650      hectare"
"             Time of concentration  35.531     4.759      35.530     minutes"
"             Time to Centroid       134.554    89.737     134.554    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        6511.76    0.01       6511.77    c.m"
"             Rainfall losses        53.501     6.084      53.501     mm"
"             Runoff depth           44.420     91.837     44.420     mm"
"             Runoff volume          2953.94    0.01       2953.94    c.m"
"             Runoff coefficient     0.454      0.000      0.454      "
"             Maximum flow           0.687      0.000      0.687      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.687     0.687     1.499     1.499"
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.830   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.747   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

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"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.135     0.687     1.499     1.499 c.m/sec"
"             Catchment 21           Pervious   Impervious Total Area "
"             Surface Area           0.747      0.083      0.830      hectare"
"             Time of concentration  16.076     2.153      13.490     minutes"
"             Time to Centroid       112.853    86.345     107.930    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        731.47     81.27      812.75     c.m"
"             Rainfall losses        53.605     6.948      48.939     mm"
"             Runoff depth           44.316     90.973     48.982     mm"
"             Runoff volume          331.04     75.51      406.55     c.m"
"             Runoff coefficient     0.453      0.929      0.500      "
"             Maximum flow           0.117      0.034      0.135      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.135     0.765     1.499     1.499"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.135     0.765     0.765     1.499"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.765    c.m/sec"
"             Hydrograph volume          3360.493    c.m"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                  2.244    c.m/sec"
"             Hydrograph volume         10025.642    c.m"
"                     0.135     0.765     0.765     2.244"
" 38          START/RE-START TOTALS 21"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      22.730    hectare"
"             Total Impervious area                      0.083    hectare"
"             Total % impervious                         0.365"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                    Modelling Files\2022-07-25"
"                Output filename:                                   Ex__REG.out"
"                Licensee name:                                            gmbp"
"                Company                                                   gmbp"
"                Date & Time last used:                 7/25/2022 at 1:51:35 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"             Maximum intensity            53.000    mm/hr"
"             Total depth                 285.000    mm"
"            6   000hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           30   Catchment 30"
"        0.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.713   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.027     0.000     0.000     0.000 c.m/sec"
"              Catchment 30           Pervious   Impervious Total Area "
"              Surface Area           0.240      0.000      0.240      hectare"
"              Time of concentration  12.633     2.243      12.633     minutes"
"              Time to Centroid       2530.545   2290.972   2530.545   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        684.00     0.00       684.00     c.m"
"              Rainfall losses        81.839     43.972     81.839     mm"
"              Runoff depth           203.161    241.028    203.161    mm"
"              Runoff volume          487.58     0.00       487.59     c.m"
"              Runoff coefficient     0.713      0.000      0.713      "
"              Maximum flow           0.027      0.000      0.027      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.027     0.027     0.000     0.000"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.027     0.027     0.027     0.000"
" 40           HYDROGRAPH   Combine    2"
"             6   Combine "
"             2   Node #"
"                 To Walser Street"
"              Maximum flow                  0.027    c.m/sec"
"              Hydrograph volume           487.585    c.m"
"                     0.027     0.027     0.027     0.027"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                     0.027     0.000     0.027     0.027"
" 33           CATCHMENT 10"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            10   Catchment 10"
"        0.000   % Impervious"
"        7.760   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        7.760   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
```

```
"       74.000   Pervious SCS Curve No."
"        0.714   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.881     0.000     0.027     0.027 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           7.760      0.000      7.760      hectare"
"             Time of concentration  42.319     7.513      42.319     minutes"
"             Time to Centroid       2572.242   2276.224   2572.241   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        2.2116     0.0000     2.2116     ha-m"
"             Rainfall losses        81.644     25.621     81.644     mm"
"             Runoff depth           203.356    259.379    203.356    mm"
"             Runoff volume          1.5780     0.0000     1.5780     ha-m"
"             Runoff coefficient     0.714      0.000      0.714      "
"             Maximum flow           0.881      0.000      0.881      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.881     0.881     0.027     0.027"
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   Catchment 11"
"        0.000   % Impervious"
"        0.130   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.130   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.723   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.014     0.881     0.027     0.027 c.m/sec"
```

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"              Catchment 11           Pervious   Impervious Total Area "
"              Surface Area           0.130      0.000      0.130      hectare"
"              Time of concentration  19.148     3.399      19.148     minutes"
"              Time to Centroid       2545.193   2266.333   2545.193   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        370.50     0.00       370.50     c.m"
"              Rainfall losses        78.940     42.646     78.940     mm"
"              Runoff depth           206.060    242.354    206.060    mm"
"              Runoff volume          267.88     0.00       267.88     c.m"
"              Runoff coefficient     0.723      0.000      0.723      "
"              Maximum flow           0.014      0.000      0.014      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.014     0.894     0.027     0.027"
" 33           CATCHMENT 40"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           40   Catchment 40"
"        0.000   % Impervious"
"        7.120   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.120   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.716   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.772     0.894     0.027     0.027 c.m/sec"
"              Catchment 40           Pervious   Impervious Total Area "
"              Surface Area           7.120      0.000      7.120      hectare"
"              Time of concentration  24.421     4.336      24.421     minutes"
"              Time to Centroid       2549.942   2258.969   2549.942   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        2.0292     0.0000     2.0292     ha-m"
"              Rainfall losses        80.848     39.404     80.848     mm"
"              Runoff depth           204.152    245.596    204.152    mm"
"              Runoff volume          1.4536     0.0000     1.4536     ha-m"
"              Runoff coefficient     0.716      0.000      0.716      "
```

```
"             Maximum flow           0.772      0.000      0.772      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.772     1.667     0.027     0.027"
" 54          POND DESIGN"
"        1.667   Current peak flow    c.m/sec"
"        0.050   Target outflow    c.m/sec"
"      30583.9   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
"             Peak outflow                1.612    c.m/sec"
"             Maximum level             409.831    metre"
"             Maximum storage           977.909    c.m"
"             Centroidal lag             42.858   hours"
"                  0.772     1.667     1.612     0.027 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.772     1.612     1.612     0.027"
" 52          CHANNEL DESIGN"
"        1.612   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow               0.468    metre"
"             Velocity                    1.098    m/sec"
"             Channel capacity           10.655    c.m/sec"
"             Critical depth              0.411    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.383   X-factor <= 0.5"
"       49.448   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
```

```
"            1   No. of sub-reaches"
"             Peak outflow                 1.606    c.m/sec"
"                     0.772     1.612     1.606     0.027 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.772     1.606     1.606     0.027"
" 52          CHANNEL DESIGN"
"        1.606   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                0.401    metre"
"             Velocity                     1.256    m/sec"
"             Channel capacity             9.246    c.m/sec"
"             Critical depth               0.339    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.248   X-factor <= 0.5"
"       23.758   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       35.644   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 1.603    c.m/sec"
"                     0.772     1.606     1.603     0.027 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.772     1.603     1.603     0.027"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.772     1.603     1.603     0.027"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total"
"             Maximum flow                 1.603    c.m/sec"
"             Hydrograph volume        30582.604    c.m"
"                     0.772     1.603     1.603     1.603"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.772     0.000     1.603     1.603"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
```

```
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"        6.650   Total Area"
"      150.000   Flow length"
"        2.000   Overland Slope"
"        6.650   Pervious Area"
"      150.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"      150.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.714   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.755     0.000     1.603     1.603 c.m/sec"
"              Catchment 20           Pervious   Impervious Total Area "
"              Surface Area           6.650      0.000      6.650      hectare"
"              Time of concentration  42.319     7.513      42.319     minutes"
"              Time to Centroid       2572.242   2276.224   2572.241   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        1.8952     0.0000     1.8952     ha-m"
"              Rainfall losses        81.644     25.621     81.644     mm"
"              Runoff depth           203.356    259.379    203.356    mm"
"              Runoff volume          1.3523     0.0000     1.3523     ha-m"
"              Runoff coefficient     0.714      0.000      0.714      "
"              Maximum flow           0.755      0.000      0.755      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.755     0.755     1.603     1.603"
" 33           CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   Catchment 20"
"       10.000   % Impervious"
"        0.830   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.747   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.083   Impervious Area"
```

```
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       74.000   Pervious SCS Curve No."
"        0.723   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.924   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.088     0.755     1.603     1.603 c.m/sec"
"              Catchment 21           Pervious   Impervious Total Area "
"              Surface Area           0.747      0.083      0.830      hectare"
"              Time of concentration  19.148     3.399      17.327     minutes"
"              Time to Centroid       2545.193   2266.333   2512.963   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        2128.95    236.55     2365.50    c.m"
"              Rainfall losses        78.940     42.646     75.310     mm"
"              Runoff depth           206.060    242.354    209.690    mm"
"              Runoff volume          1539.27    201.15     1740.42    c.m"
"              Runoff coefficient     0.723      0.850      0.736      "
"              Maximum flow           0.079      0.010      0.088      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.088     0.841     1.603     1.603"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.088     0.841     0.841     1.603"
" 64           SHOW TABLE"
"             2   Flow hydrograph"
"             4   Inflow Hydrograph"
"              Maximum flow                  0.841    c.m/sec"
"              Hydrograph volume         15263.571    c.m"
" 40           HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 Total"
"              Maximum flow                  2.444    c.m/sec"
"              Hydrograph volume         45846.176    c.m"
"                     0.088     0.841     0.841     2.444"
" 38           START/RE-START TOTALS 21"
"             3   Runoff Totals on EXIT"
"              Total Catchment area                     22.730    hectare"
"              Total Impervious area                     0.083    hectare"
"              Total % impervious                        0.365"
" 19           EXIT"
```

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411009
March 2023

Catchment 1000 : Stormwater Management Facility No. 1

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
411.00	0.00	14.8	0	0.0	CB.1 Lip
411.10	0.10	353.3	18	18.4	
411.20	0.20	1,188.7	77	95.5	
411.30	0.30	1,699.2	144	239.9	
411.40	0.40	2,215.9	196	435.7	CB.2 Lip
411.50	0.50	2,897.0	256	691.3	
411.60	0.60	3,828.7	336	1,027.6	
411.70	0.70	4,620.0	422	1,450.0	
411.80	0.80	5,096.6	486	1,935.8	
411.85	0.85	5,297.4	260	2,195.7	Weir
411.90	0.90	5,498.2	270	2,465.6	
412.00	1.00	5,792.6	565	3,030.1	Top of bank

Outlet #1
450 mm diameter pipe
250 mm orifice

Q = 0.133 m^3/s
Cd = 0.600
H = 1.045 m
2g = 19.620

A = 0.049 m^2
D = 0.250 m
D/2 = 0.125 m
Invert = 410.83

Outlet #2
525 mm diameter pipe
350 mm orifice

Q = 0.246 m^3/s
Cd = 0.600
H = 0.925 m
2g = 19.620

A = 0.096 m^2
D = 0.350 m
D/2 = 0.175 m
Invert = 410.9

Overflow Weir
Elevation = 411.85

d1 = 1.00 m
h = 0.85 m
H = 0.15 m
2g = 19.620
L = 20.00 m

Q = 1.638 m^3/s

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 250 mm (m^3/s)	Outlet #2 350mm (m^3/s)	Overflow Weir (m^3/s)	Actual Discharge (m^3/s)	
411.00	0.00	0.0	0.000	0.000	0.000	0.000	CB.1 Lip
411.10	0.10	18.4	0.032	0.000	0.000	0.032	
411.20	0.20	95.5	0.065	0.000	0.000	0.065	
411.30	0.30	239.9	0.077	0.000	0.000	0.077	
411.40	0.40	435.7	0.087	0.000	0.000	0.087	
411.50	0.50	691.3	0.096	0.000	0.000	0.096	
411.60	0.60	1,027.6	0.105	0.000	0.000	0.105	CB.2 Lip
411.70	0.70	1,450.0	0.113	0.202	0.000	0.315	
411.80	0.80	1,935.8	0.120	0.218	0.000	0.338	
411.85	0.85	2,195.7	0.123	0.225	0.000	0.349	Weir
411.90	0.90	2,465.6	0.127	0.232	0.308	0.667	
412.00	1.00	3,030.1	0.133	0.246	1.638	2.018	Top of bank

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
G&M File: 411009
March 2023

Catchment 2100 : Stormwater Management Facility No. 2

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Quality Storage (m^3)	Accum. Quality Storage (m^3)	Increm. Active Storage (m^3)	Accum. Active Storage (m^3)	
410.51	0.00	795.09	0.00	0.00			Outlet Pipe Invert
410.65	0.14	835.70	114.16	114.16	0	0.0	Pond Bottom/Knockout
410.70	0.19	888.00			43	43.1	
410.80	0.29	941.90			91	134.6	
410.90	0.39	996.40			97	231.5	
411.00	0.49	1052.40			102	333.9	
411.10	0.59	1109.60			108	442.0	CB Lip
411.20	0.69	1167.90			114	555.9	
411.30	0.79	1227.50			120	675.7	
411.40	0.89	1288.15			126	801.5	
411.50	0.99	1350.10			132	933.4	
411.60	1.09	1413.30			138	1,071.6	
411.65	1.14	1444.90			71	1,143.0	Weir
411.70	1.19	1476.50			73	1,216.0	
411.80	1.29	1559.40			152	1,367.8	Top of bank

Outlet #1
150 mm Diameter Knockout

Q = 0.032 m^3/s
Cd = 0.600
H = 0.475 m
2g = 19.620

A = 0.018 m^2
D = 0.150 m
D/2 = 0.075 m

Outlet #2
300 mm diameter orifice

Q = 0.201 m^3/s
Cd = 0.600
H = 0.940 m
2g = 19.620

A = 0.071 m^2
D = 0.300 m
D/2 = 0.150 m
Invert = 410.51

Overflow Weir
Elevation = 411.65

d1 = 1.15 m
h = 1.00 m
H = 0.15 m
2g = 19.62
L = 10.00 m

Q = 0.815 m^3/s

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 150 mm (m^3/s)	Outlet #2 300 mm (m^3/s)	Overflow Weir (m^3/s)	Actual Discharge (m^3/s)	
410.65	0.00	0.0	0.000	0.000	0.000	0.000	Pond Bottom/Knockout
410.70	0.05	43.1	0.006	0.000	0.000	0.006	
410.80	0.15	134.6	0.013	0.000	0.000	0.013	
410.90	0.25	231.5	0.020	0.000	0.000	0.020	
411.00	0.35	333.9	0.025	0.000	0.000	0.025	
411.10	0.45	442.0	0.029	0.000	0.000	0.029	CB Lip
411.20	0.55	555.9	0.000	0.138	0.000	0.138	
411.30	0.65	675.7	0.000	0.150	0.000	0.150	
411.40	0.75	801.5	0.000	0.162	0.000	0.162	
411.50	0.85	933.4	0.000	0.172	0.000	0.172	
411.60	0.95	1,071.6	0.000	0.182	0.000	0.182	
411.65	1.00	1,143.0	0.000	0.187	0.000	0.187	Weir
411.70	1.05	1,216.0	0.000	0.192	0.153	0.345	
411.80	1.15	1,367.8	0.000	0.201	0.815	1.015	Top of bank

AINLEY SUBDIVISION
TOWNSHIP OF CENTRE WELLINGTON
Our File: 411009
March 14, 2023

Catchment 3200: Proposed Super Pipe

Pipe Volumes

From	To	Length (m)	Diameter (m)	Volume (m3)	Initial Invert (Approx)	Final Invert (Approx)	Initial Obvert	Final Obvert
MH.4	MH.3	27.4	1.2	30.99	410.96	411.23	412.16	412.43
MH.3	CBMH.1	28.3	1.2	32.01	410.65	410.93	411.85	412.13
			Total	**63.00**				

Structure Volumes

	Area	Inv.	T/G	Volume (m^3) - up to Weir Depth or Top of Grate
CBMH.1	1.13	410.62	413.98	3.6
MH.3	1.13	410.93	414.66	3.3
MH.4	1.13	411.23	415.44	2.9
			Total	**9.8**

Total Volume from Pipes and Structures (Up to Weir Elevation of 413.98)	**72.84**

ELEV (m)	**INC. DEPTH (m)**	**PIPE + MANHOLE STORAGE VOL (m^3)**	**ACCUM STORAGE VOL (m^3)**	
410.62	0.00	0.00	0.00	Orifice Invert
410.87	0.25	4.85	4.85	
411.12	0.50	9.50	14.35	
411.37	0.75	9.72	24.07	
411.62	1.00	9.85	33.92	
411.87	1.25	9.85	43.77	
412.12	1.50	9.85	53.61	
412.37	1.75	9.85	63.46	
412.62	2.00	9.85	73.31	Pipe Obvert
412.87	2.25	0.85	74.16	
413.12	2.50	0.85	75.00	
413.37	2.75	0.85	75.85	
413.62	3.00	0.85	76.70	
413.98	3.36	1.22	77.92	CBMH.43 T/G Weir
414.23	3.61	0.57	78.48	Overflow

ORIFICE CALCULATIONS

Invert = 410.62 m
Q = 0.057 m^3/s
Cd = 0.6
H = 3.55 m
2g = 19.62
A = 0.011 m^2
D= 0.120 m

OVERFLOW WEIR

Q = 0.104 cu m/s
d1 = 3.610 m
h = 3.360 m
H = 0.250 m
2g = 19.620
L = 0.600 m

Super Pipe (continued)

ELEVATION	STAGE (m)	STORAGE (cu m)	ORIFICE DISCHARGE (cu m/s)	WEIR DISCHARGE (cu m/s)	TOTAL DISCHARGE (cu m/s)	
410.62	0.000	0.00	0.000	0.000	0.000	Orifice Invert
410.87	0.250	4.85	0.013	0.000	0.013	
411.12	0.500	14.35	0.020	0.000	0.020	
411.37	0.750	24.07	0.025	0.000	0.025	
411.62	1.000	33.92	0.029	0.000	0.029	
411.87	1.250	43.77	0.033	0.000	0.033	
412.12	1.500	53.61	0.036	0.000	0.036	Pipe Obvert
412.37	1.750	63.46	0.039	0.000	0.039	
412.62	2.000	73.31	0.042	0.000	0.042	
412.87	2.250	74.16	0.044	0.000	0.044	
413.12	2.500	75.00	0.047	0.000	0.047	
413.37	2.750	75.85	0.049	0.000	0.049	
413.62	3.000	76.70	0.052	0.000	0.052	
413.98	3.360	77.92	0.055	0.000	0.055	CBMH.43 T/G Weir
414.23	3.610	78.48	0.057	0.104	0.160	Overflow

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
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Catchment 4000: Wetland

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
409.63	0.00	2,833	0	0.0	Wetland Bottom
409.75	0.12	3,871	402	402.2	
410.00	0.37	10,414	1786	2,187.9	
410.25	0.62	14,634	3131	5,318.9	
410.50	0.87	19,953	4323	9,642.3	
410.75	1.12	24,730	5585	15,227.7	Overflow

WEIR CALCULATIONS

H = 1.12 m

L = 10 m

Q = 18.965 m^3/s

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Actual Discharge (m^3/s)	
409.63	0.00	0.0	0.000	Wetland Bottom
409.75	0.12	402.2	0.665	
410.00	0.37	2,187.9	3.601	
410.25	0.62	5,318.9	7.811	
410.50	0.87	9,642.3	12.984	
410.75	1.12	15,227.7	18.965	Overflow

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
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Catchment 2200 : Private Stormwater Management Facility Multi-Family Block

Stage Storage Volume Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Increm. Storage (m^3)	Accum. Storage (m^3)	
413.70	0.00	847	0	0.0	Bottom of Pond/Knockout
413.80	0.10	924	89	88.6	
413.90	0.20	1,049	99	187.2	
414.00	0.30	1,175	111	298.4	
414.10	0.40	1,302	124	422.2	
414.20	0.50	1,431	137	558.9	
414.30	0.60	1,561	150	708.5	
414.40	0.70	1,692	163	871.1	CB Lip
414.50	0.80	1,825	176	1,046.9	
414.60	0.90	1,959	189	1,236.1	
414.70	1.00	2,094	203	1,438.7	Weir
415.00	1.30	2,231	649	2,087.4	Top of bank

Outlet #1

110 mm Diameter Knockout

Q = 0.020 m^3/s
Cd = 0.600
H = 0.645 m
2g = 19.620

A = 0.010 m^2
D = 0.110 m
D/2 = 0.055 m

Outlet #2

450 mm diameter pipe

Q = 0.395 m^3/s
Cd = 0.600
H = 0.875 m
2g = 19.620

A = 0.159 m^2
D = 0.450 m
D/2 = 0.225 m
Invert = 413.6

Overflow Weir

Elevation = 414.70

d1 = 1.30 m
h = 1.00 m
H = 0.30 m
2g = 19.62
L = 10.00 m

Q = 2.369 m^3/s

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 110 mm (m^3/s)	Outlet #2 450 mm (m^3/s)	Overflow Weir (m^3/s)	Actual Discharge (m^3/s)	
413.70	0.00	0.0	0.000	0.000	0.000	0.000	Bottom of Pond/Knockout
413.80	0.10	88.6	0.005	0.000	0.000	0.005	
413.90	0.20	187.2	0.010	0.000	0.000	0.010	
414.00	0.30	298.4	0.013	0.000	0.000	0.013	
414.10	0.40	422.2	0.015	0.000	0.000	0.015	CB Lip
414.20	0.50	558.9	0.000	0.259	0.000	0.259	
414.30	0.60	708.5	0.000	0.291	0.000	0.291	
414.40	0.70	871.1	0.000	0.321	0.000	0.321	
414.50	0.80	1,046.9	0.000	0.347	0.000	0.347	
414.60	0.90	1,236.1	0.000	0.372	0.000	0.372	
414.70	1.00	1,438.7	0.000	0.395	0.000	0.395	Weir
415.00	1.30	2,087.4	0.000	0.458	2.369	2.828	Top of bank

Ainley Farm Subdivision
Our File: 411009
March 14, 2023

Catchment 1200: Proposed Infiltration Gallery

STORAGE VOLUME CALCULATIONS

ELEV (m)	INC D (m)	SURFACE AREA (Infil. Gall) (sq m)	INCR. PIPE STORAGE VOL (cu m)	INCR. GALLERY STORAGE VOL (cu m)	ACCUM STORAGE VOL (cu m)	
412.000	0.000	539.90	0.00	0.00	0.00	Bottom of Stone
412.100	0.100	539.90	25.13	9.52	34.65	
412.200	0.200	539.90	25.13	9.52	69.31	
412.300	0.300	539.90	25.13	9.52	103.96	
412.400	0.400	539.90	25.13	9.52	138.61	
412.500	0.500	539.90	0.00	17.82	156.43	
412.600	0.600	539.90	0.00	17.82	174.25	
412.700	0.700	539.90	0.00	17.82	192.06	Top of Stone
412.900	0.900	1.85	0.00	0.37	192.43	
413.230	1.230	1.85	0.00	0.61	193.04	CB 46N Lip
413.430	1.430	5.00	0.00	0.68	193.73	
413.630	1.630	10.00	0.00	1.50	195.23	
413.830	1.830	15.00	0.00	2.50	197.73	
414.030	2.030	20.00	0.00	3.50	201.23	
414.090	2.090	25.00	0.00	1.35	202.58	RYCB 46O Lip
414.290	2.290	30.00	0.00	5.50	208.08	
414.490	2.490	35.00	0.00	6.50	214.58	Overflow

BOTTOM INFILTRATION

L1(dw) = 79.4 m
W1(dw) = 3.5 m
L2(dw) = 52.4 m
W2(dw) = 5.0 m
D(dw) = 0.70 m

A(c) = 539.9 sq m
VOL(dw)= 277.4 cu m
VOL(st)= 92.5 cu m
K = 4 mm/hr
= 1.11E-04 cm/s

SIDE INFILTRATION
ALL SIDES

L1(dw) = 79.4 m
W1(dw) = 3.5 m
L2(dw) = 52.4 m
W2(dw) = 5.0 m
D(dw) = 0.7 m

A(c) = 196.4 sq m
K = 4 mm/hr
= 1.11E-04 cm/s

Weir (1)
Elevation = 413.23

d1 = 2.49 m
h = 1.23 m
H = 1.26 m
2g = 19.620
L = 0.36 m

Q = 0.799 m^3/s

Weir (2)
Elevation = 414.09

d1 = 2.49 m
h = 2.09 m
H = 0.40 m
2g = 19.620
L = 0.36 m

Q = 0.129 m^3/s

ELEVATION	STAGE (m)	STORAGE (cu m)	INFILTRATION DISCHARGE (cu m/s)	OVERFLOW WEIR (cu m/s)	OVERFLOW WEIR (cu m/s)	TOTAL DISCHARGE (cu m/s)	
412.000	0.000	0.00	0.0003	0.000	0.000	0.0003	Bottom of Stone
412.100	0.100	34.65	0.0003	0.000	0.000	0.0003	
412.200	0.200	69.31	0.0003	0.000	0.000	0.0003	
412.300	0.300	103.96	0.0003	0.000	0.000	0.0003	
412.400	0.400	138.61	0.0003	0.000	0.000	0.0003	
412.500	0.500	156.43	0.0003	0.000	0.000	0.0003	
412.600	0.600	174.25	0.0003	0.000	0.000	0.0003	
412.700	0.700	192.06	0.0003	0.000	0.000	0.0003	Top of Stone
412.900	0.900	192.43	0.0003	0.000	0.000	0.0003	
413.230	1.230	193.04	0.0003	0.000	0.000	0.0003	CB 46N Lip
413.430	1.430	193.73	0.0000	0.045	0.000	0.0453	
413.630	1.630	195.23	0.0000	0.132	0.000	0.1319	
413.830	1.830	197.73	0.0000	0.248	0.000	0.2482	
414.030	2.030	201.23	0.0000	0.390	0.000	0.3899	
414.090	2.090	202.58	0.0000	0.437	0.000	0.4369	RYCB 46O Lip
414.290	2.290	208.08	0.0000	0.608	0.045	0.6524	
414.490	2.490	214.58	0.0000	0.799	0.129	0.9278	Overflow

Ainley Farm Subdivision
Our File: 411009
March 14, 2023

Catchment 1400: Proposed Infiltration Gallery

STORAGE VOLUME CALCULATIONS

ELEV (m)	INC D (m)	SURFACE AREA (sq m)	INCR. PIPE STORAGE VOL (cu m)	INCR. GALLERY STORAGE VOL (cu m)	ACCUM STORAGE VOL (cu m)	
413.920	0.000	790.50	0.00	0.00	0.00	Bottom of Stone
414.020	0.100	790.50	0.00	26.35	26.35	
414.120	0.200	790.50	3.68	25.12	55.15	
414.220	0.300	790.50	3.68	25.12	83.95	
414.320	0.400	790.50	3.68	25.12	112.75	
414.420	0.500	790.50	0.00	26.35	139.10	
414.520	0.600	790.50	0.00	26.35	165.45	
414.620	0.700	790.50	0.00	26.35	191.80	Top of Stone
414.720	0.800	0.72	0.07	0.00	191.87	Pipe Invert
414.820	0.900	0.72	0.07	0.00	191.95	
414.920	1.000	0.72	0.07	0.00	192.02	
415.020	1.100	0.72	0.07	0.00	192.09	
415.120	1.200	0.72	0.07	0.00	192.16	Top of Grate
415.220	1.300	185.00	9.29	0.00	201.45	
415.320	1.400	565.00	37.50	0.00	238.95	
415.420	1.500	750.00	65.75	0.00	304.70	Weir
415.520	1.600	800.00	77.50	0.00	382.20	Overflow

BOTTOM INFILTRATION

L1(dw) = 79.1 m
W1(dw) = 10.0 m
D(dw) = 0.70 m

A(c) = 790.5 sq m
VOL(dw)= 553.4 cu m
VOL(st)= 184.5 cu m
K = 4 mm/hr
= 1.11E-04 cm/s

SIDE INFILTRATION
ALL SIDES

L1(dw) = 79.1 m
W1(dw) = 10.0 m
D(dw) = 0.7 m

A(c) = 124.7 sq m

K = 4 mm/hr
= 1.11E-04 cm/s

Pipe Outlet

300 mm diameter pipe
200 mm orifice
Q = 0.075 m^3/s
Cd = 0.6
H = 0.80 m
2g = 19.62

A = 0.031 m^2
D = 0.2 m
D/2 = 0.1 m

Overflow Weir

Elevation = 411.90
d1 = 1.600 m
h = 1.500 m
H = 0.100 m
2g = 19.620
L = 5.000 m

Q = 0.218 m^3/s

ELEVATION	STAGE (m)	STORAGE (cu m)	INFILTRATION DISCHARGE (cu m/s)	PIPE DISCHARGE (cu m/s)	OVERFLOW WEIR (cu m/s)	TOTAL DISCHARGE (cu m/s)	
413.920	0.000	0.00	0.0009	0.000	0.000	0.0009	Bottom of Stone
414.020	0.100	26.35	0.0009	0.000	0.000	0.0009	
414.120	0.200	55.15	0.0009	0.000	0.000	0.0009	
414.220	0.300	83.95	0.0009	0.000	0.000	0.0009	
414.320	0.400	112.75	0.0009	0.000	0.000	0.0009	
414.420	0.500	139.10	0.0009	0.000	0.000	0.0009	
414.520	0.600	165.45	0.0009	0.000	0.000	0.0009	
414.620	0.700	191.80	0.0009	0.000	0.000	0.0009	Top of Stone
414.720	0.800	191.87	0.0009	0.000	0.000	0.0009	Pipe Invert
414.820	0.900	191.95	0.0000	0.026	0.000	0.0264	
414.920	1.000	192.02	0.0000	0.037	0.000	0.0373	
415.020	1.100	192.09	0.0000	0.046	0.000	0.0457	
415.120	1.200	192.16	0.0000	0.053	0.000	0.0528	Top of Grate
415.220	1.300	201.45	0.0000	0.059	0.219	0.2777	
415.320	1.400	238.95	0.0000	0.065	0.629	0.6941	
415.420	1.500	304.70	0.0000	0.070	1.175	1.2444	Weir
415.520	1.600	382.20	0.0000	0.075	1.834	1.9086	Overflow

```
"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                       Sunday, February 07, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                   Modelling Files\2022-07-25"
"               Output filename:                                 Post__2yr.out"
"               Licensee name:                                            gmbp"
"               Company                                                   gmbp"
"               Date & Time last used:                 7/25/2022 at 11:17:12 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      695.050   Coefficient A"
"        6.387   Constant B"
"        0.793   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            93.293    mm/hr"
"             Total depth                  33.014    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.829   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.021     0.000     0.000     0.000 c.m/sec"
"            Catchment 1200         Pervious   Impervious Total Area "
"            Surface Area           0.110      0.110      0.220      hectare"
"            Time of concentration  13.484     1.233      3.680      minutes"
"            Time to Centroid       116.839    87.775     93.582     minutes"
"            Rainfall depth         33.014     33.014     33.014     mm"
"            Rainfall volume        36.32      36.32      72.63      c.m"
"            Rainfall losses        26.179     5.640      15.910     mm"
"            Runoff depth           6.835      27.374     17.104     mm"
"            Runoff volume          7.52       30.11      37.63      c.m"
"            Runoff coefficient     0.207      0.829      0.518      "
"            Maximum flow           0.003      0.021      0.021      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.021     0.021     0.000     0.000"
" 33         CATCHMENT 1300"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        1300   Catchment 1300"
"      50.000   % Impervious"
"       0.700   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.350   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.350   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.207   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.838   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.063     0.021     0.000     0.000 c.m/sec"
"            Catchment 1300         Pervious   Impervious Total Area "
"            Surface Area           0.350      0.350      0.700      hectare"
"            Time of concentration  20.437     1.868      5.553      minutes"
"            Time to Centroid       125.085    88.659     95.888     minutes"
"            Rainfall depth         33.014     33.014     33.014     mm"
"            Rainfall volume        115.55     115.55     231.10     c.m"
"            Rainfall losses        26.169     5.363      15.766     mm"
"            Runoff depth           6.845      27.651     17.248     mm"
"            Runoff volume          23.96      96.78      120.74     c.m"
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```
"              Runoff coefficient     0.207      0.838      0.522      "
"              Maximum flow           0.007      0.063      0.063      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.063     0.084     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.207   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.836   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.020     0.084     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  17.197     1.572      4.676      minutes"
"              Time to Centroid       121.230    88.299     94.841     minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        36.32      36.32      72.63      c.m"
"              Rainfall losses        26.170     5.407      15.789     mm"
"              Runoff depth           6.844      27.606     17.225     mm"
"              Runoff volume          7.53       30.37      37.90      c.m"
"              Runoff coefficient     0.207      0.836      0.522      "
"              Maximum flow           0.002      0.020      0.020      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.020     0.105     0.000     0.000"
" 54           POND DESIGN"
"         0.105   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         196.3   Hydrograph volume    c.m"
"           17.   Number of stages"
```

```
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                  0.000    c.m/sec"
"             Maximum level               412.300    metre"
"             Maximum storage             104.033    c.m"
"             Centroidal lag               85.446   hours"
"                  0.020     0.105     0.000     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                  0.000    c.m/sec"
"             Hydrograph volume           190.804    c.m"
"                     0.020     0.105     0.000     0.000"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.020     0.000     0.000     0.000"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.496   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.124   Impervious Area"
```

```
"        30.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.207   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.837   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.024     0.000     0.000     0.000 c.m/sec"
"             Catchment 1400         Pervious   Impervious Total Area "
"             Surface Area           0.496      0.124      0.620      hectare"
"             Time of concentration  26.066     2.383      14.173     minutes"
"             Time to Centroid       131.779    89.515     110.556    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        163.75     40.94      204.69     c.m"
"             Rainfall losses        26.167     5.389      22.011     mm"
"             Runoff depth           6.847      27.625     11.003     mm"
"             Runoff volume          33.96      34.26      68.22      c.m"
"             Runoff coefficient     0.207      0.837      0.333      "
"             Maximum flow           0.008      0.023      0.024      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.024     0.024     0.000     0.000"
" 54          POND DESIGN"
"         0.024   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"          68.2   Hydrograph volume    c.m"
"           17.   Number of stages"
"       413.920   Minimum water level    metre"
"       415.520   Maximum water level    metre"
"       413.920   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 413.920   0.00088     0.000"
"                 414.020   0.00088    26.350"
"                 414.120   0.00089    55.150"
"                 414.220   0.00089    83.950"
"                 414.320   0.00089   112.750"
"                 414.420   0.00090   139.100"
"                 414.520   0.00090   165.450"
"                 414.620   0.00090   191.800"
"                 414.720   0.00090   191.870"
"                 414.820   0.02640   191.950"
"                 414.920   0.03734   192.020"
"                 415.020   0.04573   192.090"
"                 415.120   0.05281   192.160"
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"               415.220    0.2777   201.450"
"               415.320    0.6941   238.950"
"               415.420     1.244   304.700"
"               415.520     1.909   382.200"
"            Peak outflow                 0.001    c.m/sec"
"            Maximum level              414.120    metre"
"            Maximum storage             55.240    c.m"
"            Centroidal lag              13.537   hours"
"                 0.024     0.024     0.001     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    1000"
"           6   Combine "
"        1000   Node #"
"               Infiltrated On-Site"
"            Maximum flow                 0.001    c.m/sec"
"            Hydrograph volume           259.018    c.m"
"                    0.024     0.024     0.001     0.001"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                    0.024     0.000     0.001     0.001"
" 33         CATCHMENT 1500"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        1500   Catchment 1500"
"      50.000   % Impervious"
"       1.110   Total Area"
"      40.000   Flow length"
"       2.000   Overland Slope"
"       0.555   Pervious Area"
"      40.000   Pervious length"
"       2.000   Pervious slope"
"       0.555   Impervious Area"
"      40.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.207   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.834   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.105     0.000     0.001     0.001 c.m/sec"
"            Catchment 1500         Pervious   Impervious Total Area "
"            Surface Area           0.555      0.555      1.110      hectare"
"            Time of concentration  30.977     2.832      8.436      minutes"
"            Time to Centroid       137.612    90.217     99.655     minutes"
"            Rainfall depth         33.014     33.014     33.014     mm"
```

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"              Rainfall volume        183.23     183.23     366.46     c.m"
"              Rainfall losses        26.164     5.467      15.815     mm"
"              Runoff depth           6.850      27.547     17.198     mm"
"              Runoff volume          38.02      152.89     190.90     c.m"
"              Runoff coefficient     0.207      0.834      0.521      "
"              Maximum flow           0.008      0.104      0.105      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.105     0.105     0.001     0.001"
" 56           DIVERSION"
"         1500   Node number"
"        0.146   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"
"              DIV01500.002hyd"
"              Major flow at 1500"
"                      0.105     0.105     0.105     0.001 c.m/sec"
" 40           HYDROGRAPH Next link "
"            5   Next link "
"                      0.105     0.105     0.105     0.001"
" 33           CATCHMENT 1000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1000   Catchment 1000"
"       50.000   % Impervious"
"        6.980   Total Area"
"      100.000   Flow length"
"        2.000   Overland Slope"
"        3.490   Pervious Area"
"      100.000   Pervious length"
"        2.000   Pervious slope"
"        3.490   Impervious Area"
"      100.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.208   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.846   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.662     0.105     0.105     0.001 c.m/sec"
"              Catchment 1000         Pervious   Impervious Total Area "
"              Surface Area           3.490      3.490      6.980      hectare"
```

```
"              Time of concentration  53.679     4.907      14.516     minutes"
"              Time to Centroid       164.608    93.181     107.253    minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        1152.19    1152.19    2304.37    c.m"
"              Rainfall losses        26.162     5.089      15.626     mm"
"              Runoff depth           6.851      27.925     17.388     mm"
"              Runoff volume          239.12     974.59     1213.71    c.m"
"              Runoff coefficient     0.208      0.846      0.527      "
"              Maximum flow           0.036      0.659      0.662      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.662     0.768     0.105     0.001"
" 33           CATCHMENT 1100"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.480   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.480   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.207   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.009     0.768     0.105     0.001 c.m/sec"
"              Catchment 1100         Pervious   Impervious Total Area "
"              Surface Area           0.480      0.000      0.480      hectare"
"              Time of concentration  20.437     1.868      20.437     minutes"
"              Time to Centroid       125.085    88.659     125.085    minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        158.47     0.00       158.47     c.m"
"              Rainfall losses        26.169     5.363      26.169     mm"
"              Runoff depth           6.845      27.651     6.845      mm"
"              Runoff volume          32.86      0.00       32.86      c.m"
"              Runoff coefficient     0.207      0.000      0.207      "
"              Maximum flow           0.009      0.000      0.009      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     0.009     0.770     0.105     0.001"
" 54          POND DESIGN"
"        0.770   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       1437.5   Hydrograph volume    c.m"
"          12.   Number of stages"
"      411.000   Minimum water level    metre"
"      412.000   Maximum water level    metre"
"      411.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.03200    18.400"
"                411.200   0.06500    95.500"
"                411.300   0.07700   239.900"
"                411.400   0.08700   435.700"
"                411.500   0.09600   691.300"
"                411.600    0.1050  1027.600"
"                411.700    0.3150  1450.000"
"                411.800    0.3380  1935.800"
"                411.850    0.3490  2195.700"
"                411.900    0.6670  2465.600"
"                412.000     2.018  3030.100"
"             Peak outflow                 0.097    c.m/sec"
"             Maximum level              411.511    metre"
"             Maximum storage            726.712    c.m"
"             Centroidal lag               3.225   hours"
"                  0.009     0.770     0.097     0.001 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.009     0.097     0.097     0.001"
" 47          FILEI_O Read/Open DIV01500.002hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV01500.002hyd"
"             Major flow at 1500"
"             Total volume                 0.000    c.m"
"             Maximum flow                 0.000    c.m/sec"
"                  0.000     0.097     0.097     0.001 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.000     0.097     0.097     0.001"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
```

```
"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.007   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.001     0.097     0.097     0.001 c.m/sec"
"            Catchment 4000         Pervious   Impervious Total Area "
"            Surface Area           7.330      0.000      7.330      hectare"
"            Time of concentration  236.855    3.611      236.826    minutes"
"            Time to Centroid       321.151    91.497     321.122    minutes"
"            Rainfall depth         33.014     33.014     33.014     mm"
"            Rainfall volume        2419.92    0.00       2419.92    c.m"
"            Rainfall losses        32.792     5.642      32.792     mm"
"            Runoff depth           0.222      27.372     0.222      mm"
"            Runoff volume          16.24      0.00       16.24      c.m"
"            Runoff coefficient     0.007      0.000      0.007      "
"            Maximum flow           0.001      0.000      0.001      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.001     0.097     0.097     0.001"
" 54         POND DESIGN"
"        0.097   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       1454.3   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"           0    Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
```

```
"              Peak outflow                  0.097    c.m/sec"
"              Maximum level               409.647    metre"
"              Maximum storage              58.572    c.m"
"              Centroidal lag                3.417   hours"
"                   0.001     0.097     0.097     0.001 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.001     0.097     0.097     0.001"
" 52           CHANNEL DESIGN"
"         0.097   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"         7.410   Left bank slope"
"         6.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                 0.163    metre"
"              Velocity                      0.544    m/sec"
"              Channel capacity             10.655    c.m/sec"
"              Critical depth                0.134    metre"
" 53           ROUTE    Channel Route 72"
"         72.40      Channel Route 72 Reach length   ( metre)"
"         0.459   X-factor <= 0.5"
"        99.839   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"       100.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.097    c.m/sec"
"                      0.001     0.097     0.097     0.001 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.001     0.097     0.097     0.001"
" 52           CHANNEL DESIGN"
"         0.097   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         2.000   Basewidth    metre"
"         2.950   Left bank slope"
"         3.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                 0.084    metre"
"              Velocity                      0.516    m/sec"
"              Channel capacity              9.246    c.m/sec"
"              Critical depth                0.060    metre"
" 53           ROUTE    Channel Route 40"
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"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.441   X-factor <= 0.5"
"       57.872   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.097    c.m/sec"
"                     0.001     0.097     0.097     0.001 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                 0.097    c.m/sec"
"             Hydrograph volume         1454.315    c.m"
"                     0.001     0.097     0.097     0.097"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.001     0.000     0.097     0.097"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.834   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.223     0.000     0.097     0.097 c.m/sec"
"             Catchment 2100         Pervious   Impervious Total Area "
"             Surface Area           0.784      1.176      1.960      hectare"
"             Time of concentration  30.977     2.832      6.834      minutes"
```

```
"              Time to Centroid       137.612    90.217     96.956     minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        258.83     388.24     647.07     c.m"
"              Rainfall losses        26.164     5.467      13.746     mm"
"              Runoff depth           6.850      27.547     19.268     mm"
"              Runoff volume          53.70      323.96     377.66     c.m"
"              Runoff coefficient     0.207      0.834      0.584      "
"              Maximum flow           0.012      0.221      0.223      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.223     0.223     0.097     0.097"
" 33           CATCHMENT 2400"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2400   Catchment 2400"
"        90.000   % Impervious"
"         0.800   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.080   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.720   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.207   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.838   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.129     0.223     0.097     0.097 c.m/sec"
"              Catchment 2400         Pervious   Impervious Total Area "
"              Surface Area           0.080      0.720      0.800      hectare"
"              Time of concentration  20.437     1.868      2.365      minutes"
"              Time to Centroid       125.085    88.659     89.634     minutes"
"              Rainfall depth         33.014     33.014     33.014     mm"
"              Rainfall volume        26.41      237.70     264.11     c.m"
"              Rainfall losses        26.169     5.363      7.444      mm"
"              Runoff depth           6.845      27.651     25.570     mm"
"              Runoff volume          5.48       199.09     204.56     c.m"
"              Runoff coefficient     0.207      0.838      0.775      "
"              Maximum flow           0.002      0.129      0.129      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
```

```
"                     0.129     0.349     0.097     0.097"
" 54          POND DESIGN"
"        0.349   Current peak flow    c.m/sec"
"        0.020   Target outflow    c.m/sec"
"        582.2   Hydrograph volume    c.m"
"          14.   Number of stages"
"      410.650   Minimum water level    metre"
"      411.950   Maximum water level    metre"
"      410.650   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    43.000"
"                410.800   0.01300   135.000"
"                410.900   0.02000   232.000"
"                411.000   0.02500   334.000"
"                411.100   0.02900   442.000"
"                411.200    0.1260   556.000"
"                411.300    0.1390   676.000"
"                411.400    0.1510   801.000"
"                411.500    0.1630   933.000"
"                411.600    0.1730  1072.000"
"                411.650    0.1780  1143.000"
"                411.700    0.3370  1216.000"
"                411.800     1.007  1368.000"
"             Peak outflow                  0.027    c.m/sec"
"             Maximum level               411.061    metre"
"             Maximum storage             400.164    c.m"
"             Centroidal lag                4.889   hours"
"                  0.129     0.349     0.027     0.097 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.129     0.027     0.027     0.097"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.432   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.048   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
```

```
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.011     0.027     0.027     0.097 c.m/sec"
"             Catchment 2300         Pervious   Impervious Total Area "
"             Surface Area           0.432      0.048      0.480      hectare"
"             Time of concentration  20.437     1.868      14.685     minutes"
"             Time to Centroid       125.085    88.659     113.801    minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        142.62     15.85      158.47     c.m"
"             Rainfall losses        26.169     5.363      24.088     mm"
"             Runoff depth           6.845      27.651     8.926      mm"
"             Runoff volume          29.57      13.27      42.84      c.m"
"             Runoff coefficient     0.207      0.838      0.270      "
"             Maximum flow           0.008      0.009      0.011      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.011     0.036     0.027     0.097"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.011     0.036     0.036     0.097"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.036    c.m/sec"
"             Hydrograph volume           625.068    c.m"
"                     0.011     0.036     0.036     0.036"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.011     0.000     0.036     0.036"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
```

```
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.834   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.130     0.000     0.036     0.036 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  30.977     2.832      4.986      minutes"
"             Time to Centroid       137.612    90.217     93.844     minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        75.93      227.80     303.73     c.m"
"             Rainfall losses        26.164     5.467      10.641     mm"
"             Runoff depth           6.850      27.547     22.373     mm"
"             Runoff volume          15.75      190.08     205.83     c.m"
"             Runoff coefficient     0.207      0.834      0.678      "
"             Maximum flow           0.004      0.129      0.130      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.130     0.130     0.036     0.036"
" 54          POND DESIGN"
"        0.130   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        205.8   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                  0.008    c.m/sec"
"             Maximum level               413.864    metre"
```

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"             Maximum storage             151.520    c.m"
"             Centroidal lag                6.574   hours"
"                  0.130     0.130     0.008     0.036 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.043    c.m/sec"
"             Hydrograph volume           830.894    c.m"
"                     0.130     0.130     0.008     0.043"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.130     0.000     0.008     0.043"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.208   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.830   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.049     0.000     0.008     0.043 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  38.137     3.486      8.435      minutes"
"             Time to Centroid       146.130    91.278     99.112     minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        55.46      83.20      138.66     c.m"
"             Rainfall losses        26.163     5.605      13.828     mm"
"             Runoff depth           6.851      27.409     19.186     mm"
"             Runoff volume          11.51      69.07      80.58      c.m"
"             Runoff coefficient     0.208      0.830      0.581      "
"             Maximum flow           0.002      0.048      0.049      c.m/sec"
```

```
" 40         HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.049     0.049     0.008     0.043"
" 56         DIVERSION"
"        32001   Node number"
"        0.067   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"
"             DIV32001.002hyd"
"             Major flow at 32001"
"                     0.049     0.049     0.049     0.043 c.m/sec"
" 40         HYDROGRAPH Next link "
"            5   Next link "
"                     0.049     0.049     0.049     0.043"
" 54         POND DESIGN"
"        0.049   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"         80.6   Hydrograph volume    c.m"
"          15.   Number of stages"
"      410.620   Minimum water level    metre"
"      414.230   Maximum water level    metre"
"      410.620   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.620     0.000     0.000"
"                410.870   0.01300     4.855"
"                411.120   0.02000    14.351"
"                411.370   0.02500    24.074"
"                411.620   0.02900    33.921"
"                411.870   0.03300    43.768"
"                412.120   0.03600    53.614"
"                412.370   0.03900    63.461"
"                412.620   0.04200    73.308"
"                412.870   0.04400    74.155"
"                413.120   0.04700    75.003"
"                413.370   0.04900    75.850"
"                413.620   0.05200    76.698"
"                413.980   0.05500    77.918"
"                414.230    0.1600    78.483"
"             Peak outflow                  0.022    c.m/sec"
"             Maximum level               411.239    metre"
"             Maximum storage              18.968    c.m"
"             Centroidal lag                1.810   hours"
"                  0.049     0.049     0.022     0.043 c.m/sec"
" 40         HYDROGRAPH Next link "
"            5   Next link "
"                     0.049     0.022     0.022     0.043"
" 33         CATCHMENT 3200"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.837   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.014     0.022     0.022     0.043 c.m/sec"
"             Catchment 3200         Pervious   Impervious Total Area "
"             Surface Area           0.052      0.078      0.130      hectare"
"             Time of concentration  25.161     2.300      5.542      minutes"
"             Time to Centroid       130.696    89.401     95.257     minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        17.17      25.75      42.92      c.m"
"             Rainfall losses        26.167     5.393      13.702     mm"
"             Runoff depth           6.847      27.621     19.312     mm"
"             Runoff volume          3.56       21.54      25.11      c.m"
"             Runoff coefficient     0.207      0.837      0.585      "
"             Maximum flow           0.001      0.014      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.014     0.034     0.022     0.043"
" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
```

```
"        2.000   Pervious slope"
"        0.144   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.207   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.026     0.034     0.022     0.043 c.m/sec"
"             Catchment 3300         Pervious   Impervious Total Area "
"             Surface Area           0.096      0.144      0.240      hectare"
"             Time of concentration  20.437     1.868      4.499      minutes"
"             Time to Centroid       125.085    88.659     93.819     minutes"
"             Rainfall depth         33.014     33.014     33.014     mm"
"             Rainfall volume        31.69      47.54      79.23      c.m"
"             Rainfall losses        26.169     5.363      13.685     mm"
"             Runoff depth           6.845      27.651     19.329     mm"
"             Runoff volume          6.57       39.82      46.39      c.m"
"             Runoff coefficient     0.207      0.838      0.585      "
"             Maximum flow           0.002      0.026      0.026      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.026     0.060     0.022     0.043"
" 47          FILEI_O Read/Open DIV32001.002hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV32001.002hyd"
"             Major flow at 32001"
"             Total volume                  0.000    c.m"
"             Maximum flow                  0.000    c.m/sec"
"                  0.000     0.060     0.022     0.043 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.000     0.060     0.022     0.043"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.000     0.060     0.060     0.043"
" 40          HYDROGRAPH   Combine    300"
"            6   Combine "
"          300   Node #"
"                To Walser Street"
"             Maximum flow                  0.060    c.m/sec"
"             Hydrograph volume           152.160    c.m"
```

```
"                    0.000     0.060     0.060     0.060"
" 40          HYDROGRAPH   Confluence    300"
"           7   Confluence "
"         300   Node #"
"               To Walser Street"
"            Maximum flow                 0.060    c.m/sec"
"            Hydrograph volume          152.160    c.m"
"                    0.000     0.060     0.060     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     0.060     0.060     0.000"
" 40          HYDROGRAPH   Combine    100"
"           6   Combine "
"         100   Node #"
"               Existing Wetland"
"            Maximum flow                 0.114    c.m/sec"
"            Hydrograph volume         1606.475    c.m"
"                    0.000     0.060     0.060     0.114"
" 40          HYDROGRAPH   Confluence    100"
"           7   Confluence "
"         100   Node #"
"               Existing Wetland"
"            Maximum flow                 0.114    c.m/sec"
"            Hydrograph volume         1606.475    c.m"
"                    0.000     0.114     0.060     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     0.114     0.114     0.000"
" 40          HYDROGRAPH   Combine    200"
"           6   Combine "
"         200   Node #"
"               To Trib. of Grand River"
"            Maximum flow                 0.156    c.m/sec"
"            Hydrograph volume         2437.367    c.m"
"                    0.000     0.114     0.114     0.156"
" 40          HYDROGRAPH   Confluence    200"
"           7   Confluence "
"         200   Node #"
"               To Trib. of Grand River"
"            Maximum flow                 0.156    c.m/sec"
"            Hydrograph volume         2437.366    c.m"
"                    0.000     0.156     0.114     0.000"
" 38          START/RE-START TOTALS 200"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                      22.610    hectare"
"            Total Impervious area                      7.847    hectare"
"            Total % impervious                        34.706"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                           Version 2.25  rev. 473"
"                MIDUSS created                        Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:         W:\Kitchener\411-2011\411009\Design Data\"
"                                                      Modelling Files\2022-07-25"
"                Output filename:                                    Post__5yr.out"
"                Licensee name:                                              gmbp"
"                Company                                                     gmbp"
"                Date & Time last used:                7/25/2022 at 11:20:45 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1459.072   Coefficient A"
"       13.690   Constant B"
"        0.850   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           113.586    mm/hr"
"             Total depth                  49.792    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.317   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.871   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                   0.029     0.000     0.000     0.000 c.m/sec"
"             Catchment 1200         Pervious   Impervious Total Area "
"             Surface Area           0.110      0.110      0.220      hectare"
"             Time of concentration  9.868      1.116      3.453      minutes"
"             Time to Centroid       109.069    86.405     92.457     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        54.77      54.77      109.54     c.m"
"             Rainfall losses        33.989     6.414      20.202     mm"
"             Runoff depth           15.803     43.377     29.590     mm"
"             Runoff volume          17.38      47.72      65.10      c.m"
"             Runoff coefficient     0.317      0.871      0.594      "
"             Maximum flow           0.007      0.028      0.029      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.029     0.029     0.000     0.000"
" 33          CATCHMENT 1300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1300   Catchment 1300"
"       50.000   % Impervious"
"        0.700   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.350   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.350   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.093     0.029     0.000     0.000 c.m/sec"
"             Catchment 1300         Pervious   Impervious Total Area "
"             Surface Area           0.350      0.350      0.700      hectare"
"             Time of concentration  14.957     1.691      5.209      minutes"
"             Time to Centroid       115.000    87.210     94.579     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        174.27     174.27     348.54     c.m"
"             Rainfall losses        33.921     5.811      19.866     mm"
"             Runoff depth           15.871     43.981     29.926     mm"
"             Runoff volume          55.55      153.93     209.48     c.m"
```

```
"              Runoff coefficient     0.319      0.883      0.601      "
"              Maximum flow           0.020      0.086      0.093      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.093     0.122     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.318   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.881   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.029     0.122     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  12.585     1.423      4.386      minutes"
"              Time to Centroid       112.243    86.878     93.610     minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        54.77      54.77      109.54     c.m"
"              Rainfall losses        33.944     5.926      19.935     mm"
"              Runoff depth           15.848     43.866     29.857     mm"
"              Runoff volume          17.43      48.25      65.69      c.m"
"              Runoff coefficient     0.318      0.881      0.600      "
"              Maximum flow           0.007      0.028      0.029      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.029     0.151     0.000     0.000"
" 54           POND DESIGN"
"         0.151   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         340.3   Hydrograph volume    c.m"
"           17.   Number of stages"
```

```
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                 0.074    c.m/sec"
"             Maximum level              413.507    metre"
"             Maximum storage            194.308    c.m"
"             Centroidal lag              49.492   hours"
"                  0.029     0.151     0.074     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.074    c.m/sec"
"             Hydrograph volume          335.882    c.m"
"                     0.029     0.151     0.074     0.074"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.029     0.000     0.074     0.074"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.496   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.124   Impervious Area"
```

```
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.882   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.038     0.000     0.074     0.074 c.m/sec"
"             Catchment 1400         Pervious   Impervious Total Area "
"             Surface Area           0.496      0.124      0.620      hectare"
"             Time of concentration  19.076     2.157      12.156     minutes"
"             Time to Centroid       119.796    87.903     106.752    minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        246.97     61.74      308.71     c.m"
"             Rainfall losses        33.923     5.866      28.312     mm"
"             Runoff depth           15.868     43.926     21.480     mm"
"             Runoff volume          78.71      54.47      133.17     c.m"
"             Runoff coefficient     0.319      0.882      0.431      "
"             Maximum flow           0.025      0.031      0.038      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.038     0.038     0.074     0.074"
" 54          POND DESIGN"
"        0.038   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"        133.2   Hydrograph volume    c.m"
"          17.   Number of stages"
"      413.920   Minimum water level    metre"
"      415.520   Maximum water level    metre"
"      413.920   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.920   0.00088     0.000"
"                414.020   0.00088    26.350"
"                414.120   0.00089    55.150"
"                414.220   0.00089    83.950"
"                414.320   0.00089   112.750"
"                414.420   0.00090   139.100"
"                414.520   0.00090   165.450"
"                414.620   0.00090   191.800"
"                414.720   0.00090   191.870"
"                414.820   0.02640   191.950"
"                414.920   0.03734   192.020"
"                415.020   0.04573   192.090"
"                415.120   0.05281   192.160"
```

```
"                415.220    0.2777   201.450"
"                415.320    0.6941   238.950"
"                415.420     1.244   304.700"
"                415.520     1.909   382.200"
"             Peak outflow                 0.001    c.m/sec"
"             Maximum level              414.361    metre"
"             Maximum storage            123.613    c.m"
"             Centroidal lag              22.741   hours"
"                  0.038     0.038     0.001     0.074 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.075    c.m/sec"
"             Hydrograph volume          469.052    c.m"
"                     0.038     0.038     0.001     0.075"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.038     0.000     0.001     0.075"
" 33          CATCHMENT 1500"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1500   Catchment 1500"
"       50.000   % Impervious"
"        1.110   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.555   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.555   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.146     0.000     0.001     0.075 c.m/sec"
"             Catchment 1500         Pervious   Impervious Total Area "
"             Surface Area           0.555      0.555      1.110      hectare"
"             Time of concentration  22.670     2.563      7.922      minutes"
"             Time to Centroid       124.006    88.517     97.975     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
```

```
"              Rainfall volume        276.34     276.34     552.69     c.m"
"              Rainfall losses        33.904     6.066      19.985     mm"
"              Runoff depth           15.888     43.726     29.807     mm"
"              Runoff volume          88.18      242.68     330.86     c.m"
"              Runoff coefficient     0.319      0.878      0.599      "
"              Maximum flow           0.026      0.139      0.146      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.146     0.146     0.001     0.075"
" 56           DIVERSION"
"          1500   Node number"
"         0.146   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"
"              DIV01500.005hyd"
"              Major flow at 1500"
"                     0.146     0.146     0.146     0.075 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                     0.146     0.146     0.146     0.075"
" 33           CATCHMENT 1000"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"         6.980   Total Area"
"       100.000   Flow length"
"         2.000   Overland Slope"
"         3.490   Pervious Area"
"       100.000   Pervious length"
"         2.000   Pervious slope"
"         3.490   Impervious Area"
"       100.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.319   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.888   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.935     0.146     0.146     0.075 c.m/sec"
"              Catchment 1000         Pervious   Impervious Total Area "
"              Surface Area           3.490      3.490      6.980      hectare"
```

```
"              Time of concentration  39.284     4.442      13.658     minutes"
"              Time to Centroid       143.413    91.124     104.955    minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        1737.73    1737.73    3475.46    c.m"
"              Rainfall losses        33.893     5.585      19.739     mm"
"              Runoff depth           15.898     44.206     30.052     mm"
"              Runoff volume          554.85     1542.80    2097.65    c.m"
"              Runoff coefficient     0.319      0.888      0.604      "
"              Maximum flow           0.113      0.920      0.935      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.935     1.081     0.146     0.075"
" 33           CATCHMENT 1100"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.480   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.480   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.319   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.028     1.081     0.146     0.075 c.m/sec"
"              Catchment 1100         Pervious   Impervious Total Area "
"              Surface Area           0.480      0.000      0.480      hectare"
"              Time of concentration  14.957     1.691      14.957     minutes"
"              Time to Centroid       114.999    87.210     114.999    minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        239.00     0.00       239.00     c.m"
"              Rainfall losses        33.921     5.811      33.921     mm"
"              Runoff depth           15.871     43.981     15.871     mm"
"              Runoff volume          76.18      0.00       76.18      c.m"
"              Runoff coefficient     0.319      0.000      0.319      "
"              Maximum flow           0.028      0.000      0.028      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.028     1.091     0.146     0.075"
" 54          POND DESIGN"
"        1.091   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       2504.7   Hydrograph volume    c.m"
"          12.   Number of stages"
"      411.000   Minimum water level    metre"
"      412.000   Maximum water level    metre"
"      411.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.03200    18.400"
"                411.200   0.06500    95.500"
"                411.300   0.07700   239.900"
"                411.400   0.08700   435.700"
"                411.500   0.09600   691.300"
"                411.600    0.1050  1027.600"
"                411.700    0.3150  1450.000"
"                411.800    0.3380  1935.800"
"                411.850    0.3490  2195.700"
"                411.900    0.6670  2465.600"
"                412.000     2.018  3030.100"
"             Peak outflow                0.234    c.m/sec"
"             Maximum level             411.661    metre"
"             Maximum storage          1286.482    c.m"
"             Centroidal lag              3.422   hours"
"                  0.028     1.091     0.234     0.075 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.028     0.234     0.234     0.075"
" 47          FILEI_O Read/Open DIV01500.005hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV01500.005hyd"
"             Major flow at 1500"
"             Total volume                0.000    c.m"
"             Maximum flow                0.000    c.m/sec"
"                  0.000     0.234     0.234     0.075 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.000     0.234     0.234     0.075"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
```

```
"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.043   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                        0.019     0.234     0.234     0.075 c.m/sec"
"            Catchment 4000         Pervious   Impervious Total Area "
"            Surface Area           7.330      0.000      7.330      hectare"
"            Time of concentration  82.074     3.269      82.072     minutes"
"            Time to Centroid       193.297    89.581     193.294    minutes"
"            Rainfall depth         49.792     49.792     49.792     mm"
"            Rainfall volume        3649.73    0.00       3649.73    c.m"
"            Rainfall losses        47.655     6.236      47.655     mm"
"            Runoff depth           2.137      43.556     2.137      mm"
"            Runoff volume          156.63     0.00       156.64     c.m"
"            Runoff coefficient     0.043      0.000      0.043      "
"            Maximum flow           0.019      0.000      0.019      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                        0.019     0.244     0.234     0.075"
" 54         POND DESIGN"
"        0.244   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       2662.1   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
```

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"              Peak outflow                  0.237    c.m/sec"
"              Maximum level               409.673    metre"
"              Maximum storage             143.048    c.m"
"              Centroidal lag                3.578   hours"
"                   0.019     0.244     0.237     0.075 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.019     0.237     0.237     0.075"
" 52           CHANNEL DESIGN"
"         0.237   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"         7.410   Left bank slope"
"         6.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                 0.228    metre"
"              Velocity                      0.680    m/sec"
"              Channel capacity             10.655    c.m/sec"
"              Critical depth                0.191    metre"
" 53           ROUTE    Channel Route 72"
"         72.40      Channel Route 72 Reach length   ( metre)"
"         0.443   X-factor <= 0.5"
"        79.856   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"        75.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.236    c.m/sec"
"                      0.019     0.237     0.236     0.075 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.019     0.236     0.236     0.075"
" 52           CHANNEL DESIGN"
"         0.236   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         2.000   Basewidth    metre"
"         2.950   Left bank slope"
"         3.000   Right bank slope"
"         0.950   Channel depth    metre"
"         1.040   Gradient   %"
"              Depth of flow                 0.140    metre"
"              Velocity                      0.699    m/sec"
"              Channel capacity              9.246    c.m/sec"
"              Critical depth                0.106    metre"
" 53           ROUTE    Channel Route 40"
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"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.403   X-factor <= 0.5"
"       42.730   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       50.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"           Peak outflow                 0.236    c.m/sec"
"                   0.019     0.236     0.236     0.075 c.m/sec"
" 40         HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"           Maximum flow                 0.236    c.m/sec"
"           Hydrograph volume         2662.062    c.m"
"                   0.019     0.236     0.236     0.236"
" 40         HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.019     0.000     0.236     0.236"
" 33         CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.304     0.000     0.236     0.236 c.m/sec"
"           Catchment 2100         Pervious   Impervious Total Area "
"           Surface Area           0.784      1.176      1.960      hectare"
"           Time of concentration  22.670     2.563      6.484      minutes"
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"             Time to Centroid       124.006    88.517     95.437     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        390.37     585.55     975.92     c.m"
"             Rainfall losses        33.904     6.066      17.201     mm"
"             Runoff depth           15.888     43.726     32.591     mm"
"             Runoff volume          124.56     514.22     638.78     c.m"
"             Runoff coefficient     0.319      0.878      0.655      "
"             Maximum flow           0.036      0.295      0.304      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.304     0.304     0.236     0.236"
" 33          CATCHMENT 2400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2400   Catchment 2400"
"       90.000   % Impervious"
"        0.800   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.080   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.720   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.177     0.304     0.236     0.236 c.m/sec"
"             Catchment 2400         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.720      0.800      hectare"
"             Time of concentration  14.957     1.691      2.203      minutes"
"             Time to Centroid       114.999    87.210     88.281     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        39.83      358.50     398.33     c.m"
"             Rainfall losses        33.921     5.811      8.622      mm"
"             Runoff depth           15.871     43.981     41.170     mm"
"             Runoff volume          12.70      316.66     329.36     c.m"
"             Runoff coefficient     0.319      0.883      0.827      "
"             Maximum flow           0.005      0.177      0.177      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
```

```
"                     0.177     0.481     0.236     0.236"
" 54          POND DESIGN"
"        0.481   Current peak flow    c.m/sec"
"        0.020   Target outflow    c.m/sec"
"        968.1   Hydrograph volume    c.m"
"          14.   Number of stages"
"      410.650   Minimum water level    metre"
"      411.950   Maximum water level    metre"
"      410.650   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    43.000"
"                410.800   0.01300   135.000"
"                410.900   0.02000   232.000"
"                411.000   0.02500   334.000"
"                411.100   0.02900   442.000"
"                411.200    0.1260   556.000"
"                411.300    0.1390   676.000"
"                411.400    0.1510   801.000"
"                411.500    0.1630   933.000"
"                411.600    0.1730  1072.000"
"                411.650    0.1780  1143.000"
"                411.700    0.3370  1216.000"
"                411.800     1.007  1368.000"
"             Peak outflow                  0.121    c.m/sec"
"             Maximum level               411.195    metre"
"             Maximum storage             550.354    c.m"
"             Centroidal lag                4.085   hours"
"                  0.177     0.481     0.121     0.236 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.177     0.121     0.121     0.236"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.432   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.048   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
```

```
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.030     0.121     0.121     0.236 c.m/sec"
"              Catchment 2300         Pervious   Impervious Total Area "
"              Surface Area           0.432      0.048      0.480      hectare"
"              Time of concentration  14.957     1.691      11.834     minutes"
"              Time to Centroid       114.999    87.210     108.457    minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        215.10     23.90      239.00     c.m"
"              Rainfall losses        33.921     5.811      31.110     mm"
"              Runoff depth           15.871     43.981     18.682     mm"
"              Runoff volume          68.56      21.11      89.67      c.m"
"              Runoff coefficient     0.319      0.883      0.375      "
"              Maximum flow           0.025      0.012      0.030      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.030     0.141     0.121     0.236"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                    0.030     0.141     0.141     0.236"
" 40           HYDROGRAPH   Combine    200"
"             6   Combine "
"           200   Node #"
"                 To Trib. of Grand River"
"              Maximum flow                  0.141    c.m/sec"
"              Hydrograph volume          1056.969    c.m"
"                    0.030     0.141     0.141     0.141"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.030     0.000     0.141     0.141"
" 33           CATCHMENT 2200"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
```

```
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.878   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.176     0.000     0.141     0.141 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  22.670     2.563      4.735      minutes"
"             Time to Centroid       124.006    88.517     92.351     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        114.52     343.56     458.08     c.m"
"             Rainfall losses        33.904     6.066      13.025     mm"
"             Runoff depth           15.888     43.726     36.767     mm"
"             Runoff volume          36.54      301.71     338.25     c.m"
"             Runoff coefficient     0.319      0.878      0.738      "
"             Maximum flow           0.011      0.173      0.176      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.176     0.176     0.141     0.141"
" 54          POND DESIGN"
"        0.176   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        338.3   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                  0.012    c.m/sec"
"             Maximum level               413.963    metre"
```

```
"             Maximum storage             257.625    c.m"
"             Centroidal lag                6.867   hours"
"                  0.176     0.176     0.012     0.141 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.151    c.m/sec"
"             Hydrograph volume          1395.219    c.m"
"                     0.176     0.176     0.012     0.151"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.176     0.000     0.012     0.151"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.877   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.067     0.000     0.012     0.151 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  27.910     3.156      7.991      minutes"
"             Time to Centroid       130.112    89.411     97.361     minutes"
"             Rainfall depth         49.792     49.792     49.792     mm"
"             Rainfall volume        83.65      125.48     209.13     c.m"
"             Rainfall losses        33.900     6.148      17.249     mm"
"             Runoff depth           15.891     43.643     32.543     mm"
"             Runoff volume          26.70      109.98     136.68     c.m"
"             Runoff coefficient     0.319      0.877      0.654      "
"             Maximum flow           0.007      0.066      0.067      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.067     0.067     0.012     0.151"
" 56          DIVERSION"
"       32001   Node number"
"       0.067   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"
"             DIV32001.005hyd"
"             Major flow at 32001"
"                    0.067     0.067     0.067     0.151 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                    0.067     0.067     0.067     0.151"
" 54          POND DESIGN"
"       0.067   Current peak flow    c.m/sec"
"       0.756   Target outflow    c.m/sec"
"       136.7   Hydrograph volume    c.m"
"         15.   Number of stages"
"     410.620   Minimum water level    metre"
"     414.230   Maximum water level    metre"
"     410.620   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"               410.620     0.000     0.000"
"               410.870   0.01300     4.855"
"               411.120   0.02000    14.351"
"               411.370   0.02500    24.074"
"               411.620   0.02900    33.921"
"               411.870   0.03300    43.768"
"               412.120   0.03600    53.614"
"               412.370   0.03900    63.461"
"               412.620   0.04200    73.308"
"               412.870   0.04400    74.155"
"               413.120   0.04700    75.003"
"               413.370   0.04900    75.850"
"               413.620   0.05200    76.698"
"               413.980   0.05500    77.918"
"               414.230    0.1600    78.483"
"             Peak outflow                  0.029    c.m/sec"
"             Maximum level               411.630    metre"
"             Maximum storage              34.317    c.m"
"             Centroidal lag                1.847   hours"
"                 0.067     0.067     0.029     0.151 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                    0.067     0.029     0.029     0.151"
" 33          CATCHMENT 3200"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.020     0.029     0.029     0.151 c.m/sec"
"              Catchment 3200         Pervious   Impervious Total Area "
"              Surface Area           0.052      0.078      0.130      hectare"
"              Time of concentration  18.414     2.082      5.253      minutes"
"              Time to Centroid       119.025    87.780     93.846     minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        25.89      38.84      64.73      c.m"
"              Rainfall losses        33.912     5.846      17.073     mm"
"              Runoff depth           15.879     43.946     32.719     mm"
"              Runoff volume          8.26       34.28      42.53      c.m"
"              Runoff coefficient     0.319      0.883      0.657      "
"              Maximum flow           0.003      0.019      0.020      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.020     0.045     0.029     0.151"
" 33           CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
```

```
"        2.000   Pervious slope"
"        0.144   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.319   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.883   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.037     0.045     0.029     0.151 c.m/sec"
"              Catchment 3300         Pervious   Impervious Total Area "
"              Surface Area           0.096      0.144      0.240      hectare"
"              Time of concentration  14.957     1.691      4.264      minutes"
"              Time to Centroid       115.000    87.210     92.599     minutes"
"              Rainfall depth         49.792     49.792     49.792     mm"
"              Rainfall volume        47.80      71.70      119.50     c.m"
"              Rainfall losses        33.921     5.811      17.055     mm"
"              Runoff depth           15.871     43.981     32.737     mm"
"              Runoff volume          15.24      63.33      78.57      c.m"
"              Runoff coefficient     0.319      0.883      0.657      "
"              Maximum flow           0.006      0.035      0.037      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.037     0.082     0.029     0.151"
" 47           FILEI_O Read/Open DIV32001.005hyd"
"             1   1=read/open; 2=write/save"
"             2   1=rainfall; 2=hydrograph"
"             1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"              DIV32001.005hyd"
"              Major flow at 32001"
"              Total volume                 0.000    c.m"
"              Maximum flow                 0.000    c.m/sec"
"                  0.000     0.082     0.029     0.151 c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.000     0.082     0.029     0.151"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.000     0.082     0.082     0.151"
" 40           HYDROGRAPH   Combine    300"
"             6   Combine "
"           300   Node #"
"                 To Walser Street"
"              Maximum flow                 0.082    c.m/sec"
"              Hydrograph volume          257.887    c.m"
```

```
"                    0.000     0.082     0.082     0.082"
" 40         HYDROGRAPH   Confluence    300"
"              7   Confluence "
"            300   Node #"
"                  To Walser Street"
"               Maximum flow                  0.082    c.m/sec"
"               Hydrograph volume           257.887    c.m"
"                    0.000     0.082     0.082     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"              8   Copy to Outflow"
"                    0.000     0.082     0.082     0.000"
" 40         HYDROGRAPH   Combine    100"
"              6   Combine "
"            100   Node #"
"                  Existing Wetland"
"               Maximum flow                  0.258    c.m/sec"
"               Hydrograph volume          2919.949    c.m"
"                    0.000     0.082     0.082     0.258"
" 40         HYDROGRAPH   Confluence    100"
"              7   Confluence "
"            100   Node #"
"                  Existing Wetland"
"               Maximum flow                  0.258    c.m/sec"
"               Hydrograph volume          2919.948    c.m"
"                    0.000     0.258     0.082     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"              8   Copy to Outflow"
"                    0.000     0.258     0.258     0.000"
" 40         HYDROGRAPH   Combine    200"
"              6   Combine "
"            200   Node #"
"                  To Trib. of Grand River"
"               Maximum flow                  0.366    c.m/sec"
"               Hydrograph volume          4315.163    c.m"
"                    0.000     0.258     0.258     0.366"
" 40         HYDROGRAPH   Confluence    200"
"              7   Confluence "
"            200   Node #"
"                  To Trib. of Grand River"
"               Maximum flow                  0.366    c.m/sec"
"               Hydrograph volume          4315.163    c.m"
"                    0.000     0.366     0.258     0.000"
" 38         START/RE-START TOTALS 200"
"              3   Runoff Totals on EXIT"
"               Total Catchment area                        22.610    hectare"
"               Total Impervious area                        7.847    hectare"
"               Total % impervious                          34.706"
" 19         EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                             Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 07, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:         W:\Kitchener\411-2011\411009\Design Data\"
"                                                         Modelling Files\2022-07-25"
"                Output filename:                                     Post__10yr.out"
"                Licensee name:                                                 gmbp"
"                Company                                                        gmbp"
"                Date & Time last used:                     7/25/2022 at 11:41:13 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2327.596   Coefficient A"
"       19.500   Constant B"
"        0.894   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           126.171    mm/hr"
"             Total depth                  61.359    mm"
"            6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.379   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.887   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.037     0.000     0.000     0.000 c.m/sec"
"            Catchment 1200         Pervious   Impervious Total Area "
"            Surface Area           0.110      0.110      0.220      hectare"
"            Time of concentration  8.639      1.063      3.329      minutes"
"            Time to Centroid       106.058    85.846     91.893     minutes"
"            Rainfall depth         61.359     61.359     61.359     mm"
"            Rainfall volume        67.50      67.50      134.99     c.m"
"            Rainfall losses        38.124     6.938      22.531     mm"
"            Runoff depth           23.235     54.421     38.828     mm"
"            Runoff volume          25.56      59.86      85.42      c.m"
"            Runoff coefficient     0.379      0.887      0.633      "
"            Maximum flow           0.011      0.032      0.037      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.037     0.037     0.000     0.000"
" 33         CATCHMENT 1300"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        1300   Catchment 1300"
"      50.000   % Impervious"
"       0.700   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.350   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.350   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.379   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.901   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.114     0.037     0.000     0.000 c.m/sec"
"            Catchment 1300         Pervious   Impervious Total Area "
"            Surface Area           0.350      0.350      0.700      hectare"
"            Time of concentration  13.094     1.611      5.010      minutes"
"            Time to Centroid       111.234    86.563     93.866     minutes"
"            Rainfall depth         61.359     61.359     61.359     mm"
"            Rainfall volume        214.76     214.76     429.51     c.m"
"            Rainfall losses        38.098     6.044      22.071     mm"
"            Runoff depth           23.262     55.315     39.288     mm"
"            Runoff volume          81.42      193.60     275.02     c.m"
```

```
"              Runoff coefficient     0.379      0.901      0.640      "
"              Maximum flow           0.032      0.100      0.114      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.114     0.151     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.380   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.898   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.036     0.151     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  11.018     1.355      4.226      minutes"
"              Time to Centroid       108.801    86.227     92.933     minutes"
"              Rainfall depth         61.359     61.359     61.359     mm"
"              Rainfall volume        67.50      67.50      134.99     c.m"
"              Rainfall losses        38.068     6.251      22.159     mm"
"              Runoff depth           23.291     55.108     39.200     mm"
"              Runoff volume          25.62      60.62      86.24      c.m"
"              Runoff coefficient     0.380      0.898      0.639      "
"              Maximum flow           0.011      0.032      0.036      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.036     0.188     0.000     0.000"
" 54           POND DESIGN"
"         0.188   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         446.7   Hydrograph volume    c.m"
"           17.   Number of stages"
```

```
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                 0.130    c.m/sec"
"             Maximum level              413.661    metre"
"             Maximum storage            195.615    c.m"
"             Centroidal lag              39.670   hours"
"                  0.036     0.188     0.130     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.130    c.m/sec"
"             Hydrograph volume          422.535    c.m"
"                     0.036     0.188     0.130     0.130"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.036     0.000     0.130     0.130"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.496   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.124   Impervious Area"
```

```
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.900   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.056     0.000     0.130     0.130 c.m/sec"
"             Catchment 1400         Pervious   Impervious Total Area "
"             Surface Area           0.496      0.124      0.620      hectare"
"             Time of concentration  16.700     2.054      11.252     minutes"
"             Time to Centroid       115.361    87.160     104.869    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        304.34     76.09      380.43     c.m"
"             Rainfall losses        38.059     6.144      31.676     mm"
"             Runoff depth           23.300     55.215     29.683     mm"
"             Runoff volume          115.57     68.47      184.04     c.m"
"             Runoff coefficient     0.380      0.900      0.484      "
"             Maximum flow           0.040      0.036      0.056      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.056     0.056     0.130     0.130"
" 54          POND DESIGN"
"        0.056   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"        184.0   Hydrograph volume    c.m"
"          17.   Number of stages"
"      413.920   Minimum water level    metre"
"      415.520   Maximum water level    metre"
"      413.920   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.920   0.00088     0.000"
"                414.020   0.00088    26.350"
"                414.120   0.00089    55.150"
"                414.220   0.00089    83.950"
"                414.320   0.00089   112.750"
"                414.420   0.00090   139.100"
"                414.520   0.00090   165.450"
"                414.620   0.00090   191.800"
"                414.720   0.00090   191.870"
"                414.820   0.02640   191.950"
"                414.920   0.03734   192.020"
"                415.020   0.04573   192.090"
"                415.120   0.05281   192.160"
```

```
"                415.220    0.2777   201.450"
"                415.320    0.6941   238.950"
"                415.420     1.244   304.700"
"                415.520     1.909   382.200"
"             Peak outflow                 0.001    c.m/sec"
"             Maximum level              414.422    metre"
"             Maximum storage            139.619    c.m"
"             Centroidal lag              30.244   hours"
"                  0.056     0.056     0.001     0.130 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.130    c.m/sec"
"             Hydrograph volume          606.570    c.m"
"                     0.056     0.056     0.001     0.130"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.056     0.000     0.001     0.130"
" 33          CATCHMENT 1500"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1500   Catchment 1500"
"       50.000   % Impervious"
"        1.110   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.555   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.555   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.174     0.000     0.001     0.130 c.m/sec"
"             Catchment 1500         Pervious   Impervious Total Area "
"             Surface Area           0.555      0.555      1.110      hectare"
"             Time of concentration  19.847     2.441      7.618      minutes"
"             Time to Centroid       118.992    87.742     97.037     minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
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"              Rainfall volume        340.54     340.54     681.09     c.m"
"              Rainfall losses        38.054     6.310      22.182     mm"
"              Runoff depth           23.305     55.050     39.177     mm"
"              Runoff volume          129.34     305.52     434.87     c.m"
"              Runoff coefficient     0.380      0.897      0.638      "
"              Maximum flow           0.041      0.162      0.174      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.174     0.174     0.001     0.130"
" 56           DIVERSION"
"          1500   Node number"
"         0.146   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow         0.028    c.m/sec"
"              Volume of diverted flow      10.733    c.m"
"              DIV01500.010hyd"
"              Major flow at 1500"
"                      0.174     0.174     0.146     0.130 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.174     0.146     0.146     0.130"
" 33           CATCHMENT 1000"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"         6.980   Total Area"
"       100.000   Flow length"
"         2.000   Overland Slope"
"         3.490   Pervious Area"
"       100.000   Pervious length"
"         2.000   Pervious slope"
"         3.490   Impervious Area"
"       100.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.380   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.905   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      1.094     0.146     0.146     0.130 c.m/sec"
"              Catchment 1000         Pervious   Impervious Total Area "
"              Surface Area           3.490      3.490      6.980      hectare"
```

```
"             Time of concentration  34.392     4.230      13.155     minutes"
"             Time to Centroid       135.773    90.174     103.666    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        2141.44    2141.44    4282.88    c.m"
"             Rainfall losses        38.029     5.843      21.936     mm"
"             Runoff depth           23.330     55.517     39.424     mm"
"             Runoff volume          814.23     1937.53    2751.76    c.m"
"             Runoff coefficient     0.380      0.905      0.643      "
"             Maximum flow           0.188      1.064      1.094      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.094     1.240     0.146     0.130"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1100   Catchment 1100"
"        0.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.480   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.379   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.043     1.240     0.146     0.130 c.m/sec"
"             Catchment 1100         Pervious   Impervious Total Area "
"             Surface Area           0.480      0.000      0.480      hectare"
"             Time of concentration  13.094     1.611      13.094     minutes"
"             Time to Centroid       111.234    86.563     111.234    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        294.52     0.00       294.52     c.m"
"             Rainfall losses        38.098     6.044      38.097     mm"
"             Runoff depth           23.262     55.315     23.262     mm"
"             Runoff volume          111.66     0.00       111.66     c.m"
"             Runoff coefficient     0.379      0.000      0.379      "
"             Maximum flow           0.043      0.000      0.043      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     0.043     1.260     0.146     0.130"
" 54          POND DESIGN"
"        1.260   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       3287.6   Hydrograph volume    c.m"
"          12.   Number of stages"
"      411.000   Minimum water level    metre"
"      412.000   Maximum water level    metre"
"      411.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.03200    18.400"
"                411.200   0.06500    95.500"
"                411.300   0.07700   239.900"
"                411.400   0.08700   435.700"
"                411.500   0.09600   691.300"
"                411.600    0.1050  1027.600"
"                411.700    0.3150  1450.000"
"                411.800    0.3380  1935.800"
"                411.850    0.3490  2195.700"
"                411.900    0.6670  2465.600"
"                412.000     2.018  3030.100"
"             Peak outflow                0.323    c.m/sec"
"             Maximum level             411.736    metre"
"             Maximum storage          1623.071    c.m"
"             Centroidal lag              3.233   hours"
"                  0.043     1.260     0.323     0.130 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.043     0.323     0.323     0.130"
" 47          FILEI_O Read/Open DIV01500.010hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV01500.010hyd"
"             Major flow at 1500"
"             Total volume               10.733    c.m"
"             Maximum flow                0.028    c.m/sec"
"                  0.028     0.323     0.323     0.130 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.028     0.323     0.323     0.130"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
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"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.073   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.050     0.323     0.323     0.130 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           7.330      0.000      7.330      hectare"
"             Time of concentration  57.122     3.114      57.121     minutes"
"             Time to Centroid       167.459    88.727     167.458    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        4497.63    0.00       4497.63    c.m"
"             Rainfall losses        56.901     6.470      56.901     mm"
"             Runoff depth           4.458      54.890     4.458      mm"
"             Runoff volume          326.76     0.00       326.77     c.m"
"             Runoff coefficient     0.073      0.000      0.073      "
"             Maximum flow           0.050      0.000      0.050      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.050     0.372     0.323     0.130"
" 54          POND DESIGN"
"        0.372   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       3625.2   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
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"             Peak outflow                  0.367    c.m/sec"
"             Maximum level               409.696    metre"
"             Maximum storage             222.278    c.m"
"             Centroidal lag                3.355   hours"
"                  0.050     0.372     0.367     0.130 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.050     0.367     0.367     0.130"
" 52          CHANNEL DESIGN"
"        0.367   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.269    metre"
"             Velocity                      0.759    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.228    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.433   X-factor <= 0.5"
"       71.586   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       75.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.367    c.m/sec"
"                     0.050     0.367     0.367     0.130 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.050     0.367     0.367     0.130"
" 52          CHANNEL DESIGN"
"        0.367   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.180    metre"
"             Velocity                      0.806    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.140    metre"
" 53          ROUTE    Channel Route 40"
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"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.378   X-factor <= 0.5"
"       37.024   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       42.857   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"            Peak outflow                 0.367    c.m/sec"
"                    0.050     0.367     0.367     0.130 c.m/sec"
" 40         HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"            Maximum flow                 0.367    c.m/sec"
"            Hydrograph volume         3625.235    c.m"
"                    0.050     0.367     0.367     0.367"
" 40         HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.050     0.000     0.367     0.367"
" 33         CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.359     0.000     0.367     0.367 c.m/sec"
"            Catchment 2100         Pervious   Impervious Total Area "
"            Surface Area           0.784      1.176      1.960      hectare"
"            Time of concentration  19.847     2.441      6.272      minutes"
```

```
"             Time to Centroid       118.992    87.742     94.620     minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        481.06     721.58     1202.64    c.m"
"             Rainfall losses        38.054     6.310      19.008     mm"
"             Runoff depth           23.305     55.050     42.352     mm"
"             Runoff volume          182.71     647.38     830.09     c.m"
"             Runoff coefficient     0.380      0.897      0.690      "
"             Maximum flow           0.058      0.342      0.359      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.359     0.359     0.367     0.367"
" 33          CATCHMENT 2400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2400   Catchment 2400"
"       90.000   % Impervious"
"        0.800   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.080   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.720   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.379   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.901   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.208     0.359     0.367     0.367 c.m/sec"
"             Catchment 2400         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.720      0.800      hectare"
"             Time of concentration  13.094     1.611      2.123      minutes"
"             Time to Centroid       111.234    86.563     87.664     minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        49.09      441.79     490.87     c.m"
"             Rainfall losses        38.098     6.044      9.250      mm"
"             Runoff depth           23.262     55.315     52.110     mm"
"             Runoff volume          18.61      398.27     416.88     c.m"
"             Runoff coefficient     0.379      0.901      0.849      "
"             Maximum flow           0.007      0.207      0.208      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
```

```
"                     0.208     0.567     0.367     0.367"
" 54         POND DESIGN"
"        0.567   Current peak flow    c.m/sec"
"        0.020   Target outflow    c.m/sec"
"       1247.0   Hydrograph volume    c.m"
"          14.   Number of stages"
"      410.650   Minimum water level    metre"
"      411.950   Maximum water level    metre"
"      410.650   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    43.000"
"                410.800   0.01300   135.000"
"                410.900   0.02000   232.000"
"                411.000   0.02500   334.000"
"                411.100   0.02900   442.000"
"                411.200    0.1260   556.000"
"                411.300    0.1390   676.000"
"                411.400    0.1510   801.000"
"                411.500    0.1630   933.000"
"                411.600    0.1730  1072.000"
"                411.650    0.1780  1143.000"
"                411.700    0.3370  1216.000"
"                411.800     1.007  1368.000"
"             Peak outflow                  0.141    c.m/sec"
"             Maximum level               411.314    metre"
"             Maximum storage             693.286    c.m"
"             Centroidal lag                3.701   hours"
"                  0.208     0.567     0.141     0.367 c.m/sec"
" 40         HYDROGRAPH Next link "
"            5   Next link "
"                     0.208     0.141     0.141     0.367"
" 33         CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.432   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.048   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
```

```
"        0.379   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.901   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.045     0.141     0.141     0.367 c.m/sec"
"             Catchment 2300         Pervious   Impervious Total Area "
"             Surface Area           0.432      0.048      0.480      hectare"
"             Time of concentration  13.094     1.611      10.694     minutes"
"             Time to Centroid       111.234    86.563     106.078    minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        265.07     29.45      294.52     c.m"
"             Rainfall losses        38.098     6.044      34.892     mm"
"             Runoff depth           23.262     55.315     26.467     mm"
"             Runoff volume          100.49     26.55      127.04     c.m"
"             Runoff coefficient     0.379      0.901      0.431      "
"             Maximum flow           0.039      0.014      0.045      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.045     0.178     0.141     0.367"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.045     0.178     0.178     0.367"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.178    c.m/sec"
"             Hydrograph volume          1373.708    c.m"
"                     0.045     0.178     0.178     0.178"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.045     0.000     0.178     0.178"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
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"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.897   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.206     0.000     0.178     0.178 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  19.847     2.441      4.594      minutes"
"             Time to Centroid       118.992    87.742     91.606     minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        141.13     423.38     564.51     c.m"
"             Rainfall losses        38.054     6.310      14.246     mm"
"             Runoff depth           23.305     55.050     47.113     mm"
"             Runoff volume          53.60      379.84     433.44     c.m"
"             Runoff coefficient     0.380      0.897      0.768      "
"             Maximum flow           0.017      0.201      0.206      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.206     0.206     0.178     0.178"
" 54          POND DESIGN"
"        0.206   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        433.4   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                  0.014    c.m/sec"
"             Maximum level               414.033    metre"
```

```
"             Maximum storage             338.951    c.m"
"             Centroidal lag                7.231   hours"
"                  0.206     0.206     0.014     0.178 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.190    c.m/sec"
"             Hydrograph volume          1807.152    c.m"
"                     0.206     0.206     0.014     0.190"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.206     0.000     0.014     0.190"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.380   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.895   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.078     0.000     0.014     0.190 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  24.434     3.005      7.732      minutes"
"             Time to Centroid       124.292    88.564     96.444     minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        103.08     154.63     257.71     c.m"
"             Rainfall losses        38.047     6.437      19.081     mm"
"             Runoff depth           23.312     54.922     42.278     mm"
"             Runoff volume          39.16      138.40     177.57     c.m"
"             Runoff coefficient     0.380      0.895      0.689      "
"             Maximum flow           0.011      0.075      0.078      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.078     0.078     0.014     0.190"
" 56          DIVERSION"
"        32001   Node number"
"        0.067   Overflow threshold"
"        1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.011    c.m/sec"
"             Volume of diverted flow       3.174    c.m"
"             DIV32001.010hyd"
"             Major flow at 32001"
"                     0.078     0.078     0.067     0.190 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.078     0.067     0.067     0.190"
" 54          POND DESIGN"
"        0.067   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        174.4   Hydrograph volume    c.m"
"          15.   Number of stages"
"      410.620   Minimum water level    metre"
"      414.230   Maximum water level    metre"
"      410.620   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.620     0.000     0.000"
"                410.870   0.01300     4.855"
"                411.120   0.02000    14.351"
"                411.370   0.02500    24.074"
"                411.620   0.02900    33.921"
"                411.870   0.03300    43.768"
"                412.120   0.03600    53.614"
"                412.370   0.03900    63.461"
"                412.620   0.04200    73.308"
"                412.870   0.04400    74.155"
"                413.120   0.04700    75.003"
"                413.370   0.04900    75.850"
"                413.620   0.05200    76.698"
"                413.980   0.05500    77.918"
"                414.230    0.1600    78.483"
"             Peak outflow                  0.033    c.m/sec"
"             Maximum level               411.906    metre"
"             Maximum storage              45.197    c.m"
"             Centroidal lag                1.881   hours"
"                  0.078     0.067     0.033     0.190 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.078     0.033     0.033     0.190"
" 33          CATCHMENT 3200"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.379   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.901   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.024     0.033     0.033     0.190 c.m/sec"
"              Catchment 3200         Pervious   Impervious Total Area "
"              Surface Area           0.052      0.078      0.130      hectare"
"              Time of concentration  16.121     1.983      5.083      minutes"
"              Time to Centroid       114.721    87.040     93.109     minutes"
"              Rainfall depth         61.359     61.359     61.359     mm"
"              Rainfall volume        31.91      47.86      79.77      c.m"
"              Rainfall losses        38.081     6.103      18.894     mm"
"              Runoff depth           23.278     55.256     42.465     mm"
"              Runoff volume          12.10      43.10      55.20      c.m"
"              Runoff coefficient     0.379      0.901      0.692      "
"              Maximum flow           0.004      0.023      0.024      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.024     0.051     0.033     0.190"
" 33           CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
```

```
"         2.000   Pervious slope"
"         0.144   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.379   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.901   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.045     0.051     0.033     0.190 c.m/sec"
"             Catchment 3300         Pervious   Impervious Total Area "
"             Surface Area           0.096      0.144      0.240      hectare"
"             Time of concentration  13.094     1.611      4.125      minutes"
"             Time to Centroid       111.234    86.563     91.965     minutes"
"             Rainfall depth         61.359     61.359     61.359     mm"
"             Rainfall volume        58.90      88.36      147.26     c.m"
"             Rainfall losses        38.097     6.044      18.866     mm"
"             Runoff depth           23.262     55.315     42.494     mm"
"             Runoff volume          22.33      79.65      101.98     c.m"
"             Runoff coefficient     0.379      0.901      0.693      "
"             Maximum flow           0.009      0.041      0.045      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.045     0.096     0.033     0.190"
" 47          FILEI_O Read/Open DIV32001.010hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV32001.010hyd"
"             Major flow at 32001"
"             Total volume                  3.174    c.m"
"             Maximum flow                  0.011    c.m/sec"
"                   0.011     0.096     0.033     0.190 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.011     0.107     0.033     0.190"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                      0.011     0.107     0.107     0.190"
" 40          HYDROGRAPH   Combine    300"
"            6   Combine "
"          300   Node #"
"                To Walser Street"
"             Maximum flow                  0.107    c.m/sec"
"             Hydrograph volume           334.694    c.m"
```

```
"                    0.011     0.107     0.107     0.107"
" 40          HYDROGRAPH   Confluence    300"
"            7   Confluence "
"          300   Node #"
"                To Walser Street"
"             Maximum flow                  0.107    c.m/sec"
"             Hydrograph volume           334.694    c.m"
"                    0.011     0.107     0.107     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.011     0.107     0.107     0.000"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                  0.395    c.m/sec"
"             Hydrograph volume          3959.929    c.m"
"                    0.011     0.107     0.107     0.395"
" 40          HYDROGRAPH   Confluence    100"
"            7   Confluence "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                  0.395    c.m/sec"
"             Hydrograph volume          3959.929    c.m"
"                    0.011     0.395     0.107     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.011     0.395     0.395     0.000"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.551    c.m/sec"
"             Hydrograph volume          5767.070    c.m"
"                    0.011     0.395     0.395     0.551"
" 40          HYDROGRAPH   Confluence    200"
"            7   Confluence "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.551    c.m/sec"
"             Hydrograph volume          5767.070    c.m"
"                    0.011     0.551     0.395     0.000"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      22.610    hectare"
"             Total Impervious area                      7.847    hectare"
"             Total % impervious                        34.706"
" 19          EXIT"
```

```
"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                          Version 2.25  rev. 473"
"               MIDUSS created                       Sunday, February 07, 2010"
"          10   Units used:                                          ie METRIC"
"               Job folder:         W:\Kitchener\411-2011\411009\Design Data\"
"                                              Modelling Files\2022-07-25"
"               Output filename:                                Post__25yr.out"
"               Licensee name:                                            gmbp"
"               Company                                                   gmbp"
"               Date & Time last used:                 7/25/2022 at 11:43:00 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3701.648   Coefficient A"
"       25.500   Constant B"
"        0.937   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          143.371    mm/hr"
"             Total depth                 75.581    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.440   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.899   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                     0.047     0.000     0.000     0.000 c.m/sec"
"             Catchment 1200         Pervious   Impervious Total Area "
"             Surface Area           0.110      0.110      0.220      hectare"
"             Time of concentration  7.622      1.005      3.181      minutes"
"             Time to Centroid       103.628    85.398     91.394     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        83.14      83.14      166.28     c.m"
"             Rainfall losses        42.296     7.669      24.982     mm"
"             Runoff depth           33.285     67.912     50.598     mm"
"             Runoff volume          36.61      74.70      111.32     c.m"
"             Runoff coefficient     0.440      0.899      0.669      "
"             Maximum flow           0.018      0.038      0.047      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.047     0.047     0.000     0.000"
" 33          CATCHMENT 1300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1300   Catchment 1300"
"       50.000   % Impervious"
"        0.700   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.350   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.350   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.144     0.047     0.000     0.000 c.m/sec"
"             Catchment 1300         Pervious   Impervious Total Area "
"             Surface Area           0.350      0.350      0.700      hectare"
"             Time of concentration  11.553     1.523      4.782      minutes"
"             Time to Centroid       108.042    85.984     93.151     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        264.53     264.53     529.07     c.m"
"             Rainfall losses        42.253     6.330      24.292     mm"
"             Runoff depth           33.328     69.250     51.289     mm"
"             Runoff volume          116.65     242.38     359.02     c.m"
```

```
"              Runoff coefficient     0.441      0.916      0.679      "
"              Maximum flow           0.047      0.118      0.144      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.144     0.191     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.439   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.912   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.046     0.191     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  9.721      1.281      4.026      minutes"
"              Time to Centroid       106.001    85.673     92.284     minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        83.14      83.14      166.28     c.m"
"              Rainfall losses        42.377     6.681      24.529     mm"
"              Runoff depth           33.204     68.900     51.052     mm"
"              Runoff volume          36.52      75.79      112.31     c.m"
"              Runoff coefficient     0.439      0.912      0.675      "
"              Maximum flow           0.016      0.038      0.046      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.046     0.238     0.000     0.000"
" 54           POND DESIGN"
"         0.238   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         582.7   Hydrograph volume    c.m"
"           17.   Number of stages"
```

```
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                 0.213    c.m/sec"
"             Maximum level              413.791    metre"
"             Maximum storage            197.238    c.m"
"             Centroidal lag              30.349   hours"
"                  0.046     0.238     0.213     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.213    c.m/sec"
"             Hydrograph volume          559.248    c.m"
"                     0.046     0.238     0.213     0.213"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.046     0.000     0.213     0.213"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.496   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.124   Impervious Area"
```

```
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                       0.082     0.000     0.213     0.213 c.m/sec"
"             Catchment 1400         Pervious   Impervious Total Area "
"             Surface Area           0.496      0.124      0.620      hectare"
"             Time of concentration  14.734     1.942      10.366     minutes"
"             Time to Centroid       111.700    86.497     103.093    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        374.88     93.72      468.60     c.m"
"             Rainfall losses        42.213     6.364      35.043     mm"
"             Runoff depth           33.368     69.217     40.538     mm"
"             Runoff volume          165.50     85.83      251.33     c.m"
"             Runoff coefficient     0.441      0.916      0.536      "
"             Maximum flow           0.061      0.042      0.082      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                       0.082     0.082     0.213     0.213"
" 54          POND DESIGN"
"        0.082   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"        251.3   Hydrograph volume    c.m"
"          17.   Number of stages"
"      413.920   Minimum water level    metre"
"      415.520   Maximum water level    metre"
"      413.920   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.920   0.00088     0.000"
"                414.020   0.00088    26.350"
"                414.120   0.00089    55.150"
"                414.220   0.00089    83.950"
"                414.320   0.00089   112.750"
"                414.420   0.00090   139.100"
"                414.520   0.00090   165.450"
"                414.620   0.00090   191.800"
"                414.720   0.00090   191.870"
"                414.820   0.02640   191.950"
"                414.920   0.03734   192.020"
"                415.020   0.04573   192.090"
"                415.120   0.05281   192.160"
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"                415.220    0.2777   201.450"
"                415.320    0.6941   238.950"
"                415.420     1.244   304.700"
"                415.520     1.909   382.200"
"             Peak outflow                 0.017    c.m/sec"
"             Maximum level              414.821    metre"
"             Maximum storage            191.951    c.m"
"             Centroidal lag              27.025   hours"
"                  0.082     0.082     0.017     0.213 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.213    c.m/sec"
"             Hydrograph volume          808.641    c.m"
"                     0.082     0.082     0.017     0.213"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.082     0.000     0.017     0.213"
" 33          CATCHMENT 1500"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1500   Catchment 1500"
"       50.000   % Impervious"
"        1.110   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.555   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.555   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.213     0.000     0.017     0.213 c.m/sec"
"             Catchment 1500         Pervious   Impervious Total Area "
"             Surface Area           0.555      0.555      1.110      hectare"
"             Time of concentration  17.510     2.308      7.265      minutes"
"             Time to Centroid       114.842    87.059     96.118     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
```

```
"              Rainfall volume        419.47     419.47     838.95     c.m"
"              Rainfall losses        42.200     6.593      24.396     mm"
"              Runoff depth           33.381     68.988     51.185     mm"
"              Runoff volume          185.27     382.88     568.15     c.m"
"              Runoff coefficient     0.442      0.913      0.677      "
"              Maximum flow           0.064      0.190      0.213      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.213     0.213     0.017     0.213"
" 56           DIVERSION"
"          1500   Node number"
"         0.146   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow         0.067    c.m/sec"
"              Volume of diverted flow      46.077    c.m"
"              DIV01500.025hyd"
"              Major flow at 1500"
"                      0.213     0.213     0.146     0.213 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.213     0.146     0.146     0.213"
" 33           CATCHMENT 1000"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"         6.980   Total Area"
"       100.000   Flow length"
"         2.000   Overland Slope"
"         3.490   Pervious Area"
"       100.000   Pervious length"
"         2.000   Pervious slope"
"         3.490   Impervious Area"
"       100.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.442   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.917   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      1.292     0.146     0.146     0.213 c.m/sec"
"              Catchment 1000         Pervious   Impervious Total Area "
"              Surface Area           3.490      3.490      6.980      hectare"
```

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"              Time of concentration  30.343     4.000      12.568     minutes"
"              Time to Centroid       129.499    89.355     102.412    minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        2637.77    2637.77    5275.54    c.m"
"              Rainfall losses        42.180     6.290      24.235     mm"
"              Runoff depth           33.401     69.291     51.346     mm"
"              Runoff volume          1165.68    2418.25    3583.93    c.m"
"              Runoff coefficient     0.442      0.917      0.679      "
"              Maximum flow           0.298      1.235      1.292      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     1.292     1.438     0.146     0.213"
" 33           CATCHMENT 1100"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1100   Catchment 1100"
"         0.000   % Impervious"
"         0.480   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.480   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.441   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.000   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.065     1.438     0.146     0.213 c.m/sec"
"              Catchment 1100         Pervious   Impervious Total Area "
"              Surface Area           0.480      0.000      0.480      hectare"
"              Time of concentration  11.553     1.523      11.553     minutes"
"              Time to Centroid       108.042    85.984     108.042    minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        362.79     0.00       362.79     c.m"
"              Rainfall losses        42.253     6.330      42.253     mm"
"              Runoff depth           33.328     69.250     33.328     mm"
"              Runoff volume          159.97     0.00       159.98     c.m"
"              Runoff coefficient     0.441      0.000      0.441      "
"              Maximum flow           0.065      0.000      0.065      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
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"            4   Add Runoff "
"                     0.065     1.476     0.146     0.213"
" 54          POND DESIGN"
"        1.476   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       4266.0   Hydrograph volume    c.m"
"          12.   Number of stages"
"      411.000   Minimum water level    metre"
"      412.000   Maximum water level    metre"
"      411.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.03200    18.400"
"                411.200   0.06500    95.500"
"                411.300   0.07700   239.900"
"                411.400   0.08700   435.700"
"                411.500   0.09600   691.300"
"                411.600    0.1050  1027.600"
"                411.700    0.3150  1450.000"
"                411.800    0.3380  1935.800"
"                411.850    0.3490  2195.700"
"                411.900    0.6670  2465.600"
"                412.000     2.018  3030.100"
"             Peak outflow                0.398    c.m/sec"
"             Maximum level             411.858    metre"
"             Maximum storage          2237.928    c.m"
"             Centroidal lag              3.270   hours"
"                  0.065     1.476     0.398     0.213 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.065     0.398     0.398     0.213"
" 47          FILEI_O Read/Open DIV01500.025hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV01500.025hyd"
"             Major flow at 1500"
"             Total volume               46.077    c.m"
"             Maximum flow                0.067    c.m/sec"
"                  0.067     0.398     0.398     0.213 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.067     0.398     0.398     0.213"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
```

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"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.109   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.114     0.398     0.398     0.213 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           7.330      0.000      7.330      hectare"
"             Time of concentration  43.720     2.944      43.719     minutes"
"             Time to Centroid       151.037    87.974     151.037    minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        5540.07    0.01       5540.08    c.m"
"             Rainfall losses        67.305     6.942      67.305     mm"
"             Runoff depth           8.276      68.639     8.276      mm"
"             Runoff volume          606.62     0.01       606.62     c.m"
"             Runoff coefficient     0.109      0.000      0.109      "
"             Maximum flow           0.114      0.000      0.114      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.114     0.512     0.398     0.213"
" 54          POND DESIGN"
"        0.512   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       4920.7   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
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"             Peak outflow                  0.485    c.m/sec"
"             Maximum level               409.717    metre"
"             Maximum storage             293.288    c.m"
"             Centroidal lag                3.326   hours"
"                  0.114     0.512     0.485     0.213 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.114     0.485     0.485     0.213"
" 52          CHANNEL DESIGN"
"        0.485   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.298    metre"
"             Velocity                      0.813    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.254    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.426   X-factor <= 0.5"
"       66.766   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       75.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.484    c.m/sec"
"                     0.114     0.485     0.484     0.213 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.114     0.484     0.484     0.213"
" 52          CHANNEL DESIGN"
"        0.484   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.210    metre"
"             Velocity                      0.880    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.166    metre"
" 53          ROUTE    Channel Route 40"
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"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.359   X-factor <= 0.5"
"       33.931   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       42.857   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.482    c.m/sec"
"                     0.114     0.484     0.482     0.213 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                 0.482    c.m/sec"
"             Hydrograph volume         4920.682    c.m"
"                     0.114     0.484     0.482     0.482"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.114     0.000     0.482     0.482"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.435     0.000     0.482     0.482 c.m/sec"
"             Catchment 2100         Pervious   Impervious Total Area "
"             Surface Area           0.784      1.176      1.960      hectare"
"             Time of concentration  17.510     2.308      6.016      minutes"
```

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"             Time to Centroid       114.842    87.059     93.835     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        592.55     888.83     1481.38    c.m"
"             Rainfall losses        42.200     6.593      20.835     mm"
"             Runoff depth           33.381     68.988     54.745     mm"
"             Runoff volume          261.71     811.30     1073.01    c.m"
"             Runoff coefficient     0.442      0.913      0.724      "
"             Maximum flow           0.090      0.402      0.435      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.435     0.435     0.482     0.482"
" 33          CATCHMENT 2400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2400   Catchment 2400"
"       90.000   % Impervious"
"        0.800   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.080   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.720   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.246     0.435     0.482     0.482 c.m/sec"
"             Catchment 2400         Pervious   Impervious Total Area "
"             Surface Area           0.080      0.720      0.800      hectare"
"             Time of concentration  11.553     1.523      2.032      minutes"
"             Time to Centroid       108.042    85.984     87.103     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        60.46      544.18     604.65     c.m"
"             Rainfall losses        42.253     6.330      9.923      mm"
"             Runoff depth           33.328     69.250     65.658     mm"
"             Runoff volume          26.66      498.60     525.27     c.m"
"             Runoff coefficient     0.441      0.916      0.869      "
"             Maximum flow           0.011      0.243      0.246      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
```

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"                     0.246     0.680     0.482     0.482"
" 54          POND DESIGN"
"       0.680   Current peak flow    c.m/sec"
"       0.020   Target outflow    c.m/sec"
"      1598.3   Hydrograph volume    c.m"
"         14.   Number of stages"
"     410.650   Minimum water level    metre"
"     411.950   Maximum water level    metre"
"     410.650   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"               410.650     0.000     0.000"
"               410.700   0.00600    43.000"
"               410.800   0.01300   135.000"
"               410.900   0.02000   232.000"
"               411.000   0.02500   334.000"
"               411.100   0.02900   442.000"
"               411.200    0.1260   556.000"
"               411.300    0.1390   676.000"
"               411.400    0.1510   801.000"
"               411.500    0.1630   933.000"
"               411.600    0.1730  1072.000"
"               411.650    0.1780  1143.000"
"               411.700    0.3370  1216.000"
"               411.800     1.007  1368.000"
"            Peak outflow                 0.161    c.m/sec"
"            Maximum level              411.484    metre"
"            Maximum storage            911.685    c.m"
"            Centroidal lag               3.538   hours"
"                 0.246     0.680     0.161     0.482 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                    0.246     0.161     0.161     0.482"
" 33          CATCHMENT 2300"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        2300   Catchment 2300"
"      10.000   % Impervious"
"       0.480   Total Area"
"      20.000   Flow length"
"       2.000   Overland Slope"
"       0.432   Pervious Area"
"      20.000   Pervious length"
"       2.000   Pervious slope"
"       0.048   Impervious Area"
"      20.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
```

```
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.067     0.161     0.161     0.482 c.m/sec"
"              Catchment 2300         Pervious   Impervious Total Area "
"              Surface Area           0.432      0.048      0.480      hectare"
"              Time of concentration  11.553     1.523      9.671      minutes"
"              Time to Centroid       108.042    85.984     103.905    minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        326.51     36.28      362.79     c.m"
"              Rainfall losses        42.253     6.330      38.660     mm"
"              Runoff depth           33.328     69.250     36.920     mm"
"              Runoff volume          143.98     33.24      177.22     c.m"
"              Runoff coefficient     0.441      0.916      0.488      "
"              Maximum flow           0.059      0.016      0.067      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.067     0.214     0.161     0.482"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                      0.067     0.214     0.214     0.482"
" 40           HYDROGRAPH   Combine    200"
"             6   Combine "
"           200   Node #"
"                 To Trib. of Grand River"
"              Maximum flow                  0.214    c.m/sec"
"              Hydrograph volume          1777.141    c.m"
"                      0.067     0.214     0.214     0.214"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                      0.067     0.000     0.214     0.214"
" 33           CATCHMENT 2200"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
```

```
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.913   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.245     0.000     0.214     0.214 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  17.510     2.308      4.420      minutes"
"             Time to Centroid       114.842    87.059     90.917     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        173.84     521.51     695.34     c.m"
"             Rainfall losses        42.200     6.593      15.494     mm"
"             Runoff depth           33.381     68.988     60.086     mm"
"             Runoff volume          76.78      476.02     552.80     c.m"
"             Runoff coefficient     0.442      0.913      0.795      "
"             Maximum flow           0.026      0.236      0.245      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.245     0.245     0.214     0.214"
" 54          POND DESIGN"
"        0.245   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        552.8   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                  0.027    c.m/sec"
"             Maximum level               414.105    metre"
```

```
"             Maximum storage             428.861    c.m"
"             Centroidal lag                7.439   hours"
"                  0.245     0.245     0.027     0.214 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.227    c.m/sec"
"             Hydrograph volume          2329.845    c.m"
"                     0.245     0.245     0.027     0.227"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.245     0.000     0.027     0.227"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.442   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.908   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.091     0.000     0.027     0.227 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  21.558     2.842      7.426      minutes"
"             Time to Centroid       119.480    87.822     95.576     minutes"
"             Rainfall depth         75.581     75.581     75.581     mm"
"             Rainfall volume        126.98     190.46     317.44     c.m"
"             Rainfall losses        42.201     6.986      21.072     mm"
"             Runoff depth           33.380     68.594     54.509     mm"
"             Runoff volume          56.08      172.86     228.94     c.m"
"             Runoff coefficient     0.442      0.908      0.721      "
"             Maximum flow           0.017      0.086      0.091      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.091     0.091     0.027     0.227"
" 56          DIVERSION"
"        32001   Node number"
"        0.067   Overflow threshold"
"        1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.024    c.m/sec"
"             Volume of diverted flow      12.772    c.m"
"             DIV32001.025hyd"
"             Major flow at 32001"
"                     0.091     0.091     0.067     0.227 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.091     0.067     0.067     0.227"
" 54          POND DESIGN"
"        0.067   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        216.2   Hydrograph volume    c.m"
"          15.   Number of stages"
"      410.620   Minimum water level    metre"
"      414.230   Maximum water level    metre"
"      410.620   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.620     0.000     0.000"
"                410.870   0.01300     4.855"
"                411.120   0.02000    14.351"
"                411.370   0.02500    24.074"
"                411.620   0.02900    33.921"
"                411.870   0.03300    43.768"
"                412.120   0.03600    53.614"
"                412.370   0.03900    63.461"
"                412.620   0.04200    73.308"
"                412.870   0.04400    74.155"
"                413.120   0.04700    75.003"
"                413.370   0.04900    75.850"
"                413.620   0.05200    76.698"
"                413.980   0.05500    77.918"
"                414.230    0.1600    78.483"
"             Peak outflow                  0.038    c.m/sec"
"             Maximum level               412.267    metre"
"             Maximum storage              59.408    c.m"
"             Centroidal lag                1.926   hours"
"                  0.091     0.067     0.038     0.227 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.091     0.038     0.038     0.227"
" 33          CATCHMENT 3200"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.029     0.038     0.038     0.227 c.m/sec"
"              Catchment 3200         Pervious   Impervious Total Area "
"              Surface Area           0.052      0.078      0.130      hectare"
"              Time of concentration  14.223     1.875      4.878      minutes"
"              Time to Centroid       111.113    86.404     92.413     minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        39.30      58.95      98.26      c.m"
"              Rainfall losses        42.219     6.365      20.706     mm"
"              Runoff depth           33.362     69.216     54.874     mm"
"              Runoff volume          17.35      53.99      71.34      c.m"
"              Runoff coefficient     0.441      0.916      0.726      "
"              Maximum flow           0.007      0.026      0.029      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.029     0.058     0.038     0.227"
" 33           CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
```

```
"        2.000   Pervious slope"
"        0.144   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.441   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.916   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.055     0.058     0.038     0.227 c.m/sec"
"              Catchment 3300         Pervious   Impervious Total Area "
"              Surface Area           0.096      0.144      0.240      hectare"
"              Time of concentration  11.553     1.523      3.959      minutes"
"              Time to Centroid       108.042    85.984     91.342     minutes"
"              Rainfall depth         75.581     75.581     75.581     mm"
"              Rainfall volume        72.56      108.84     181.39     c.m"
"              Rainfall losses        42.253     6.330      20.699     mm"
"              Runoff depth           33.328     69.250     54.881     mm"
"              Runoff volume          31.99      99.72      131.72     c.m"
"              Runoff coefficient     0.441      0.916      0.726      "
"              Maximum flow           0.013      0.049      0.055      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.055     0.113     0.038     0.227"
" 47           FILEI_O Read/Open DIV32001.025hyd"
"             1   1=read/open; 2=write/save"
"             2   1=rainfall; 2=hydrograph"
"             1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"              DIV32001.025hyd"
"              Major flow at 32001"
"              Total volume                 12.772    c.m"
"              Maximum flow                  0.024    c.m/sec"
"                  0.024     0.113     0.038     0.227 c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.024     0.137     0.038     0.227"
" 40           HYDROGRAPH Copy to Outflow"
"             8   Copy to Outflow"
"                     0.024     0.137     0.137     0.227"
" 40           HYDROGRAPH   Combine    300"
"             6   Combine "
"           300   Node #"
"                 To Walser Street"
"              Maximum flow                  0.137    c.m/sec"
"              Hydrograph volume           431.922    c.m"
```

```
"                     0.024     0.137     0.137     0.137"
" 40          HYDROGRAPH   Confluence    300"
"           7   Confluence "
"         300   Node #"
"               To Walser Street"
"            Maximum flow                  0.137    c.m/sec"
"            Hydrograph volume           431.922    c.m"
"                     0.024     0.137     0.137     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                     0.024     0.137     0.137     0.000"
" 40          HYDROGRAPH   Combine    100"
"           6   Combine "
"         100   Node #"
"               Existing Wetland"
"            Maximum flow                  0.524    c.m/sec"
"            Hydrograph volume          5352.604    c.m"
"                     0.024     0.137     0.137     0.524"
" 40          HYDROGRAPH   Confluence    100"
"           7   Confluence "
"         100   Node #"
"               Existing Wetland"
"            Maximum flow                  0.524    c.m/sec"
"            Hydrograph volume          5352.604    c.m"
"                     0.024     0.524     0.137     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                     0.024     0.524     0.524     0.000"
" 40          HYDROGRAPH   Combine    200"
"           6   Combine "
"         200   Node #"
"               To Trib. of Grand River"
"            Maximum flow                  0.719    c.m/sec"
"            Hydrograph volume          7682.439    c.m"
"                     0.024     0.524     0.524     0.719"
" 40          HYDROGRAPH   Confluence    200"
"           7   Confluence "
"         200   Node #"
"               To Trib. of Grand River"
"            Maximum flow                  0.719    c.m/sec"
"            Hydrograph volume          7682.439    c.m"
"                     0.024     0.719     0.524     0.000"
" 38          START/RE-START TOTALS 200"
"           3   Runoff Totals on EXIT"
"            Total Catchment area                         22.610    hectare"
"            Total Impervious area                         7.847    hectare"
"            Total % impervious                           34.706"
" 19          EXIT"
```

```
"               MIDUSS Output ----------------------------------------------->"
"               MIDUSS version                           Version 2.25  rev. 473"
"               MIDUSS created                        Sunday, February 07, 2010"
"          10   Units used:                                           ie METRIC"
"               Job folder:         W:\Kitchener\411-2011\411009\Design Data\"
"                                                     Modelling Files\2022-07-25"
"               Output filename:                                  Post__50yr.out"
"               Licensee name:                                              gmbp"
"               Company                                                     gmbp"
"               Date & Time last used:                   7/25/2022 at 11:46:50 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     5089.418   Coefficient A"
"       30.000   Constant B"
"        0.967   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           156.350    mm/hr"
"             Total depth                  86.737    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.479   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.904   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                    0.055     0.000     0.000     0.000 c.m/sec"
"             Catchment 1200         Pervious   Impervious Total Area "
"             Surface Area           0.110      0.110      0.220      hectare"
"             Time of concentration  7.056      0.968      3.076      minutes"
"             Time to Centroid       102.283    85.178     91.100     minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        95.41      95.41      190.82     c.m"
"             Rainfall losses        45.201     8.296      26.748     mm"
"             Runoff depth           41.536     78.441     59.988     mm"
"             Runoff volume          45.69      86.28      131.97     c.m"
"             Runoff coefficient     0.479      0.904      0.692      "
"             Maximum flow           0.021      0.041      0.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.055     0.055     0.000     0.000"
" 33          CATCHMENT 1300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1300   Catchment 1300"
"       50.000   % Impervious"
"        0.700   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.350   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.350   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.169     0.055     0.000     0.000 c.m/sec"
"             Catchment 1300         Pervious   Impervious Total Area "
"             Surface Area           0.350      0.350      0.700      hectare"
"             Time of concentration  10.695     1.467      4.627      minutes"
"             Time to Centroid       106.283    85.675     92.731     minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        303.58     303.58     607.16     c.m"
"             Rainfall losses        44.994     6.561      25.777     mm"
"             Runoff depth           41.743     80.176     60.959     mm"
"             Runoff volume          146.10     280.61     426.72     c.m"
```

```
"              Runoff coefficient     0.481      0.924      0.703      "
"              Maximum flow           0.060      0.131      0.169      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.169     0.224     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.480   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.919   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.054     0.224     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  9.000      1.235      3.900      minutes"
"              Time to Centroid       104.357    85.382     91.895     minutes"
"              Rainfall depth         86.737     86.737     86.737     mm"
"              Rainfall volume        95.41      95.41      190.82     c.m"
"              Rainfall losses        45.077     7.038      26.057     mm"
"              Runoff depth           41.660     79.699     60.679     mm"
"              Runoff volume          45.83      87.67      133.49     c.m"
"              Runoff coefficient     0.480      0.919      0.700      "
"              Maximum flow           0.020      0.042      0.054      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.054     0.279     0.000     0.000"
" 54           POND DESIGN"
"         0.279   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         692.2   Hydrograph volume    c.m"
"           17.   Number of stages"
```

```
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                 0.270    c.m/sec"
"             Maximum level              413.868    metre"
"             Maximum storage            198.404    c.m"
"             Centroidal lag              24.205   hours"
"                  0.054     0.279     0.270     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.270    c.m/sec"
"             Hydrograph volume          710.278    c.m"
"                     0.054     0.279     0.270     0.270"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.054     0.000     0.270     0.270"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.496   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.124   Impervious Area"
```

```
"       30.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.482   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.105     0.000     0.270     0.270 c.m/sec"
"            Catchment 1400         Pervious   Impervious Total Area "
"            Surface Area           0.496      0.124      0.620      hectare"
"            Time of concentration  13.641     1.872      9.825      minutes"
"            Time to Centroid       109.632    86.148     102.018    minutes"
"            Rainfall depth         86.737     86.737     86.737     mm"
"            Rainfall volume        430.21     107.55     537.77     c.m"
"            Rainfall losses        44.941     6.526      37.258     mm"
"            Runoff depth           41.796     80.211     49.479     mm"
"            Runoff volume          207.31     99.46      306.77     c.m"
"            Runoff coefficient     0.482      0.925      0.570      "
"            Maximum flow           0.079      0.047      0.105      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.105     0.105     0.270     0.270"
" 54         POND DESIGN"
"        0.105   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"        306.8   Hydrograph volume    c.m"
"          17.   Number of stages"
"      413.920   Minimum water level    metre"
"      415.520   Maximum water level    metre"
"      413.920   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"               413.920   0.00088     0.000"
"               414.020   0.00088    26.350"
"               414.120   0.00089    55.150"
"               414.220   0.00089    83.950"
"               414.320   0.00089   112.750"
"               414.420   0.00090   139.100"
"               414.520   0.00090   165.450"
"               414.620   0.00090   191.800"
"               414.720   0.00090   191.870"
"               414.820   0.02640   191.950"
"               414.920   0.03734   192.020"
"               415.020   0.04573   192.090"
"               415.120   0.05281   192.160"
```

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"                415.220    0.2777   201.450"
"                415.320    0.6941   238.950"
"                415.420     1.244   304.700"
"                415.520     1.909   382.200"
"             Peak outflow                 0.046    c.m/sec"
"             Maximum level              415.121    metre"
"             Maximum storage            192.296    c.m"
"             Centroidal lag              22.464   hours"
"                  0.105     0.105     0.046     0.270 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.271    c.m/sec"
"             Hydrograph volume         1014.930    c.m"
"                     0.105     0.105     0.046     0.271"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.105     0.000     0.046     0.271"
" 33          CATCHMENT 1500"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1500   Catchment 1500"
"       50.000   % Impervious"
"        1.110   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.555   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.555   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.242     0.000     0.046     0.271 c.m/sec"
"             Catchment 1500         Pervious   Impervious Total Area "
"             Surface Area           0.555      0.555      1.110      hectare"
"             Time of concentration  16.211     2.224      7.023      minutes"
"             Time to Centroid       112.570    86.667     95.554     minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
```

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"              Rainfall volume        481.39     481.39     962.78     c.m"
"              Rainfall losses        44.974     6.774      25.874     mm"
"              Runoff depth           41.763     79.963     60.863     mm"
"              Runoff volume          231.78     443.80     675.58     c.m"
"              Runoff coefficient     0.481      0.922      0.702      "
"              Maximum flow           0.084      0.210      0.242      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.242     0.242     0.046     0.271"
" 56           DIVERSION"
"          1500   Node number"
"         0.146   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow         0.096    c.m/sec"
"              Volume of diverted flow      90.793    c.m"
"              DIV01500.050hyd"
"              Major flow at 1500"
"                     0.242     0.242     0.146     0.271 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                     0.242     0.146     0.146     0.271"
" 33           CATCHMENT 1000"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"         6.980   Total Area"
"       100.000   Flow length"
"         2.000   Overland Slope"
"         3.490   Pervious Area"
"       100.000   Pervious length"
"         2.000   Pervious slope"
"         3.490   Impervious Area"
"       100.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.482   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.923   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     1.452     0.146     0.146     0.271 c.m/sec"
"              Catchment 1000         Pervious   Impervious Total Area "
"              Surface Area           3.490      3.490      6.980      hectare"
```

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"             Time of concentration  28.092     3.854      12.172     minutes"
"             Time to Centroid       125.992    88.892     101.624    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        3027.11    3027.11    6054.23    c.m"
"             Rainfall losses        44.916     6.695      25.806     mm"
"             Runoff depth           41.821     80.042     60.931     mm"
"             Runoff volume          1459.54    2793.46    4253.00    c.m"
"             Runoff coefficient     0.482      0.923      0.702      "
"             Maximum flow           0.393      1.367      1.452      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.452     1.598     0.146     0.271"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1100   Catchment 1100"
"        0.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.480   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.082     1.598     0.146     0.271 c.m/sec"
"             Catchment 1100         Pervious   Impervious Total Area "
"             Surface Area           0.480      0.000      0.480      hectare"
"             Time of concentration  10.695     1.467      10.695     minutes"
"             Time to Centroid       106.283    85.675     106.283    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        416.34     0.00       416.34     c.m"
"             Rainfall losses        44.994     6.561      44.994     mm"
"             Runoff depth           41.743     80.176     41.743     mm"
"             Runoff volume          200.37     0.00       200.37     c.m"
"             Runoff coefficient     0.481      0.000      0.481      "
"             Maximum flow           0.082      0.000      0.082      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     0.082     1.654     0.146     0.271"
" 54          POND DESIGN"
"        1.654   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       5038.2   Hydrograph volume    c.m"
"          12.   Number of stages"
"      411.000   Minimum water level    metre"
"      412.000   Maximum water level    metre"
"      411.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.03200    18.400"
"                411.200   0.06500    95.500"
"                411.300   0.07700   239.900"
"                411.400   0.08700   435.700"
"                411.500   0.09600   691.300"
"                411.600    0.1050  1027.600"
"                411.700    0.3150  1450.000"
"                411.800    0.3380  1935.800"
"                411.850    0.3490  2195.700"
"                411.900    0.6670  2465.600"
"                412.000     2.018  3030.100"
"             Peak outflow                 0.658    c.m/sec"
"             Maximum level              411.899    metre"
"             Maximum storage           2458.114    c.m"
"             Centroidal lag               3.134   hours"
"                  0.082     1.654     0.658     0.271 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.082     0.658     0.658     0.271"
" 47          FILEI_O Read/Open DIV01500.050hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV01500.050hyd"
"             Major flow at 1500"
"             Total volume                90.793    c.m"
"             Maximum flow                 0.096    c.m/sec"
"                  0.096     0.658     0.658     0.271 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.096     0.658     0.658     0.271"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
```

```
"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.137   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.183     0.658     0.658     0.271 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           7.330      0.000      7.330      hectare"
"             Time of concentration  37.472     2.837      37.472     minutes"
"             Time to Centroid       142.983    87.552     142.982    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        6357.80    0.01       6357.80    c.m"
"             Rainfall losses        74.812     7.307      74.812     mm"
"             Runoff depth           11.925     79.429     11.925     mm"
"             Runoff volume          874.09     0.01       874.10     c.m"
"             Runoff coefficient     0.137      0.000      0.137      "
"             Maximum flow           0.183      0.000      0.183      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                      0.183     0.841     0.658     0.271"
" 54          POND DESIGN"
"        0.841   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       6000.2   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
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"             Peak outflow                 0.768    c.m/sec"
"             Maximum level              409.759    metre"
"             Maximum storage            466.326    c.m"
"             Centroidal lag               3.164   hours"
"                  0.183     0.841     0.768     0.271 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.183     0.768     0.768     0.271"
" 52          CHANNEL DESIGN"
"        0.768   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                0.354    metre"
"             Velocity                     0.912    m/sec"
"             Channel capacity            10.655    c.m/sec"
"             Critical depth               0.306    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.412   X-factor <= 0.5"
"       59.519   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.767    c.m/sec"
"                     0.183     0.768     0.767     0.271 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.183     0.767     0.767     0.271"
" 52          CHANNEL DESIGN"
"        0.767   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                0.270    metre"
"             Velocity                     1.013    m/sec"
"             Channel capacity             9.246    c.m/sec"
"             Critical depth               0.220    metre"
" 53          ROUTE    Channel Route 40"
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"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.323   X-factor <= 0.5"
"       29.473   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                 0.766    c.m/sec"
"                      0.183     0.767     0.766     0.271 c.m/sec"
" 40           HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"              Maximum flow                 0.766    c.m/sec"
"              Hydrograph volume         6000.176    c.m"
"                      0.183     0.767     0.766     0.766"
" 40           HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                      0.183     0.000     0.766     0.766"
" 33           CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.491     0.000     0.766     0.766 c.m/sec"
"              Catchment 2100         Pervious   Impervious Total Area "
"              Surface Area           0.784      1.176      1.960      hectare"
"              Time of concentration  16.211     2.224      5.836      minutes"
```

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"              Time to Centroid       112.570    86.667     93.357     minutes"
"              Rainfall depth         86.737     86.737     86.737     mm"
"              Rainfall volume        680.02     1020.02    1700.04    c.m"
"              Rainfall losses        44.974     6.773      22.054     mm"
"              Runoff depth           41.763     79.963     64.683     mm"
"              Runoff volume          327.42     940.37     1267.79    c.m"
"              Runoff coefficient     0.481      0.922      0.746      "
"              Maximum flow           0.119      0.446      0.491      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.491     0.491     0.766     0.766"
" 33           CATCHMENT 2400"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2400   Catchment 2400"
"        90.000   % Impervious"
"         0.800   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.080   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.720   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.924   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.274     0.491     0.766     0.766 c.m/sec"
"              Catchment 2400         Pervious   Impervious Total Area "
"              Surface Area           0.080      0.720      0.800      hectare"
"              Time of concentration  10.695     1.467      1.972      minutes"
"              Time to Centroid       106.283    85.675     86.802     minutes"
"              Rainfall depth         86.737     86.737     86.737     mm"
"              Rainfall volume        69.39      624.50     693.89     c.m"
"              Rainfall losses        44.994     6.561      10.404     mm"
"              Runoff depth           41.743     80.176     76.332     mm"
"              Runoff volume          33.39      577.26     610.66     c.m"
"              Runoff coefficient     0.481      0.924      0.880      "
"              Maximum flow           0.014      0.270      0.274      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
```

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"                     0.274     0.764     0.766     0.766"
" 54          POND DESIGN"
"        0.764   Current peak flow    c.m/sec"
"        0.020   Target outflow    c.m/sec"
"       1878.4   Hydrograph volume    c.m"
"          14.   Number of stages"
"      410.650   Minimum water level    metre"
"      411.950   Maximum water level    metre"
"      410.650   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.650     0.000     0.000"
"                410.700   0.00600    43.000"
"                410.800   0.01300   135.000"
"                410.900   0.02000   232.000"
"                411.000   0.02500   334.000"
"                411.100   0.02900   442.000"
"                411.200    0.1260   556.000"
"                411.300    0.1390   676.000"
"                411.400    0.1510   801.000"
"                411.500    0.1630   933.000"
"                411.600    0.1730  1072.000"
"                411.650    0.1780  1143.000"
"                411.700    0.3370  1216.000"
"                411.800     1.007  1368.000"
"             Peak outflow                  0.175    c.m/sec"
"             Maximum level               411.616    metre"
"             Maximum storage            1094.876    c.m"
"             Centroidal lag                3.520   hours"
"                  0.274     0.764     0.175     0.766 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.274     0.175     0.175     0.766"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.432   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.048   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
```

```
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.086     0.175     0.175     0.766 c.m/sec"
"             Catchment 2300         Pervious   Impervious Total Area "
"             Surface Area           0.432      0.048      0.480      hectare"
"             Time of concentration  10.695     1.467      9.072      minutes"
"             Time to Centroid       106.283    85.675     102.658    minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        374.70     41.63      416.34     c.m"
"             Rainfall losses        44.994     6.561      41.150     mm"
"             Runoff depth           41.743     80.176     45.586     mm"
"             Runoff volume          180.33     38.48      218.81     c.m"
"             Runoff coefficient     0.481      0.924      0.526      "
"             Maximum flow           0.074      0.018      0.086      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.086     0.242     0.175     0.766"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.086     0.242     0.242     0.766"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.242    c.m/sec"
"             Hydrograph volume          2097.427    c.m"
"                    0.086     0.242     0.242     0.242"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.086     0.000     0.242     0.242"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
```

```
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.275     0.000     0.242     0.242 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  16.211     2.224      4.298      minutes"
"             Time to Centroid       112.570    86.667     90.508     minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        199.49     598.48     797.98     c.m"
"             Rainfall losses        44.974     6.774      16.324     mm"
"             Runoff depth           41.763     79.963     70.413     mm"
"             Runoff volume          96.05      551.75     647.80     c.m"
"             Runoff coefficient     0.481      0.922      0.812      "
"             Maximum flow           0.035      0.262      0.275      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.275     0.275     0.242     0.242"
" 54          POND DESIGN"
"        0.275   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        647.8   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                  0.061    c.m/sec"
"             Maximum level               414.119    metre"
```

```
"             Maximum storage             447.957    c.m"
"             Centroidal lag                6.667   hours"
"                  0.275     0.275     0.061     0.242 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.267    c.m/sec"
"             Hydrograph volume          2744.608    c.m"
"                     0.275     0.275     0.061     0.267"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.275     0.000     0.061     0.267"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.482   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.917   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.102     0.000     0.061     0.267 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  19.958     2.738      7.208      minutes"
"             Time to Centroid       116.779    87.402     95.027     minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        145.72     218.58     364.29     c.m"
"             Rainfall losses        44.916     7.204      22.289     mm"
"             Runoff depth           41.821     79.533     64.448     mm"
"             Runoff volume          70.26      200.42     270.68     c.m"
"             Runoff coefficient     0.482      0.917      0.743      "
"             Maximum flow           0.023      0.095      0.102      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.102     0.102     0.061     0.267"
" 56          DIVERSION"
"        32001   Node number"
"        0.067   Overflow threshold"
"        1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.035    c.m/sec"
"             Volume of diverted flow      24.243    c.m"
"             DIV32001.050hyd"
"             Major flow at 32001"
"                     0.102     0.102     0.067     0.267 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.102     0.067     0.067     0.267"
" 54          POND DESIGN"
"        0.067   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        246.4   Hydrograph volume    c.m"
"          15.   Number of stages"
"      410.620   Minimum water level    metre"
"      414.230   Maximum water level    metre"
"      410.620   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.620     0.000     0.000"
"                410.870   0.01300     4.855"
"                411.120   0.02000    14.351"
"                411.370   0.02500    24.074"
"                411.620   0.02900    33.921"
"                411.870   0.03300    43.768"
"                412.120   0.03600    53.614"
"                412.370   0.03900    63.461"
"                412.620   0.04200    73.308"
"                412.870   0.04400    74.155"
"                413.120   0.04700    75.003"
"                413.370   0.04900    75.850"
"                413.620   0.05200    76.698"
"                413.980   0.05500    77.918"
"                414.230    0.1600    78.483"
"             Peak outflow                  0.041    c.m/sec"
"             Maximum level               412.539    metre"
"             Maximum storage              70.123    c.m"
"             Centroidal lag                1.956   hours"
"                  0.102     0.067     0.041     0.267 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.102     0.041     0.041     0.267"
" 33          CATCHMENT 3200"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.034     0.041     0.041     0.267 c.m/sec"
"              Catchment 3200         Pervious   Impervious Total Area "
"              Surface Area           0.052      0.078      0.130      hectare"
"              Time of concentration  13.168     1.807      4.730      minutes"
"              Time to Centroid       109.105    86.056     91.988     minutes"
"              Rainfall depth         86.737     86.737     86.737     mm"
"              Rainfall volume        45.10      67.65      112.76     c.m"
"              Rainfall losses        45.027     6.490      21.905     mm"
"              Runoff depth           41.710     80.247     64.832     mm"
"              Runoff volume          21.69      62.59      84.28      c.m"
"              Runoff coefficient     0.481      0.925      0.747      "
"              Maximum flow           0.008      0.029      0.034      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.034     0.064     0.041     0.267"
" 33           CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
```

```
"         2.000   Pervious slope"
"         0.144   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.924   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.064     0.064     0.041     0.267 c.m/sec"
"             Catchment 3300         Pervious   Impervious Total Area "
"             Surface Area           0.096      0.144      0.240      hectare"
"             Time of concentration  10.695     1.467      3.845      minutes"
"             Time to Centroid       106.283    85.675     90.985     minutes"
"             Rainfall depth         86.737     86.737     86.737     mm"
"             Rainfall volume        83.27      124.90     208.17     c.m"
"             Rainfall losses        44.994     6.561      21.934     mm"
"             Runoff depth           41.743     80.176     64.803     mm"
"             Runoff volume          40.07      115.45     155.53     c.m"
"             Runoff coefficient     0.481      0.924      0.747      "
"             Maximum flow           0.016      0.054      0.064      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.064     0.128     0.041     0.267"
" 47          FILEI_O Read/Open DIV32001.050hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV32001.050hyd"
"             Major flow at 32001"
"             Total volume                 24.243    c.m"
"             Maximum flow                  0.035    c.m/sec"
"                  0.035     0.128     0.041     0.267 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.035     0.163     0.041     0.267"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.035     0.163     0.163     0.267"
" 40          HYDROGRAPH   Combine    300"
"            6   Combine "
"          300   Node #"
"                To Walser Street"
"             Maximum flow                  0.163    c.m/sec"
"             Hydrograph volume           510.569    c.m"
```

```
"                   0.035     0.163     0.163     0.163"
" 40         HYDROGRAPH   Confluence    300"
"          7   Confluence "
"        300   Node #"
"              To Walser Street"
"            Maximum flow                 0.163    c.m/sec"
"            Hydrograph volume          510.569    c.m"
"                   0.035     0.163     0.163     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                   0.035     0.163     0.163     0.000"
" 40         HYDROGRAPH   Combine    100"
"          6   Combine "
"        100   Node #"
"              Existing Wetland"
"            Maximum flow                 0.817    c.m/sec"
"            Hydrograph volume         6510.743    c.m"
"                   0.035     0.163     0.163     0.817"
" 40         HYDROGRAPH   Confluence    100"
"          7   Confluence "
"        100   Node #"
"              Existing Wetland"
"            Maximum flow                 0.817    c.m/sec"
"            Hydrograph volume         6510.742    c.m"
"                   0.035     0.817     0.163     0.000"
" 40         HYDROGRAPH Copy to Outflow"
"          8   Copy to Outflow"
"                   0.035     0.817     0.817     0.000"
" 40         HYDROGRAPH   Combine    200"
"          6   Combine "
"        200   Node #"
"              To Trib. of Grand River"
"            Maximum flow                 1.063    c.m/sec"
"            Hydrograph volume         9255.348    c.m"
"                   0.035     0.817     0.817     1.063"
" 40         HYDROGRAPH   Confluence    200"
"          7   Confluence "
"        200   Node #"
"              To Trib. of Grand River"
"            Maximum flow                 1.063    c.m/sec"
"            Hydrograph volume         9255.348    c.m"
"                   0.035     1.063     0.817     0.000"
" 38         START/RE-START TOTALS 200"
"          3   Runoff Totals on EXIT"
"            Total Catchment area                        22.610    hectare"
"            Total Impervious area                        7.847    hectare"
"            Total % impervious                          34.706"
" 19         EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                         Sunday, February 07, 2010"
"           10   Units used:                                           ie METRIC"
"                Job folder:         W:\Kitchener\411-2011\411009\Design Data\"
"                                                      Modelling Files\2022-07-25"
"                Output filename:                                 Post__100yr.out"
"                Licensee name:                                               gmbp"
"                Company                                                      gmbp"
"                Date & Time last used:                    7/25/2022 at 11:49:23 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     6933.019   Coefficient A"
"       34.699   Constant B"
"        0.998   Exponent C"
"        0.380   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           168.777    mm/hr"
"             Total depth                  97.921    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.511   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.908   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

```
"                     0.063     0.000     0.000     0.000 c.m/sec"
"             Catchment 1200         Pervious   Impervious Total Area "
"             Surface Area           0.110      0.110      0.220      hectare"
"             Time of concentration  6.616      0.937      2.983      minutes"
"             Time to Centroid       101.199    85.009     90.841     minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        107.71     107.71     215.43     c.m"
"             Rainfall losses        47.838     8.977      28.408     mm"
"             Runoff depth           50.084     88.944     69.514     mm"
"             Runoff volume          55.09      97.84      152.93     c.m"
"             Runoff coefficient     0.511      0.908      0.710      "
"             Maximum flow           0.026      0.045      0.063      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.063     0.063     0.000     0.000"
" 33          CATCHMENT 1300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1300   Catchment 1300"
"       50.000   % Impervious"
"        0.700   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.350   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.350   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.931   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.194     0.063     0.000     0.000 c.m/sec"
"             Catchment 1300         Pervious   Impervious Total Area "
"             Surface Area           0.350      0.350      0.700      hectare"
"             Time of concentration  10.027     1.421      4.487      minutes"
"             Time to Centroid       104.871    85.423     92.352     minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        342.72     342.72     685.45     c.m"
"             Rainfall losses        47.483     6.787      27.135     mm"
"             Runoff depth           50.438     91.134     70.786     mm"
"             Runoff volume          176.53     318.97     495.50     c.m"
```

```
"              Runoff coefficient     0.515      0.931      0.723      "
"              Maximum flow           0.074      0.144      0.194      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.194     0.257     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.516   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.924   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.062     0.257     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  8.438      1.196      3.791      minutes"
"              Time to Centroid       103.033    85.162     91.567     minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        107.71     107.71     215.43     c.m"
"              Rainfall losses        47.375     7.430      27.402     mm"
"              Runoff depth           50.546     90.491     70.519     mm"
"              Runoff volume          55.60      99.54      155.14     c.m"
"              Runoff coefficient     0.516      0.924      0.720      "
"              Maximum flow           0.025      0.045      0.062      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.062     0.319     0.000     0.000"
" 54           POND DESIGN"
"         0.319   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         803.6   Hydrograph volume    c.m"
"           17.   Number of stages"
```

```
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                 0.316    c.m/sec"
"             Maximum level              413.928    metre"
"             Maximum storage            199.438    c.m"
"             Centroidal lag              21.816   hours"
"                  0.062     0.319     0.316     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.316    c.m/sec"
"             Hydrograph volume          794.278    c.m"
"                     0.062     0.319     0.316     0.316"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.062     0.000     0.316     0.316"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
"       30.000   Flow length"
"        2.000   Overland Slope"
"        0.496   Pervious Area"
"       30.000   Pervious length"
"        2.000   Pervious slope"
"        0.124   Impervious Area"
```

```
"        30.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.516   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.932   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.129     0.000     0.316     0.316 c.m/sec"
"              Catchment 1400         Pervious   Impervious Total Area "
"              Surface Area           0.496      0.124      0.620      hectare"
"              Time of concentration  12.789     1.812      9.373      minutes"
"              Time to Centroid       107.990    85.865     101.105    minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        485.69     121.42     607.11     c.m"
"              Rainfall losses        47.421     6.662      39.270     mm"
"              Runoff depth           50.500     91.259     58.652     mm"
"              Runoff volume          250.48     113.16     363.64     c.m"
"              Runoff coefficient     0.516      0.932      0.599      "
"              Maximum flow           0.098      0.051      0.129      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.129     0.129     0.316     0.316"
" 54           POND DESIGN"
"         0.129   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"         363.6   Hydrograph volume    c.m"
"           17.   Number of stages"
"       413.920   Minimum water level    metre"
"       415.520   Maximum water level    metre"
"       413.920   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 413.920   0.00088     0.000"
"                 414.020   0.00088    26.350"
"                 414.120   0.00089    55.150"
"                 414.220   0.00089    83.950"
"                 414.320   0.00089   112.750"
"                 414.420   0.00090   139.100"
"                 414.520   0.00090   165.450"
"                 414.620   0.00090   191.800"
"                 414.720   0.00090   191.870"
"                 414.820   0.02640   191.950"
"                 414.920   0.03734   192.020"
"                 415.020   0.04573   192.090"
"                 415.120   0.05281   192.160"
```

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"                415.220    0.2777   201.450"
"                415.320    0.6941   238.950"
"                415.420     1.244   304.700"
"                415.520     1.909   382.200"
"             Peak outflow                 0.090    c.m/sec"
"             Maximum level              415.137    metre"
"             Maximum storage            193.705    c.m"
"             Centroidal lag              18.767   hours"
"                  0.129     0.129     0.090     0.316 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.317    c.m/sec"
"             Hydrograph volume         1164.892    c.m"
"                     0.129     0.129     0.090     0.317"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.129     0.000     0.090     0.317"
" 33          CATCHMENT 1500"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1500   Catchment 1500"
"       50.000   % Impervious"
"        1.110   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.555   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.555   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.277     0.000     0.090     0.317 c.m/sec"
"             Catchment 1500         Pervious   Impervious Total Area "
"             Surface Area           0.555      0.555      1.110      hectare"
"             Time of concentration  15.199     2.153      6.817      minutes"
"             Time to Centroid       110.688    86.345     95.048     minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
```

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"              Rainfall volume        543.46     543.46     1086.93    c.m"
"              Rainfall losses        47.301     6.948      27.124     mm"
"              Runoff depth           50.621     90.973     70.797     mm"
"              Runoff volume          280.94     504.90     785.85     c.m"
"              Runoff coefficient     0.517      0.929      0.723      "
"              Maximum flow           0.105      0.230      0.277      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.277     0.277     0.090     0.317"
" 56           DIVERSION"
"          1500   Node number"
"         0.146   Overflow threshold"
"         1.000   Required diverted fraction"
"             0   Conduit type; 1=Pipe;2=Channel"
"              Peak of diverted flow         0.131    c.m/sec"
"              Volume of diverted flow     145.528    c.m"
"              DIV01500.100hyd"
"              Major flow at 1500"
"                      0.277     0.277     0.146     0.317 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.277     0.146     0.146     0.317"
" 33           CATCHMENT 1000"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1000   Catchment 1000"
"        50.000   % Impervious"
"         6.980   Total Area"
"       100.000   Flow length"
"         2.000   Overland Slope"
"         3.490   Pervious Area"
"       100.000   Pervious length"
"         2.000   Pervious slope"
"         3.490   Impervious Area"
"       100.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.517   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.926   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      1.610     0.146     0.146     0.317 c.m/sec"
"              Catchment 1000         Pervious   Impervious Total Area "
"              Surface Area           3.490      3.490      6.980      hectare"
```

```
"             Time of concentration  26.337     3.732      11.833     minutes"
"             Time to Centroid       123.197    88.516     100.945    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        3417.45    3417.45    6834.91    c.m"
"             Rainfall losses        47.249     7.203      27.226     mm"
"             Runoff depth           50.672     90.719     70.695     mm"
"             Runoff volume          1768.46    3166.08    4934.54    c.m"
"             Runoff coefficient     0.517      0.926      0.722      "
"             Maximum flow           0.497      1.489      1.610      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.610     1.756     0.146     0.317"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1100   Catchment 1100"
"        0.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.480   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.101     1.756     0.146     0.317 c.m/sec"
"             Catchment 1100         Pervious   Impervious Total Area "
"             Surface Area           0.480      0.000      0.480      hectare"
"             Time of concentration  10.027     1.421      10.027     minutes"
"             Time to Centroid       104.871    85.423     104.871    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        470.02     0.00       470.02     c.m"
"             Rainfall losses        47.483     6.787      47.483     mm"
"             Runoff depth           50.438     91.134     50.438     mm"
"             Runoff volume          242.10     0.00       242.10     c.m"
"             Runoff coefficient     0.515      0.000      0.515      "
"             Maximum flow           0.101      0.000      0.101      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     0.101     1.830     0.146     0.317"
" 54          POND DESIGN"
"        1.830   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       5817.0   Hydrograph volume    c.m"
"          12.   Number of stages"
"      411.000   Minimum water level    metre"
"      412.000   Maximum water level    metre"
"      411.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                411.000     0.000     0.000"
"                411.100   0.03200    18.400"
"                411.200   0.06500    95.500"
"                411.300   0.07700   239.900"
"                411.400   0.08700   435.700"
"                411.500   0.09600   691.300"
"                411.600    0.1050  1027.600"
"                411.700    0.3150  1450.000"
"                411.800    0.3380  1935.800"
"                411.850    0.3490  2195.700"
"                411.900    0.6670  2465.600"
"                412.000     2.018  3030.100"
"             Peak outflow                 0.970    c.m/sec"
"             Maximum level              411.923    metre"
"             Maximum storage           2593.056    c.m"
"             Centroidal lag               2.996   hours"
"                  0.101     1.830     0.970     0.317 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.101     0.970     0.970     0.317"
" 47          FILEI_O Read/Open DIV01500.100hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV01500.100hyd"
"             Major flow at 1500"
"             Total volume              145.528    c.m"
"             Maximum flow                0.131    c.m/sec"
"                  0.131     0.970     0.970     0.317 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.131     0.970     0.970     0.317"
" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
```

```
"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.164   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.268     0.970     0.970     0.317 c.m/sec"
"            Catchment 4000         Pervious   Impervious Total Area "
"            Surface Area           7.330      0.000      7.330      hectare"
"            Time of concentration  32.980     2.747      32.980     minutes"
"            Time to Centroid       137.344    87.189     137.344    minutes"
"            Rainfall depth         97.921     97.921     97.921     mm"
"            Rainfall volume        7177.62    0.01       7177.63    c.m"
"            Rainfall losses        81.821     7.496      81.821     mm"
"            Runoff depth           16.100     90.426     16.100     mm"
"            Runoff volume          1180.13    0.01       1180.14    c.m"
"            Runoff coefficient     0.164      0.000      0.164      "
"            Maximum flow           0.268      0.000      0.268      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.268     1.235     0.970     0.317"
" 54         POND DESIGN"
"        1.235   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       7146.6   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                409.630     0.000     0.000"
"                409.750    0.6650   402.200"
"                410.000     3.601  2187.900"
"                410.250     7.811  5318.900"
"                410.500    12.984  9642.300"
"                410.750    18.965  15227.70"
```

```
"             Peak outflow                  1.083    c.m/sec"
"             Maximum level               409.786    metre"
"             Maximum storage             656.386    c.m"
"             Centroidal lag                3.013   hours"
"                  0.268     1.235     1.083     0.317 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.268     1.083     1.083     0.317"
" 52          CHANNEL DESIGN"
"        1.083   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        0.000   Basewidth    metre"
"        7.410   Left bank slope"
"        6.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.403    metre"
"             Velocity                      0.994    m/sec"
"             Channel capacity             10.655    c.m/sec"
"             Critical depth                0.351    metre"
" 53          ROUTE    Channel Route 72"
"        72.40      Channel Route 72 Reach length   ( metre)"
"        0.400   X-factor <= 0.5"
"       54.618   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  1.078    c.m/sec"
"                     0.268     1.083     1.078     0.317 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.268     1.078     1.078     0.317"
" 52          CHANNEL DESIGN"
"        1.078   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        2.000   Basewidth    metre"
"        2.950   Left bank slope"
"        3.000   Right bank slope"
"        0.950   Channel depth    metre"
"        1.040   Gradient   %"
"             Depth of flow                 0.325    metre"
"             Velocity                      1.120    m/sec"
"             Channel capacity              9.246    c.m/sec"
"             Critical depth                0.269    metre"
" 53          ROUTE    Channel Route 40"
```

```
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.291   X-factor <= 0.5"
"       26.647   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"              Peak outflow                  1.074    c.m/sec"
"                     0.268     1.078     1.074     0.317 c.m/sec"
" 40           HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"              Maximum flow                  1.074    c.m/sec"
"              Hydrograph volume          7146.616    c.m"
"                     0.268     1.078     1.074     1.074"
" 40           HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.268     0.000     1.074     1.074"
" 33           CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.554     0.000     1.074     1.074 c.m/sec"
"              Catchment 2100         Pervious   Impervious Total Area "
"              Surface Area           0.784      1.176      1.960      hectare"
"              Time of concentration  15.199     2.153      5.683      minutes"
```

```
"              Time to Centroid       110.688    86.345     92.932     minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        767.70     1151.55    1919.26    c.m"
"              Rainfall losses        47.301     6.948      23.089     mm"
"              Runoff depth           50.621     90.973     74.832     mm"
"              Runoff volume          396.87     1069.84    1466.71    c.m"
"              Runoff coefficient     0.517      0.929      0.764      "
"              Maximum flow           0.148      0.488      0.554      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.554     0.554     1.074     1.074"
" 33           CATCHMENT 2400"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2400   Catchment 2400"
"        90.000   % Impervious"
"         0.800   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.080   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.720   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.515   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.931   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.301     0.554     1.074     1.074 c.m/sec"
"              Catchment 2400         Pervious   Impervious Total Area "
"              Surface Area           0.080      0.720      0.800      hectare"
"              Time of concentration  10.027     1.421      1.919      minutes"
"              Time to Centroid       104.871    85.423     86.549     minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        78.34      705.03     783.37     c.m"
"              Rainfall losses        47.483     6.787      10.857     mm"
"              Runoff depth           50.438     91.134     87.065     mm"
"              Runoff volume          40.35      656.17     696.52     c.m"
"              Runoff coefficient     0.515      0.931      0.889      "
"              Maximum flow           0.017      0.296      0.301      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
```

```
"                     0.301     0.854     1.074     1.074"
" 54          POND DESIGN"
"        0.854   Current peak flow    c.m/sec"
"        0.020   Target outflow    c.m/sec"
"       2163.2   Hydrograph volume    c.m"
"          14.   Number of stages"
"      410.650   Minimum water level    metre"
"      411.950   Maximum water level    metre"
"      410.650   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"               410.650     0.000     0.000"
"               410.700   0.00600    43.000"
"               410.800   0.01300   135.000"
"               410.900   0.02000   232.000"
"               411.000   0.02500   334.000"
"               411.100   0.02900   442.000"
"               411.200    0.1260   556.000"
"               411.300    0.1390   676.000"
"               411.400    0.1510   801.000"
"               411.500    0.1630   933.000"
"               411.600    0.1730  1072.000"
"               411.650    0.1780  1143.000"
"               411.700    0.3370  1216.000"
"               411.800     1.007  1368.000"
"             Peak outflow                  0.306    c.m/sec"
"             Maximum level               411.690    metre"
"             Maximum storage            1201.847    c.m"
"             Centroidal lag                3.398   hours"
"                  0.301     0.854     0.306     1.074 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.301     0.306     0.306     1.074"
" 33          CATCHMENT 2300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2300   Catchment 2300"
"       10.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.432   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.048   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
```

```
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.931   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.105     0.306     0.306     1.074 c.m/sec"
"             Catchment 2300         Pervious   Impervious Total Area "
"             Surface Area           0.432      0.048      0.480      hectare"
"             Time of concentration  10.027     1.421      8.588      minutes"
"             Time to Centroid       104.871    85.423     101.619    minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        423.02     47.00      470.02     c.m"
"             Rainfall losses        47.483     6.787      43.413     mm"
"             Runoff depth           50.438     91.134     54.508     mm"
"             Runoff volume          217.89     43.74      261.64     c.m"
"             Runoff coefficient     0.515      0.931      0.557      "
"             Maximum flow           0.091      0.020      0.105      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.105     0.355     0.306     1.074"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.105     0.355     0.355     1.074"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.355    c.m/sec"
"             Hydrograph volume          2419.666    c.m"
"                     0.105     0.355     0.355     0.355"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.105     0.000     0.355     0.355"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
```

```
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.306     0.000     0.355     0.355 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  15.199     2.153      4.194      minutes"
"             Time to Centroid       110.688    86.345     90.153     minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        225.22     675.66     900.88     c.m"
"             Rainfall losses        47.301     6.948      17.036     mm"
"             Runoff depth           50.621     90.973     80.885     mm"
"             Runoff volume          116.43     627.71     744.14     c.m"
"             Runoff coefficient     0.517      0.929      0.826      "
"             Maximum flow           0.043      0.286      0.306      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.306     0.306     0.355     0.355"
" 54          POND DESIGN"
"        0.306   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        744.1   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                  0.099    c.m/sec"
"             Maximum level               414.134    metre"
```

```
"             Maximum storage             469.233    c.m"
"             Centroidal lag                6.040   hours"
"                 0.306     0.306     0.099     0.355 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  0.454    c.m/sec"
"             Hydrograph volume          3165.424    c.m"
"                    0.306     0.306     0.099     0.454"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.306     0.000     0.099     0.454"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.517   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.114     0.000     0.099     0.454 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  18.712     2.651      7.014      minutes"
"             Time to Centroid       114.625    87.045     94.538     minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        164.51     246.76     411.27     c.m"
"             Rainfall losses        47.295     7.442      23.384     mm"
"             Runoff depth           50.626     90.479     74.538     mm"
"             Runoff volume          85.05      228.01     313.06     c.m"
"             Runoff coefficient     0.517      0.924      0.761      "
"             Maximum flow           0.029      0.104      0.114      c.m/sec"
```

```
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.114     0.114     0.099     0.454"
" 56          DIVERSION"
"        32001   Node number"
"        0.067   Overflow threshold"
"        1.000   Required diverted fraction"
"            0   Conduit type; 1=Pipe;2=Channel"
"             Peak of diverted flow         0.047    c.m/sec"
"             Volume of diverted flow      39.992    c.m"
"             DIV32001.100hyd"
"             Major flow at 32001"
"                     0.114     0.114     0.067     0.454 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.114     0.067     0.067     0.454"
" 54          POND DESIGN"
"        0.067   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        273.1   Hydrograph volume    c.m"
"          15.   Number of stages"
"      410.620   Minimum water level    metre"
"      414.230   Maximum water level    metre"
"      410.620   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.620     0.000     0.000"
"                410.870   0.01300     4.855"
"                411.120   0.02000    14.351"
"                411.370   0.02500    24.074"
"                411.620   0.02900    33.921"
"                411.870   0.03300    43.768"
"                412.120   0.03600    53.614"
"                412.370   0.03900    63.461"
"                412.620   0.04200    73.308"
"                412.870   0.04400    74.155"
"                413.120   0.04700    75.003"
"                413.370   0.04900    75.850"
"                413.620   0.05200    76.698"
"                413.980   0.05500    77.918"
"                414.230    0.1600    78.483"
"             Peak outflow                  0.050    c.m/sec"
"             Maximum level               413.465    metre"
"             Maximum storage              76.172    c.m"
"             Centroidal lag                1.972   hours"
"                  0.114     0.067     0.050     0.454 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.114     0.050     0.050     0.454"
" 33          CATCHMENT 3200"
```

```
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.516   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.932   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.038     0.050     0.050     0.454 c.m/sec"
"              Catchment 3200         Pervious   Impervious Total Area "
"              Surface Area           0.052      0.078      0.130      hectare"
"              Time of concentration  12.345     1.749      4.607      minutes"
"              Time to Centroid       107.474    85.796     91.642     minutes"
"              Rainfall depth         97.921     97.921     97.921     mm"
"              Rainfall volume        50.92      76.38      127.30     c.m"
"              Rainfall losses        47.364     6.648      22.934     mm"
"              Runoff depth           50.557     91.273     74.987     mm"
"              Runoff volume          26.29      71.19      97.48      c.m"
"              Runoff coefficient     0.516      0.932      0.766      "
"              Maximum flow           0.010      0.032      0.038      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.038     0.070     0.050     0.454"
" 33           CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
```

```
"        2.000   Pervious slope"
"        0.144   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.515   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.931   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.072     0.070     0.050     0.454 c.m/sec"
"             Catchment 3300         Pervious   Impervious Total Area "
"             Surface Area           0.096      0.144      0.240      hectare"
"             Time of concentration  10.027     1.421      3.740      minutes"
"             Time to Centroid       104.871    85.423     90.664     minutes"
"             Rainfall depth         97.921     97.921     97.921     mm"
"             Rainfall volume        94.00      141.01     235.01     c.m"
"             Rainfall losses        47.483     6.787      23.065     mm"
"             Runoff depth           50.438     91.134     74.856     mm"
"             Runoff volume          48.42      131.23     179.65     c.m"
"             Runoff coefficient     0.515      0.931      0.764      "
"             Maximum flow           0.020      0.059      0.072      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.072     0.142     0.050     0.454"
" 47          FILEI_O Read/Open DIV32001.100hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV32001.100hyd"
"             Major flow at 32001"
"             Total volume                39.992    c.m"
"             Maximum flow                 0.047    c.m/sec"
"                 0.047     0.142     0.050     0.454 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.047     0.190     0.050     0.454"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.047     0.190     0.190     0.454"
" 40          HYDROGRAPH   Combine    300"
"            6   Combine "
"          300   Node #"
"                To Walser Street"
"             Maximum flow                 0.190    c.m/sec"
"             Hydrograph volume          590.014    c.m"
```

```
"                    0.047     0.190     0.190     0.190"
" 40          HYDROGRAPH   Confluence    300"
"            7   Confluence "
"          300   Node #"
"                To Walser Street"
"             Maximum flow                  0.190    c.m/sec"
"             Hydrograph volume           590.014    c.m"
"                    0.047     0.190     0.190     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.047     0.190     0.190     0.000"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                  1.138    c.m/sec"
"             Hydrograph volume          7736.632    c.m"
"                    0.047     0.190     0.190     1.138"
" 40          HYDROGRAPH   Confluence    100"
"            7   Confluence "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                  1.138    c.m/sec"
"             Hydrograph volume          7736.631    c.m"
"                    0.047     1.138     0.190     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.047     1.138     1.138     0.000"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  1.475    c.m/sec"
"             Hydrograph volume         10902.038    c.m"
"                    0.047     1.138     1.138     1.475"
" 40          HYDROGRAPH   Confluence    200"
"            7   Confluence "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                  1.475    c.m/sec"
"             Hydrograph volume         10902.038    c.m"
"                    0.047     1.475     1.138     0.000"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                         22.610    hectare"
"             Total Impervious area                         7.847    hectare"
"             Total % impervious                           34.706"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:          W:\Kitchener\411-2011\411009\Design Data\"
"                                                    Modelling Files\2022-07-25"
"                Output filename:                                 Post__REG.out"
"                Licensee name:                                            gmbp"
"                Company                                                   gmbp"
"                Date & Time last used:                7/25/2022 at 12:28:09 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"    12000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"     2880.000   Duration"
"       48.000   Rainfall intensity values"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.028     2.028     2.028     2.028"
"                  2.028     2.026     2.026     2.026     2.028"
"                  2.026     6.000     4.000     6.000    13.000"
"                 17.000    13.000    23.000    13.000    13.000"
"                 53.000    38.000    13.000"
"             Maximum intensity            53.000    mm/hr"
"             Total depth                 285.000    mm"
"            6   000hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 1200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1200   Catchment 1200"
"       50.000   % Impervious"
"        0.220   Total Area"
"       10.000   Flow length"
"        2.000   Overland Slope"
"        0.110   Pervious Area"
"       10.000   Pervious length"
"        2.000   Pervious slope"
"        0.110   Impervious Area"
"       10.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.719   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.846   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.027     0.000     0.000     0.000 c.m/sec"
"              Catchment 1200         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  8.237      1.480      4.583      minutes"
"              Time to Centroid       2489.666   2307.003   2390.883   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        313.50     313.50     627.00     c.m"
"              Rainfall losses        80.153     43.756     61.955     mm"
"              Runoff depth           204.847    241.244    223.045    mm"
"              Runoff volume          225.33     265.37     490.70     c.m"
"              Runoff coefficient     0.719      0.846      0.783      "
"              Maximum flow           0.013      0.014      0.027      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.027     0.027     0.000     0.000"
" 33           CATCHMENT 1300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1300   Catchment 1300"
"       50.000   % Impervious"
"        0.700   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.350   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.350   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.754   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.846   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.085     0.027     0.000     0.000 c.m/sec"
"              Catchment 1300         Pervious   Impervious Total Area "
"              Surface Area           0.350      0.350      0.700      hectare"
"              Time of concentration  12.485     2.243      7.071      minutes"
```

```
"              Time to Centroid       2505.277   2290.972   2391.991   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        997.50     997.50     1995.00    c.m"
"              Rainfall losses        70.073     43.972     57.023     mm"
"              Runoff depth           214.927    241.028    227.977    mm"
"              Runoff volume          752.24     843.60     1595.84    c.m"
"              Runoff coefficient     0.754      0.846      0.800      "
"              Maximum flow           0.040      0.045      0.085      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.085     0.112     0.000     0.000"
" 33           CATCHMENT 1600"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          1600   Catchment 1600"
"        50.000   % Impervious"
"         0.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
"         0.110   Pervious Area"
"        15.000   Pervious length"
"         2.000   Pervious slope"
"         0.110   Impervious Area"
"        15.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.739   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.844   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.027     0.112     0.000     0.000 c.m/sec"
"              Catchment 1600         Pervious   Impervious Total Area "
"              Surface Area           0.110      0.110      0.220      hectare"
"              Time of concentration  10.506     1.887      5.911      minutes"
"              Time to Centroid       2500.832   2301.045   2394.331   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        313.50     313.50     627.00     c.m"
"              Rainfall losses        74.380     44.547     59.463     mm"
"              Runoff depth           210.620    240.453    225.537    mm"
"              Runoff volume          231.68     264.50     496.18     c.m"
"              Runoff coefficient     0.739      0.844      0.791      "
"              Maximum flow           0.013      0.014      0.027      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
```

```
"                    0.027     0.139     0.000     0.000"
" 54          POND DESIGN"
"        0.139   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"       2582.7   Hydrograph volume    c.m"
"          17.   Number of stages"
"      412.000   Minimum water level    metre"
"      414.490   Maximum water level    metre"
"      412.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                412.000   0.00031     0.000"
"                412.100   0.00031    34.650"
"                412.200   0.00031    69.310"
"                412.300   0.00032   103.960"
"                412.400   0.00032   138.610"
"                412.500   0.00032   156.430"
"                412.600   0.00032   174.250"
"                412.700   0.00032   192.060"
"                412.900   0.00032   192.430"
"                413.230   0.00032   193.040"
"                413.430   0.04528   193.730"
"                413.630    0.1319   195.230"
"                413.830    0.2482   197.730"
"                414.030    0.3899   201.230"
"                414.090    0.4369   202.580"
"                414.290    0.6524   208.080"
"                414.490    0.9278   214.580"
"             Peak outflow                  0.138    c.m/sec"
"             Maximum level               413.642    metre"
"             Maximum storage             195.375    c.m"
"             Centroidal lag               49.356   hours"
"                 0.027     0.139     0.138     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                  0.138    c.m/sec"
"             Hydrograph volume          2556.484    c.m"
"                    0.027     0.139     0.138     0.138"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.027     0.000     0.138     0.138"
" 33          CATCHMENT 1400"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1400   Catchment 1400"
"       20.000   % Impervious"
"        0.620   Total Area"
```

```
"        30.000   Flow length"
"         2.000   Overland Slope"
"         0.496   Pervious Area"
"        30.000   Pervious length"
"         2.000   Pervious slope"
"         0.124   Impervious Area"
"        30.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.764   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.849   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.071     0.000     0.138     0.138 c.m/sec"
"              Catchment 1400         Pervious   Impervious Total Area "
"              Surface Area           0.496      0.124      0.620      hectare"
"              Time of concentration  15.924     2.860      13.084     minutes"
"              Time to Centroid       2515.051   2276.456   2463.191   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        1413.60    353.40     1767.00    c.m"
"              Rainfall losses        67.258     43.116     62.430     mm"
"              Runoff depth           217.742    241.884    222.570    mm"
"              Runoff volume          1080.00    299.94     1379.93    c.m"
"              Runoff coefficient     0.764      0.849      0.781      "
"              Maximum flow           0.055      0.016      0.071      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.071     0.071     0.138     0.138"
" 54           POND DESIGN"
"         0.071   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"        1379.9   Hydrograph volume    c.m"
"           17.   Number of stages"
"       413.920   Minimum water level    metre"
"       415.520   Maximum water level    metre"
"       413.920   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 413.920   0.00088     0.000"
"                 414.020   0.00088    26.350"
"                 414.120   0.00089    55.150"
"                 414.220   0.00089    83.950"
"                 414.320   0.00089   112.750"
"                 414.420   0.00090   139.100"
"                 414.520   0.00090   165.450"
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"                414.620   0.00090   191.800"
"                414.720   0.00090   191.870"
"                414.820   0.02640   191.950"
"                414.920   0.03734   192.020"
"                415.020   0.04573   192.090"
"                415.120   0.05281   192.160"
"                415.220    0.2777   201.450"
"                415.320    0.6941   238.950"
"                415.420     1.244   304.700"
"                415.520     1.909   382.200"
"             Peak outflow                 0.070    c.m/sec"
"             Maximum level              415.128    metre"
"             Maximum storage            192.887    c.m"
"             Centroidal lag              48.418   hours"
"                  0.071     0.071     0.070     0.138 c.m/sec"
" 40          HYDROGRAPH   Combine    1000"
"            6   Combine "
"         1000   Node #"
"                Infiltrated On-Site"
"             Maximum flow                 0.208    c.m/sec"
"             Hydrograph volume         3933.528    c.m"
"                     0.071     0.071     0.070     0.208"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.071     0.000     0.070     0.208"
" 33          CATCHMENT 1500"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1500   Catchment 1500"
"       50.000   % Impervious"
"        1.110   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.555   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.555   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.765   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
```

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"                    0.129     0.000     0.070     0.208 c.m/sec"
"            Catchment 1500         Pervious   Impervious Total Area "
"            Surface Area           0.555      0.555      1.110      hectare"
"            Time of concentration  18.924     3.399      10.752     minutes"
"            Time to Centroid       2520.774   2266.333   2386.847   minutes"
"            Rainfall depth         285.000    285.000    285.000    mm"
"            Rainfall volume        1581.75    1581.75    3163.50    c.m"
"            Rainfall losses        66.918     42.646     54.782     mm"
"            Runoff depth           218.082    242.354    230.218    mm"
"            Runoff volume          1210.36    1345.07    2555.42    c.m"
"            Runoff coefficient     0.765      0.850      0.808      "
"            Maximum flow           0.060      0.070      0.129      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.129     0.129     0.070     0.208"
" 56         DIVERSION"
"        1500   Node number"
"       0.146   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"
"            DIV01500.000hyd"
"            Major flow at 1500"
"                    0.129     0.129     0.129     0.208 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.129     0.129     0.129     0.208"
" 33         CATCHMENT 1000"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"        1000   Catchment 1000"
"      50.000   % Impervious"
"       6.980   Total Area"
"     100.000   Flow length"
"       2.000   Overland Slope"
"       3.490   Pervious Area"
"     100.000   Pervious length"
"       2.000   Pervious slope"
"       3.490   Impervious Area"
"     100.000   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      78.000   Pervious SCS Curve No."
"       0.764   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       7.164   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
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"        0.884   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.768     0.129     0.129     0.208 c.m/sec"
"             Catchment 1000         Pervious   Impervious Total Area "
"             Surface Area           3.490      3.490      6.980      hectare"
"             Time of concentration  32.793     5.891      18.359     minutes"
"             Time to Centroid       2537.302   2260.661   2388.880   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        0.9947     0.9947     1.9893     ha-m"
"             Rainfall losses        67.335     33.040     50.188     mm"
"             Runoff depth           217.665    251.960    234.812    mm"
"             Runoff volume          0.7597     0.8793     1.6390     ha-m"
"             Runoff coefficient     0.764      0.884      0.824      "
"             Maximum flow           0.407      0.441      0.768      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.768     0.898     0.129     0.208"
" 33          CATCHMENT 1100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         1100   Catchment 1100"
"        0.000   % Impervious"
"        0.480   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.480   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.754   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.055     0.898     0.129     0.208 c.m/sec"
"             Catchment 1100         Pervious   Impervious Total Area "
"             Surface Area           0.480      0.000      0.480      hectare"
"             Time of concentration  12.485     2.243      12.485     minutes"
"             Time to Centroid       2505.277   2290.972   2505.276   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        1368.00    0.00       1368.00    c.m"
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"              Rainfall losses        70.073     43.972     70.073     mm"
"              Runoff depth           214.927    241.028    214.927    mm"
"              Runoff volume          1031.65    0.00       1031.65    c.m"
"              Runoff coefficient     0.754      0.000      0.754      "
"              Maximum flow           0.055      0.000      0.055      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.055     0.952     0.129     0.208"
" 54           POND DESIGN"
"         0.952   Current peak flow    c.m/sec"
"         0.250   Target outflow    c.m/sec"
"       19977.0   Hydrograph volume    c.m"
"           12.   Number of stages"
"       411.000   Minimum water level    metre"
"       412.000   Maximum water level    metre"
"       411.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 411.000     0.000     0.000"
"                 411.100   0.03200    18.400"
"                 411.200   0.06500    95.500"
"                 411.300   0.07700   239.900"
"                 411.400   0.08700   435.700"
"                 411.500   0.09600   691.300"
"                 411.600    0.1050  1027.600"
"                 411.700    0.3150  1450.000"
"                 411.800    0.3380  1935.800"
"                 411.850    0.3490  2195.700"
"                 411.900    0.6670  2465.600"
"                 412.000     2.018  3030.100"
"              Peak outflow                 0.875    c.m/sec"
"              Maximum level              411.919    metre"
"              Maximum storage           2573.825    c.m"
"              Centroidal lag              40.971   hours"
"                   0.055     0.952     0.875     0.208 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                      0.055     0.875     0.875     0.208"
" 47           FILEI_O Read/Open DIV01500.000hyd"
"             1   1=read/open; 2=write/save"
"             2   1=rainfall; 2=hydrograph"
"             1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"              DIV01500.000hyd"
"              Major flow at 1500"
"              Total volume                 0.000    c.m"
"              Maximum flow                 0.000    c.m/sec"
"                   0.000     0.875     0.875     0.208 c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.000     0.875     0.875     0.208"
```

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" 33          CATCHMENT 4000"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         4000   Catchment 4000"
"        0.000   % Impervious"
"        7.330   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        7.330   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       50.000   Pervious SCS Curve No."
"        0.453   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"       25.400   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                       0.619     0.875     0.875     0.208 c.m/sec"
"             Catchment 4000         Pervious   Impervious Total Area "
"             Surface Area           7.330      0.000      7.330      hectare"
"             Time of concentration  27.692     4.336      27.692     minutes"
"             Time to Centroid       2672.198   2258.968   2672.197   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        2.0890     0.0000     2.0891     ha-m"
"             Rainfall losses        155.800    39.404     155.800    mm"
"             Runoff depth           129.200    245.596    129.200    mm"
"             Runoff volume          9470.35    0.02       9470.37    c.m"
"             Runoff coefficient     0.453      0.000      0.453      "
"             Maximum flow           0.619      0.000      0.619      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                       0.619     1.494     0.875     0.208"
" 54          POND DESIGN"
"        1.494   Current peak flow    c.m/sec"
"        0.250   Target outflow    c.m/sec"
"      29575.5   Hydrograph volume    c.m"
"           6.   Number of stages"
"      409.630   Minimum water level    metre"
"      410.750   Maximum water level    metre"
"      409.630   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
```

```
"               409.630     0.000     0.000"
"               409.750    0.6650   402.200"
"               410.000     3.601  2187.900"
"               410.250     7.811  5318.900"
"               410.500    12.984  9642.300"
"               410.750    18.965  15227.70"
"            Peak outflow                 1.444    c.m/sec"
"            Maximum level              409.816    metre"
"            Maximum storage            875.731    c.m"
"            Centroidal lag              42.281   hours"
"                 0.619     1.494     1.444     0.208 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.619     1.444     1.444     0.208"
" 52         CHANNEL DESIGN"
"       1.444   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       0.000   Basewidth    metre"
"       7.410   Left bank slope"
"       6.000   Right bank slope"
"       0.950   Channel depth    metre"
"       1.040   Gradient   %"
"            Depth of flow                0.449    metre"
"            Velocity                     1.068    m/sec"
"            Channel capacity            10.655    c.m/sec"
"            Critical depth               0.394    metre"
" 53         ROUTE    Channel Route 72"
"       72.40      Channel Route 72 Reach length   ( metre)"
"       0.388   X-factor <= 0.5"
"      50.828   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      62.069   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 1.438    c.m/sec"
"                    0.619     1.444     1.438     0.208 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.619     1.438     1.438     0.208"
" 52         CHANNEL DESIGN"
"       1.438   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       2.000   Basewidth    metre"
"       2.950   Left bank slope"
"       3.000   Right bank slope"
"       0.950   Channel depth    metre"
```

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"        1.040   Gradient   %"
"             Depth of flow                0.378    metre"
"             Velocity                     1.217    m/sec"
"             Channel capacity             9.246    c.m/sec"
"             Critical depth               0.318    metre"
" 53          ROUTE    Channel Route 40"
"        39.80      Channel Route 40 Reach length   ( metre)"
"        0.260   X-factor <= 0.5"
"       24.517   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       36.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 1.436    c.m/sec"
"                     0.619     1.438     1.436     0.208 c.m/sec"
" 40          HYDROGRAPH   Combine    100"
"            6   Combine "
"          100   Node #"
"                Existing Wetland"
"             Maximum flow                 1.436    c.m/sec"
"             Hydrograph volume        29574.402    c.m"
"                     0.619     1.438     1.436     1.436"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.619     0.000     1.436     1.436"
" 33          CATCHMENT 2100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2100   Catchment 2100"
"       60.000   % Impervious"
"        1.960   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.784   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        1.176   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.765   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
```

```
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.232     0.000     1.436     1.436 c.m/sec"
"              Catchment 2100         Pervious   Impervious Total Area "
"              Surface Area           0.784      1.176      1.960      hectare"
"              Time of concentration  18.924     3.399      9.220      minutes"
"              Time to Centroid       2520.773   2266.333   2361.739   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        2234.40    3351.60    5586.00    c.m"
"              Rainfall losses        66.918     42.646     52.354     mm"
"              Runoff depth           218.082    242.354    232.646    mm"
"              Runoff volume          1709.77    2850.09    4559.85    c.m"
"              Runoff coefficient     0.765      0.850      0.816      "
"              Maximum flow           0.085      0.148      0.232      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.232     0.232     1.436     1.436"
" 33           CATCHMENT 2400"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2400   Catchment 2400"
"        90.000   % Impervious"
"         0.800   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.080   Pervious Area"
"        20.000   Pervious length"
"         2.000   Pervious slope"
"         0.720   Impervious Area"
"        20.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        78.000   Pervious SCS Curve No."
"         0.754   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         7.164   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.846   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                     0.102     0.232     1.436     1.436 c.m/sec"
"              Catchment 2400         Pervious   Impervious Total Area "
"              Surface Area           0.080      0.720      0.800      hectare"
"              Time of concentration  12.485     2.243      3.166      minutes"
"              Time to Centroid       2505.277   2290.972   2310.291   minutes"
"              Rainfall depth         285.000    285.000    285.000    mm"
"              Rainfall volume        228.00     2052.00    2280.00    c.m"
"              Rainfall losses        70.073     43.972     46.582     mm"
```

```
"              Runoff depth           214.927    241.028    238.418    mm"
"              Runoff volume          171.94     1735.40    1907.34    c.m"
"              Runoff coefficient     0.754      0.846      0.837      "
"              Maximum flow           0.009      0.092      0.102      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                     0.102     0.334     1.436     1.436"
" 54           POND DESIGN"
"         0.334   Current peak flow    c.m/sec"
"         0.020   Target outflow    c.m/sec"
"        6467.2   Hydrograph volume    c.m"
"           14.   Number of stages"
"       410.650   Minimum water level    metre"
"       411.950   Maximum water level    metre"
"       410.650   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 410.650     0.000     0.000"
"                 410.700   0.00600    43.000"
"                 410.800   0.01300   135.000"
"                 410.900   0.02000   232.000"
"                 411.000   0.02500   334.000"
"                 411.100   0.02900   442.000"
"                 411.200    0.1260   556.000"
"                 411.300    0.1390   676.000"
"                 411.400    0.1510   801.000"
"                 411.500    0.1630   933.000"
"                 411.600    0.1730  1072.000"
"                 411.650    0.1780  1143.000"
"                 411.700    0.3370  1216.000"
"                 411.800     1.007  1368.000"
"              Peak outflow                 0.268    c.m/sec"
"              Maximum level              411.678    metre"
"              Maximum storage           1184.491    c.m"
"              Centroidal lag              41.101   hours"
"                   0.102     0.334     0.268     1.436 c.m/sec"
" 40           HYDROGRAPH Next link "
"             5   Next link "
"                     0.102     0.268     0.268     1.436"
" 33           CATCHMENT 2300"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"          2300   Catchment 2300"
"        10.000   % Impervious"
"         0.480   Total Area"
"        20.000   Flow length"
"         2.000   Overland Slope"
"         0.432   Pervious Area"
"        20.000   Pervious length"
```

```
"        2.000   Pervious slope"
"        0.048   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.754   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.846   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                        0.055     0.268     0.268     1.436 c.m/sec"
"             Catchment 2300         Pervious   Impervious Total Area "
"             Surface Area           0.432      0.048      0.480      hectare"
"             Time of concentration  12.485     2.243      11.350     minutes"
"             Time to Centroid       2505.277   2290.972   2481.532   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        1231.20    136.80     1368.00    c.m"
"             Rainfall losses        70.073     43.972     67.463     mm"
"             Runoff depth           214.927    241.028    217.537    mm"
"             Runoff volume          928.48     115.69     1044.18    c.m"
"             Runoff coefficient     0.754      0.846      0.763      "
"             Maximum flow           0.049      0.006      0.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                        0.055     0.315     0.268     1.436"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                        0.055     0.315     0.315     1.436"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                 0.315    c.m/sec"
"             Hydrograph volume         7582.879    c.m"
"                        0.055     0.315     0.315     0.315"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                        0.055     0.000     0.315     0.315"
" 33          CATCHMENT 2200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         2200   Catchment 2200"
"       75.000   % Impervious"
"        0.920   Total Area"
"       40.000   Flow length"
```

```
"        2.000   Overland Slope"
"        0.230   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.690   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.765   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.112     0.000     0.315     0.315 c.m/sec"
"             Catchment 2200         Pervious   Impervious Total Area "
"             Surface Area           0.230      0.690      0.920      hectare"
"             Time of concentration  18.924     3.399      6.981      minutes"
"             Time to Centroid       2520.774   2266.333   2325.042   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        655.50     1966.50    2622.00    c.m"
"             Rainfall losses        66.918     42.646     48.714     mm"
"             Runoff depth           218.082    242.354    236.286    mm"
"             Runoff volume          501.59     1672.25    2173.83    c.m"
"             Runoff coefficient     0.765      0.850      0.829      "
"             Maximum flow           0.025      0.087      0.112      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.112     0.112     0.315     0.315"
" 54          POND DESIGN"
"        0.112   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"       2173.8   Hydrograph volume    c.m"
"          12.   Number of stages"
"      413.700   Minimum water level    metre"
"      415.000   Maximum water level    metre"
"      413.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                413.700     0.000     0.000"
"                413.800   0.00500    88.600"
"                413.900   0.01000   187.200"
"                414.000   0.01300   298.400"
"                414.100   0.01500   422.200"
"                414.200    0.2590   558.900"
"                414.300    0.2910   708.500"
"                414.400    0.3210   871.100"
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"                414.500    0.3470  1046.900"
"                414.600    0.3720  1236.100"
"                414.700    0.3950  1438.700"
"                415.000     2.828  2087.400"
"             Peak outflow                 0.099    c.m/sec"
"             Maximum level              414.137    metre"
"             Maximum storage            473.254    c.m"
"             Centroidal lag              42.637   hours"
"                  0.112     0.112     0.099     0.315 c.m/sec"
" 40          HYDROGRAPH   Combine    200"
"            6   Combine "
"          200   Node #"
"                To Trib. of Grand River"
"             Maximum flow                 0.406    c.m/sec"
"             Hydrograph volume         9743.426    c.m"
"                     0.112     0.112     0.099     0.406"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.112     0.000     0.099     0.406"
" 33          CATCHMENT 3100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3100   Catchment 3100"
"       60.000   % Impervious"
"        0.420   Total Area"
"       40.000   Flow length"
"        1.000   Overland Slope"
"        0.168   Pervious Area"
"       40.000   Pervious length"
"        1.000   Pervious slope"
"        0.252   Impervious Area"
"       40.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.761   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.860   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.049     0.000     0.099     0.406 c.m/sec"
"             Catchment 3100         Pervious   Impervious Total Area "
"             Surface Area           0.168      0.252      0.420      hectare"
"             Time of concentration  23.298     4.185      11.277     minutes"
"             Time to Centroid       2524.169   2259.596   2357.767   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
```

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"             Rainfall volume        478.80     718.20     1197.00    c.m"
"             Rainfall losses        68.199     40.012     51.287     mm"
"             Runoff depth           216.801    244.988    233.713    mm"
"             Runoff volume          364.23     617.37     981.59     c.m"
"             Runoff coefficient     0.761      0.860      0.820      "
"             Maximum flow           0.019      0.032      0.049      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.049     0.049     0.099     0.406"
" 56          DIVERSION"
"        32001   Node number"
"        0.067   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"
"             DIV32001.000hyd"
"             Major flow at 32001"
"                    0.049     0.049     0.049     0.406 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.049     0.049     0.049     0.406"
" 54          POND DESIGN"
"        0.049   Current peak flow    c.m/sec"
"        0.756   Target outflow    c.m/sec"
"        981.6   Hydrograph volume    c.m"
"          15.   Number of stages"
"      410.620   Minimum water level    metre"
"      414.230   Maximum water level    metre"
"      410.620   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                410.620     0.000     0.000"
"                410.870   0.01300     4.855"
"                411.120   0.02000    14.351"
"                411.370   0.02500    24.074"
"                411.620   0.02900    33.921"
"                411.870   0.03300    43.768"
"                412.120   0.03600    53.614"
"                412.370   0.03900    63.461"
"                412.620   0.04200    73.308"
"                412.870   0.04400    74.155"
"                413.120   0.04700    75.003"
"                413.370   0.04900    75.850"
"                413.620   0.05200    76.698"
"                413.980   0.05500    77.918"
"                414.230    0.1600    78.483"
"             Peak outflow                  0.040    c.m/sec"
"             Maximum level               412.466    metre"
"             Maximum storage              67.240    c.m"
```

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"             Centroidal lag               39.444   hours"
"                  0.049     0.049     0.040     0.406 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.049     0.040     0.040     0.406"
" 33          CATCHMENT 3200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3200   Catchment 3200"
"       60.000   % Impervious"
"        0.130   Total Area"
"       20.000   Flow length"
"        1.000   Overland Slope"
"        0.052   Pervious Area"
"       20.000   Pervious length"
"        1.000   Pervious slope"
"        0.078   Impervious Area"
"       20.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.763   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.848   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.016     0.040     0.040     0.406 c.m/sec"
"             Catchment 3200         Pervious   Impervious Total Area "
"             Surface Area           0.052      0.078      0.130      hectare"
"             Time of concentration  15.371     2.761      7.490      minutes"
"             Time to Centroid       2513.554   2278.554   2366.679   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        148.20     222.30     370.50     c.m"
"             Rainfall losses        67.436     43.264     52.933     mm"
"             Runoff depth           217.564    241.736    232.067    mm"
"             Runoff volume          113.13     188.55     301.69     c.m"
"             Runoff coefficient     0.763      0.848      0.814      "
"             Maximum flow           0.006      0.010      0.016      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.016     0.053     0.040     0.406"
" 33          CATCHMENT 3300"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"         3300   Catchment 3300"
```

```
"       60.000   % Impervious"
"        0.240   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.096   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.144   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       78.000   Pervious SCS Curve No."
"        0.754   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        7.164   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.846   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.029     0.053     0.040     0.406 c.m/sec"
"             Catchment 3300         Pervious   Impervious Total Area "
"             Surface Area           0.096      0.144      0.240      hectare"
"             Time of concentration  12.485     2.243      6.061      minutes"
"             Time to Centroid       2505.277   2290.972   2370.872   minutes"
"             Rainfall depth         285.000    285.000    285.000    mm"
"             Rainfall volume        273.60     410.40     684.00     c.m"
"             Rainfall losses        70.073     43.972     54.413     mm"
"             Runoff depth           214.927    241.028    230.587    mm"
"             Runoff volume          206.33     347.08     553.41     c.m"
"             Runoff coefficient     0.754      0.846      0.809      "
"             Maximum flow           0.011      0.018      0.029      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.029     0.077     0.040     0.406"
" 47          FILEI_O Read/Open DIV32001.000hyd"
"            1   1=read/open; 2=write/save"
"            2   1=rainfall; 2=hydrograph"
"            1   1=runoff; 2=inflow; 3=outflow; 4=junction"
"             DIV32001.000hyd"
"             Major flow at 32001"
"             Total volume                  0.000    c.m"
"             Maximum flow                  0.000    c.m/sec"
"                  0.000     0.077     0.040     0.406 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.000     0.077     0.040     0.406"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.000     0.077     0.077     0.406"
```

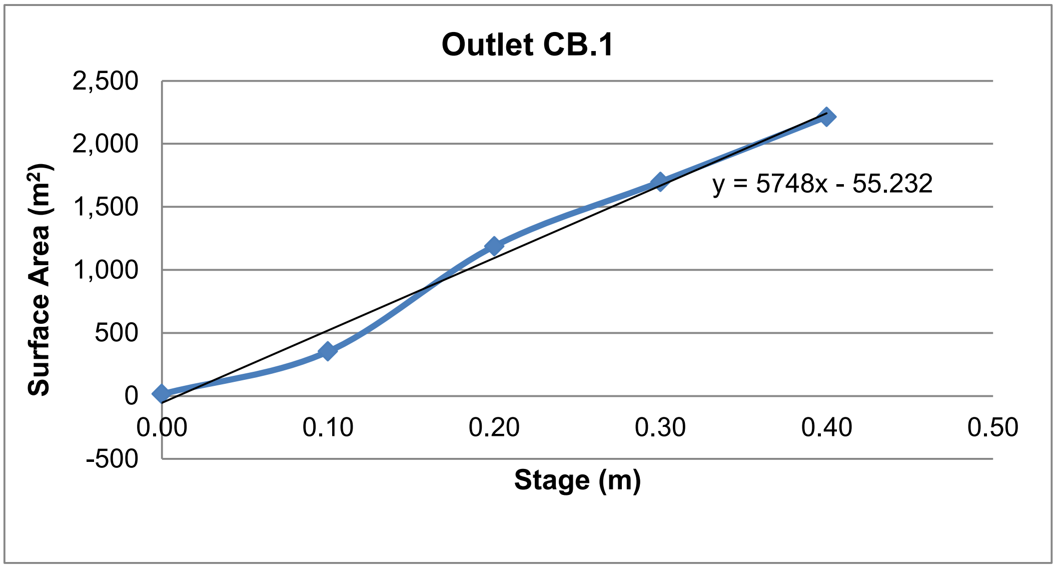
```
" 40          HYDROGRAPH   Combine    300"
"           6   Combine "
"         300   Node #"
"               To Walser Street"
"            Maximum flow                  0.077    c.m/sec"
"            Hydrograph volume          1827.049    c.m"
"                    0.000     0.077     0.077     0.077"
" 40          HYDROGRAPH   Confluence    300"
"           7   Confluence "
"         300   Node #"
"               To Walser Street"
"            Maximum flow                  0.077    c.m/sec"
"            Hydrograph volume          1827.049    c.m"
"                    0.000     0.077     0.077     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     0.077     0.077     0.000"
" 40          HYDROGRAPH   Combine    100"
"           6   Combine "
"         100   Node #"
"               Existing Wetland"
"            Maximum flow                  1.511    c.m/sec"
"            Hydrograph volume         31401.453    c.m"
"                    0.000     0.077     0.077     1.511"
" 40          HYDROGRAPH   Confluence    100"
"           7   Confluence "
"         100   Node #"
"               Existing Wetland"
"            Maximum flow                  1.511    c.m/sec"
"            Hydrograph volume         31401.457    c.m"
"                    0.000     1.511     0.077     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                    0.000     1.511     1.511     0.000"
" 40          HYDROGRAPH   Combine    200"
"           6   Combine "
"         200   Node #"
"               To Trib. of Grand River"
"            Maximum flow                  1.917    c.m/sec"
"            Hydrograph volume         41144.883    c.m"
"                    0.000     1.511     1.511     1.917"
" 40          HYDROGRAPH   Confluence    200"
"           7   Confluence "
"         200   Node #"
"               To Trib. of Grand River"
"            Maximum flow                  1.917    c.m/sec"
"            Hydrograph volume         41144.879    c.m"
"                    0.000     1.917     1.511     0.000"
" 38          START/RE-START TOTALS 200"
"           3   Runoff Totals on EXIT"
```

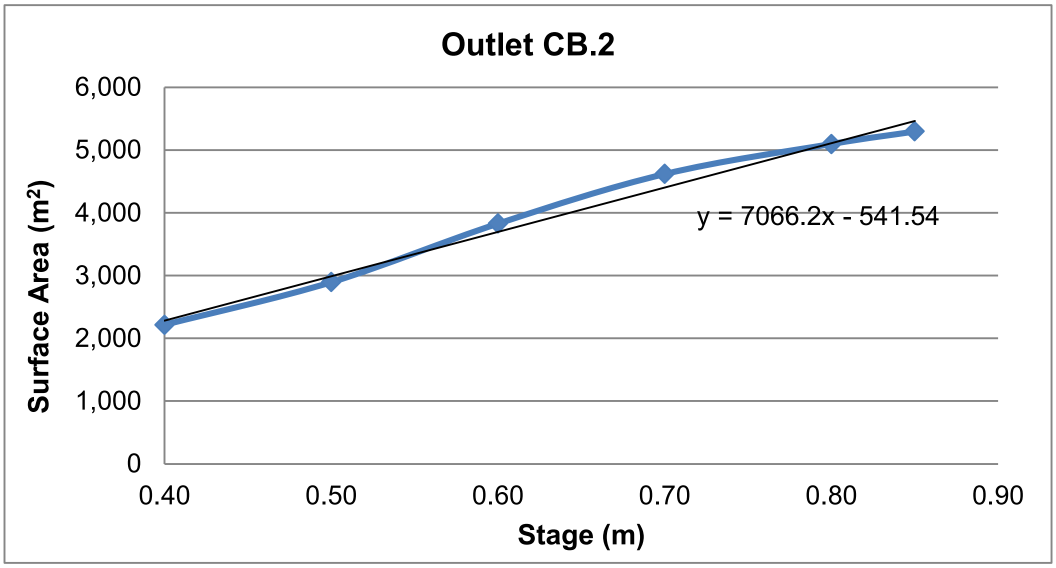
```
"              Total Catchment area                          22.610    hectare"
"              Total Impervious area                          7.847    hectare"
"              Total % impervious                            34.706"
" 19           EXIT"
```

Ainley Farm Subdivision
Our File: 411009
March 14, 2023

Stormwater Management Facility No. 1 - Drawdown Calculations

Elevation	Stage (m)	Surface area (m^2)	
411.00	0.00	15	CB.1 Lip
411.10	0.10	353	
411.20	0.20	1,189	
411.30	0.30	1,699	
411.40	0.40	2,216	CB.2 Lip
411.50	0.50	2,897	
411.60	0.60	3,829	
411.70	0.70	4,620	
411.80	0.80	5,097	
411.85	0.85	5,297	Weir
411.90	0.90	5,498	Top of Bank
412.00	1.00	5792.6	





$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_o}$$ Eq. 4.11 (MOE, 2003)

Outlet - CB.1
250mm Orifice

Given: d = 0.250
A_o = 0.049
C_2 = 5748
C_3 = 55.232

Outlet - CB.2
350mm Orifice

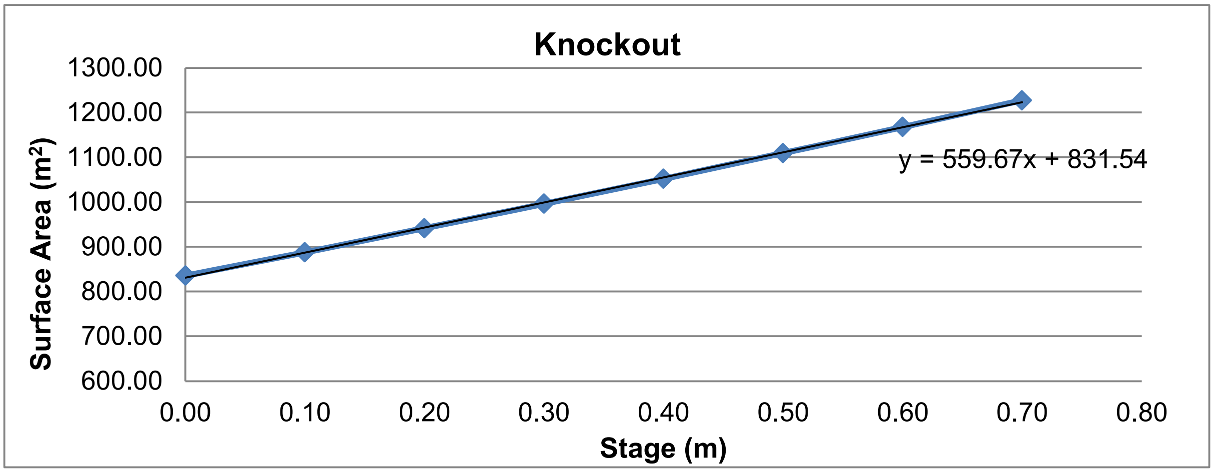
Given: d = 0.350
A_o = 0.096
C_2 = 7066.2
C_3 = 541.54

Storm	Ponding Depth	CB 1 Outlet h (m)	CB.1 Outlet Drawdown (hr)	CB.2 Outlet h (m)	CB.2 Outlet Drawdown (hr)	Total Drawdown (hr)
2 Year	411.50	0.50	2.9	--	--	**2.9**
5 Year	411.66	0.60	3.8	0.1	0.4	**4.2**
10 Year	411.73	0.60	3.8	0.1	0.6	**4.4**
25 Year	411.85	0.60	3.8	0.3	1.2	**5.0**
50 Year	411.89	0.60	3.8	0.3	1.2	**5.0**
100 Year	411.92	0.60	3.8	0.3	1.2	**5.0**
Regional Storm	411.92	0.60	3.8	0.3	1.2	**5.0**

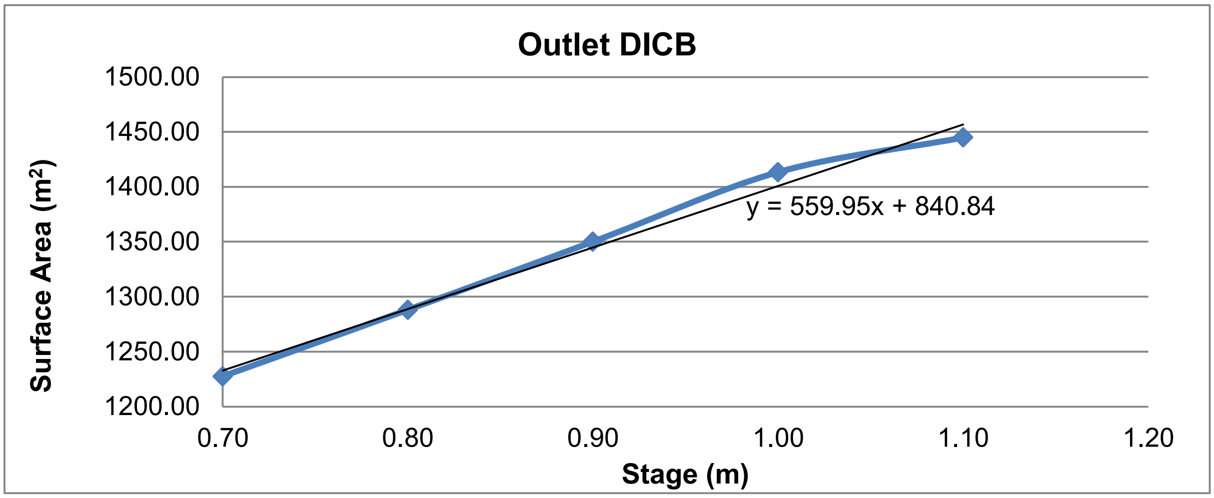
Ainley Farm Subdivision
Our File: 411009
March 14, 2023

Stormwater Management Facility No. 2Drawdown Calculations

Elevation	Stage (m)	Surface area (m^2)	
410.65	0.00	835.70	Knockout
410.70	0.10	888.00	
410.80	0.20	941.90	
410.90	0.30	996.40	
411.00	0.40	1052.40	
411.10	0.50	1109.60	
411.20	0.60	1167.90	
411.30	0.70	1227.50	CB Lip
411.40	0.80	1288.15	
411.50	0.90	1350.10	
411.60	1.00	1413.30	
411.65	1.10	1444.90	Weir
411.70	1.20	1476.50	
411.80	1.30	1559.40	Top of bank



Ainley Farm Subdivision
Our File: 411009
March 14, 2023



$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_o}$$ Eq. 4.11 (MOE, 2003)

Knockout
150mm Orifice

Given: $d = 0.150$
$A_o = 0.018$
$C_2 = 559.67$
$C_3 = 831.54$

Outlet - DICB
300mm Orifice

Given: $d = 0.300$
$A_o = 0.071$
$C_2 = 559.95$
$C_3 = 840.84$

Storm	Ponding Depth	Knockout h (m)	Knockout Drawdown (hr)	Outlet - DICB h (m)	Outlet - DICB Drawdown (hr)	Total Drawdown (hr)
2 Year	411.06	0.41	6.6	--	--	**6.6**
5 Year	411.19	0.54	7.8	--	--	**7.8**
10 Year	411.31	0.66	8.9	0.01	0.2	**9.1**
25 Year	411.48	0.95	11.2	0.18	1.1	**12.3**
50 Year	411.61	0.95	11.2	0.31	1.4	**12.6**
100 Year	411.69	0.95	11.2	0.35	1.5	**12.8**
Regional Storm	411.68	0.95	11.2	0.35	1.5	**12.8**

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/15/2022

Province:	Ontario
City:	Elora
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Ainley Farm Subdivision
Project Number:	411009
Designer Name:	Patricia Wiebe
Designer Company:	GM BluePlan Engineering Ltd.
Designer Email:	patricia.wiebe@gmblueplan.ca
Designer Phone:	519-748-1440
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	SWM Pond 1, Outlet 1 - South
Drainage Area (ha):	2.32
% Imperviousness:	50.00

Runoff Coefficient 'c': 0.60

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	43.29
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	72
EF6	83
EF8	88
EF10	92
EF12	95

Recommended Stormceptor EF Model: **EF6**

Estimated Net Annual Sediment (TSS) Load Reduction (%): **83**

Water Quality Runoff Volume Capture (%): **> 90**

THIRD-PARTY TESTING AND VERIFICATION

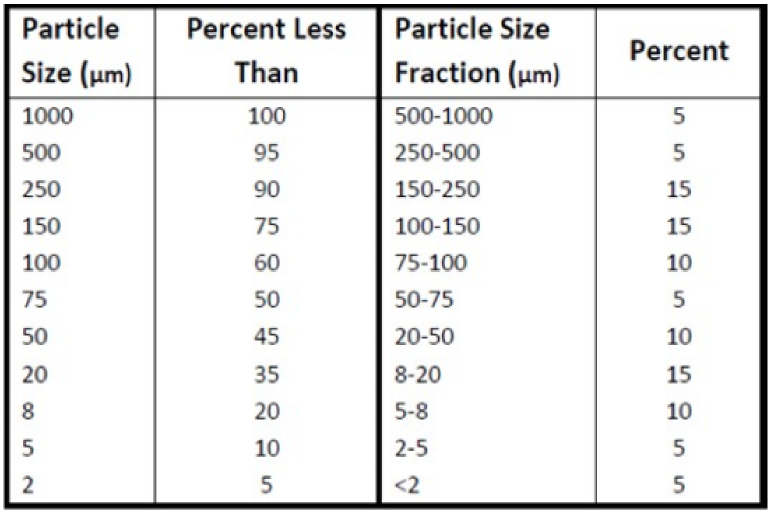
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

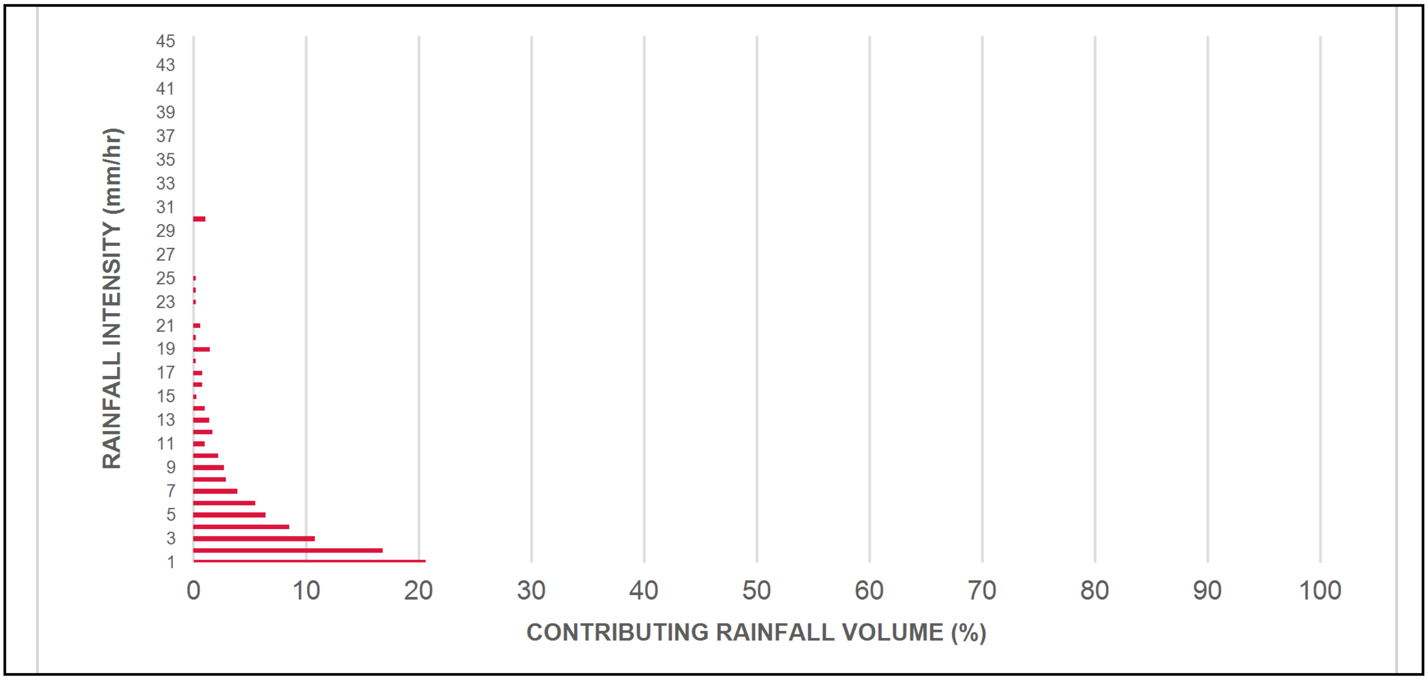


Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

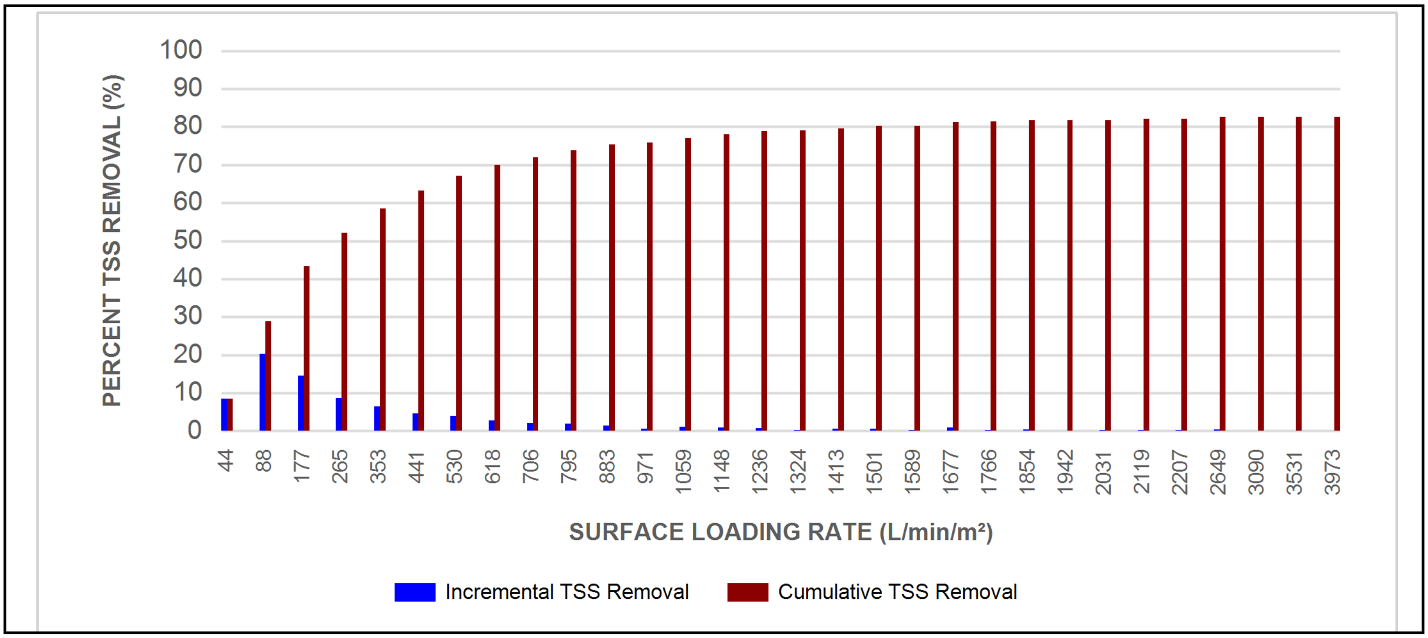
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.5	8.5	1.93	116.0	44.0	100	8.5	8.5
1	20.6	29.1	3.87	232.0	88.0	98	20.3	28.8
2	16.8	45.9	7.74	464.0	177.0	87	14.6	43.4
3	10.8	56.7	11.61	697.0	265.0	80	8.6	52.1
4	8.5	65.2	15.48	929.0	353.0	76	6.4	58.5
5	6.4	71.6	19.35	1161.0	441.0	73	4.7	63.2
6	5.5	77.0	23.22	1393.0	530.0	72	3.9	67.1
7	3.9	81.0	27.09	1625.0	618.0	71	2.8	69.9
8	2.9	83.9	30.96	1857.0	706.0	70	2.0	71.9
9	2.7	86.5	34.83	2090.0	795.0	69	1.9	73.8
10	2.2	88.7	38.70	2322.0	883.0	69	1.5	75.3
11	1.0	89.7	42.57	2554.0	971.0	68	0.7	75.9
12	1.7	91.3	46.44	2786.0	1059.0	69	1.1	77.1
13	1.4	92.8	50.31	3018.0	1148.0	70	1.0	78.1
14	1.0	93.7	54.18	3251.0	1236.0	72	0.7	78.8
15	0.3	94.0	58.05	3483.0	1324.0	74	0.2	79.0
16	0.8	94.8	61.92	3715.0	1413.0	75	0.6	79.6
17	0.8	95.7	65.79	3947.0	1501.0	70	0.6	80.2
18	0.2	95.8	69.66	4179.0	1589.0	66	0.1	80.3
19	1.5	97.3	73.53	4412.0	1677.0	63	0.9	81.2
20	0.2	97.5	77.40	4644.0	1766.0	60	0.1	81.4
21	0.6	98.2	81.26	4876.0	1854.0	57	0.4	81.7
22	0.0	98.2	85.13	5108.0	1942.0	54	0.0	81.7
23	0.2	98.4	89.00	5340.0	2031.0	52	0.1	81.8
24	0.2	98.6	92.87	5572.0	2119.0	50	0.1	82.0
25	0.2	98.9	96.74	5805.0	2207.0	48	0.1	82.1
30	1.1	100.0	116.09	6966.0	2649.0	41	0.5	82.5
35	0.0	100.0	135.44	8126.0	3090.0	35	0.0	82.5
40	0.0	100.0	154.79	9287.0	3531.0	30	0.0	82.5
45	0.0	100.0	174.14	10448.0	3973.0	27	0.0	82.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**83 %**

Climate Station ID: 6158731 *Years of Rainfall Data*: 20

RAINFALL DATA FROM TORONTO INTL AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

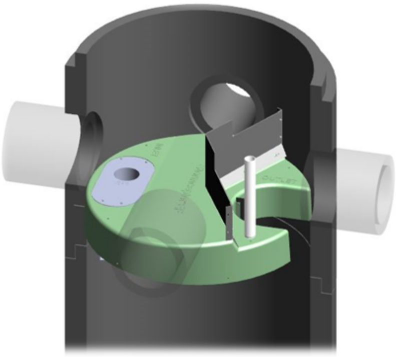
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

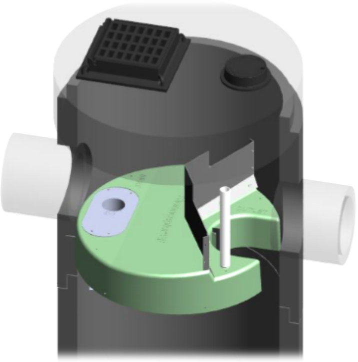
DESIGN FLEXIBILITY

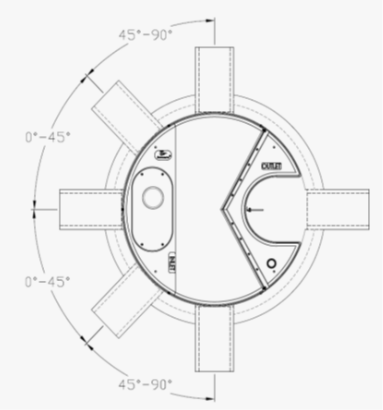
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/15/2022

Province:	Ontario
City:	Elora
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Ainley Farm Subdivision
Project Number:	411009
Designer Name:	Patricia Wiebe
Designer Company:	GM BluePlan Engineering Ltd.
Designer Email:	patricia.wiebe@gmblueplan.ca
Designer Phone:	519-748-1440
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	SWM Pond 1, Outlet 1 - North

Drainage Area (ha):	3.15
% Imperviousness:	50.00

Runoff Coefficient 'c': 0.60

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	58.77
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	67
EF6	78
EF8	85
EF10	90
EF12	92

Recommended Stormceptor EF Model:	**EF8**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**85**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

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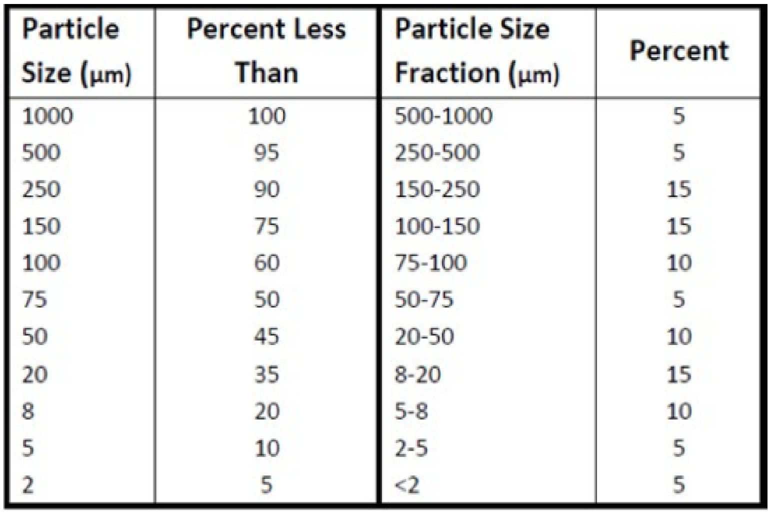
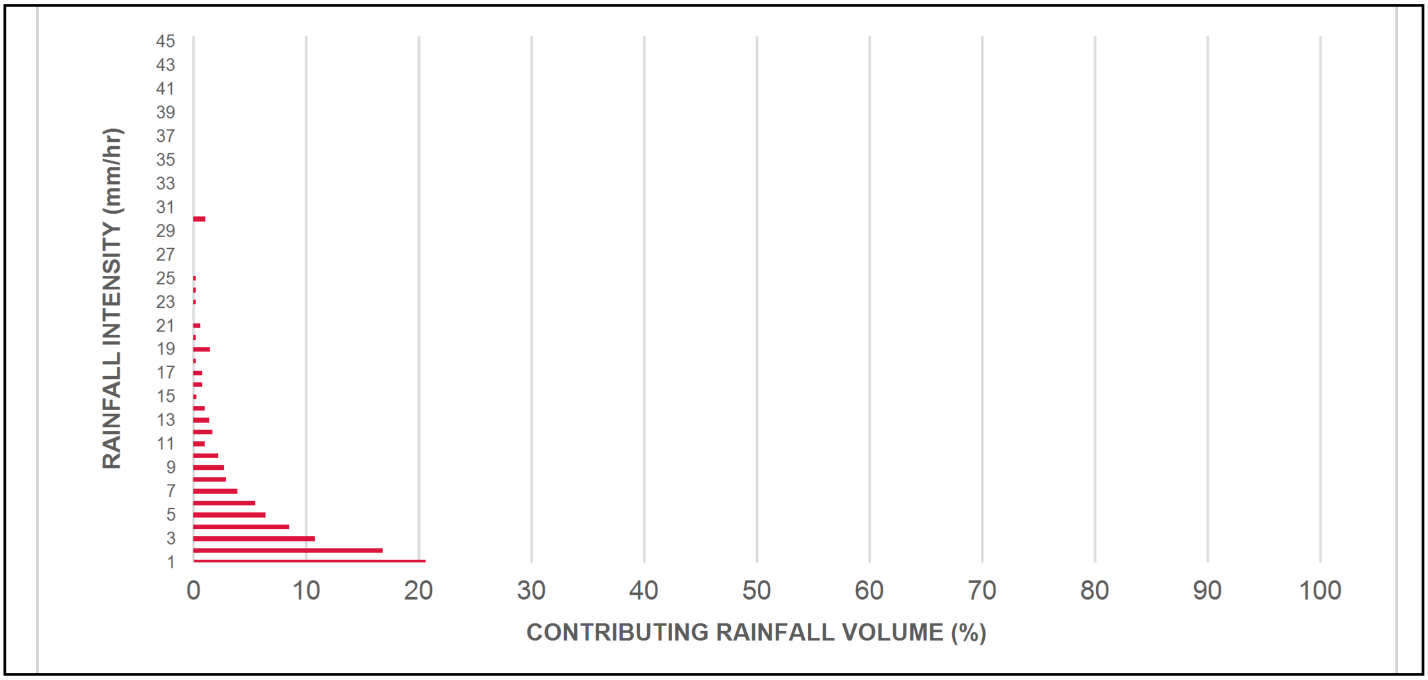


Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

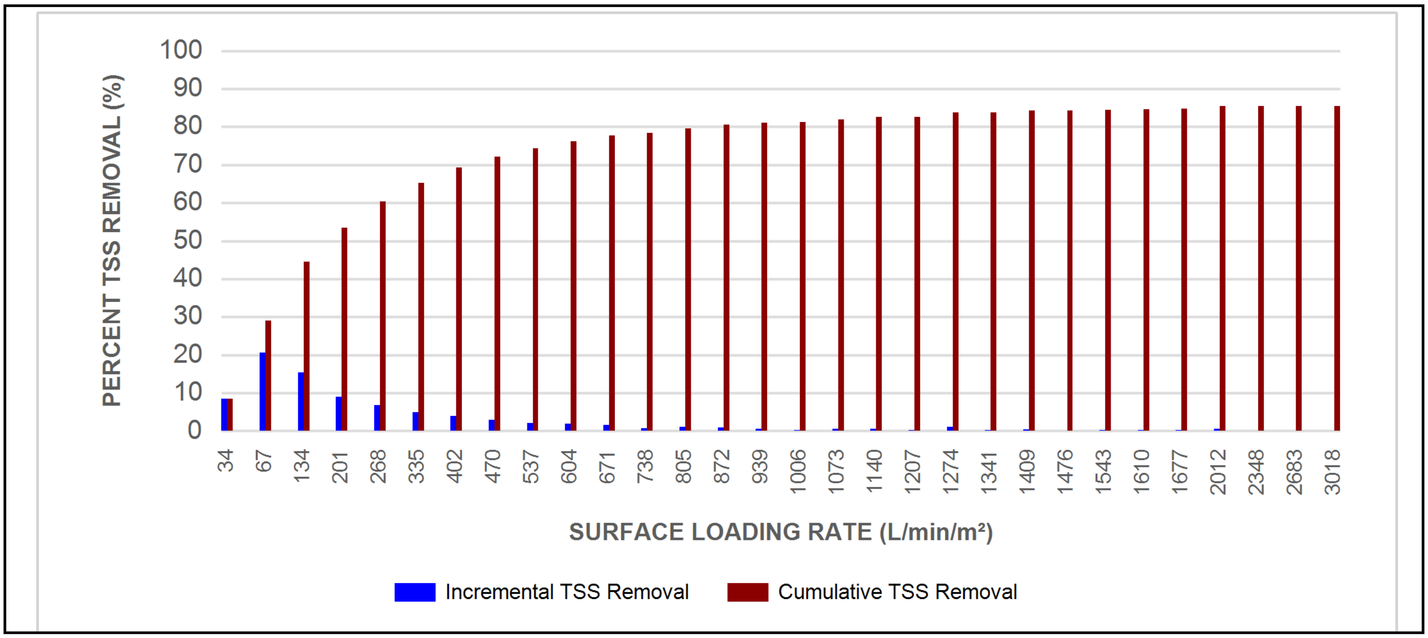
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.5	8.5	2.63	158.0	34.0	100	8.5	8.5
1	20.6	29.1	5.25	315.0	67.0	100	20.6	29.1
2	16.8	45.9	10.51	631.0	134.0	92	15.5	44.6
3	10.8	56.7	15.76	946.0	201.0	83	8.9	53.5
4	8.5	65.2	21.02	1261.0	268.0	80	6.8	60.3
5	6.4	71.6	26.27	1576.0	335.0	77	4.9	65.3
6	5.5	77.0	31.53	1892.0	402.0	74	4.0	69.3
7	3.9	81.0	36.78	2207.0	470.0	73	2.9	72.2
8	2.9	83.9	42.03	2522.0	537.0	72	2.1	74.3
9	2.7	86.5	47.29	2837.0	604.0	71	1.9	76.1
10	2.2	88.7	52.54	3153.0	671.0	70	1.5	77.7
11	1.0	89.7	57.80	3468.0	738.0	70	0.7	78.4
12	1.7	91.3	63.05	3783.0	805.0	69	1.1	79.5
13	1.4	92.8	68.30	4098.0	872.0	69	1.0	80.5
14	1.0	93.7	73.56	4414.0	939.0	68	0.7	81.1
15	0.3	94.0	78.81	4729.0	1006.0	68	0.2	81.3
16	0.8	94.8	84.07	5044.0	1073.0	69	0.5	81.9
17	0.8	95.7	89.32	5359.0	1140.0	70	0.6	82.5
18	0.2	95.8	94.58	5675.0	1207.0	72	0.1	82.6
19	1.5	97.3	99.83	5990.0	1274.0	73	1.1	83.7
20	0.2	97.5	105.08	6305.0	1341.0	74	0.1	83.8
21	0.6	98.2	110.34	6620.0	1409.0	75	0.5	84.3
22	0.0	98.2	115.59	6936.0	1476.0	72	0.0	84.3
23	0.2	98.4	120.85	7251.0	1543.0	69	0.2	84.5
24	0.2	98.6	126.10	7566.0	1610.0	66	0.2	84.6
25	0.2	98.9	131.36	7881.0	1677.0	63	0.2	84.8
30	1.1	100.0	157.63	9458.0	2012.0	53	0.6	85.4
35	0.0	100.0	183.90	11034.0	2348.0	45	0.0	85.4
40	0.0	100.0	210.17	12610.0	2683.0	41	0.0	85.4
45	0.0	100.0	236.44	14186.0	3018.0	35	0.0	85.4
Estimated Net Annual Sediment (TSS) Load Reduction =								**85 %**

Climate Station ID: 6158731 *Years of Rainfall Data*: 20

RAINFALL DATA FROM TORONTO INTL AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

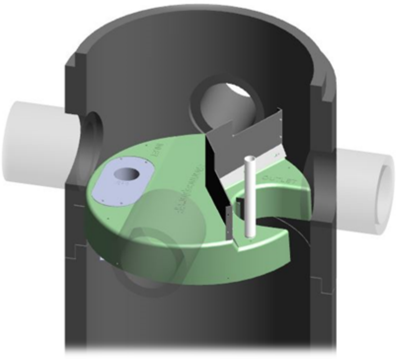
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

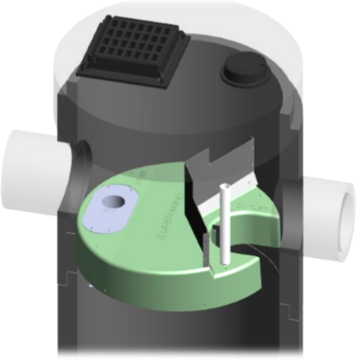
DESIGN FLEXIBILITY

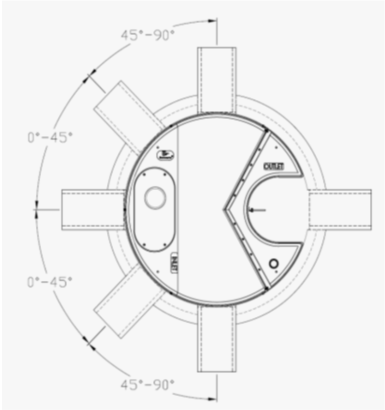
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/15/2022

Province:	Ontario
City:	Elora
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Ainley Farm Subdivision
Project Number:	411009
Designer Name:	Patricia Wiebe
Designer Company:	GM BluePlan Engineering Ltd.
Designer Email:	patricia.wiebe@gmblueplan.ca
Designer Phone:	519-748-1440
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	SWM Pond 1, Outlet 2
Drainage Area (ha):	2.32
% Imperviousness:	50.00

Runoff Coefficient 'c': 0.60

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	43.29
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	72
EF6	83
EF8	88
EF10	92
EF12	95

Recommended Stormceptor EF Model:	**EF6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**83**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

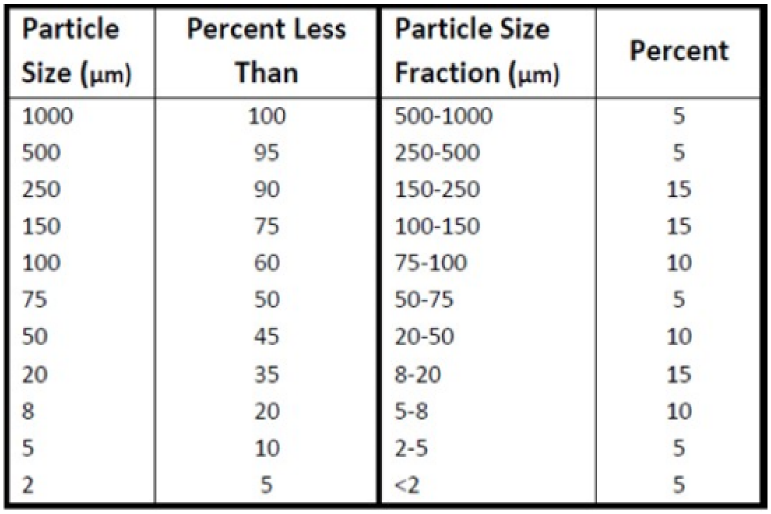
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.



Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.5	8.5	1.93	116.0	44.0	100	8.5	8.5
1	20.6	29.1	3.87	232.0	88.0	98	20.3	28.8
2	16.8	45.9	7.74	464.0	177.0	87	14.6	43.4
3	10.8	56.7	11.61	697.0	265.0	80	8.6	52.1
4	8.5	65.2	15.48	929.0	353.0	76	6.4	58.5
5	6.4	71.6	19.35	1161.0	441.0	73	4.7	63.2
6	5.5	77.0	23.22	1393.0	530.0	72	3.9	67.1
7	3.9	81.0	27.09	1625.0	618.0	71	2.8	69.9
8	2.9	83.9	30.96	1857.0	706.0	70	2.0	71.9
9	2.7	86.5	34.83	2090.0	795.0	69	1.9	73.8
10	2.2	88.7	38.70	2322.0	883.0	69	1.5	75.3
11	1.0	89.7	42.57	2554.0	971.0	68	0.7	75.9
12	1.7	91.3	46.44	2786.0	1059.0	69	1.1	77.1
13	1.4	92.8	50.31	3018.0	1148.0	70	1.0	78.1
14	1.0	93.7	54.18	3251.0	1236.0	72	0.7	78.8
15	0.3	94.0	58.05	3483.0	1324.0	74	0.2	79.0
16	0.8	94.8	61.92	3715.0	1413.0	75	0.6	79.6
17	0.8	95.7	65.79	3947.0	1501.0	70	0.6	80.2
18	0.2	95.8	69.66	4179.0	1589.0	66	0.1	80.3
19	1.5	97.3	73.53	4412.0	1677.0	63	0.9	81.2
20	0.2	97.5	77.40	4644.0	1766.0	60	0.1	81.4
21	0.6	98.2	81.26	4876.0	1854.0	57	0.4	81.7
22	0.0	98.2	85.13	5108.0	1942.0	54	0.0	81.7
23	0.2	98.4	89.00	5340.0	2031.0	52	0.1	81.8
24	0.2	98.6	92.87	5572.0	2119.0	50	0.1	82.0
25	0.2	98.9	96.74	5805.0	2207.0	48	0.1	82.1
30	1.1	100.0	116.09	6966.0	2649.0	41	0.5	82.5
35	0.0	100.0	135.44	8126.0	3090.0	35	0.0	82.5
40	0.0	100.0	154.79	9287.0	3531.0	30	0.0	82.5
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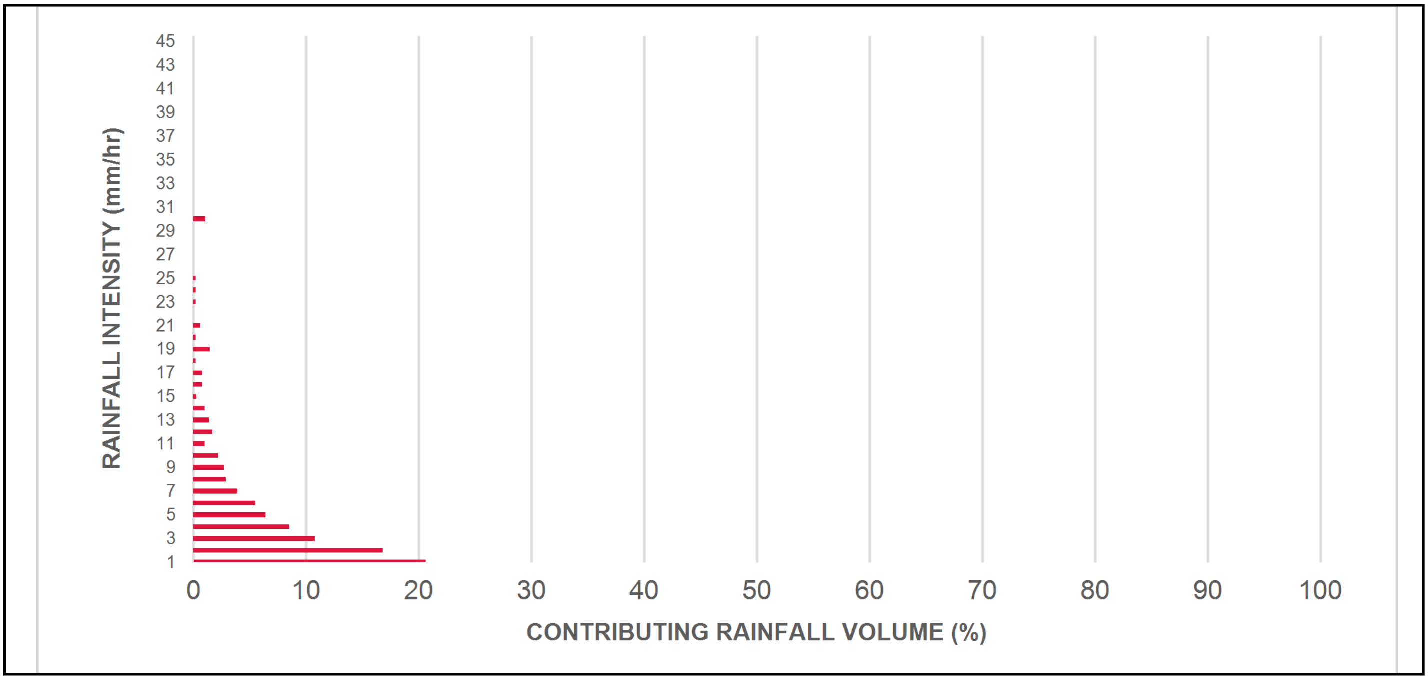

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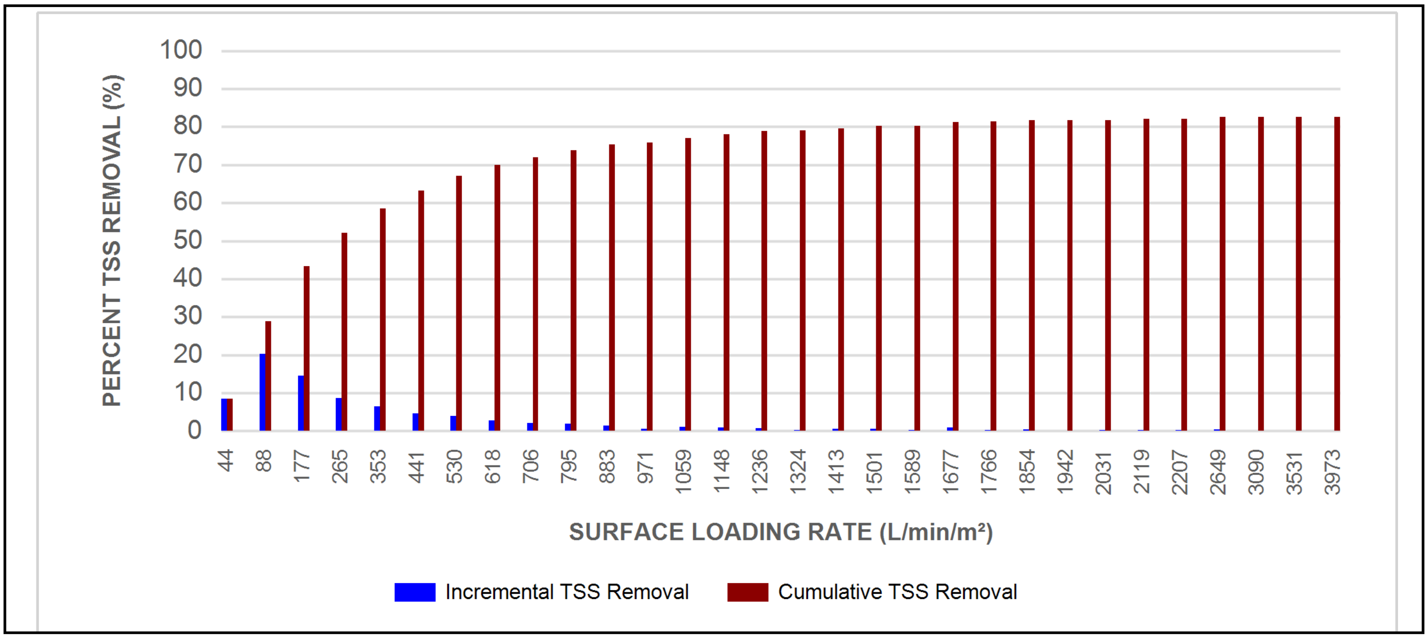

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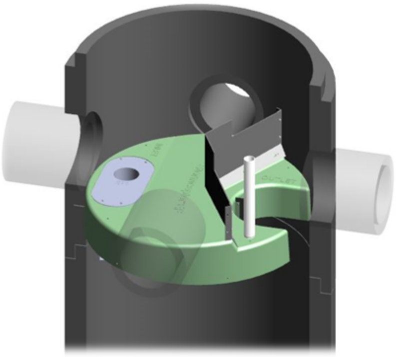

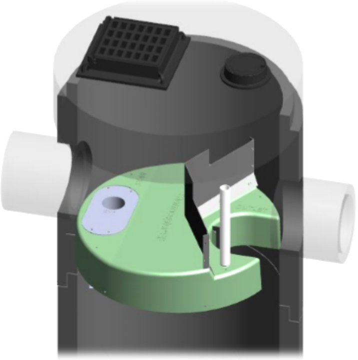

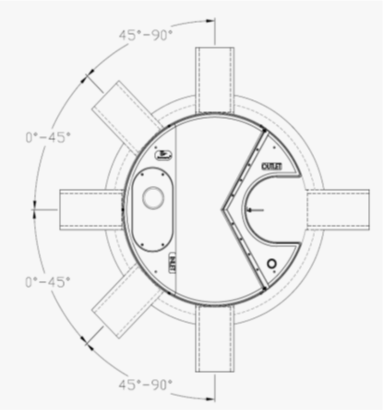

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	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
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EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

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** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

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Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

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STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators.**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

07/15/2022

Province:	Ontario
City:	Elora
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Site Name:	SWM Pond 2

Drainage Area (ha):	2.75
% Imperviousness:	69.00

Runoff Coefficient 'c': 0.71

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	61.06
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Ainley Farm Subdivision
Project Number:	411009
Designer Name:	Patricia Wiebe
Designer Company:	GM BluePlan Engineering Ltd.
Designer Email:	patricia.wiebe@gmblueplan.ca
Designer Phone:	519-748-1440
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	66
EF6	78
EF8	85
EF10	89
EF12	92

Recommended Stormceptor EF Model:	**EF8**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**85**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

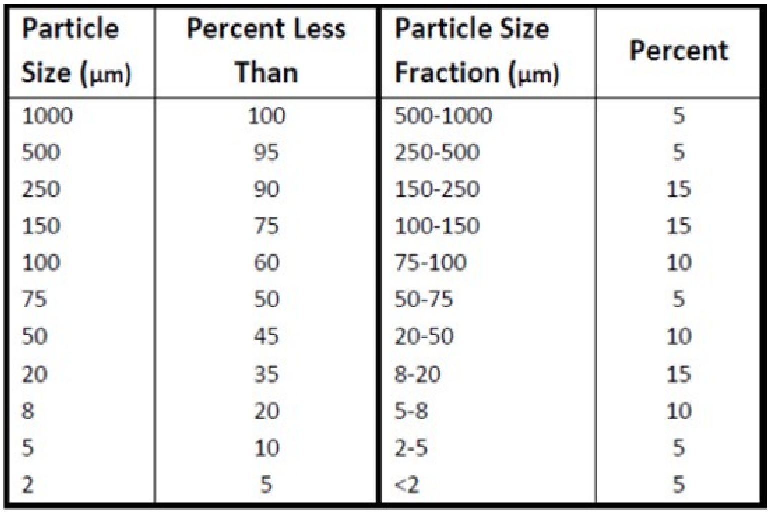
►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

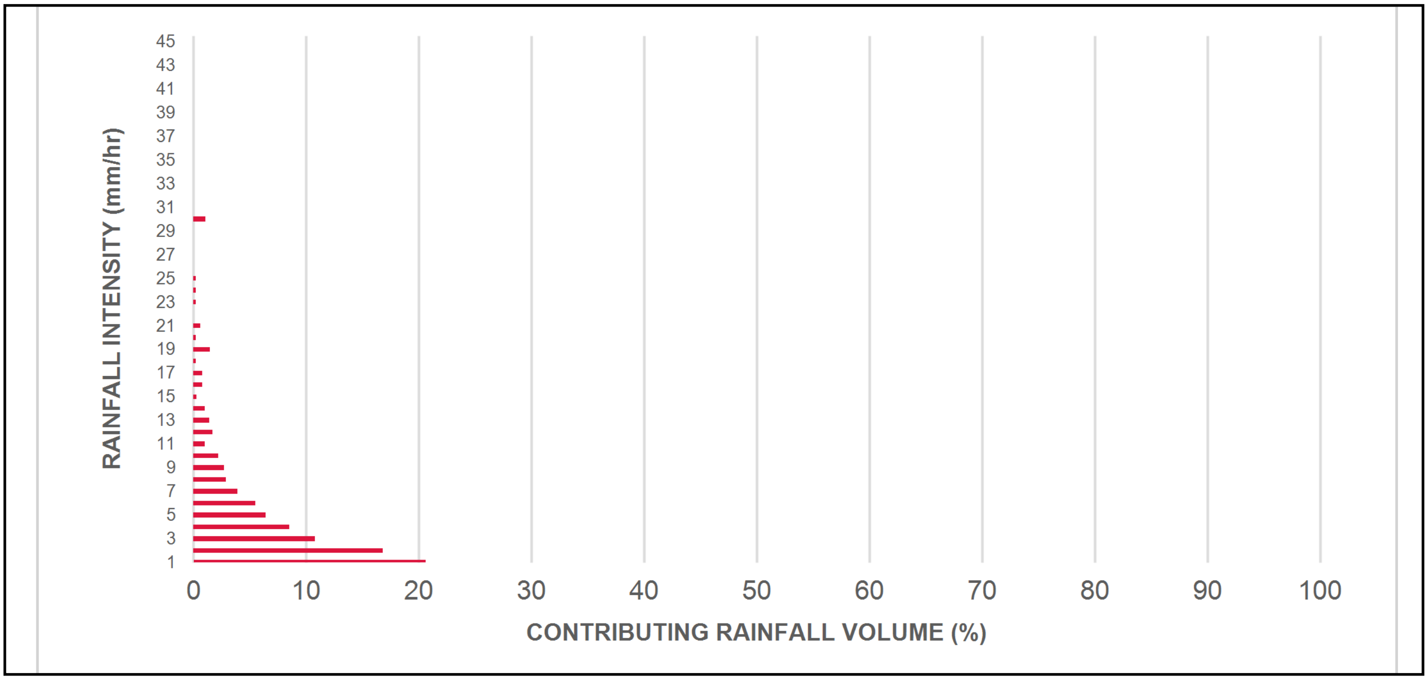


Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

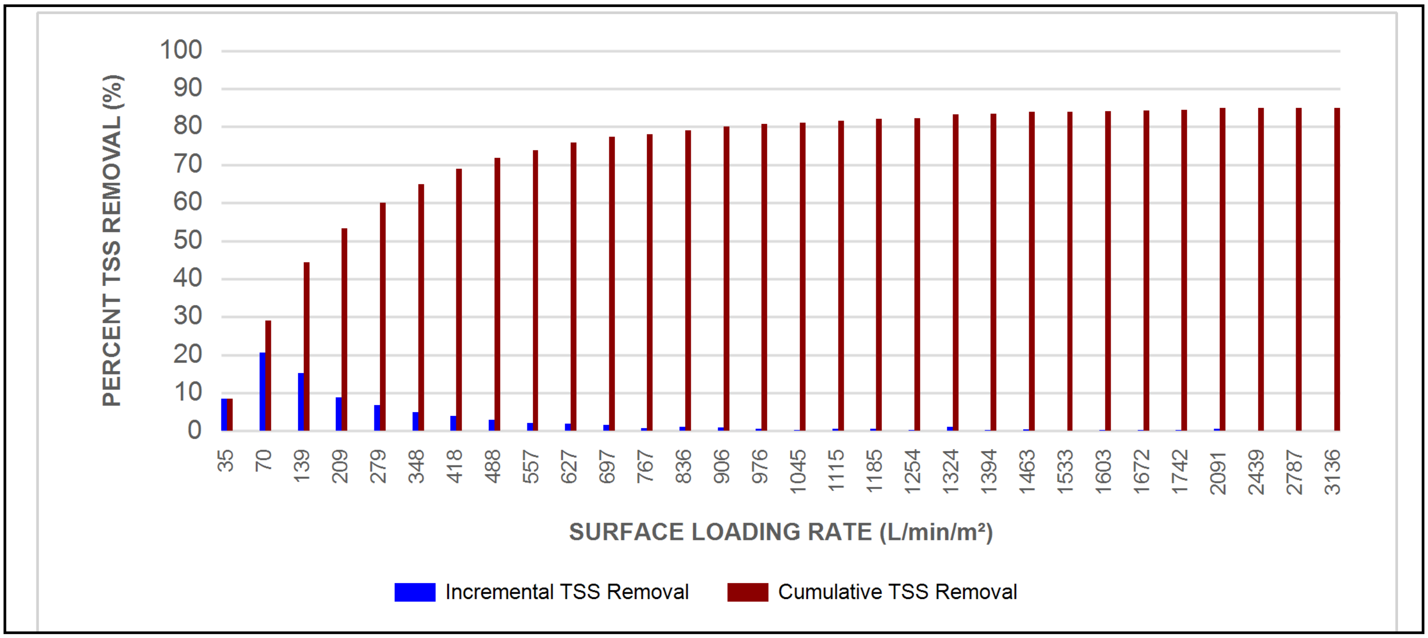
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	8.5	8.5	2.73	164.0	35.0	100	8.5	8.5
1	20.6	29.1	5.46	328.0	70.0	100	20.6	29.1
2	16.8	45.9	10.92	655.0	139.0	91	15.3	44.4
3	10.8	56.7	16.38	983.0	209.0	83	8.9	53.3
4	8.5	65.2	21.83	1310.0	279.0	80	6.7	60.0
5	6.4	71.6	27.29	1638.0	348.0	77	4.9	64.9
6	5.5	77.0	32.75	1965.0	418.0	74	4.0	69.0
7	3.9	81.0	38.21	2293.0	488.0	73	2.9	71.8
8	2.9	83.9	43.67	2620.0	557.0	72	2.1	73.9
9	2.7	86.5	49.13	2948.0	627.0	71	1.9	75.8
10	2.2	88.7	54.59	3275.0	697.0	70	1.5	77.3
11	1.0	89.7	60.04	3603.0	767.0	70	0.7	78.0
12	1.7	91.3	65.50	3930.0	836.0	69	1.1	79.1
13	1.4	92.8	70.96	4258.0	906.0	68	1.0	80.1
14	1.0	93.7	76.42	4585.0	976.0	68	0.7	80.8
15	0.3	94.0	81.88	4913.0	1045.0	68	0.2	81.0
16	0.8	94.8	87.34	5240.0	1115.0	70	0.6	81.5
17	0.8	95.7	92.80	5568.0	1185.0	71	0.6	82.1
18	0.2	95.8	98.25	5895.0	1254.0	73	0.1	82.2
19	1.5	97.3	103.71	6223.0	1324.0	74	1.1	83.3
20	0.2	97.5	109.17	6550.0	1394.0	75	0.2	83.5
21	0.6	98.2	114.63	6878.0	1463.0	72	0.4	83.9
22	0.0	98.2	120.09	7205.0	1533.0	69	0.0	83.9
23	0.2	98.4	125.55	7533.0	1603.0	66	0.1	84.1
24	0.2	98.6	131.00	7860.0	1672.0	63	0.2	84.2
25	0.2	98.9	136.46	8188.0	1742.0	61	0.1	84.4
30	1.1	100.0	163.76	9825.0	2091.0	50	0.6	85.0
35	0.0	100.0	191.05	11463.0	2439.0	43	0.0	85.0
40	0.0	100.0	218.34	13100.0	2787.0	39	0.0	85.0
45	0.0	100.0	245.63	14738.0	3136.0	34	0.0	85.0
Estimated Net Annual Sediment (TSS) Load Reduction =								**85 %**

Climate Station ID: 6158731 *Years of Rainfall Data*: 20

RAINFALL DATA FROM TORONTO INTL AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL
FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

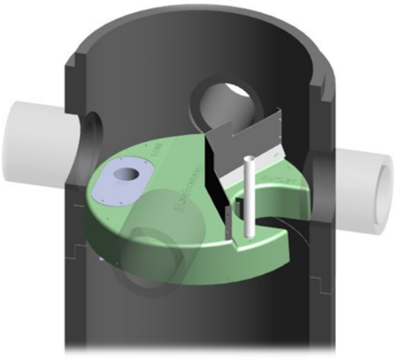
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

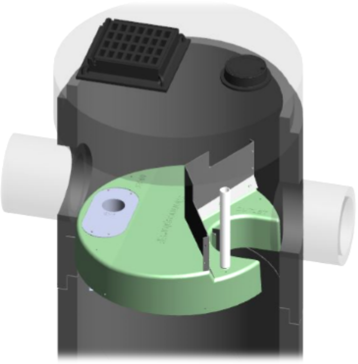
DESIGN FLEXIBILITY

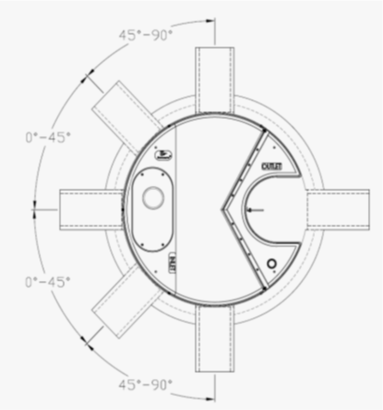
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

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PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

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3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

> 3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.
>
> 3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.
>
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>
> 3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

> 3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

APPENDIX E

WATER BUDGET ANALYSES

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
Monthly Water Balance (Thornthwaite and Mather Method)
Date: July 2022

EXISTING CONDITION

Contributing Catchments: All
Contributing Area = 22.62 ha
Percent Impervious = 0% %

Soil Type: Clay Loam
Vegetation: Shallow-rooted crops
Root Zone Depth = 0.40m
Soil Moisture Retention Capacity = 100mm

Runoff Factor = 0.84
Evapotranspiration Factor for Impervious Surfaces = 0.36

Month	Daily Average Temperature (°C)	Monthly Heat Index	Unadjusted Daily Potential Evapotranspiration (mm)	Correction Factors	Adjusted Potential Evapotranspiration (mm)	Average Precipitation (mm)	P-PE (mm)	Accum. Pot. Water Loss (mm)	Storage (mm)	ΔS (mm)	Pervious ET	Actual Evapotrans-piration (mm)	Pervious ET - Actual ET	Moisture Deficit (mm)	Moisture Surplus (mm)	Water Runoff (mm)	Snow Melt Runoff (mm)	Total Recharge & Runoff (mm)	Actual Runoff (mm)	Runoff Volume (m^3)	Recharge Volume (m^3)
Jan	-7.40	0.00	0.00	24.3	0.00	67.90	67.9		236.5	0.0		0.0	0.0	0.0	0.0	9.9	0.0	9.9	8.3	1,887	351
Feb	-6.30	0.00	0.00	24.6	0.00	55.90	55.9		292.4	0.0		0.0	0.0	0.0	0.0	4.9	0.0	4.9	4.2	944	176
Mar	-1.90	0.00	0.00	30.6	0.00	59.60	59.6		352.0	0.0		0.0	0.0	0.0	0.0	2.5	0.0	2.5	2.1	472	88
Apr	5.70	1.22	0.90	33.6	30.24	74.10	43.9		100.0	0.0	30.2	30.2	0.0	0.0	43.9	21.9	25.2	47.1	39.7	8,988	1,673
May	12.20	3.86	2.00	37.8	75.60	86.90	11.3		100.0	0.0	75.6	75.6	0.0	0.0	11.3	16.6	113.4	130.0	109.6	24,795	4,614
Jun	17.50	6.66	2.90	38.4	111.36	83.80	-27.6	-27.6	75.0	-25.0	108.8	108.8	0.0	2.6	-2.6	7.0	56.7	63.7	53.7	12,154	2,262
Jul	20.00	8.16	3.40	38.7	131.58	89.20	-42.4	-69.9	49.0	-26.0	115.2	115.2	0.0	16.4	-16.4	-4.7	28.4	23.7	20.0	4,515	840
Aug	19.00	7.55	3.20	36.0	115.20	96.60	-18.6	-88.5	40.0	-9.0	105.6	105.6	0.0	9.6	-9.6	-7.1	14.2	7.0	5.9	1,342	250
Sep	14.90	5.22	2.50	31.2	78.00	93.10	15.1		55.1	15.1	78.0	78.0	0.0	0.0	0.0	-3.6	7.7	4.1	3.5	788	147
Oct	8.30	2.15	1.30	28.5	37.05	77.20	40.2		95.3	40.2	37.1	37.1	0.0	0.0	0.0	-1.8	4.0	2.2	1.9	423	79
Nov	2.10	0.27	0.30	24.3	7.29	93.00	85.7		100.0	4.8	7.3	7.3	0.0	0.0	81.0	39.6	2.5	42.1	35.5	8,027	1,494
Dec	-3.90	0.00	0.00	23.1	0.00	68.60	68.6		168.6	0.0		0.0	0.0	0.0	0.0	19.8	0.0	19.8	16.7	3,775	702
Total		**35.1**				**945.9**	**359.6**				**557.8**	**557.8**		**28.5**	**107.6**	**105.1**	**252.0**	**357.1**	**301.1**	**68,109**	**12,674**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1981-2010 for Fergus Shand Dam

Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*

Monthy Heat Index (I) from Table 2 of *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance*

Correction Factors from Table 6 of *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance*

Evaporation Factor for Impervious Surfaces = Average Annual Evapotranspiration for Impervious Surfaces (200mm/year) / Average Annual Evapotranspiration for Pervious Surfaces (558mm/year) = 0.36

Runoff Factor = [(Impervious Percentage of Site x Average Annual Runoff for Impervious Surfaces (745.9mm/year)) + (Pervious Silt Till Percentage of Site x Average Annual Runoff for Pervious Silt Till Surfaces (301.1 mm/year))] / Total Annual Recharge & Runoff

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
Monthly Water Balance (Thornthwaite and Mather Method)
Date: July 2022

POST-DEVELOPMENT CONDITIONS - TO WETLAND

Contributing Catchments:	All	Soil Type: Clay Loam	
Contributing Area =	22.62 ha	Vegetation: Shallow-rooted crops	
Percent Impervious =	36%	Root Zone Depth = 0.40m	
		Soil Moisture Retention Capacity = 100mm	

Runoff Factor =	0.95
Evapotranspiration Factor for Impervious	0.36

Month	Daily Average Temperature (°C)	Monthly Heat Index	Unadjusted Daily Potential Evapotranspiration (mm)	Correction Factors	Adjusted Potential Evapotranspiration (mm)	Average Precipitation (mm)	P-PE (mm)	Accum. Pot. Water Loss (mm)	Storage (mm)	ΔS (mm)	Pervious ET	Actual Evapotrans-piration (mm)	Pervious ET - Actual ET	Moisture Deficit (mm)	Moisture Surplus (mm)	Water Runoff (mm)	Snow Melt Runoff (mm)	Total Recharge & Runoff (mm)	Actual Runoff (mm)	Runoff Volume (m^3)	Recharge Volume (m^3)	Enhanced Recharge (m^3)
Jan	-7.40	0.00	0.00	24.3	0.00	67.90	67.9		236.5	0.0		0.0	0.0	0.0	0.0	11.9	0.0	11.9	11.3	2,381	135	184
Feb	-6.30	0.00	0.00	24.6	0.00	55.90	55.9		292.4	0.0		0.0	0.0	0.0	0.0	6.0	0.0	6.0	5.7	1,190	67	92
Mar	-1.90	0.00	0.00	30.6	0.00	59.60	59.6		352.0	0.0		0.0	0.0	0.0	0.0	3.0	0.0	3.0	2.8	595	34	46
Apr	5.70	1.22	0.90	33.6	30.24	74.10	43.9		100.0	0.0	30.2	23.3	7.0	7.0	50.8	25.4	25.2	50.6	48.1	10,095	571	785
May	12.20	3.86	2.00	37.8	75.60	86.90	11.3		100.0	0.0	75.6	58.1	17.5	17.5	28.8	27.1	113.4	140.5	133.5	28,773	1,584	1,421
Jun	17.50	6.66	2.90	38.4	111.36	83.80	-27.6	-27.6	75.0	-25.0	108.8	83.7	25.1	27.7	22.6	24.8	56.7	81.5	77.5	16,455	919	1,067
Jul	20.00	8.16	3.40	38.7	131.58	89.20	-42.4	-69.9	49.0	-26.0	115.2	88.6	26.6	43.0	10.2	17.5	28.4	45.9	43.6	9,165	517	695
Aug	19.00	7.55	3.20	36.0	115.20	96.60	-18.6	-88.5	40.0	-9.0	105.6	81.2	24.4	34.0	14.8	16.2	14.2	30.3	28.8	6,066	342	452
Sep	14.90	5.22	2.50	31.2	78.00	93.10	15.1		55.1	15.1	78.0	60.0	18.0	18.0	18.0	17.1	7.7	24.8	23.5	4,958	279	368
Oct	8.30	2.15	1.30	28.5	37.05	77.20	40.2		95.3	40.2	37.1	28.5	8.6	8.6	8.6	12.8	4.0	16.8	16.0	3,366	190	249
Nov	2.10	0.27	0.30	24.3	7.29	93.00	85.7		100.0	4.8	7.3	5.6	1.7	1.7	82.6	47.7	2.5	50.2	47.7	10,021	566	775
Dec	-3.90	0.00	0.00	23.1	0.00	68.60	68.6		168.6	0.0		0.0	0.0	0.0	0.0	23.9	0.0	23.9	22.7	4,762	269	368
Total		**35.1**				**945.9**	**359.6**				**557.8**	**429.0**	**128.8**	**157.3**	**236.4**	**233.4**	**252.0**	**485.4**	**461.2**	**97,828**	**5,473**	**6,502**
																					Total Recharge Volume	**11,974**
																					Total Enhanced Recharge Surplus (post-development volume - pre-development volume)	**-700**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1981-2010 for Fergus Shand Dam

Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*

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Ainley Farm Subdivision
Township of Centre Wellington (Elora)
Monthly Water Balance (Thornthwaite and Mather Method)
Date: July 2022

Catchment 1200 - Stormwater Management Pond 1 Infiltration Gallery

Infiltration Gallery No. 1

Area = 540 m^2
Depth= 0.70 m
Perforated Pipe Diameter= 0.450 m
No. of Pipes= 4 - 6

Volume of Perforated Pipe = 100.52 cu m
Volume of Clear Stone = 277.41 cu m
Clear Stone Void Ratio= 0.33

Total Storage Volume of Structure = 192.06 cu m

A = contact area of structure = 540 sq m
V = runoff volume to be infiltrated = 192.06 cu m
P = percolation rate of native soils = 4.00 mm/h
n = porosity of storage media (weighted) = 0.51
T = retention time = Solve for T

T = (1000 x V) / (P x n x A) = 175.00 hours or 7.3 day draindown period

Contributing Area 1.14 ha
Recharge Time 175.0 hours / 7.3 days
Recharge Volume Potential 192.06 m^3

Month	Total Runoff from Contributing Area (mm)	No. of days	Max Potential Recharge (m^3)	Available Recharge (m^3)	Enhanced Recharge (m^3)
Jan	12.4	31	817	142	135
Feb	6.2	28	738	71	67
Mar	3.1	31	817	35	34
Apr	50.8	30	790	579	551
May	141.4	31	817	1,612	776
Jun	86.5	30	790	986	751
Jul	53.3	31	817	608	577
Aug	38.5	31	817	439	417
Sep	32.1	30	790	366	348
Oct	22.0	31	817	251	238
Nov	52.2	30	790	595	566
Dec	24.9	31	817	284	270
Total	**523.5**	**365**	**9,614**	**5,968**	**4,728**

Ainley Farm Subdivision
Township of Centre Wellington (Elora)
Monthly Water Balance (Thornthwaite and Mather Method)
Date: July 2022

Catchment 1400 - Park Infiltration Gallery

Infiltration Gallery No. 3

Length = 79.05 m
Width = 10.00 m
Depth= 0.70 m
Perforated Pipe Diameter = 0.30 m
No. of Pipes= 1.00

Area of Material = 790.50 sq m

Volume of Perf. Pipe = 11.03
Volume of Clear Stone = 542.32 cu m
Clear Stone Void Ratio= 0.33

Total Storage Volume of Structure = 191.80 cu m

A = contact area of structure = 790.50 sq m
V = runoff volume to be infiltrated = 191.80 cu m
P = percolation rate of native soils = 4.00 mm/h
n = porosity of storage media (weighted) = 0.34
T = retention time = Solve for T

T = (1000 x V) / (P x n x A) = 176.67 hours or 7.4 day draindown period

Contributing Area 0.62 ha
Recharge Time 176.7 hours / 7.4 days
Recharge Volume Potential 191.80 m^3

Month	**Total Runoff from Contributing Area**	**No. of days**	**Max Potential Recharge**	**Available Recharge**	**Enhanced Recharge**
	(mm)		**(m^3)**	**(m^3)**	**(m^3)**
Jan	8.3	31	808	52	49
Feb	4.2	28	730	26	25
Mar	2.1	31	808	13	12
Apr	39.7	30	782	246	234
May	109.6	31	808	680	646
Jun	53.7	30	782	333	316
Jul	20.0	31	808	124	118
Aug	5.9	31	808	37	35
Sep	3.5	30	782	22	21
Oct	1.9	31	808	12	11
Nov	35.5	30	782	220	209
Dec	16.7	31	808	103	98
Total	**301.1**	**365**	**9,511**	**1,867**	**1,773**